☐ **Executed Contract File**
☐ **Contractor**
☐ **Finance**
☐ **City Clerk**
☐ **Surety**
☐ **Granting Agency**
☐ Project Manager
☐ CM/Inspector
☐ Design Professional
☐ _____

City of Kansas City, Missouri
Water Services Department
Kenneth C. Morgan P.E., Director

Project Manual

PROJECT/CONTRACT NO. 81000927/1698

TODD CREEK WASTEWATER TREATMENT PLANT EXPANSION & MAJOR UPGRADES

DISAVENTAGE BUSINESS ENTERPISE (DBE) QUALIFICATIONS

BIDDER/ADDRESS

Company
Contact
Address
Phone
Fax
Email

Project Managers: Shawn Cross
Telephone: 816-513-0442
Email: shawn.cross@kcmo.org
& Conner Hanlon
Telephone: 816-513-0526
Email: conner.hanlon@kcmo.org

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

CERTIFICATION PAGE

Project/Contract Numbers: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrades

I am responsible for the following specifications and drawings:

Drawings:

Specifications:

Sections:

07 16 00
09 90 00
41 22 00

_____ (SEAL)

I certify under penalty of law that the document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted, and that the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

CERTIFICATION PAGE

Project/Contract Numbers: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrades

I am responsible for the following specifications and drawings:

Drawings:

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Specifications:

Sections:

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04 20 00	08 41 13	10 44 16
06 10 00	08 45 23	10 51 13
06 41 16	08 71 00	10 73 16
07 41 13.16	08 80 00	11 24 29.17
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07 72 53	10 14 16	12 48 13
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07 84 43	10 14 23	
07 92 00	10 22 39	
07 92 19		
08 16 13		

STATE OF MISSOURI
JASON SCOTT BARKER
NUMBER A-2005001198
REGISTERED ARCHITECT

12.17.2025 (SEAL)

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CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

CERTIFICATION PAGE

Project/Contract Numbers: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrades

I am responsible for the following specifications and drawings:

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Specifications:

Sections:

02 41 00
31 23 33
33 01 30.19
33 11 00
33 31 50
33 33 11

_____ (SEAL)

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HEART OF THE NATION

KANSAS CITY
MISSOURI

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Project/Contract Numbers: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrades

I am responsible for the following specifications and drawings:

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C123	

Specifications:

Sections:

31 11 00	32 15 00
31 20 50	32 16 00
32 12 17	32 31 13

_____ (SEAL)

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CITY OF FOUNTAINS
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KANSAS CITY
MISSOURI

CERTIFICATION PAGE

Project/Contract Numbers: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrades

I am responsible for the following specifications and drawings:

Drawings:

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E007	E205	E421	E801	
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Specifications:

Sections:

13 46 00	26 05 53	26 24 19
26 05 10	26 05 73	26 27 26
26 05 19	26 09 23	26 28 13
26 05 26	26 22 13	26 29 13
26 05 33	26 24 13	26 29 23
26 05 36	26 24 14	26 33 53
26 05 43	26 24 16	26 43 13
26 05 48		26 50 00

_____ (SEAL)

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KANSAS CITY
MISSOURI

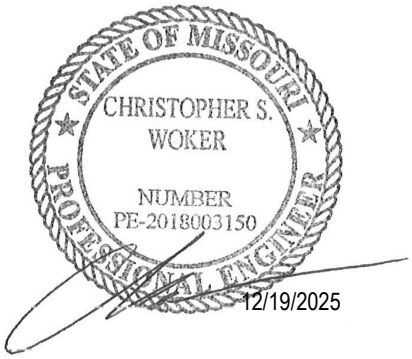
CERTIFICATION PAGE

Project/Contract Numbers: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrades

I am responsible for the following specifications and drawings:

Drawings:	Specifications:
FA700 FA701 FA702 FA703	Sections: 28 31 00



12/19/2025

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KANSAS CITY
MISSOURI

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I am responsible for the following specifications and drawings:

Drawings: Specifications:

Sections:

31 66 12

_____ (SEAL)

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Project/Contract Numbers: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrades

I am responsible for the following specifications and drawings:

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Specifications:

Sections
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28 15 23
28 20 00

40 60 00
40 61 96
40 61 96A
40 62 00
40 66 00
40 67 00
40 68 00
40 70 00
40 70 00A
40 71 90

STATE OF MISSOURI
SHAWN TAYLOR
NUMBER
PE-2015030345
12/18/2025
PROFESSIONAL ENGINEER

_____ (SEAL)

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CITY OF FOUNTAINS
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Project/Contract Numbers: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrades

I am responsible for the following specifications and drawings:

Drawings:

L000 L111
L100 L500
L110

Specifications:

Sections:

32 92 00.10
32 93 00
32 93 13

12/17/25

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Project/Contract Numbers: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrades

I am responsible for the following specifications and drawings:

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M001	M401	M703	P001
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M361			

Specifications:

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22 05 13	22 11 23	23 05 13
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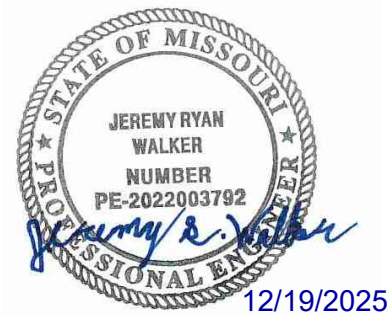
22 11 19	22 47 13	23 37 13
		23 37 23
		23 74 13
		23 74 33
		23 81 13
		23 82 39



12/19/2025

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I am responsible for the following specifications and drawings:

Drawings:

G001	Y703	D304	D705
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33 32 22	46 21 13	46 53 60
35 20 16	46 21 16	46 66 00
43 11 33	46 23 00	46 71 33
43 23 57	46 33 33	
43 23 58		

_____ (SEAL)

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Project/Contract Numbers: 81000927/1698

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I am responsible for the following specifications and drawings:

Drawings:

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Specifications:

Sections:

03 10 00	05 05 19
03 15 50	05 12 00
03 20 00	05 45 00
03 30 00	06 85 81
03 41 00	08 34 83
03 52 16	

_____ (SEAL)

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I am responsible for the following specifications and drawings:

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S417	S803	
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S421	S807	

Specifications:

Sections:

_____ (SEAL)

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Project Title: Todd Creek WWTP Expansion & Major Upgrades

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23 07 13 Duct Insulation
23 09 00 Instrumentation and Control for HVAC
23 31 13 Metal Ducts
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23 34 23 HVAC Power Ventilators
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26 05 19 Low-Voltage Electrical Conductors and Cables
26 05 26 Grounding and Bonding for Electrical Systems
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26 24 13 Switchboards

26 24 14 Docking Station for Portable Generator
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26 29 13 Enclosed Controllers
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26 33 53 Static Uninterruptible Power Supply
26 43 13 Surge Protection Devices for Low Voltage Electrical Power Equipment
26 50 00 Lighting

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28 15 23 Video Intercom Entry Systems
28 20 00 Video Surveillance System
28 31 00 Addressable Fire Alarm Systems

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31 20 50 Site Preparation and Earthwork
31 23 33 Trenching & Backfilling for Open-Cut Construction
31 66 12 Subsurface Improvement

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32 15 00 Aggregate Surface Course
32 16 00 Curb, Gutter, Sidewalk, Median, and Paved Drainage
32 31 13 Chain Link Fence
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32 93 00 Trees and Shrubs
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33 11 00 Pressure Pipe
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40 62 00 Computer System Hardware and Ancillaries
40 66 00 Process Control Networks
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40 70 00A Instrument List
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AGS System Preselection Information

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CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

LIST OF DRAWINGS

Project/Contract Numbers: 81000927/1698

Project Title: Todd Creek Facility Plan Update

Item #	Drawing Name	Drawing Number	Dated
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2	LIST OF DRAWINGS SHEET 1	G002	
3	LIST OF DRAWINGS SHEET 2	G003	
4	PROCESS DESIGN CRITERIA	G004	
5	GENERAL NOTES AND LEGEND	C101	
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CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

INVITATION TO BID

Project/Contract Numbers: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrades

The General Services Department of Kansas City, Missouri will receive sealed Bids until 2:00 PM, on **February 3, 2026** at 4800 E 63rd Street, Kansas City, Missouri 64130, for **Project No. 81000927/Contract No. 1698, Todd Creek WWTP Expansion & Major Upgrades.** Bids will be opened after that time at the same Location.

City desires that Disadvantaged Business Enterprises (DBE) have an opportunity to participate in the performance of City contracts. The goals for this specific Project are stated in the Missouri State Revolving Fund Procedures for Implementation.

Bidding Documents will be available online to all interested parties at the Kansas City, Missouri Plan Room, http://www.kcmoplanroom.org. All addenda will be posted at this location. Any document or plan may be viewed or downloaded from this location.

Bidders are requested to attend the **mandatory** Pre-Bid Conference at 2:00 PM, January 15, 2026, on TEAMs and in-person at Kansas City Water Services Department, 4800 E 63rd Street, Kansas City, Missouri 64130. Teams Meeting Link: Todd Creek Pre-Bid Conference | Meeting-Join | Microsoft Teams

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+1 872-212-5076,,284320930# United States, Chicago
Find a local number

Project Manager: Shawn Cross
Phone Number: 816-513-0442
Fax Number: 816-513-0343
E-mail: Shawn.Cross@kcmo.org

Contract Administrator: Marzella Newman-Buckner
Phone Number: (816) 513-0319
Fax Number: 816-513-0343
E-mail: Marzella.Newman-Buckner@kcmo.org

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CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

INSTRUCTIONS TO BIDDERS

Project Number: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrades

(DBE)

1. Sealed Bids for the ***Todd Creek WWTP Expansion & Major Upgrades*** project will be received by the General Services Department at 4800 E 63rd Street, Kansas City, Missouri 64130 **until 2:00 P.M., February 3rd, 2026,** at which time bidding will be closed.

   a. All Bids will be opened and read aloud. The Bid Envelope must contain all required submissions to be included with the Bid. No Bid may be withdrawn for a period of ninety (90) days after the Bid is opened. Bid security shall likewise continue for the same ninety (90) days unless earlier released by the City. The successful Bidder shall comply with all Bidding and contract requirements. Bids, once opened and read, may not be withdrawn without forfeiture of the Bid security.

   b. All Bids shall be addressed to *the Senior Officer off Procurement Services Marzella N. Buckner*, shall state on the outside of the sealed Bid envelope "Bid Enclosed", title and Project number, and shall be deposited in the locked Bid box. All Bids must comply with the Bidding Requirements of Kansas City, Missouri (CITY).

2. Consideration of Bids

   a. The City will determine the lowest, responsive and responsible Bid. The City may reject any or all bids. If the City rejects all Bids, the City may: (1) resolicit Bids following the City's normal solicitation procedure; or (2) solicit Bids only from those Bidders that submitted a Bid pursuant to the original solicitation; or (3) use an expedited Bid submission schedule with or without readvertising or issuing any other public notice when the City determines that the delay from the normal City solicitation procedure would not be in the City's best interests.

   b. Alternates. If this solicitation includes Bid Alternates, the City, in its sole discretion, may include any, all or none of the Alternates in determining the lowest, responsive and responsible Bid. In determining lowest, responsive and responsible Bid, the City may include the Alternates in any combination and in any order or priority or choose none of the Alternates. The City may make this determination at any time after Bid Closing and prior to Contract award. The City will act in the best interest of the City in determining whether to include any, all or none of the Alternates and the combination and priority of any Alternates selected. If additional funding becomes available after Contract award, City may add any or all of the Alternates to the Contract by change order.

3. Evidence of Competency to Perform. Each bidder shall furnish with the bid satisfactory evidence of Bidder's competency to perform the proposed work. Such evidence of competency shall consist of the following:

   a. Completed Form 00410.01 Experience Reference Summary for three projects of similar scope performed within the past 5 years including the name, address and telephone number of the contact person having knowledge of the project and the dollar value of the project.

   b. Statement that, during the three (3) years immediately preceding the date of the Bid, Bidder has received no written notices of violations of any federal or state prevailing wage statute in which prevailing wage penalties were assessed against the Bidder or Bidder has been found in such but has made restitution to affected workmen and complied with any statutory penalty; and a

statement that Bidder is current on payment of Federal and State income tax withholdings and unemployment insurance payments

c. Statement that Bidder participates in a training program that facilitates entry into the construction industry and which may include an on-the-job or in-house training program. By submitting its Bid, Bidder is agreeing to timely submit during the 48 hours after Bid opening an affidavit of describing such program and Bidder's participation.

d. Identify the following Key Personnel proposed for the Project. (**NOTE:** Key Personnel must be committed to the Project for its duration and may not be removed or substituted without the City's prior written consent.)

   (1) GC Project Manager

   (2) On-Site Field Superintendent

   (3) QC/QA Manager

   (4) Safety Officer

e. For each of the Key Personnel, provide the following background information.

   (1) Years of employment with current employer

   (2) City of residence

   (3) Identify any other projects this person will be involved with concurrently with the Project, and state the time commitment for the Project and each other project

   (4) Discuss professional registrations, education, certifications, and credentials held by this person that are applicable to the Project

f. Discuss generally the tasks involved in the Project.

g. Illustrate clearly and concisely Bidder's understanding of the technical elements that must be addressed for successful completion of the Project.

h. Submit a bid schedule with anticipated milestones for the Project using Microsoft Project 2007 or later format.

i. Describe key issues that might affect the Project schedule and how Bidder proposes to address them.

j. Summary of the Project Safety Plan for the Project.

   (1) Describe how Bidder proposes to address any unique safety issues for the Project

   (2) Describe your safety record and environmental compliance record along with your Firm's OSHA reportable accident rates on recent comparable size projects

   (3) Statement of Bidder's Experience Modification Ratio (EMR)

k. Discuss Bidder's understanding of the traffic control required for the Project, if applicable, and how traffic control will impact the Project schedule. Discuss any major traffic control issues that need to be addressed and Bidder's proposed solutions.

l. Identify any other special issues or problems that are likely to be encountered. Outline the manner in which Bidder suggests resolving them.

m. Outline key community relations issues and how they might be resolved.

n. Describe any difficulties Bidder anticipates encountering in serving the City, in light of the City's status as a municipality and public entity. Explain how Bidder plans to manage them.

o. Summary of Bidder's Quality Assurance/Quality Control Plan for this project

p. Statement regarding all work performed two (2) years immediately preceding the date of the Bid, that contains either (a) a contract by contract listing of any written notices of violations of any

federal, state or local DBE/MBE/WBE Program and any damages assessed; or (b) a statement that there have been no such written notices of violations or such penalties assessed; and a statement that Program requirements have been met.

q. Statement that the Bidder has not been rescinded or debarred from any bidding, contractual, procurement, or other such programs by federal, state or local entities.

r. Statement that Bidder is current on payment of Federal and State income tax withholdings and unemployment insurance payments

s. Statement of Bidder's litigation and/or arbitration history over the past five (5) years including final ruling.

t. Statement of Bidder's bond history over the past five (5) years including any incidences of failure to perform.

u. MBE / WBE past project performance and compliance with participation goals in comparable size commercial projects

v. Other.

4. Waiver of Bid Requirements The City Manager or his delegate at any time may waive any requirements imposed by this solicitation or by any City regulation when failure to grant the waiver will result in an increased cost to the City and the requirement waived would be waived for all Bidders for this solicitation and it is in the best interest of the City to grant the waiver. The City Council at any time may waive any requirements imposed in this solicitation by the City's Code of Ordinances when it finds failure to grant the waiver will result in an increased cost to the City and the waived requirement would be waived for all Bidders for this solicitation and it is in the best interest of the City to grant the waiver. The City reserves the right to waive any irregularities and/or formalities as deemed appropriate.

5. Late Bids Bids and modifications of Bids received after the exact hour and date specified for receipt will not be considered unless: (1) the Bid is sent via the U.S. Postal Service, common carrier or contract carrier, by a delivery method that guarantees the Bid will be delivered to the City prior to the submission deadline; or (2) if the Bid is submitted by mail, common carrier or contract carrier it is determined by the City that the late receipt was due solely to an error by the U.S Postal Service, common carrier or contract carrier; or (3) the Bid is timely delivered to the City but is at a different City location than that specified in this IFB; or (4) the City extends the time after the deadline for a force majeure event that could potentially affect any or all Bidders meeting the deadline.

6. Interpretations and Addenda All questions about the meaning or intent of the Bidding Documents may be directed to the Project Manager listed at the end of these Instructions to Bidders. Interpretations or clarifications considered necessary by the Project Manager in response to such questions will be issued by Addenda to all parties recorded as having received the Bidding Documents. Questions received less than ten (10) days prior to the date for opening of Bids may not be answered. Only answers issued by formal written Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect. Addenda may also be issued to modify the Bidding Documents as deemed advisable by the City.

7. Bid Security Requirements All Bids submitted must be accompanied by a Bid deposit in the amount of five percent (5%) of the base Bid which shall be in the form of a Bid Bond (on the form provided in these Bidding Documents), Cashier's Check, Letter of Credit, Certificate of Deposit or other instrument approved in advance by the City. Prior to submittal of the Bid the City Treasurer must approve both the financial institution and text of a Letter of Credit. A Cashier's Check or a Certificate of Deposit shall be payable to the City Treasurer.

8. Forfeiture of Security If a Bidder fails or refuses to execute the Contract when requested by the City, any Bid security given to the City shall immediately become due and payable and forfeited to the City as liquidated damages.

9. Mistake in Bid Security By submitting a Bid, Bidder agrees to correct any mistakes on a Bid security submission when requested by the City. When such a mistake occurs and a Bidder fails or refuses to

correct the mistake or execute the Contract when requested by the City, any Bid security shall be forfeited to the City and the Bidder shall also be subject to debarment and damages.

10. Bids that Exceed the Engineer's Estimate The City may offer the apparent lowest, responsive and responsible Bidders the option of performing the Work for the Engineer's estimate for the Project with no changes to the Bid requirements or scope of the Project if the Bid is not more than five percent higher than the Engineer's estimate.

11. Post Bid Required Submissions The successful Bidder will be required to submit the following documents with the signed copies of the Bid Form/Contract or within the timeframes specified in the Notice of Intent to Contract letter. Copies of the City's forms that the successful Bidder will be required to sign are bound into this Project Manual for information:

a. Properly signed, dated, and sealed Performance and Maintenance Bond and Payment Bond;

b. Properly completed certificates of insurance;

c. Copies of licenses required by the City to do the Work;

d. A copy of CONTRACTOR's current Certificate of Good Standing or Fictitious Name Registration from the Missouri Secretary of State, or other acceptable proof; and

12. Indemnification – City of Kansas City. The contract documents contains a requirement that Contractor shall indemnify, defend and hold harmless the City and any of its agencies, officials, officers, or employees from and against all claims, damages, liability, losses, costs, and expenses, including reasonable attorneys' fees, arising out of or resulting from any acts or omissions in connection with the contract, caused in whole or in part by Contractor, its employees, agents, or Subcontractors, or caused by others for whom Contractor is liable, including negligent acts or omissions of the City, its agencies, officials, officers, or employees. The contract requires Contractor to obtain specified limits of insurance to insure the indemnity obligation. Contractor has the opportunity to recover the cost of the required insurance in the Contract Price by including the cost of that insurance in the Bid amount.

13. City's Buy American and Missouri Preference Policies It is the policy of the City that any manufactured goods or commodities used or supplied in the performance of any City contract or any subcontract thereto shall be manufactured or produced in the United States whenever possible. When Bids offer quality, price, conformity with specifications, term of delivery and other conditions imposed in the specifications that are equal, the City shall select the Bid that uses manufactured goods or commodities that are manufactured or produced in the United States. The City shall give preference to all commodities manufactured, produced, or grown within the State of Missouri and to all firms, corporations, or individuals doing business as Missouri firms, corporations or individuals, when quality is equal or better and delivered price is the same or less. It is the bidder's responsibility to claim these preferences.

14. Affirmative Action It is the policy of the City that any person or entity entering into a contract with the City, will employ applicants and treat employees equally without regard to their race, color, sex, religion, national origin or ancestry, disability, sexual orientation, gender identity or age. Bidder will be required to comply with the City's Affirmative Action ordinance if Bidder is awarded a contract from the City totaling more than $300,000.00. If you have any questions regarding the City's Affirmative Action requirements, please contact CREO KC at (816) 513-1836 or visit the City's website at www.kcmo.gov.

15. Tax Clearance Bidder will be required to furnish to CITY sufficient proof from City's Commissioner of Revenue, verifying that Bidder is in compliance with the license and tax ordinances administered by City's Revenue Division as a precondition to CITY making its first payment under any CONTRACT over $160,000.00. Bidder will also be required to obtain proof of City tax compliance from all of its Subcontractors prior to the Subcontractors performing any Work.

16. Substitutions or "Or-Equal" Items The procedure for submission of substitutions or "or-equal" items is set forth in the General Conditions and Supplementary Conditions.

17. Prevailing Wage Requirements The successful Bidder shall pay the prevailing hourly rate of wages as determined by the Missouri Annual Wage Order and/or Federal Wage Determination set forth in the Project Manual. In case of a conflict between Missouri and Federal wage rates, the higher rate shall apply.

Successful Bidder shall be required to use City's Internet web based Prevailing Wage Reporting System provided by City and protocols included in that software during the term of this Contract. When requested by the City, Bidder shall submit user applications to City's provided Prevailing Wage Reporting System for all applicable personnel and shall require subcontractors to submit same.

18. Contract Information Management System Successful Bidder shall be required to use City's Internet web-based Contract Information Management System/Project Management Communications Tool provided by City and protocols included in that software during the term of this Contract. Bidder/Proposer shall submit user applications to City's provided Contract Information Management System for all personnel, subcontractors or suppliers as applicable.

19. Disadvantaged Business Statement The Kansas City Water Services Department is an Equal Opportunity Employer and invites the submission of bids from Disadvantaged Business Enterprises.

20. Forfeiture of Bid Bonds for Failure to Make DBE Submission: By submitting its Bid, Bidders is agreeing to following the (1) Bidder has made by Bid opening a good faith effort to meet the DBE requirements established for the Project; or Bidder will continue to make during the **48 hours** after Bid opening a good faith effort to meet the DBE requirements. Established for the Project: and a timely submitting its **00990.01** attachment form for the DBE Missouri requirements.

21. DBE Program Requirements City desires that Disadvantaged Business Enterprises (DBE) have a maximum opportunity to participate in the performance of City contracts. Program specifics are available in Section 00990 Clean Water State Revolving Funds Specification Requirements.

22. Workforce Program Requirements City desires that minorities and women have a maximum opportunity to practice their trades on city construction projects. The minimum company-wide goals are a ten percent (10%) minority workforce and two percent (2%) women workforce. The City's CREO KC Forms and CREO KC Instructions for Construction Projects are incorporated into these Bidding Documents and the Contract Documents.

Successful Bidder shall be required to use City's Internet web-based Workforce Program Reporting System provided by City and protocols included in that software during the term of this Contract. When requested by the City, Bidder shall submit user applications to City's provided Workforce Program Reporting System for all applicable personnel and shall require subcontractors to submit same.

23. Subcontractors, Suppliers and Others

a. If the Contract Documents require the identity of certain Subcontractors, Suppliers and other persons and organizations (including those who are to furnish the principal items of material and equipment) to be submitted to City, the apparent lowest, responsive and responsible Bidder, and any other Bidder so requested, shall submit to City a list of all such Subcontractors, Suppliers and other persons and organizations proposed for those portions of the Work for which such identification is required. An experience statement shall accompany such list with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier or organization if requested by City. If City has reasonable objection to any proposed Subcontractor, Supplier or other person or organization, City may request the apparent lowest, responsive and responsible Bidder to submit an acceptable substitute without an increase in Bid price.

b. By submitting its Bid, Bidder agrees that it has read and understands all the provisions of General Condition No. 6.07, Concerning Subcontractors, Suppliers and Others, and that it will comply with all those provisions including but not limited to mandatory mediation of disputes and the prohibition against paid-if-paid and paid-when-paid contract clauses. It is the City's expectation that all Subcontractors and Suppliers will be treated fairly and in good faith by the successful Bidders and that the successful Bidder will make all reasonable efforts to resolve contract disputes with a Subcontractor or Supplier in a prompt and fair manner. If the City is notified by a Subcontractor or Supplier of a contract claim with the successful Bidder, City will notify the successful Bidder and will request prompt resolution of the claim. City will provide any such Subcontractor or Supplier information regarding mandatory mediation as well as a copy of the Payment Bond. City may notify the Surety that City has taken cognizance of such claim.

c. In accordance with the Missouri Prompt Payment Act, City reserves the right to withhold payment(s) in good faith from the successful Bidder due to: i)the successful Bidder's failure to comply with any

material provision of the contract; ii)third party claims filed or reasonable evidence that a claim will be filed; iii)the successful Bidder's failure to make timely payments for labor, equipment or materials; or iv)for damage to a Subcontractor or Supplier.

d. By submitting its Bid, Bidder agrees it will not deny any Subcontractor subcontracting opportunities solely because the Subcontractor is not a signatory to collective bargaining agreements with organized labor.

e. The provisions of GC 6.07 are a material term of the Contract with the City and failure by the successful Bidder to comply with the provisions of this section will be taken into consideration by City in making the determination of lowest, responsive and responsible bidder in any subsequent City contracts.

24. Pre-Bid Conference The Water Services Department will hold a pre-Bid conference on January 9th, 2026, at 2:00 PM on Microsoft Teams and in-person at Kansas City Water Services Department. Contact the Project Manager prior to the meeting for the link to attend. Attendance at the pre-Bid conference is **mandatory** for all Bidders on this Project. For this Project, the City shall not contract with a Bidder who has not attended the entire pre-Bid conference for this Project.

25. On-Site Inspection The Project Site will be available for inspection by Bidders. Bidders visiting the Project Site shall be responsible for their own safety. The Project Site shall be available for inspection by appointment from 8 AM to 3 PM each day Monday through Friday (holidays excepted). Bidders may contact the following individual from the Water Services Department for an appointment.

Contact: Shawn Cross

Phone: (816) 503-0442

E-mail: shawn.cross@kcmo.org

26. Signatures Each copy of the Bid Form/Contract must be signed and properly dated by the following, as applicable:

Limited Liability Company:

□ a member of the limited liability Company authorized to sign on behalf of the company.

Partnership:

□ a partner authorized to sign on behalf of the partnership.

Sole Proprietor:

□ the proprietor.

Joint Venture:

□ the parties to the Joint Venture authorized to sign on behalf of each party to the Joint Venture, or a person authorized by each party to the Joint Venture to sign on behalf of all parties to the Joint Venture.

Corporation:

□ a corporate office authorized to sign on behalf of the corporation. Corporation's seal must be attached to the signature.

27. SRF Statement This project is being financed through the Missouri State Revolving Fund, by the Water and Wastewater Loan Revolving Fund and federal Capitalization Grants to Missouri.

28. Forward all questions in writing to the following Project Manager and Contract Administrator. Questions received less than three (3) days prior to the Bid Date may not be answered. Interpretations or clarifications considered necessary by the Project Manager in response to such questions will be issued by Addenda to all Bidders. Oral or other interpretations or clarifications shall be without legal effect, even if made at a Pre-Bid Meeting.

Shawn Cross, Project Manager
Water Services Department
4800 E. 63rd Street
Kansas City, Missouri 64130
Phone: (816) 513-0442
Fax: (816) 513-0343
E-mail: Shawn.Cross@kcmo.org

Marzella Newman-Buckner, Contract Administration
Water Services Department
4800 E. 63rd Street
Kansas City, Missouri 64130
(816) 513-0319
E-mail: Marzella.Newman-Buckner@kcmo.org

For persons with disabilities needing reasonable accommodations please contact Daniel O'Conner at 816-513-1824 or Cowan Byers at 816-513-1802. If you need to use the Relay Missouri Center call 1-800-RELAY-MO (1-800-735-2966).

Bidder: _____

BID FORM/CONTRACT

Project Number: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrades

1. Bidder, having examined the Bidding Documents, related documents and the Site of the Work, and being familiar with all the conditions affecting the construction of the proposed Work, including Laws and Regulations and the availability of materials and supplies, agrees, if this Bid is selected by CITY, this Bid Form/Contract will become the Contract between Bidder and CITY for Bidder to furnish all labor and materials, equipment and services necessary for the proper completion of the Work in accordance with the Contract Documents, including general construction work at the price(s) stated below, which stated sums include fees and all other charges applicable to materials, appliances, labor and all things subject to and upon which other charges may be levied.
2. Bidder agrees the Contract Documents will comprise the entire agreement between CITY and Bidder. The Contract Documents are identified in the General Conditions and are incorporated into and made part hereof this Bid Form/Contract by reference.
3. Bidder agrees that if this Bid Form/Contract is executed by CITY, Bidder's offer is accepted and this Bid Form/Contract that incorporates all other Contract Documents shall constitute the Contract between the parties. Bidder authorizes the CITY to fill in the Contract Price on this Bid Form/Contract in accordance with Bidder's Bid. Bidder agrees that this Bid Form/Contract may be executed in one or more counterparts, each of which will be deemed an original copy of this Bid Form/Contract and all of which, when taken together, will be deemed to constitute one and the same Bid Form/Contract. This Bid Form/Contract shall be effective upon the execution of counterparts by both parties, notwithstanding that both parties may not sign the same counterpart. The parties' signatures transmitted by facsimile or by other electronic means shall be proof of the execution of this Bid Form/Contract and shall be acceptable in a court of law. A copy of this Bid Form/Contract shall constitute an original and shall be acceptable in a court of law.
4. The Bid Price(s) shall be shown in numeric figures only.

TOTAL BASE BID IN NUMERIC FIGURES	$_____
ALLOWANCE NO. 1 – Unknown Site Conditions	$250,000.00
ALLOWANCE NO. 2 – Admin Building Furnishings	$500,000.00
ALLOWANCE NO. 3 – Evergy Power Buildout	$4,250,000.00
TOTAL BID IN NUMERIC FIGURES	$_____

5. The undersigned Bidder has given CITY'S Project Manager written notice of all conflicts, errors or discrepancies that it has discovered in the Contract Documents and the written resolution thereof by the Project Manager or by the DESIGN PROFESSIONAL is acceptable to Bidder.
6. The undersigned Bidder agrees that this Bid shall remain subject to selection by CITY, and may not be withdrawn for ninety (90) days after the day Bids are opened.
7. The undersigned Bidder certifies that this Bid contains no modifications, deviations, riders or qualifications.
8. Form(s) 00411 Itemized Prices, contain prices included in the Base Bid, and are incorporated into this Bid. Form(s) must be completed and returned with this Bid.

a. The itemized prices provided for in this Bid Form shall apply only in the event of a Change Order providing for such increase or decrease in the quantities.

b. The Contract Price will be subject to adjustment according to final measured, used, or delivered quantities, and the adjustment unit prices in the Bid will apply to such final quantities

9. The undersigned Bidder acknowledges receipt of the following addenda listed by number and date appearing on each addendum:

Addendum Number	Dated	Addendum Number	Dated
(_____)	(_____)	(_____)	(_____)
(_____)	(_____)	(_____)	(_____)
(_____)	(_____)	(_____)	(_____)
(_____)	(_____)	(_____)	(_____)
(_____)	(_____)	(_____)	(_____)
(_____)	(_____)	(_____)	(_____)
(_____)	(_____)	(_____)	(_____)

10. By submitting its bid, Bidder is agreeing to meet or exceed the minimum employment goals of 10% minority and 6.9% women during the term of its contract with the City, or request a waiver of the goals. If a waiver is requested, Bidder must establish good faith efforts towards meeting the goals as set forth in the CREO-KC Instructions for Construction Contracts and the City's Workforce Ordinance. Should Bidder fail to meet or exceed the minimum employment goals or otherwise establish that Bidder is entitled to a waiver under circumstances in which Bidder has previously failed to meet or exceed the goals on one or more occasions with the twenty-four month period immediately preceding the completion of the Work under this Bid Form/Contract, Bidder may be suspended from participating, either as a contractor or subcontractor, on any future contract with the City for a period ranging from thirty days to six months as further specified in the Contract Documents.

11. By submitting its bid, Bidder warrants that if its bid should exceed $300,000.00 and Bidder employs fifty (50) or more people, Bidder has an affirmative action program in place and will maintain the affirmative action program in place for the duration of its contract with the City. Bidder further warrants that it will comply with the affirmative action requirements contained in the General Conditions as incorporated by reference into this Bid Form/Contract.

12. Section 13 through Section 14 constitutes the Affidavit of Intended Utilization required to be submitted by Bidders.

13. By submitting its bid, Bidder is agreeing to the following: (1) Bidder has made by bid opening a good faith effort to meet the DBE goals established for the project; or Bidder will continue to make during the 48 hours after bid opening a good faith effort to meet the DBE goals established for the project; and (2) Bidder will timely submit its **Missouri State Revolving Fund Disadvantaged Business Enterprise Utilization Worksheet (found in Section 00990 Clean Water State Revolving Fund Requirements** for each DBE listed; and (3) Bidder will submit documentation of its good faith efforts to meet the DBE goals when requested by the City or State. Failure to meet these requirements in good faith will result in Bidder forfeiting its bid bond.

14. To the best of Bidder's knowledge, the following are names of certified DBEs with whom Bidder, or Bidder's subcontractors, presently intend to contract with if awarded the Contract on the above project:

A. Name of DBE Firm _____
Address _____
Telephone No. _____
I.R.S. No. _____
Area/Scope of work _____
Subcontract amount _____

B. Name of DBE Firm _____
Address _____
Telephone No. _____
I.R.S. No. _____
Area/Scope of work _____
Subcontract amount _____

C. Name of DBE Firm _____
Address _____
Telephone No. _____
I.R.S. No. _____
Area/Scope of work _____
Subcontract amount _____

D. Name of DBE Firm _____
Address _____
Telephone No. _____
I.R.S. No. _____
Area/Scope of work _____
Subcontract amount _____

E. Name of DBE Firm _____
Address _____
Telephone No. _____
I.R.S. No. _____
Area/Scope of work _____
Subcontract amount _____

F. Name of DBE Firm _____
Address _____
Telephone No. _____
I.R.S. No. _____
Area/Scope of work _____
Subcontract amount _____

(List additional DBEs, if any, on additional pages and attach to this form)

Business Entity Type:

(__) Missouri Corporation
(__) Foreign Corporation
(__) Fictitious Name Registration
(__) Sole Proprietor
(__) Limited Liability Company
(__) Partnership
(__) Joint Venture
(__) Other: (Specify)_____

BIDDER
Legal name & address of Bidder, person firm, partnership, corporation, or association submitting Bid:

_____
Phone No: _____
Cell No: _____
Facsimile No: _____
Bidder's E-Mail: _____

_____
Federal ID. No. _____

I hereby certify that I have authority to execute this document on behalf of Bidder, person, firm, partnership, corporation or association submitting Bid.

By: _____
(Signature)

_____
(Print Name)

Title:_____

Date:_____

(Attach corporate seal if applicable)

NOTARY

Subscribed and sworn to before me this _____ day of _____, 20__.

My Commission Expires: _____ _____

ACCEPTANCE OF BID

CITY, by executing this Bid Form/Contract, hereby accepts Bidder's Bid and this Bid Form/Contract that incorporates all other Contract Documents shall constitute the Contract between the Parties.

CITY shall pay CONTRACTOR for completion of the Work in accordance with the Contract Documents a maximum amount of _____ Dollars, ($ _____). The Contract Price includes:

00411 Itemized Prices, included in the Bid, a copy of which is attached

00413 Allowances, included in the Bid, a copy of which is attached

By executing this Bid Form/Contract, CITY accepts Bidder's offer for the Contract Price stated above and this Bid Form/Contract that incorporates all other Contract Documents shall constitute the Contract between the parties

_____

City of Kansas City, Missouri (OWNER or City)

Approved as to form:

_____

Assistant City Attorney

I hereby certify that there is a balance, otherwise unencumbered, to the credit of the appropriation to which the foregoing expenditure is to be charged, and a cash balance, otherwise unencumbered, in the treasury, to the credit of the fund from which payment is to be made, each sufficient to meet the obligation hereby incurred.

_____

Director of Finance (Date)

EXPERIENCE AND REFERENCE SUMMARY

Project/Contract Numbers: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrade

Firm's Legal Name	
Mailing Address	
Contact – Name & Email	
Contact – Phone & Fax	

NO.	PROJECT & LOCATION	OWNER NAME & ADDRESS CONTACT & PHONE NUMBER	PROJECT DURATION & DATE COMPLETED	$ VALUE
1.				
2.				
3.				
4.				
5.				
6.				
7.				

SECTION 00410.04 – EQUIPMENT QUESTIONNAIRE

The Bidder shall enter in the spaces provided the names of the manufacturers of equipment which Bidder proposes to furnish and shall submit this Equipment Questionnaire with its Bid. Owner will review and evaluate the information before award of the Contract.

Only one manufacturer's name shall be listed for each item of equipment. Upon award of a contract, the named equipment shall be furnished. Substitutions will be permitted only if named equipment does not meet the requirements of the Contract Documents, the manufacturer is unable to meet the delivery requirements of the construction schedule, or the manufacturer is dilatory in complying with the requirements of the Contract Documents. Substitutions shall be subject to concurrence of Owner and shall be confirmed by Change Order.

Preliminary acceptance of equipment listed by manufacturer's name shall not in any way constitute a waiver of the specifications covering such equipment; final acceptance will be based on full conformity with the Contract Documents.

Failure to furnish all information requested or entering more than one manufacturer's name for any item in this Equipment Questionnaire may be cause for rejection of the Bid.

	Equipment	Manufacturer
	Section 26 24 13 - SWITCHBOARDS	
	Section 26 24 14 - DOCKING STATION FOR PORTABLE GENERATOR	
	Section 26 24 16 - PANELBOARDS	
	Section 26 24 19 – Motor Control Centers	
	Section 26 29 23 – Variable-Frequency Motor Controllers	
	Section 26 33 53 – Static Uninterruptible Power Supply	
	Section 26 50 00 - Lighting	
	Section 31 66 13.13 – Rammed Aggregate Piles	
	Section 33 32 22 – Submersible Pumps	
	Section 35 20 16 – Slide Gates	
	Section 43 11 38 – Positive Displacement Blowers	
	Section 43 23 57 – Progressive Cavity Pumps	
	Section 43 23 58 – Rotary Lobe Pumps	

	Section 46 21 13 – Screening Equipment	
	Section 46 33 33 – Polymer Feed	
	Section 46 66 00 – Ultraviolet Light Disinfection Equipment	
	Section 46 71 33 – Rotary Drum Thickener	

End of Section

SECTION 00410.05 – INSTRUMENTATION AND CONTROL SYSTEM SUPPLIER QUESTIONNAIRE

The Bidder shall submit with its Bid a copy of this Instrumentation and Control System Supplier Questionnaire completed by Bidder's intended Instrumentation and Control System Supplier. Owner will review and evaluate the information before award of the Contract.

Upon award of a contract, the named Instrumentation and Control System Supplier shall be employed to perform the work and the named equipment shall be furnished, unless changes are specifically authorized by Owner. Substitutions will be permitted only if named equipment does not meet the requirements of the Contract Documents, the manufacturer is unable to meet the delivery requirements of the construction schedule, or the manufacturer is dilatory in complying with the requirements of the Contract Documents.

Preliminary acceptance of equipment listed by manufacturer's name shall not in any way constitute a waiver of the specifications covering such equipment; final acceptance will be based on full conformity with the Contract Documents.

Failure to furnish all information requested or entering more than one manufacturer's name for any item in this Instrumentation and Control System Supplier Questionnaire may be cause for rejection of the Bid.

1. Instrumentation and Control System Supplier _____

   Address _____

   Telephone Number _____

2. Number of Full-Time Design Personnel on Staff _____
3. Number of Full-Time Service Personnel on staff (not including personnel in line 2 above.) _____
4. Geographic Location of Service Personnel for this Project _____
5. Number of years Supplier has successfully Provided Similar Work _____

a. Reference- Project Owners Name _____

Address _____

_____

Contact Person's Name _____

Telephone Number _____

General Description of the project _____

b. Reference- Project Owners Name _____

Address _____

_____

Contact Person's Name _____

Telephone Number _____

General Description of the project _____

_____

c. Reference- Project Owners Name _____

Address _____

_____

Contact Person's Name _____

Telephone Number _____

General Description of the project _____

_____

6. Manufacturers of Principle Devices for use on this Project. (one manufacturer only for each item)

a. Section 40 70 00 Magnetic Flow Meters _____

b. Section 40 70 00 Thermal Mass Flow Meters _____

c. Section 40 70 00 Radar Level Transmitters _____

d. Section 40 70 00 Pressure Transmitters _____

e. Section 40 70 00 Dissolved Oxygen Analyzers _____

f. Section 40 70 00 pH, ORP, and Conductivity Equipment _____

g. Section 40 70 00 UVT Analyzers _____

End of Section

00410.06 Electrical (Sub-)Contractor(s) Readiness Questionnaire (Above 240 V)

Project/Contract Numbers: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrades

Firm: _____

The Bidder shall submit with its Bid a copy of this Electrical Contractor Readiness Questionnaire completed by each firm that will be doing electrical work on power systems above 240 Volts. Owner will review and evaluate the information before the award of the Contract.

Electrical Contractor Readiness:

1. **Does the electrical contractor have a documented electrical safety program updated with the most current version of NFPA 70 & 70e requirements? Yes or No, if no explain.**

2. **Does the electrical contractor have record of all direct hire employees who have reviewed and accepted to follow the electrical contractors documented electrical safety program? Yes or No, if no explain. Please provide a copy of the original acceptance with full names and dates.**

3. **Does the electrical contractor have current records to ensure all employees have been trained in NFPA 70e Standard for Electrical Safety in the Workplace requirements? Are the records current within the last three years? Yes or No, if no explain. Please provide a copy of the original records with full names and dates to also include the employee's classification, i.e. journeyman, apprentice or other.**

4. **Are all the electrical contractor's direct hire employees considered "Qualified Person(s)" per NFPA 70 & 70e? Yes or No, if no explain. Provide the on-site employee list to indicate who is considered Qualified and who is considered Non-qualified.**

5. **Does the electrical contractor have an energized work permit template that complies with NFPA 70e requirements? If so, will it be utilized to complete energized tasks for the project? Yes or No, if no explain.**

6. **Has the electrical contractor provided the necessary training, PPE, insulated tools, and testing equipment for the employees who will be required to work in potentially energized conditions? Yes or No, if no explain.**

7. **Is the electrical contractor and employees willing to participate in a risk hazard analysis with the owner and received concurrence prior to completing energized testing, switching or entry into energized or potentially energized electrical equipment? Yes or no, if no explain.**

8. **If subcontracting to another electrical contractor, please provide the documented control parameters that will be utilized to ensure all NFPA requirements are fully adhered to. Submit all the required documentation and appropriate responses to the above questions 1-7 for each subcontractor.**

References:
National Fire Protection Agency (NFPA) 70E Standard for Electrical Safety in the Workplace (latest edition)
NFPA 70 National Electrical Code

SECTION 00410.07 – GROUND IMPROVEMENT SUPPLIER QUESTIONNAIRE

The Bidder shall submit with its Bid a copy of this Ground Improvement Supplier Questionnaire completed by Bidder's intended Ground Improvement Supplier. Owner will review and evaluate the information before award of the Contract. Failure to furnish all information requested or entering more than one contractor's name in this Questionnaire may be cause for rejection of the Bid. The required information is in coordination with Section 31 66 12 of the technical specifications.

1. Professional Engineer responsible for design of ground improvement
    a. Name of Company or Individual _____
    b. Missouri PE Number _____
    c. Address _____
    d. Phone Number _____
    e. email _____
2. Ground Improvement Contractor
    a. Name _____
    b. Address _____
    c. Phone Number _____
    d. email _____

3. Provide experience qualifications as follows:
    a. Evidence that the Ground Improvement Contractor has experience in this type of ground improvement.
    b. A list of previously completed projects of similar scope and purpose for review by the Owner. The list shall include a description of the project, relative size, and contact person with current phone number.
    c. Resumes of the project manager, superintendent, engineer, and other related key personnel, for review by the Owner.

4. Provide a description of the type of ground improvement method proposed for this project.

End of Section

Bidder: _____

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

ITEMIZED PRICES

Project/Contract Numbers: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrade

Item No.	Unit	Item Description:	Unit Price
1	LS	Aerated Granular Sludge Biological Treatment System, including hardware, aeration system, instrumentation, controls, training, and startup	$11,487,685
2	LS	Grit Removal Equipment including concentrator, washer/classifier, dewatering unit, instrumentation, controls, freight, training, and startup	$972,559
3	CY	Imported site fill	5,500

Note: May be printed, for manual fill-in, or filled in on electronic excel spreadsheet version.

Bidder: _____

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

ALLOWANCE FORM

Project/Contract Numbers: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrade

Allowance No.:	Allowance Description:	Allowance in Figures:
1	Unforseen Site Conditions and Hazardous Materials Disposal	$250,000.00
2	Administration Building Furniture	$500,000.00
3	Evergy Power Distribution Buildout	$4,250,000.00

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

BID BOND

Project/Contract Numbers: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrade

Bond Number _____

KNOW ALL MEN BY THESE PRESENTS: That _____ of _____, as Principal, and _____ as Surety, hereby bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents unto KANSAS CITY, MISSOURI, a constitutionally chartered municipal corporation, as Obligee, in the sum of

_____Dollars ($_____), lawful money of the United States.

WHEREAS, Principal is herewith submitting its Bid to enter into a contract with Kansas City for the above referenced project,

NOW, THEREFORE the condition of this obligation is such that if the Principal is awarded the contract the Principal will, within the time required, enter into a contract and give a good and sufficient surety bonds to secure the performance of the terms and conditions of the contract and for the prompt payment of all labor and material furnished in the prosecution thereof as required by the contract documents, then this obligation shall be void; otherwise the Principal and Surety will immediately pay unto the Obligee the full amount of this bond as liquidated damages for failure to fulfill the conditions of this obligation, but in no event shall the Surety's liability exceed the penal sum hereof.

Signed, sealed and delivered this _____ day of _____. _____.

BIDDER AND PRINCIPAL

Name, address and facsimile number of Bidder and Principal

_____

_____

_____

_____

I hereby certify that I have authority to execute this document on behalf of Bidder and Principal.

By: _____

Title:_____

(Attach corporate seal if applicable)

SURETY

Name, address and facsimile number of Surety:

_____

_____

_____

_____

I hereby certify that (1) I have authority to execute this document on behalf of Surety; (2) Surety has an A.M. Best rating of A- or better; (3) Surety is named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (most current revision) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury; and (4) Surety is duly licensed to issue bonds in the State of Missouri and in the jurisdiction in which the Project is located.

By:_____

Title:_____

Date:_____

(Attach seal and Power of Attorney)

CREO KC INSTRUCTIONS

FOR CONSTRUCTION CONTRACTS

PART A. ECONOMIC EQUITY & INCLUSION GOALS--MBE/WBE PROGRAM

I. City's Economic Equity & Inclusion Goals--MBE/WBE Program.

A. The City has adopted an Economic Equity & Inclusion Goals--Minority/Women Business Enterprise ("MBE/WBE") Program (Sections 3-421 through 3-469, Code of Ordinances) (the "Program") to implement the City's policy of supporting the fullest possible participation in City contracts and change orders of firms owned and controlled by minorities and women. Each construction contract may have an MBE and/or WBE goal for participation. An MBE or WBE goal is a numerical objective the City has set for the contract that may be awarded pursuant to these bid specifications. Goals are stated as a percentage of contract dollars. For example, if an MBE goal for a contract is 10% and a Bidder submits a bid of $100,000, the goal for MBE participation would equal $10,000. The specific MBE/WBE goals on this contract are set forth elsewhere in the bid specifications.

B. These Civil Rights & Equal Opportunity Department ("CREO KC") Forms & Instructions are part of the BIDDING DOCUMENTS and CONTRACT DOCUMENTS as defined in the General Conditions. By submitting a Bid, the Bidder agrees, as a material term of the contract, to carry out the City's MBE/WBE Program by making good faith efforts to include certified MBE/WBEs in the contract work to the extent of the goals listed for the contract and to the fullest extent consistent with submitting the lowest and best bid to the City. Bidder agrees that the Program is incorporated into this document and agrees to follow the Program. Although it is not a requirement that a Bidder in fact meet or exceed both the MBE and WBE Goals, it is a requirement for approval of the Bid that a Bidder objectively demonstrate to the City that good faith efforts have been made to meet the Goals. Bidders must attempt to meet both the MBE and WBE goals and request a waiver if either is not met.

C. The following CREO KC Forms are attached and must be used for MBE/WBE submittals:

1. Contractor Utilization Plan/Request for Waiver (CREO KC Form 8); and
2. Letter of Intent to Subcontract (CREO KC Form 00450.01); and
3. Timetable for MBE/WBE Utilization (CREO KC Form 10); and
4. Request for Modification or Substitution (CREO KC Form 11); and
5. Contractor Affidavit for Final Payment (Form 01290.14); and
6. Subcontractor Affidavit for Final Payment (Form 01290.15).

Warning: The City only gives MBE/WBE credit for a Bidder's use of City certified MBE/WBEs. A certified MBE/WBE firm is a firm that has been certified by the City's Civil Rights & Equal Opportunity Department as such. An MBE/WBE firm must be certified before the date on which the contractor utilization plan is due. Certified MBEs and WBEs are listed in the M/W/DBE Kansas City Mo. Online Directory, which is available on the City's website at www.kcmo.org. Before a Bidder submits a bid, Bidder

should contact CREO KC and consult the directory to make sure any firm proposed for use for MBE/WBE participation has been certified.

II. Required Submissions Following Bid Opening.

A. Bidder must submit the following documents within forty-eight (48) hours of bid opening:

1. **Contractor Utilization Plan/Request for Waiver (CREO KC Form 8).** This form states a Bidder's plan to use specific certified MBE/WBEs in the performance of the contract and includes the following:

   a. The work to be performed by each MBE/WBE and the amounts each is to be paid for the work; and

   b. The name, address, race or ethnic origin, gender and employer identification number or social security number of each MBE/WBE that will perform the work.

   c. An automatic request for waiver in the event Bidder has not met or exceeded the MBE and/or WBE goals for the contract but believes that it has made good faith efforts to meet or exceed the goals and desires a waiver of the goals. If a waiver is requested, CREO KC will examine the Bidder's documentation of good faith efforts and make a recommendation to grant or deny the waiver. CREO KC will recommend a waiver be granted only if the Bidder has made good faith efforts to obtain MBE/WBE participation.

2. **Letter(s) of Intent to Subcontract (CREO KC Form 00450.01)**. A letter must be provided from each MBE/WBE listed on the Contractor Utilization Plan. These letters verify that the MBE/WBE has agreed to execute a formal agreement for the work and indicate the scope of work to be performed and the price agreed upon for the work.

III. Required Submission when Requested by City.

A. Bidder must submit the following documents when requested by City:

1. **Timetable for MBE/WBE Utilization (CREO KC Form 10).**

2. **Documentation of good faith efforts.**

IV. Required Monthly Submissions during term of Contract.

A. Bidder must submit the following report on a monthly basis if awarded the contract:

1. **M/WBE Monthly Utilization Report.** This report must be submitted to the Director by the 15th of each month. Failure to submit timely reports may result in delays in processing of current and future contract approvals and payment applications. The method of submission of this report is through the B2GNow Diversity Management System (B2GNow).

V. Required Submittals for Final Contract Payment.

A. Contractor must submit the following documents with its request for final payment under

the contract:

1. **Contractor Affidavit for Final Payment (Form 01290.14)**
2. **Subcontractor Affidavit(s) for Final Payment (Form 01290.15)**
3. **Final B2GNow Monthly Contract Audit Report with all payment audits confirmed.**

VI. Additional Submittals.

A. Contractor may be required to make additional submittals during the term of the Contract, including **Request for Modification or Substitution (CREO KC Form 11)**. Refer to Section IX, Modification of the Contractor Utilization Plan or Substitution of an MBE/WBE, for additional instructions on when this form must be submitted.

VII. MBE/WBE Participation Credit.

A. The following shall be credited towards achieving the goals:

1. The total contract dollar amount that a prime contractor has paid or is obligated to pay to a subcontractor that is a certified MBE or WBE, except as otherwise expressly provided for herein.
2. The total contract dollar amount that a prime contractor that is a certified MBE or WBE performed itself.
3. Sixty percent (60%) of the total dollar amount paid or to be paid by a prime contractor to obtain supplies or goods from a supplier who is a certified MBE or WBE.
4. Ten percent (10%) of the total dollar amount paid or to be paid by a prime contractor to obtain supplies or goods from a supply broker who is a certified MBE or WBE.
5. One hundred percent (100%) of the total dollar amount paid or to be paid by a prime contractor to a manufacturer of construction supplies who is a certified MBE or WBE.
6. Subcontractor participation with a lower tier MBE/WBE subcontractor using one of the above methods of participation.

B. **NO CREDIT**, however, will be given for the following:

1. Participation in a contract by a MBE or WBE that does not perform a commercially useful function as defined by the Program; and
2. Any portion of the value of the contract that an MBE or WBE subcontractor subcontracts back to the prime contractor or any other contractor who is not a qualified MBE/WBE; and
3. Materials and supplies used on the contract unless the MBE/WBE is responsible for negotiating the price, determining quality and quantity, ordering the materials and installing (where applicable) and paying for material itself; and
4. Work performed by an MBE or WBE in a scope of work other than that in which the MBE or WBE is currently certified.

VIII. Methods for Securing Participation of MBE/WBEs and Good Faith Efforts.

A. A bidder is required to make good faith efforts to achieve the MBE/WBE goals. Good faith efforts are efforts that, given all relevant circumstances, a Bidder actively and aggressively seeking to meet the goals can reasonably be expected to make. Good faith efforts must be made before the Bidder submits a Contractor Utilization Plan, in other words, within 48 hours of bid opening. However, efforts made to increase participation of MBEs and WBEs following submission of the CUP can be considered as evidence of good faith efforts to meet the goals.

B. In evaluating good faith efforts, the Director of CREO KC will consider whether the Bidder has performed the following, along with any other relevant factors:

1. Advertised for at least 15 calendar days prior to the bid or proposal due date opportunities to participate in the contract in general circulation media, trade and professional association publications, small and minority business media, and publications of minority and women's business organizations which are included in a list along with their current contact information identified on the directory as the list of publications available to publish such advertisements, which list shall be updated by CREO KC no less than every three (3) month.

2. Sent written notices at least fifteen (15) calendar days prior to the bid or proposal due date containing the information required in section (9) below, by certified mail, e-mail, or facsimile, to at least 80% of MBEs and WBEs which are included in a list along with their contact information identified on the directory as the list of organizations available to receive such notices, which list shall be updated by CREO KC no less than every three (3) months.

3. Sent written notices, containing the information required by section (9) below, by certified mail, e-mail or facsimile, to at least 80% of MBEs and WBEs listed on the directory certified in the applicable scopes of work for the particular bid soliciting their participation in the contract at least 15 calendar days prior to the bid or proposal due date.

4. Attempted to identify portions of the work for qualified MBE and/or WBE participation in order to increase the likelihood of meeting the goals, including breaking down contracts into economically feasible units that take into consideration the capacity of available MBE/WBEs appearing on the CREO KC directory.

5. At any time prior to submission of the CUP or submittal of a request for modification of a CUP, requested assistance in achieving the goals from the Director and acted on the Director's recommendations.

6. Conferred with certified MBEs and WBEs which inquired about or responded to the bid solicitation and explained to such MBEs and WBEs the scope and requirements of the work for which their bids or proposals were solicited, and if not all certified MBEs and WBEs in the particular scopes listed on the directory have inquired about or responded to the bid solicitation for each scope of work, then contact by certified mail, e-mail or telephone the greater of ten (10) or 80% of additional certified MBEs and WBEs in the particular scopes of work listed on the directory and offer to confer with such MBEs and WBEs for such particular scope of work and request such MBEs

and WBEs to submit a proposal.

7. Attempted to negotiate in good faith with certified MBEs and WBEs which responded to the bid solicitation or those certified MBEs and WBEs that were conferred with as contemplated in section (6) above, and other qualified MBEs and WBEs, at the option of the bidder, proposer, or contractor, as applicable, to perform specific subcontracts, not rejecting them as unqualified without sound reasons based on a thorough investigation of their capabilities by the bidder, proposer, or contractor; in the event an MBE or WBE is the low bid, but rejected as unqualified, the bidder, proposer, or contractor and the director or board, as applicable, shall provide sound reasons for rejecting such MBE or WBE.
8. Attended pre-bid meeting when such meetings were indicated in the solicitation of bids or otherwise by the bidder, proposer, or contractor, as applicable or by the director provided the director provides written direction to the bidder, proposer, or contractor at the time the goals are recommended.
9. Written notices and advertisements to be provided pursuant to sections (1), (2) and (3) above shall include the following information:
    a. The bid due date;
    b. The name of the project;
    c. The address or general location of the project;
    d. The location of plans and specifications for viewing;
    e. Contact information of the prime contractor;
    f. A general description of the scopes of work that are the subject of the solicitation;
    g. The goals established for the applicable contract, and if the goals are still subject to board approval, then a statement that the goals as stated are preliminary and are subject to board approval;
    h. If the project or any portion of the project is subject to prevailing wage then a statement that all or a portion of the project will be subject to prevailing wage, as applicable; and if only a portion of the scopes are subject to prevailing wage, then identification of such scopes provided that such scopes are known as of the time of bid solicitation;
    i. The date and time of any pre-bid meeting(s), if any, which have been scheduled by the bidder, proposer, contractor or developer as of the bid solicitation; and

    Any other information deemed relevant by the bidder, proposer, contractor or developer, as applicable, or the director to the extent the director provides written direction to the bidder, proposer, contractor or developer of such additional information at the time the goals are recommended by the director. 8. Within five (5) working days after drawing the bid specifications, sent certified letters, verifiable e-mails or proof of facsimiles to certified MBEs and WBEs listed in the M/W/DBE Kansas City Mo. Online Directory.

C. A Bidder may be required to give the City documentation to prove that it made good faith efforts. The Bidder will be contacted by the City with further instructions about when this documentation must be submitted.

IX. Modification of the Contractor Utilization Plan or Substitution of an MBE/WBE.

A. After bid opening, a Bidder or Contractor may need to substitute an MBE and/or WBE or request that the amount of MBE/WBE participation listed in its Contractor Utilization Plan be modified. Bidder or Contractor must file a **Request for Modification or Substitution (CREO KC Form 11) prior to actual substitution and within a reasonable time after learning that a modification or substitution is necessary.** The Director may approve substitutions or modifications and upon approval, the modifications and substitutions will become an amendment to the Contractor Utilization Plan. Modifications or substitutions may be approved when:

1. The Director finds that the Bidder or Contractor made and provided evidence of good faith efforts to substitute the MBE/WBE listed on the Contractor Utilization Plan with other certified MBE/WBEs for the scope of work or any other scope of work in the contract; and
2. The Bidder or Contractor has not attempted intentionally to evade the requirements of the program and it is in the best interests of the City to allow a modification or substitution; and
3. The Director also finds one of the following:
    a. The listed MBE/WBE is non-responsive or cannot perform; or
    b. The listed MBE/WBE has increased its previously quoted price to the bidder, proposer or contractor without a corresponding change in the scope of the work; or
    c. The listed MBE/WBE has committed a material default or breach of its contract with the contractor; or
    d. Requirements of the scope of work of the contract have changed and render subcontracting not feasible or not feasible at the levels required by the goals established for the contract; or
    e. The listed MBE/WBE is unacceptable to the contracting department; or
    f. The listed MBE/WBE thereafter had its certification revoked; or

B. A modification shall not be made unless the modification or substitution has first been requested and approved by the Director. Once a modification has been made, a Construction Contractor Employee Identification Report (CREO KC Form 0485.04) for the newly approved subcontractor must be submitted at least ten (10) days prior to the approved subcontractor commencing work on a City contract.

X. Appeals.

A. In conformance with the Act, appeals may be made to the City Fairness in Construction Board or Fairness in Professional Services and Goods Board on the following:

1. The grant or denial of a Request for Waiver;
2. Substitution for an MBE/WBE listed on a Contractor Utilization Plan;
3. Modification of the percentage of MBE/WBE participation on a Contractor Utilization Plan;
4. Liquidated Damages;
5. The amount of MBE/WBE credit the Contractor may receive for MBE/WBE participation identified in the contractor utilization plan.

B. Any appeal must be filed in writing with the Director within fifteen (15) calendar days of notice of the determination. Mailing, faxing, personal delivery or posting at CREO KC of determinations shall constitute notice. The appeal shall state with specificity why the Bidder or Contractor believes the determination is incorrect

C. Failure to file a timely appeal shall constitute a waiver of a Bidder's or Contractor's right to appeal such determination and such person shall be estopped to deny the validity of any determination which could have been timely appealed.

XI. Access to Documents and Records.

A. By submitting a Bid, each Bidder agrees to permit the City, its duly authorized agents or employees, access at all reasonable times to all books and business records of Bidder as may be necessary to ascertain compliance with the requirements of this document and the Act, within ten (10) calendar days of the date of the written request.

B. All Bidders agree to cooperate with the contracting department and CREO KC in studies and surveys regarding the MBE/WBE program.

XII. Miscellaneous.

A. A Bidder or Contractor shall bear the burden of proof with regard to all issues on appeal.

B. In the event of any conflict between this document and the Program, the provisions of the Program shall control. The terms used in this document are defined in the Program.

C. Oral representations are not binding on the City.

D. The City Council may waive the requirements of this document and the Program and award the contract to the lowest and best bidder if the City Council determines a waiver is in the best interests of the City.

E. The Director may grant extensions of time to Bidders to submit Letters of Intent to Subcontract (CREO KC Form 00450.01).

XIII. Liquidated Damages – Economic Equity & Inclusion Goals--MBE/WBE Program.

A. If Contractor fails to achieve the MBE/WBE goals stated in its Contractor Utilization Plan, as amended, the City will sustain damages, the exact extent of which would be difficult or impossible to ascertain. Therefore, in order to liquidate those damages, the monetary difference between either (1) the amount of the MBE/WBE goals set forth in the Contractor Utilization Plan, as amended, or (2) the goals established (whichever is lower) and the amount actually paid to qualified MBEs and WBEs for performing a commercially useful function will be deducted from the Contractor's payments as

liquidated damages. In determining the amount actually paid to qualified MBEs and WBEs, no credit will be given for the portion of participation that was not approved by the Director, unless the Director determines that the Contractor acted in good faith. No deduction for liquidated damages will be made when, for reasons beyond the control of the Contractor, the MBE/WBE participation stated in the Contractor Utilization Plan, as amended and approved by the Director is not met.

PART B. CONSTRUCTION EMPLOYMENT PROGRAM REQUIREMENTS

IMPORTANT: This Part B is applicable to City construction contracts estimated by the City prior to solicitation as: (1) requiring more than 800 construction labor hours and (2) valued in excess of $300,000.00. This program is distinguished from the M/WBE Program in that it is based on workforce hours of the Bidder and *all* its participating subcontractors rather than the actual contract value of work. The instructions herein detail the specifics related to this program. This program is in *addition* to the M/WBE program.

I. City's Construction Employment Program.

A. The City has adopted a Construction Employment Program (Sections 3-501 through 3-525, Code of Ordinances) (the "Workforce Program" or "Program") to implement the City's policy of supporting the fullest possible utilization of minority and women workers in the construction industry.

B. The minimum workforce goals are currently set by ordinance at 10% for minorities and 2% for women. These goals are separate from M/WBE goals. Public recognition may be provided if the bidder achieves at least twice the minimum participation.

C. Construction contracts subject to the Workforce Program and the company-wide and project-specific workforce goals ("workforce goals") are those contracts to construct, reconstruct, improve, enlarge or alter any fixed work that is estimated by the City prior to solicitation to: (1) require more than 800 construction labor hours, (2) has estimated costs that exceed $300,000.00, and (3) involve the expenditure of public funds.

D. The successful bidder may meet company-wide goals by counting the bidder's utilization of minorities and women throughout the Kansas City metropolitan statistical area. In addition, the successful Bidder is responsible to ensure that it and its subcontractors cumulatively make good faith efforts to meet project-specific goals for utilization of minorities and women.

E. These Civil Rights & Equal Opportunity Department ("CREO KC") Forms & Instructions are part of the BIDDING DOCUMENTS and CONTRACT DOCUMENTS as defined in the General Conditions. By submitting a Bid, the Bidder agrees, as a material term of the contract, to carry out the City's Construction Employment Program by making good faith efforts to utilize minority and women workers to the fullest extent consistent with submitting the lowest and best bid to the City. Bidder agrees that the Program is incorporated into this document and agrees to follow the Program. Although it is not a requirement that a Bidder in fact meet or exceed the construction employment goals to receive approval from CREO KC, a Bidder not doing so is required to

objectively demonstrate to CREO KC that good faith efforts have been made.

F. The following reports are to be used for Construction Employment Program submittals:

1. Project Workforce Monthly Report
2. Company-Wide Workforce Monthly Report

II. Required Submissions.

A. Within forty-eight (48) hours after bid opening, the construction contractor shall submit the **Construction Employee Identification Report** (CREO KC Form 00485.04) and shall include: the name, home address, job title, sex and race/ethnicity of each person working for the Prime. The individuals to be listed on the form are those which the construction contractor *anticipates* will be performing construction labor hours creditable towards the minimum workforce goals applicable to the construction contractor individually.

The following circumstances also require the submission of a Construction Employee Identification Report:

a. Prior to contract execution for those City construction contracts awarded pursuant to a request for proposals (RFP), the construction contractor shall submit a **Construction Employee Identification Report** (CREO KC Form 00485.04).

b. At least ten (10) days prior to the date upon which any subcontractor is to commence work under a City construction contract, the Prime shall submit a **Construction Employee Identification Report** (CREO KC Form 00485.04) for the subcontractor.

B. The CREO KC Director has established the B2GNow Diversity Management System ("B2GNOW") (an online reporting tool) as the preferred method for fulfilling reporting requirements of the Workforce Program. The CREO KC Director will allow paper submission in lieu of on-line submission if the on-line submission process presents a hardship to the contractor.

C. Bidder must submit the following documents through B2GNow on a monthly basis if awarded the contract:

1. **Project Workforce Monthly Report.** This report is contract specific. This report must be submitted to the Director by the 15th of each month for the Contractor and each subcontractor. It will be utilized to report the Contractor's own workforce compliance data with regard to the City's construction contract. Failure to submit timely reports may result in delays in processing of current and future contract approvals and payment applications.

2. **Company-Wide Workforce Monthly Report.** This report is not contract specific; it is used to report on the utilization of women and minorities, by trade, company-wide. This report must be submitted to the Director by the 15th of each month. It will be utilized to report the Contractor's own workforce compliance data with regard to

every contract (both privately and publicly funded) that the Contractor has in progress throughout the Kansas City Metropolitan Statistical Area. Failure to submit timely reports may result in delays in processing of current and future contract approvals and payment applications.

III. Submittal Required for Final Contract Payment.

A. The final Project Workforce Monthly Report(s) and Company-Wide Workforce Monthly Report must be submitted before final payment will be made and/or retainage released. Contractor shall note the submittal of the final reports by notation in the box entitled "Final Report"

IV. Methods for Securing Workforce Participation and Good Faith Efforts.

A. A bidder is required to make good faith efforts to achieve the construction employment goals and ensure its subcontractors are making good faith efforts to achieve the construction employment goals. If a Bidder or its subcontractors will be unable to secure enough minority and female participation to meet or exceed the construction employment goals, a bidder must, within a reasonable time after so learning, request a waiver or modification of the goals by the Director of CREO KC. The Director will request evidence of the Bidder's and its' subcontractors' good faith efforts to meet the goals. The Director will examine the Bidder's request and the Bidder's documentation of good faith efforts for itself and its subcontractors. The Director will examine the Bidder's request and the Bidder's documentation of good faith efforts and grant or deny a waiver or modification. The Director will grant a waiver or modification only if the Bidder has made good faith efforts to secure minority and female participation.

IMPORTANT: The Bidder's subcontractors on a city construction contract must meet the workforce goals collectively. The bidder is responsible to ensure the subcontractors make good faith efforts to meet the workforce goals. Bidders are required to include language in its subcontracts that ensure the subcontractors make good faith efforts to meet or exceed the workforce goals.

B. In evaluating good faith efforts, the Director will consider whether the Bidder and its subcontractors have performed the following:

1. For those bidders that are not signatories to a collective bargaining agreement with organized labor:

    a. Requested in writing the assistance of the Director with respect to efforts to promote the utilization of minorities and women in the workforce and acted upon the Director's recommendations; and

    b. Advertised in minority or women trade association newsletters and/or minority or women owned media at least 15 calendar days prior to the utilization of any construction services on the city construction contract and used terminology that sufficiently describes the work available, the pay scale, the application process, and anything else that one might reasonably be expected to be informed of relevant to the position being advertised; and

    c. Maintained copies of each advertisement and a log identifying the publication and date of publication; and

d. Conducted real and substantial recruitment efforts, both oral and written, targeting resident, minority and women community-based organization, schools with a significant minority student population, and training organizations serving the recruitment area; and

e. Established and maintained a current list of resident, minority and women recruitment sources, providing written notification to the recruitment sources of available employment opportunities, and maintained records of the notices submitted to the organizations and any responses thereto; and

f. Maintained a current file for the time period of the city construction contract with the name, address, and telephone number of each resident, minority and woman job applicant, the source of the referral, whether or not the person was hired, and in the event that the applicant was not hired, the reason therefore; and

g. Promoted the retention of minorities and women in its workforce with the goals of achieving sufficient annual hours for minorities and women to qualify for applicable benefits; and

h. Required by written contract that all subcontractors comply with the above efforts.

2. For those bidders that are signatories to collective bargaining agreements with organized labor:

a. Requested in writing from each labor union representing crafts to be employed that:

i. the labor union make efforts to promote the utilization of residents of the City, minorities and women in the workforce; and

ii. the labor union identify any residents of the City, minorities and women in its membership eligible for employment; and

b. Collaborated with labor unions in promoting mentoring programs for journeypersons intended to assist minorities and women in increasing retention with the goals of achieving sufficient annual hours to qualify for applicable benefits; and

c. Maintained a current file with the name, address, and telephone number of each resident, minority and women worker identified by the labor union, whether or not the person was hired, and in the event the person was not hired, the reason therefore.

d. To the extent the good-faith efforts applicable to bidders that are signatories to collective bargaining agreements with organized labor conflict with the procedures implemented by the bidder in order to comply with the relevant bargaining agreement, the bidder shall substitute other procedures as may be approved by the Director in writing, in order to accomplish the purpose and intent of this section.

C. In the event workforce goals are not met or there is anticipation that goals will not be

met, a Bidder will be required to give the City documentation to prove that it and/or it's subcontractors made good faith efforts. The Bidder will be contacted by the City with further instructions about when this documentation must be submitted.

V. Access to Documents and Records.

A. By submitting a Bid, each Bidder agrees to permit the City, its duly authorized agents or employees, access at all reasonable times to all books and business records of Bidder as may be necessary to ascertain compliance with the requirements of this document and the Program, within ten (10) days of the date of the written request. Each bidder further agrees to require, if awarded the contract, that every subcontractor permit the City the same access to documents and records.

B. All Bidders agree to cooperate with the contracting department and CREO KC in studies and surveys regarding the construction employment program.

VI. Appeals.

A. In conformance with the Program, appeals may be made to the Construction Workforce Board on the following:

1. Determinations by the Director that a contractor did not meet the construction employment goals and did not make a good faith effort to meet the goals;
2. Recommendations by the Director to assess liquidated damages;
3. Recommendation by the Director that a contractor be declared ineligible to receive any city construction contract for a period of time up to one year.

B. Any appeal must be filed in writing with the Director within ten (10) working days of notice of the recommendation or determination. The appeal shall state with specificity why the Bidder or Contractor believes the recommendation or determination is incorrect.

C. Failure to file a timely appeal shall constitute a waiver of a Bidder's or Contractor's right to appeal such determination or recommendation and such person shall be estopped to deny the validity of any order, determination, recommendation or action of CREO KC which could have been timely appealed.

VII. Miscellaneous.

A. A Bidder or Contractor shall bear the burden of proof with regard to all issues on appeal.

B. The successful bidder may be required to meet with the Director of CREO KC or the Director's designee for the purpose of discussing the construction employment program, the bidder's efforts to realize the goals, and any other problems and/or issues affecting the realization of the goals or the program in general.

C. In the event of any conflict between this document and the Program, the provisions of the Program shall control. The terms used in this document are defined in the Program.

D. Oral representations are not binding on the City.

VIII. Failure to Meet Workforce Goals

A. If Contractor or its subcontractors fail to achieve the construction employment goals or make good faith efforts to achieve those goals without having previously obtained a

waiver or modification of those goals, the City will sustain damages, the exact extent of which would be difficult or impossible to ascertain. These damages are magnified if the failure to abide by the requirements of the Workforce Program is recurring. Therefore, if the directory finds that the contractor or subcontractor have not met, or made good faith efforts to meet, the construction employment goals for any quarter, the director may:

1. Assess liquidated damages against the construction contractor, as specified in the city construction contract;
2. Require the contractor to attend mandatory training, as specified in the construction contract;
3. Declare the contractor ineligible to receive any city construction contract or participate as a subcontractor under any city construction contract for a period of time up to six months, as specified in the construction contract.

IX. First Source Program

A. The City has established a labor force recruiting program intended to assist contractors in identifying, interviewing and hiring qualified job applicants residing in Kansas City, Missouri. While the contractor awarded a City construction contract is not prohibited from hiring persons residing outside Kansas City, Missouri, the recruiting resource provided for herein (the "First Source Program") must be utilized by the contractor subject to the construction employment goals as set forth in this **PART B, CONSTRUCTION EMPLOYMENT PROGRAM REQUIREMENTS**.

B. The City utilizes the services of the Full Employment Council, Inc., to administer the First Source Program. The contractor shall contact the Full Employment Council within 48 hours of contract award, regardless of whether the contractor has any hiring needs at that time, and within 48 hours following any job vacancy which the contractor reasonably anticipates filling during the term of the City construction contract. The contractor shall comply with the First Source Program requirements as implemented by the Full Employment Council unless otherwise excused in writing by the Director of CREO KC for good cause shown. To ensure compliance with the First Source Program, the contractor shall contact those persons at the Full Employment Council responsible for administering the program, which may be identified by visiting their website at www.feckc.org and clicking on the link for KCMO First Source Hiring Program. The contractor shall not hire any individual to provide construction services on a City construction contract unless the contractor has met the requirements of the First Source Program.

C. The contractor shall require that its subcontractors utilize the First Source Program to the same extent that the contractor is required to do so, and shall incorporate the requirements of this Section IX into every subcontract. Every subcontractor shall be required to contact the Full Employment Council within 48 hours of subcontract award, regardless of whether the subcontractor has any hiring needs at that time, and within 48 hours following any job vacancy which the subcontractor reasonably anticipates filling during the term of their subcontract on a City construction project.

CREO KC MONTHLY REPORTING INSTRUCTIONS

M/WBE Monthly Utilization Report Instructions

1. MBE/WBE Reporting applies to Contracts that have approved MBE/WBE goals assigned.
2. The City will utilize a web-based MBE/WBE Reporting System in the administration of this Contract. This web-based application database is a collaboration tool selected and provided by the City, which will allow Contractors and Consultants/Subcontractors and Subconsultants to enter data and report on compliance.

Prevailing Wage Certified Payroll Report Instructions

1. Prevailing Wage Certified Payroll Report applies to Contracts that include Prevailing Wage or Davis Bacon Provisions.
2. This web-based application database is provided by the City for reporting certified payrolls and other related prevailing wage data.
3. Computer Requirements: Minimum Intel Pentium® 4 Processor 2.4 GHz or equivalent processor with 512MB of RAM; recommended Centrino Duo® Processors 1.6 GHz or equivalent with 2GB of RAM, or higher.
    a. Computer Operation System: Windows XP, Windows Vista, or Windows 7
    b. Web Browser: Google Chrome
    c. Connection Speed/Minimum Bandwidth: DSL, ADSL or T1 Line for transferring a minimum of 3 Mbps Downstream and 512 Kbps Upstream
4. City will assist Contractor in providing training of personnel and Subcontractor's personnel.
5. Contractor and Subcontractors shall have the responsibility for visiting the web site and entering data in on timely basis, and as necessary to be in compliance with Prevailing Wage Requirements included in their contracts.

Workforce Monthly Report Instructions

1. Workforce Monthly Reporting only applies to Construction Contracts greater than $300,000 and greater than 800 projected labor hours.
2. The City will utilize a web-based Reporting System in the administration of this Contract. This web-based application database is a collaboration tool selected and provided by the City, which will allow Contractors and Subcontractors to enter data and report on Workforce compliance.

CITY OF KANSAS CITY, MISSOURI
Human Relations Department
M/WBE MONTHLY UTILIZATION REPORT

Report Date:	**Project Name:**		**City Project Number:**					
Project Address:			**Contract Award Date:**				**City Vendor ID:**	
General Contractor (GC):			**City Contract Number:**				**City Department Name**	
Contact Person/Phone:			**General Contract Amount:** $		**Total Amount Paid By City To Date:** $			
General Contractor Address:			**Contract Goals:**		_____% DBE _____% MBE _____% WBE			
Email Address:			**Total Contract Days:**				**Completion Date:**	
MBE/DBE Subcontractor	**Date of Certification**	**Date of Subcontract**	**Subcontract Amount**	**% of Total Contract**	**Estimated Start date**	**Amount Paid This Period**	**Amount Paid To Date**	**% of Contract Paid to Date**
WBE/DBE Subcontractor								
Totals								

Contractor should submit report by the 15th of each month.

Phillip Yelder, Director
Human Relations Department
414 E. 12th Street, 4th Floor
Kansas City, MO 64106
Phone: 816-513-1836
FAX: 816-513-1805

Narrative:

Report Submitted By: _____ **Date** _____

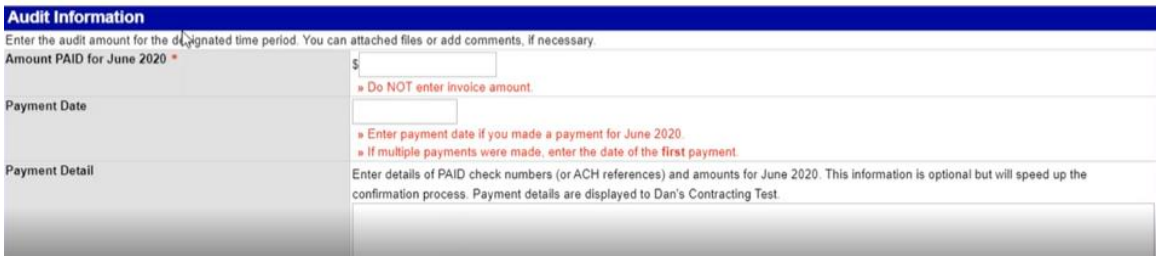
REMINDER: CONTRACTOR is responsible for meeting or exceeding the the D/M/WBE participation amounts in its Contractor Utilization Plan (CUP) as amended by any previously approved Request for Modification/Substitution. Any Change Orders or amendements modifying the amount CONTRACTOR is to be compensated will have correspondingly impacted the amount of compensation due D/M/WBEs for purposes of meeting or exceeding the Bidder/Proposer participation. CONTRACTOR is again advised to consider the effect of any Change Order or amendment, and to submit a Request for Modification/Substitution if appropriate.

M/WBE Monthly Compliance Audit Online Reporting Instructions

PRIME INSTRUCTIONS:

The Prime's responsibility is to report payments made to subcontractors for the prior month.

1. Log into B2GNow Diversity Management System (B2GNow)
2. On the Dashboard, click Contract Audits.
3. Select the specific audit that needs to be completed. Any and all money that changed hands during the month of the audit must be reported to the specific audit month.
4. To complete audit select Report 1 Subcontractor Payment. Under the actions column, select Submit Response for the specific subcontractor that needs reporting or select the Submit ALL Incomplete Records button to go to all the subcontractors to report amounts. Under the audit information answer the following questions:

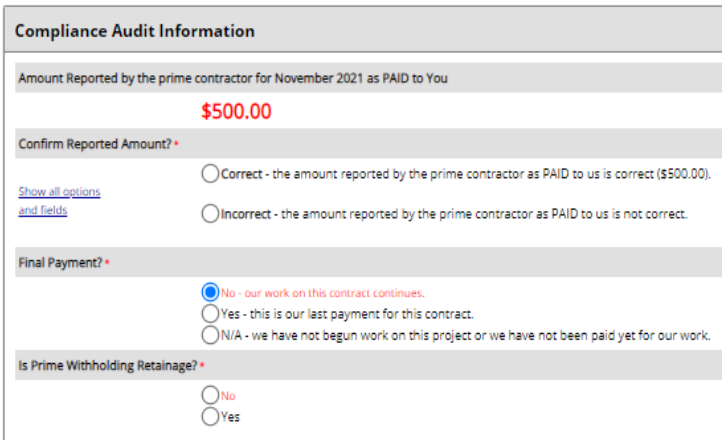


Once information has been entered, select review and save. Complete same steps for all subcontractors. If there were subcontractors that did not receive a payment for the specific audit month, click the Mark Remaining Subcontractors as Zero button to mark remaining subcontractors as 0.

SUBCONTRACTOR INSTRUCTIONS:

The responsibility of the Subcontractor is to confirm payment received for specific audit month.

1. Log in to B2GNow Diversity Management System (B2GNow)
2. On the Dashboard, select Contract Audits.
3. Select the specific audit that needs to be completed.
4. To complete audit, select Confirm Payment Received. There will be two options: correct or incorrect. Select correct if payment was in fact received OR if payment was not received or amount was different select incorrect. Answer all questions and select save to complete.



NOTE: Complete one M/WBE report per project.

An email notice will be sent from our organization monthly to notify Prime & Subcontractor users of incomplete audits.

Project-Specific Workforce Monthly Report

Human Relations Department - City of Kansas City Missouri

Report Date:		Reporting Period:		Project Description:	
Project Name:		Contractor:		Contract Awarded Date:	
City Project Number:		Contractor Address:		City Contract Number:	
Project Address:				City Vendor ID:	
		Contact Person/Phone:		Contractor Report ☐	Subcontractor Report ☐
E-mail Address:				Final Cumulative Report:	☐ Yes ☐ No

Report the total monthly hours of work performed by all workers on the City Construction Contract. Enter the total hours on all lines and in all columns. Reported workforce hours should be based on payroll records.

JOB CATEGORIES	OVERALL TOTAL (Sum of all Columns, A thru F Male & Female)	A Total Hours White Employees		B Total Hours Black Employees		C Total Hours Hispanic Employees		D Total Hours Asian/Pacific Islander		E Total Hours Native American Employee		F Total Hours Other/Unknown Race Employee		G KCMO Resident Hours
		M	F	M	F	M	F	M	F	M	F	M	F	Total #
Foreman/Supervisor														
Asbestos Worker Journeyman														
Asbestos Worker Apprentice														
Boilermaker Journeyman														
Boilermaker Apprentice														
Bricklayer Journeyman														
Bricklayer Apprentice														
Carpenter Journeyman														
Carpenter Apprentice														
Cement Mason Journeyman														
Cement Mason Apprentice														
Electrician Journeyman														
Electrician Apprentice														
Elevator Constructor Journeyman														
Elevator Constructor Apprentice														
Glazier Journeyman														
Glazier Apprentice														
Iron Worker Journeyman														
Iron Worker Apprentice														
Laborer Journeyman														
Laborer Apprentice														
Operating Engineer Journeyman														
Operating Engineer Apprentice														
Painter Journeyman														
Painter Apprentice														
Pipe Fitter/Plumber Journeyman														
Pipe Fitter/Plumber Apprentice														
Plasterer Journeyman														
Plasterer Apprentice														
Roofer Journeyman														
Roofer Apprentice														
Sheet Metal Journeyman														
Sheet Metal Apprentice														
Sprinkler Fitter														
Sprinkler Fitter Apprentice														
Truck Driver Journeyman														
Truck Driver Apprentice														
Welder Journeyman														
Welder Apprentice														
Other														
Monthly Total Hours														-
Total % of Monthly Hrs.														

Contractor shall submit report by the 15th of each month.

Phillip Yelder, Director Human Relations Department
414 E. 12th Street, 4th Floor Kansas City, MO 64106
Phone: 816-513-1836 Email HRDcontractcompliance@kcmo.org

Report Submitted By: _____

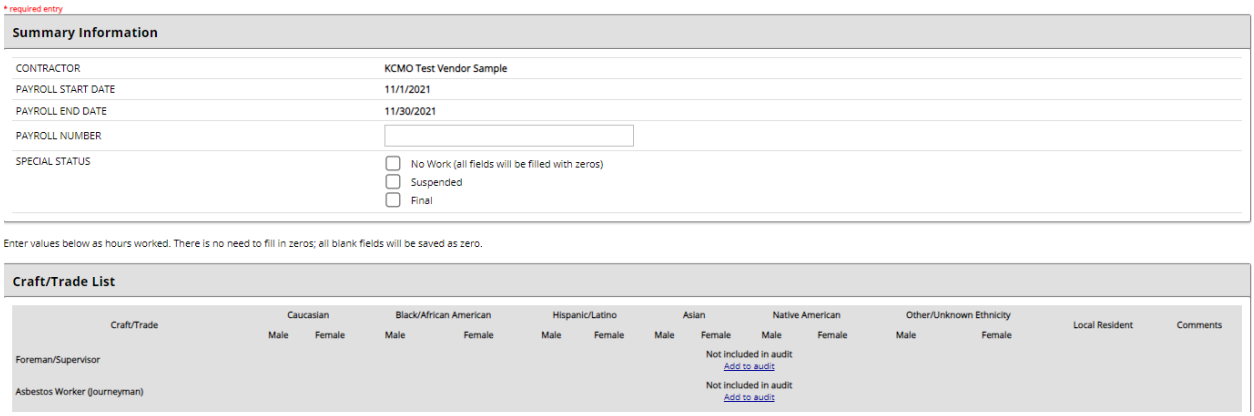
Date: _____

Workforce Monthly Report Forms only apply to Construction Contracts greater than $300,000.00 with greater than 800 projected labor hours.

Workforce Monthly Report Instructions

(Instructions for online reporting)

Completing a Workforce Audit:
To report your workforce hours:
1. Log into B2GNow Diversity Management System (B2GNow)
2. Click on the red underlined number of 'Incomplete audits' under Workforce Audits
3. Click View for the incomplete audit that needs to be completed.
4. Click Fill in Audit
5. Complete the form including the Payroll Number. Select Add to Audit to report hours worked for specific Craft/Trade.


* required entry

Summary Information

CONTRACTOR	KCMO Test Vendor Sample
PAYROLL START DATE	11/1/2021
PAYROLL END DATE	11/30/2021
PAYROLL NUMBER	
SPECIAL STATUS	☐ No Work (all fields will be filled with zeros) ☐ Suspended ☐ Final

Enter values below as hours worked. There is no need to fill in zeros; all blank fields will be saved as zero.

Craft/Trade List

Craft/Trade	Caucasian		Black/African American		Hispanic/Latino		Asian		Native American		Other/Unknown Ethnicity		Local Resident	Comments
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female		
Foreman/Supervisor								Not included in audit Add to audit						
Asbestos Worker (Journeyman)								Not included in audit Add to audit						

6. Scroll down and select review once hours have been reported.
7. Save and Certify to submit OR Save but Certify Later (to save a draft of your audit response). Audit must be certified for the workforce audit to be submitted for review. If there is an audit where no work was performed, and have 0 hours to report, select the Mark as No Work Audit button on step 4 to report 0 hours for all your employees. Select Certify & Release to Organization to complete. Mark Final for Special Status if the audit being completed is the last month of work, this will notify the system to stop generating monthly audits.

NOTE: If subcontractor has completed Workforce Audit, Prime MUST either accept audit and release to the organization or reject audit back to Subcontractor for correction.

An email notice will be sent from our organization monthly to notify Prime & Subcontractor users of incomplete audits.

Company-Wide Workforce Monthly Report

Human Relations Department - City of Kansas City, Missouri

Report Date:		Reporting Period:		Contract Awarded Date:	
Contractor:				City Vendor ID:	
Contact Person/Phone:		Contractor Address:		Contractor Report ☐	Subcontractor Report ☐
E-mail Address:		Have you hired any new construction workers this month?	☐ Yes ☐ No #:	Final Cumulative Report:	☐ Yes ☐ No

Report total of all hours of work performed company-wide on all projects in the KCMO Metropolitan Statistical Area (MSA). Enter the total hours on all lines and in all columns. Workforce hours should be based on payroll records.

JOB CATEGORIES	OVERALL TOTAL (Sum of all Columns, A thru F Male & Female)	A Total Hours White Employees		B Total Hours Black Employees		C Total Hours Hispanic Employees		D Total Hours Asian/Pacific Islander		E Total Hours Native American Employee		F Total Hours Other/Unknown Race Employee		G KCMO Resident Hours
		M	F	M	F	M	F	M	F	M	F	M	F	Total #
Foreman/Supervisor														
Asbestos Worker Journeyman														
Asbestos Worker Apprentice														
Boilermaker Journeyman														
Boilermaker Apprentice														
Bricklayer Journeyman														
Bricklayer Apprentice														
Carpenter Journeyman														
Carpenter Apprentice														
Cement Mason Journeyman														
Cement Mason Apprentice														
Electrician Journeyman														
Electrician Apprentice														
Elevator Constructor Journeyman														
Elevator Constructor Apprentice														
Glazier Journeyman														
Glazier Apprentice														
Iron Worker Journeyman														
Iron Worker Apprentice														
Laborer Journeyman														
Laborer Apprentice														
Operating Engineer Journeyman														
Operating Engineer Apprentice														
Painter Journeyman														
Painter Apprentice														
Pipe Fitter/Plumber Journeyman														
Pipe Fitter/Plumber Apprentice														
Plasterer Journeyman														
Plasterer Apprentice														
Roofer Journeyman														
Roofer Apprentice														
Sheet Metal Journeyman														
Sheet Metal Apprentice														
Sprinkler Fitter														
Sprinkler Fitter Apprentice														
Truck Driver Journeyman														
Truck Driver Apprentice														
Welder Journeyman														
Welder Apprentice														
Other														
Total Monthly Hours														-
Total % of Hours														

Contractor shall submit report by the 15th of each month.

Phillip Yelder, Director Human Relations Department
414 E. 12th Street, 4th Floor, Kansas City, MO 64106
Phone: 816-513-1836 Email HRDcontractcompliance@kcmo.org

Report Submitted By: _____

Date: _____

City of Kansas City, Missouri
Civil Rights & Equal Opportunity Department
Construction Contractor Employee Identification Report

Company Name: _____ **Prime's Name:** _____

Company Address: _____ **KCMO Project Name:** _____

Company City, State, Zip: _____ **KCMO Project Number:** _____

Name of Person Completing Report: _____ **Today's Date:** _____

Phone Number: _____

Email: _____ **City Department:** _____

Instructions:

1) Each applicable Prime Contractors **must complete this form for its company within 48 hours of bid opening**
2) The Civil Rights & Equal Opportunity Department strongly recommends usage of the electronic version of this form. This form may be obtained by visiting www.kcmo.gov website. The website is enabled with a "search" function on the Home page on the right corner. Select the magnifying glass and type in the search field "Contract Central". Select the first result, then click on the link to Standard City Contract Forms. Scroll down to Construction Contractor Employee Identification Report and click the link to open this document. Complete the fields in the Employee section; the Official Use Only section will automatically populate. NOTE: This form can be printed and attached to other required Bid documents.
3) All subcontractors shall be required to complete this form and submit to the Prime Contractor. For each subcontractor, the Prime must submit this form to City at least at least (10) days prior to the date the subcontractor shall commence work under a city construction contract.
4) Complete this form if you are the Prime contractor on a City construction project estimated over **$300,000 & over 800 man hours.**
5) Complete this form with data from your **current construction workforce** (no office personnel).
6) Prime contractor is responsible to ensure subcontractor completes this form as required in #3 above.

Official Use Only

Females		*KCMO Resident*
African American	*0*	*0*
Asian/Pacific Islander American	*0*	*0*
Caucasian American	*0*	*0*
Hispanic/Latino American	*0*	*0*
Native American	*0*	*0*
Other	*0*	*0*
	0	*0*

Males		*KCMO Resident*
African American	######	*0*
Asian/Pacific Islander American	######	*0*
Caucasian American	######	*0*
Hispanic/Latino American	######	*0*
Native American	######	*0*
Other	######	*0*
	######	*0*

Number of KCMO Residents	*0*
Number of Journeyman	*0*
Number of Apprentice	*0*

	Journeyman	*Apprentice*
Foreman/Supervisor	*0*	*--*
Asbestos Worker	*0*	*0*
Boilermaker	*0*	*0*
Bricklayer	*0*	*0*
Carpenter	*0*	*0*
Cement Mason	*0*	*0*
Electrician	*0*	*0*
Elevator Constructor	*0*	*0*
Glazier	*0*	*0*
Iron Worker	*0*	*0*
Laborer	*0*	*0*
	0	0

	Journeyman	*Apprentice*
Operating Engineer	*0*	*0*
Painter	*0*	*0*
Pipe Fitter/Plumber	*0*	*0*
Plasterer	*0*	*0*
Roofer	*0*	*0*
Sheet Metal	*0*	*0*
Sprinkler Fitter	*0*	*0*
Truck Driver	*0*	*0*
Welder	*0*	*0*
Other	*0*	*--*
	0	*0*

Company Name: 0 KCMO Project Name: 0 KCMO Project Number: 0

	Name		Job Title (*use drop down menu*)	Address	City	State	Zip Code	KCMO Resident	Gender	Ethnicity
	Last	First								
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										

Company Name: 0 KCMO Project Name: 0 KCMO Project Number: 0

	Name		Job Title (*use drop down menu*)	Address	City	State	Zip Code	KCMO Resident	Gender	Ethnicity
	Last	First								
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
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43										
44										
45										
46										
47										
48										
49										

AFFIRMATIVE ACTION PROGRAM AFFIDAVIT

(required for any contractor with 50 or more employees and
a contract with the City of Kansas City, Missouri, in excess of $300,000.00)

STATE OF _____)
) ss
COUNTY OF _____)

On this _____ day of _____, 20___, before me appeared _____, personally known by me or otherwise proven to be the person whose name is subscribed on this affidavit and who, being duly sworn, stated as follows:

I am of sound mind, capable of making this affidavit, and personally swear or affirm that the statements made herein are truthful to the best of my knowledge. I am the _____ (title) of _____ (business entity) and I am duly authorized, directed or empowered to act with full authority on behalf of the business entity in making this affidavit.

I hereby swear or affirm that [*enter business entity name*] has an affirmative action program (the "Program") in place and will maintain the Program for the duration of its contract with the City of Kansas City, Missouri ("City") as required by Chapter 3 of the City's Code of Ordinances.

I hereby additionally swear or affirm that attached hereto is a true copy of the Program.

I hereby additionally swear or affirm that the business entity shall not discriminate against any employee or applicant for employment because of race, color, sex, religion, national origin or ancestry, disability, sexual orientation, gender identity or age in a manner prohibited by Chapter 3 of the City's Code of Ordinances.

I acknowledge that I am signing this affidavit as the free act and deed of the business entity and that I am not doing so under duress.

_____
Affiant's signature

Subscribed and sworn to before me this _____ day of _____, 20____.

_____
Notary Public

My Commission expires:

AFFIDAVIT OF TRAINING PROGRAM

This form must be submitted with 48 hours of Bid Opening

Bidder _____

Project Title and Number _____

STATE OF MISSOURI)
) ss:
COUNTY OF _____)

After being duly sworn the person whose name and signature appears below hereby states under penalty of perjury that:

1. I am the duly authorized officer of the business indicated above ("Bidder") and I make this affidavit on behalf of Bidder.
2. Bidder certifies that it presently participates in a training program that facilitates entry into the construction industry and which may include an on-the-job or in-house training program, further described as follows:

(attach additional pages, if necessary)

3. If requested by the City, Bidder agrees to provide City further documentation of, or other information about, this training program within 48 hours of the request.
4. Bidder acknowledges that failure to submit this form to the City within 48 hours of the Bid Opening will automatically render its bid non-responsive.

I am authorized to make this Affidavit on behalf of the Bidder named below as:

_____ of _____
(Title) (Name of Bidder)

Dated: _____ By: _____
(Affiant)

Subscribed and sworn to before me this _____ day of _____, 20____.

My Commission Expires: _____ _____
Notary Public

Civil Rights and Equal Opportunity Department
Civil Rights and Wage Assurances

Non-discrimination in Employment. Contractor shall not discriminate against any employee or candidate for employment on the basis of an individual's race, hair texture or hair style associated with an individual's race, color, sex, religion, national origin, or ancestry, disability, sexual orientation, gender identity, age, or in any other manner prohibited by Chapter 38 of the City Code. Contractor shall not engage in any discrimination as prohibited by Chapter 3 of the City Code.

Ban the Box in Hiring and Promotion.

(a) Pursuant to Section 38-104, City Code Ordinances, Contractor shall not base a hiring or promotional decision on an applicant's criminal history or sentence related thereto, unless the employer can demonstrate that the employment-related decision was based on all information available including consideration of the frequency, recentness and severity of a criminal record and that the record was reasonably related to the duties and responsibilities of the position.

(b) Notwithstanding subsection (a), Contractor may inquire about an applicant's criminal history after it has been determined that the individual is otherwise qualified for the position, and only after the applicant has been interviewed for the position. Any such inquiry may be made of all applicants who are within the final selection pool of candidates from which a job will be filled.

(c) This provision shall not apply to positions where employers are required to exclude applicants with certain criminal convictions from employment due to local, state or federal law or regulation.

Title VI of the Civil Rights Act of 1964. Title VI of the Civil Rights Act of 1964 requires that no person in the United States shall, on the grounds of race, color, or national or origin (including limited English proficient individuals), be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance. The City of Kansas City, Missouri requires compliance with the requirements of Title VI in all of its programs and activities regardless of the funding source.
Contractor shall not discriminate on the grounds of race, color, or national or origin (including limited English proficient individuals).

Quality Services Assurance Act. If this Contract exceeds $160,000.00, Contractor certifies Contractor will pay all employees who will work on this Contract in the city limits of Kansas City, Missouri at least $15.00 per hour in compliance with the City's Quality Services Assurance Act,

Section 3-66, Code of Ordinances or City has granted Contractor an exemption pursuant to the Quality Services Assurance Act.

Anti-Discrimination Against Israel. If this Contract exceeds $100,000.00 and Contractor employs at least ten employees, pursuant to Section 34.600, RSMo., by executing this Contract, Contractor certifies it is not currently engaged in and shall not, for the duration of this contract, engage in a boycott of goods or services from the State of Israel; companies doing business in or with Israel or authorized by, licensed by, or organized under the laws of the State of Israel; or persons or entities doing business in the State of Israel.

Affirmative Action. If this Contract exceeds $300,000.00 and Contractor employs fifty (50) or more people, Contractor shall comply with City's Affirmative Action requirements in accordance with the provisions of Chapter 38 of City's Code, the rules and regulations relating to those sections, and any additions or amendments thereto; in executing any Contract subject to said provisions, Contractor warrants that it has an affirmative action program in place and will maintain the affirmative action program in place for the duration of the Contract. Contractor shall not discriminate against any employee or applicant for employment because of race, color, sex, religion, national origin or ancestry, disability, sexual orientation, gender identity or age in a manner prohibited by Chapter 38 of City's Code. Contractor shall:

(a) Execute and submit the City of Kansas City, Missouri CREO Affirmative Action Program Affidavit warranting that the Contractor has an affirmative action program in place and will maintain the affirmative action program in place for the duration of the Contract.

(b) Submit, in print or electronic format, a copy of Contractor's current certificate of compliance to the City's Civil Rights and Equal Opportunity Department (CREO) prior to receiving the first payment under the Contract, unless a copy has already been submitted to CREO at any point within the previous two (2) calendar years. If, and only if, Contractor does not possess a current certification of compliance, Contractor shall submit, in print or electronic format, a copy of its affirmative action program to CREO prior to receiving the first payment under the Contract, unless a copy has already been submitted to CREO at any point within the previous two (2) calendar years.

(c) Require any Subcontractor awarded a subcontract exceeding $300,000.00 to affirm that Subcontractor has an affirmative action program in place and will maintain the affirmative action program in place for the duration of the subcontract.

(d) Obtain from any Subcontractor awarded a subcontract exceeding $300,000.00 a copy of the Subcontractor's current certificate of compliance and tender a copy of the same, in print or electronic format, to CREO within thirty (30) days from the date the subcontract is executed. If, and only if, Subcontractor does not possess a current certificate of compliance, Contractor shall obtain a copy of the Subcontractor's affirmative action program and tender a copy of the same, in print or electronic format, to CREO within thirty (30) days from the date the subcontract is executed.

City has the right to take action as directed by City's Civil Rights and Equal Opportunity Department to enforce this provision. If Contractor fails, refuses or neglects to comply with the provisions of Chapter 38 of City's Code, then such failure shall be deemed a total breach of this Contract and this Contract may be terminated, cancelled or suspended, in whole or in part, and Contractor may be declared ineligible for any further contracts funded by City for a period of one (1) year. This is a material term of this Contract.

Compliance with Laws. Contractor shall comply with all federal, state and local laws, ordinances and regulations applicable to the work and this Agreement. Contractor shall maintain in effect all the licenses, permissions, authorizations, consents and permits that it needs to carry out its obligations under this Agreement.

Prevailing Wage. If the Agreement exceeds $75,000.00 and any of the Services performed by Contractor includes construction, reconstruction, improvement, enlargement, alteration, painting and decorating, or major repair, that is subject to the Missouri Prevailing Wage Law (Section 290.210, RSMo – 290.340, RSMo), Contractor shall immediately notify the City prior to performing Services so the parties can execute an agreement that incorporates, the appropriate Wage Order. Contractor shall comply with all requirements of Section 290.210, RSMo – 290.340, RSMo even if Contractor fails to notify
the City.

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

Pre Contract Bidder's Certification

Project/Contract Numbers: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrade

STATE OF)
) SS
COUNTY OF)

Before me, the undersigned authority, personally appeared, who, being by me duly sworn deposed as follows:

I am authorized to make this affidavit on behalf of the named Bidder. I am of sound mind, capable of making this affidavit, and personally acquainted with the facts herein stated:

A. Bidder is current on payment of its Federal and State Income tax withholding and unemployment insurance payments, either in Missouri for companies doing business in Missouri, or in the state in which Bidder has its principal office; and

B. Bidder declares one of the following, regarding all work performed two (2) years immediately preceding the date of the Bid (check one):

☐ Contract by contract listing of all of Bidder's written notices of violations of any Federal or State prevailing wage statute in which prevailing wage penalties were assessed against the Bidder or paid by the Bidder (Complete and attach additional sheets if necessary):

1. _____
2. _____
3. _____

☐ There have been no written notices of violations of any Federal or State prevailing wage statute in which prevailing wage penalties were assessed against the Bidder or paid by the Bidder.

C. Bidder is currently in good standing with the Missouri Secretary of State or Bidder has filed a Registration of Fictitious Name with the Missouri Secretary of State.

_____
(Bidder's Name) (Date)

Signature of Person Making This Affidavit

In witness whereof, I have hereunto subscribed my name and affixed my official seal this ___day of , 20__.

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

CONTRACT REQUIRED SUBMISSIONS

Project/Contract Number: 81000927/1698

Project/Contract Title: Todd Creek WWTP Expansion & Major Upgrade

These instructions are to assist Contractor in providing all necessary documents to enter into a contract with the City.

MISSOURI SECRETARY OF STATE BUSINESS ENTITY REGISTRATION

- ☐ For a corporation, current Certificate of Good Standing from the Missouri Secretary of State ((816) 889-2925 or (816) 889-2926 or a web site print-out, dated no more than ninety (90) days before the date furnished to the City – One Copy.
- ☐ For a business that is not a corporation and not doing business in the exact name of the proprietor, a copy from the Secretary of State, ((816) 889-2925 or (816) 889-2926 of the filed Registration of Fictitious Name dated no more than ninety (90) days before the date furnished to the City – One Copy.

EMPLOYEE ELIGIBILITY VERIFICATION AFFIDAVIT

- ☐ 00515.01 Employee Eligibility Verification Affidavit – One Executed Affidavit
- ☐ First and last pages of the E-Verify Program Memorandum of Understanding that your company has received from the U.S. Department of Homeland Security verifying enrollment in the program. For assistance, contact E-Verify Operations at 888-464-4218 – One Copy.

SUBCONTRACTORS LISTING

- ☐ 01290.09 Subcontractors & Major Material Suppliers List – One Copy

PAYMENT BONDS (If applicable)

- ☐ Each copy of the Payment bond must be signed and properly dated by the following, as applicable:

  Corporation - A corporate officer authorized to sign on behalf of the corporation and the signature must be attested by a witness to the signature; OR

  Limited Liability Company - A member of the limited liability company authorized to sign on behalf of the company and a witness to the signature must attest the signature; OR

  Partnership - A partner authorized to sign on behalf of the partnership and the signature must be attested by a witness to the signature; OR

  Sole Proprietor - By the proprietor and the signature must be attested by a witness to the signature; OR

  Joint Venture - The parties to the Joint Venture authorized to sign on behalf of each party to the Joint Venture, or a person authorized by each party to the Joint Venture to sign on behalf of all parties to the Joint Venture; AND

  Surety - A person authorized by the Surety to sign on behalf of the Surety. A power of attorney issued by the Surety Company authorizing its representative to sign the Agreement must be attached to the Agreement and each copy.

PERFORMANCE AND MAINTENANCE BOND (If applicable)

- ☐ As applicable, each copy of the Performance and Maintenance bond must be signed and properly dated by:

  Corporation - A corporate officer authorized to sign on behalf of the corporation and the signature must be attested by a witness to the signature; OR

  Limited Liability Company - A member of the limited liability company authorized to sign on behalf of the company and a witness to the signature must attest the signature; OR

  Partnership - A partner authorized to sign on behalf of the partnership and the signature must be attested by a witness to the signature; OR

  Sole Proprietor - By the proprietor and the signature must be attested by a witness to the signature; OR

  Joint Venture - The parties to the Joint Venture authorized to sign on behalf of each party to the Joint Venture, or a person authorized by each party to the Joint Venture to sign on behalf of all parties to the Joint Venture; AND

  Surety - A person authorized by the Surety to sign on behalf of the Surety. A power of attorney issued by the Surety Company authorizing its representative to sign the Agreement must be attached to the Agreement and each copy.

CERTIFICATES OF INSURANCE Sample form provided - If you have any questions regarding requirements for insurance certificates, please contact the City's Risk Management Office, 816 513-1299.

- ☐ Provide a certificate of insurance for all insurance that may be required in the contract such as:

  Commercial General Liability
  Workers' Compensation and Employers' Liability
  Commercial Automobile Liability
  Railroad Protective Liability
  Environmental Liability
  Asbestos Liability
  Longshoremen's Insurance
  Property Insurance

- ☐ List the NAIC Number (National Association of Insurance Commissioners) or A.M. Best Number for each Insurer listed on the Certificate of Insurance.

- ☐ Certificate "Kansas City, Missouri" must named as an Additional Insured.

- ☐ Check the insurance requirements of the Contract. If Contract Documents require that other entities be included as additional insureds, each entity shall be listed on the certificate(s).

- ☐ Description of Operations must include Project/Contract Number and Project/Contract Title/Description as contained in the Contract Documents. The Certificate Holder and address block shall be completed as follows:

  Kansas City, Missouri
  Water Services Department
  Marzella Newman-Buckner
  4800 E 63rd St
  Kansas City, Missouri 64130

- ☐ If your insurance agent prepares an ACORD form, the automobile insurance must be "any auto" or better for acceptance by the City.

AFFIRMATIVE ACTION REQUIREMENTS

- ☐ Proposed Affirmative Action Program or a copy of a Certificate of Affirmative Action Compliance – One copy.

PRE-CONTRACT BIDDER'S CERTIFICATION (Prevailing Wage Contracts; Form provided)

- ☐ Submit form 00490 - Bidder's Pre-Contract Certification (provided).

HEALTH AND SAFETY PLAN (If applicable)

- ☐ Bidder's Health and Safety Plan – One copy.

EMPLOYEE ELIGIBILITY VERIFICATION AFFIDAVIT

(Required for any contract with the City of Kansas City, Missouri in excess of $5,000.00)

STATE OF _____)
) ss
COUNTY OF _____)

On this _____ day of _____, 20___, before me appeared _____, personally known by me or otherwise proven to be the person whose name is subscribed on this affidavit and who, being duly sworn, stated as follows:

I am of sound mind, capable of making this affidavit, and personally swear or affirm that the statements made herein are truthful to the best of my knowledge. I am the _____ (title) of _____ (business entity) and I am duly authorized, directed or empowered to act with full authority on behalf of the business entity in making this affidavit.

I hereby swear or affirm that the business entity does not knowingly employ any person in connection with the contracted services who does not have the legal right or authorization under federal law to work in the United States as defined in 8 U.S.C. § 1324a(h)(3).

I hereby additionally swear or affirm that the business entity is enrolled in an electronic verification of work program operated by the United States Department of Homeland Security (E-Verify) or an equivalent federal work authorization program operated by the United States Department of Homeland Security to verify information of newly hired employees, under the Immigration Reform and Control Act of 1986, and that the business entity will participate in said program with respect to any person hired by the business entity to perform any work in connection with the contracted services. I have attached hereto documentation sufficient to establish the business entity's enrollment and participation in the required electronic verification of work program.

I am aware and recognize that unless certain contractual requirements are satisfied and affidavits obtained as provided in Section 285.530, RSMo, the business entity may face liability for violations committed by its subcontractors, notwithstanding the fact that the business entity may itself be compliant.

I acknowledge that I am signing this affidavit as the free act and deed of the business entity and that I am not doing so under duress.

_____
Affiant's signature

Subscribed and sworn to before me this _____ day of _____, 20____.

_____
Notary Public

My Commission expires:

Company ID Number:

THE E-VERIFY
MEMORANDUM OF UNDERSTANDING
FOR EMPLOYERS

ARTICLE I
PURPOSE AND AUTHORITY

The parties to this agreement are the Department of Homeland Security (DHS) and the _____ (Employer). The purpose of this agreement is to set forth terms and conditions which the Employer will follow while participating in E-Verify.

E-Verify is a program that electronically confirms an employee's eligibility to work in the United States after completion of Form I-9, Employment Eligibility Verification (Form I-9). This Memorandum of Understanding (MOU) explains certain features of the E-Verify program and describes specific responsibilities of the Employer, the Social Security Administration (SSA), and DHS.

Authority for the E-Verify program is found in Title IV, Subtitle A, of the Illegal Immigration Reform and Immigrant Responsibility Act of 1996 (IIRIRA), Pub. L. 104-208, 110 Stat. 3009, as amended (8 U.S.C. § 1324a note). The Federal Acquisition Regulation (FAR) Subpart 22.18, "Employment Eligibility Verification" and Executive Order 12989, as amended, provide authority for Federal contractors and subcontractors (Federal contractor) to use E-Verify to verify the employment eligibility of certain employees working on Federal contracts.

ARTICLE II
RESPONSIBILITIES

A. RESPONSIBILITIES OF THE EMPLOYER

1. The Employer agrees to display the following notices supplied by DHS in a prominent place that is clearly visible to prospective employees and all employees who are to be verified through the system:

   a. Notice of E-Verify Participation

   b. Notice of Right to Work

2. The Employer agrees to provide to the SSA and DHS the names, titles, addresses, and telephone numbers of the Employer representatives to be contacted about E-Verify. The Employer also agrees to keep such information current by providing updated information to SSA and DHS whenever the representatives' contact information changes.

3. The Employer agrees to grant E-Verify access only to current employees who need E-Verify access. Employers must promptly terminate an employee's E-Verify access if the employer is separated from the company or no longer needs access to E-Verify.

4. The Employer agrees to become familiar with and comply with the most recent version of the E-Verify User Manual.

5. The Employer agrees that any Employer Representative who will create E-Verify cases will complete the E-Verify Tutorial before that individual creates any cases.

a. The Employer agrees that all Employer representatives will take the refresher tutorials when prompted by E-Verify in order to continue using E-Verify. Failure to complete a refresher tutorial will prevent the Employer Representative from continued use of E-Verify.

6. The Employer agrees to comply with current Form I-9 procedures, with two exceptions:

a. If an employee presents a "List B" identity document, the Employer agrees to only accept "List B" documents that contain a photo. (List B documents identified in 8 C.F.R. § 274a.2(b)(1)(B)) can be presented during the Form I-9 process to establish identity.) If an employee objects to the photo requirement for religious reasons, the Employer should contact E-Verify at 888-464-4218.

b. If an employee presents a DHS Form I-551 (Permanent Resident Card), Form I-766 (Employment Authorization Document), or U.S. Passport or Passport Card to complete Form I-9, the Employer agrees to make a photocopy of the document and to retain the photocopy with the employee's Form I-9. The Employer will use the photocopy to verify the photo and to assist DHS with its review of photo mismatches that employees contest. DHS may in the future designate other documents that activate the photo screening tool.

Note: Subject only to the exceptions noted previously in this paragraph, employees still retain the right to present any List A, or List B and List C, document(s) to complete the Form I-9.

7. The Employer agrees to record the case verification number on the employee's Form I-9 or to print the screen containing the case verification number and attach it to the employee's Form I-9.

8. The Employer agrees that, although it participates in E-Verify, the Employer has a responsibility to complete, retain, and make available for inspection Forms I-9 that relate to its employees, or from other requirements of applicable regulations or laws, including the obligation to comply with the antidiscrimination requirements of section 274B of the INA with respect to Form I-9 procedures.

a. The following modified requirements are the only exceptions to an Employer's obligation to not employ unauthorized workers and comply with the anti-discrimination provision of the INA: (1) List B identity documents must have photos, as described in paragraph 6 above; (2) When an Employer confirms the identity and employment eligibility of newly hired employee using E-Verify procedures, the Employer establishes a rebuttable presumption that it has not violated section 274A(a)(1)(A) of the Immigration and Nationality Act (INA) with respect to the hiring of that employee; (3) If the Employer receives a final nonconfirmation for an employee, but continues to employ that person, the Employer must notify DHS and the Employer is subject to a civil money penalty between $550 and $1,100 for each failure to notify DHS of continued employment following a final nonconfirmation; (4) If the Employer continues to employ an employee after receiving a final nonconfirmation, then the Employer is subject to a rebuttable presumption that it has knowingly

employed an unauthorized alien in violation of section 274A(a)(1)(A); and (5) no E-Verify participant is civilly or criminally liable under any law for any action taken in good faith based on information provided through the E-Verify.

b. DHS reserves the right to conduct Form I-9 compliance inspections, as well as any other enforcement or compliance activity authorized by law, including site visits, to ensure proper use of E-Verify.

9. The Employer is strictly prohibited from creating an E-Verify case before the employee has been hired, meaning that a firm offer of employment was extended and accepted and Form I-9 was completed. The Employer agrees to create an E-Verify case for new employees within three Employer business days after each employee has been hired (after both Sections 1 and 2 of Form I-9 have been completed), and to complete as many steps of the E-Verify process as are necessary according to the E-Verify User Manual. If E-Verify is temporarily unavailable, the three-day time period will be extended until it is again operational in order to accommodate the Employer's attempting, in good faith, to make inquiries during the period of unavailability.

10. The Employer agrees not to use E-Verify for pre-employment screening of job applicants, in support of any unlawful employment practice, or for any other use that this MOU or the E-Verify User Manual does not authorize.

11. The Employer must use E-Verify for all new employees. The Employer will not verify selectively and will not verify employees hired before the effective date of this MOU. Employers who are Federal contractors may qualify for exceptions to this requirement as described in Article II.B of this MOU.

12. The Employer agrees to follow appropriate procedures (see Article III below) regarding tentative nonconfirmations. The Employer must promptly notify employees in private of the finding and provide them with the notice and letter containing information specific to the employee's E-Verify case. The Employer agrees to provide both the English and the translated notice and letter for employees with limited English proficiency to employees. The Employer agrees to provide written referral instructions to employees and instruct affected employees to bring the English copy of the letter to the SSA. The Employer must allow employees to contest the finding, and not take adverse action against employees if they choose to contest the finding, while their case is still pending. Further, when employees contest a tentative nonconfirmation based upon a photo mismatch, the Employer must take additional steps (see Article III.B. below) to contact DHS with information necessary to resolve the challenge.

13. The Employer agrees not to take any adverse action against an employee based upon the employee's perceived employment eligibility status while SSA or DHS is processing the verification request unless the Employer obtains knowledge (as defined in 8 C.F.R. § 274a.1(l)) that the employee is not work authorized. The Employer understands that an initial inability of the SSA or DHS automated verification system to verify work authorization, a tentative nonconfirmation, a case in continuance (indicating the need for additional time for the government to resolve a case), or the finding of a photo mismatch, does not establish, and should not be interpreted as, evidence that the employee is not work authorized. In any of such cases, the employee must be provided a full and fair opportunity to contest the finding, and if he or she does so, the employee may not be terminated or suffer any adverse employment consequences based upon the employee's perceived employment eligibility status

(including denying, reducing, or extending work hours, delaying or preventing training, requiring an employee to work in poorer conditions, withholding pay, refusing to assign the employee to a Federal contract or other assignment, or otherwise assuming that he or she is unauthorized to work) until and unless secondary verification by SSA or DHS has been completed and a final nonconfirmation has been issued. If the employee does not choose to contest a tentative nonconfirmation or a photo mismatch or if a secondary verification is completed and a final nonconfirmation is issued, then the Employer can find the employee is not work authorized and terminate the employee's employment. Employers or employees with questions about a final nonconfirmation may call E-Verify at 1-888-464-4218 (customer service) or 1-888-897-7781 (worker hotline).

14. The Employer agrees to comply with Title VII of the Civil Rights Act of 1964 and section 274B of the INA as applicable by not discriminating unlawfully against any individual in hiring, firing, employment eligibility verification, or recruitment or referral practices because of his or her national origin or citizenship status, or by committing discriminatory documentary practices. The Employer understands that such illegal practices can include selective verification or use of E-Verify except as provided in part D below, or discharging or refusing to hire employees because they appear or sound "foreign" or have received tentative nonconfirmations. The Employer further understands that any violation of the immigration-related unfair employment practices provisions in section 274B of the INA could subject the Employer to civil penalties, back pay awards, and other sanctions, and violations of Title VII could subject the Employer to back pay awards, compensatory and punitive damages. Violations of either section 274B of the INA or Title VII may also lead to the termination of its participation in E-Verify. If the Employer has any questions relating to the anti-discrimination provision, it should contact OSC at 1-800-255-8155 or 1-800-237-2515 (TDD).

15. The Employer agrees that it will use the information it receives from E-Verify only to confirm the employment eligibility of employees as authorized by this MOU. The Employer agrees that it will safeguard this information, and means of access to it (such as PINS and passwords), to ensure that it is not used for any other purpose and as necessary to protect its confidentiality, including ensuring that it is not disseminated to any person other than employees of the Employer who are authorized to perform the Employer's responsibilities under this MOU, except for such dissemination as may be authorized in advance by SSA or DHS for legitimate purposes.

16. The Employer agrees to notify DHS immediately in the event of a breach of personal information. Breaches are defined as loss of control or unauthorized access to E-Verify personal data. All suspected or confirmed breaches should be reported by calling 1-888-464-4218 or via email at E-Verify@dhs.gov. Please use "Privacy Incident – Password" in the subject line of your email when sending a breach report to E-Verify.

17. The Employer acknowledges that the information it receives from SSA is governed by the Privacy Act (5 U.S.C. § 552a(i)(1) and (3)) and the Social Security Act (42 U.S.C. 1306(a)). Any person who obtains this information under false pretenses or uses it for any purpose other than as provided for in this MOU may be subject to criminal penalties.

18. The Employer agrees to cooperate with DHS and SSA in their compliance monitoring and evaluation of E-Verify, which includes permitting DHS, SSA, their contractors and other agents, upon

reasonable notice, to review Forms I-9 and other employment records and to interview it and its employees regarding the Employer's use of E-Verify, and to respond in a prompt and accurate manner to DHS requests for information relating to their participation in E-Verify.

19. The Employer shall not make any false or unauthorized claims or references about its participation in E-Verify on its website, in advertising materials, or other media. The Employer shall not describe its services as federally-approved, federally-certified, or federally-recognized, or use language with a similar intent on its website or other materials provided to the public. Entering into this MOU does not mean that E-Verify endorses or authorizes your E-Verify services and any claim to that effect is false.

20. The Employer shall not state in its website or other public documents that any language used therein has been provided or approved by DHS, USCIS or the Verification Division, without first obtaining the prior written consent of DHS.

21. The Employer agrees that E-Verify trademarks and logos may be used only under license by DHS/USCIS (see M-795 (Web)) and, other than pursuant to the specific terms of such license, may not be used in any manner that might imply that the Employer's services, products, websites, or publications are sponsored by, endorsed by, licensed by, or affiliated with DHS, USCIS, or E-Verify.

22. The Employer understands that if it uses E-Verify procedures for any purpose other than as authorized by this MOU, the Employer may be subject to appropriate legal action and termination of its participation in E-Verify according to this MOU.

B. RESPONSIBILITIES OF FEDERAL CONTRACTORS

1. If the Employer is a Federal contractor with the FAR E-Verify clause subject to the employment verification terms in Subpart 22.18 of the FAR, it will become familiar with and comply with the most current version of the E-Verify User Manual for Federal Contractors as well as the E-Verify Supplemental Guide for Federal Contractors.

2. In addition to the responsibilities of every employer outlined in this MOU, the Employer understands that if it is a Federal contractor subject to the employment verification terms in Subpart 22.18 of the FAR it must verify the employment eligibility of any "employee assigned to the contract" (as defined in FAR 22.1801). Once an employee has been verified through E-Verify by the Employer, the Employer may not create a second case for the employee through E-Verify.

a. An Employer that is not enrolled in E-Verify as a Federal contractor at the time of a contract award must enroll as a Federal contractor in the E-Verify program within 30 calendar days of contract award and, within 90 days of enrollment, begin to verify employment eligibility of new hires using E-Verify. The Employer must verify those employees who are working in the United States, whether or not they are assigned to the contract. Once the Employer begins verifying new hires, such verification of new hires must be initiated within three business days after the hire date. Once enrolled in E-Verify as a Federal contractor, the Employer must begin verification of employees assigned to the contract within 90 calendar days after the date of enrollment or within 30 days of an employee's assignment to the contract, whichever date is later.

b. Employers enrolled in E-Verify as a Federal contractor for 90 days or more at the time of a contract award must use E-Verify to begin verification of employment eligibility for new hires of the Employer who are working in the United States, whether or not assigned to the contract, within three business days after the date of hire. If the Employer is enrolled in E-Verify as a Federal contractor for 90 calendar days or less at the time of contract award, the Employer must, within 90 days of enrollment, begin to use E-Verify to initiate verification of new hires of the contractor who are working in the United States, whether or not assigned to the contract. Such verification of new hires must be initiated within three business days after the date of hire. An Employer enrolled as a Federal contractor in E-Verify must begin verification of each employee assigned to the contract within 90 calendar days after date of contract award or within 30 days after assignment to the contract, whichever is later.

c. Federal contractors that are institutions of higher education (as defined at 20 U.S.C. 1001(a)), state or local governments, governments of Federally recognized Indian tribes, or sureties performing under a takeover agreement entered into with a Federal agency under a performance bond may choose to only verify new and existing employees assigned to the Federal contract. Such Federal contractors may, however, elect to verify all new hires, and/or all existing employees hired after November 6, 1986. Employers in this category must begin verification of employees assigned to the contract within 90 calendar days after the date of enrollment or within 30 days of an employee's assignment to the contract, whichever date is later.

d. Upon enrollment, Employers who are Federal contractors may elect to verify employment eligibility of all existing employees working in the United States who were hired after November 6, 1986, instead of verifying only those employees assigned to a covered Federal contract. After enrollment, Employers must elect to verify existing staff following DHS procedures and begin E-Verify verification of all existing employees within 180 days after the election.

e. The Employer may use a previously completed Form I-9 as the basis for creating an E-Verify case for an employee assigned to a contract as long as:

i. That Form I-9 is complete (including the SSN) and complies with Article II.A.6,

ii. The employee's work authorization has not expired, and

iii. The Employer has reviewed the Form I-9 information either in person or in communications with the employee to ensure that the employee's Section 1, Form I-9 attestation has not changed (including, but not limited to, a lawful permanent resident alien having become a naturalized U.S. citizen).

f. The Employer shall complete a new Form I-9 consistent with Article II.A.6 or update the previous Form I-9 to provide the necessary information if:

i. The Employer cannot determine that Form I-9 complies with Article II.A.6,

ii. The employee's basis for work authorization as attested in Section 1 has expired or changed, or

iii. The Form I-9 contains no SSN or is otherwise incomplete.

Note: If Section 1 of Form I-9 is otherwise valid and up-to-date and the form otherwise complies with

Article II.C.5, but reflects documentation (such as a U.S. passport or Form I-551) that expired after completing Form I-9, the Employer shall not require the production of additional documentation, or use the photo screening tool described in Article II.A.5, subject to any additional or superseding instructions that may be provided on this subject in the E-Verify User Manual.

g. The Employer agrees not to require a second verification using E-Verify of any assigned employee who has previously been verified as a newly hired employee under this MOU or to authorize verification of any existing employee by any Employer that is not a Federal contractor based on this Article.

3. The Employer understands that if it is a Federal contractor, its compliance with this MOU is a performance requirement under the terms of the Federal contract or subcontract, and the Employer consents to the release of information relating to compliance with its verification responsibilities under this MOU to contracting officers or other officials authorized to review the Employer's compliance with Federal contracting requirements.

C. RESPONSIBILITIES OF SSA

1. SSA agrees to allow DHS to compare data provided by the Employer against SSA's database. SSA sends DHS confirmation that the data sent either matches or does not match the information in SSA's database.

2. SSA agrees to safeguard the information the Employer provides through E-Verify procedures. SSA also agrees to limit access to such information, as is appropriate by law, to individuals responsible for the verification of Social Security numbers or responsible for evaluation of E-Verify or such other persons or entities who may be authorized by SSA as governed by the Privacy Act (5 U.S.C. § 552a), the Social Security Act (42 U.S.C. 1306(a)), and SSA regulations (20 CFR Part 401).

3. SSA agrees to provide case results from its database within three Federal Government work days of the initial inquiry. E-Verify provides the information to the Employer.

4. SSA agrees to update SSA records as necessary if the employee who contests the SSA tentative nonconfirmation visits an SSA field office and provides the required evidence. If the employee visits an SSA field office within the eight Federal Government work days from the date of referral to SSA, SSA agrees to update SSA records, if appropriate, within the eight-day period unless SSA determines that more than eight days may be necessary. In such cases, SSA will provide additional instructions to the employee. If the employee does not visit SSA in the time allowed, E-Verify may provide a final nonconfirmation to the employer.

Note: If an Employer experiences technical problems, or has a policy question, the employer should contact E-Verify at 1-888-464-4218.

D. RESPONSIBILITIES OF DHS

1. DHS agrees to provide the Employer with selected data from DHS databases to enable the Employer to conduct, to the extent authorized by this MOU:

a. Automated verification checks on alien employees by electronic means, and

b. Photo verification checks (when available) on employees.

2. DHS agrees to assist the Employer with operational problems associated with the Employer's participation in E-Verify. DHS agrees to provide the Employer names, titles, addresses, and telephone numbers of DHS representatives to be contacted during the E-Verify process.

3. DHS agrees to provide to the Employer with access to E-Verify training materials as well as an E-Verify User Manual that contain instructions on E-Verify policies, procedures, and requirements for both SSA and DHS, including restrictions on the use of E-Verify.

4. DHS agrees to train Employers on all important changes made to E-Verify through the use of mandatory refresher tutorials and updates to the E-Verify User Manual. Even without changes to E-Verify, DHS reserves the right to require employers to take mandatory refresher tutorials.

5. DHS agrees to provide to the Employer a notice, which indicates the Employer's participation in E-Verify. DHS also agrees to provide to the Employer anti-discrimination notices issued by the Office of Special Counsel for Immigration-Related Unfair Employment Practices (OSC), Civil Rights Division, U.S. Department of Justice.

6. DHS agrees to issue each of the Employer's E-Verify users a unique user identification number and password that permits them to log in to E-Verify.

7. DHS agrees to safeguard the information the Employer provides, and to limit access to such information to individuals responsible for the verification process, for evaluation of E-Verify, or to such other persons or entities as may be authorized by applicable law. Information will be used only to verify the accuracy of Social Security numbers and employment eligibility, to enforce the INA and Federal criminal laws, and to administer Federal contracting requirements.

8. DHS agrees to provide a means of automated verification that provides (in conjunction with SSA verification procedures) confirmation or tentative nonconfirmation of employees' employment eligibility within three Federal Government work days of the initial inquiry.

9. DHS agrees to provide a means of secondary verification (including updating DHS records) for employees who contest DHS tentative nonconfirmations and photo mismatch tentative nonconfirmations. This provides final confirmation or nonconfirmation of the employees' employment eligibility within 10 Federal Government work days of the date of referral to DHS, unless DHS determines that more than 10 days may be necessary. In such cases, DHS will provide additional verification instructions.

ARTICLE III

REFERRAL OF INDIVIDUALS TO SSA AND DHS

A. REFERRAL TO SSA

1. If the Employer receives a tentative nonconfirmation issued by SSA, the Employer must print the notice as directed by E-Verify. The Employer must promptly notify employees in private of the finding and provide them with the notice and letter containing information specific to the employee's E-Verify

case. The Employer also agrees to provide both the English and the translated notice and letter for employees with limited English proficiency to employees. The Employer agrees to provide written referral instructions to employees and instruct affected employees to bring the English copy of the letter to the SSA. The Employer must allow employees to contest the finding, and not take adverse action against employees if they choose to contest the finding, while their case is still pending.

2. The Employer agrees to obtain the employee's response about whether he or she will contest the tentative nonconfirmation as soon as possible after the Employer receives the tentative nonconfirmation. Only the employee may determine whether he or she will contest the tentative nonconfirmation.

3. After a tentative nonconfirmation, the Employer will refer employees to SSA field offices only as directed by E-Verify. The Employer must record the case verification number, review the employee information submitted to E-Verify to identify any errors, and find out whether the employee contests the tentative nonconfirmation. The Employer will transmit the Social Security number, or any other corrected employee information that SSA requests, to SSA for verification again if this review indicates a need to do so.

4. The Employer will instruct the employee to visit an SSA office within eight Federal Government work days. SSA will electronically transmit the result of the referral to the Employer within 10 Federal Government work days of the referral unless it determines that more than 10 days is necessary.

5. While waiting for case results, the Employer agrees to check the E-Verify system regularly for case updates.

6. The Employer agrees not to ask the employee to obtain a printout from the Social Security Administration number database (the Numident) or other written verification of the SSN from the SSA.

B. REFERRAL TO DHS

1. If the Employer receives a tentative nonconfirmation issued by DHS, the Employer must promptly notify employees in private of the finding and provide them with the notice and letter containing information specific to the employee's E-Verify case. The Employer also agrees to provide both the English and the translated notice and letter for employees with limited English proficiency to employees. The Employer must allow employees to contest the finding, and not take adverse action against employees if they choose to contest the finding, while their case is still pending.

2. The Employer agrees to obtain the employee's response about whether he or she will contest the tentative nonconfirmation as soon as possible after the Employer receives the tentative nonconfirmation. Only the employee may determine whether he or she will contest the tentative nonconfirmation.

3. The Employer agrees to refer individuals to DHS only when the employee chooses to contest a tentative nonconfirmation.

4. If the employee contests a tentative nonconfirmation issued by DHS, the Employer will instruct the

employee to contact DHS through its toll-free hotline (as found on the referral letter) within eight Federal Government work days.

5. If the Employer finds a photo mismatch, the Employer must provide the photo mismatch tentative nonconfirmation notice and follow the instructions outlined in paragraph 1 of this section for tentative nonconfirmations, generally.

6. The Employer agrees that if an employee contests a tentative nonconfirmation based upon a photo mismatch, the Employer will send a copy of the employee's Form I-551, Form I-766, U.S. Passport, or passport card to DHS for review by:

a. Scanning and uploading the document, or

b. Sending a photocopy of the document by express mail (furnished and paid for by the employer).

7. The Employer understands that if it cannot determine whether there is a photo match/mismatch, the Employer must forward the employee's documentation to DHS as described in the preceding paragraph. The Employer agrees to resolve the case as specified by the DHS representative who will determine the photo match or mismatch.

8. DHS will electronically transmit the result of the referral to the Employer within 10 Federal Government work days of the referral unless it determines that more than 10 days is necessary.

9. While waiting for case results, the Employer agrees to check the E-Verify system regularly for case updates.

ARTICLE IV
SERVICE PROVISIONS

A. NO SERVICE FEES

1. SSA and DHS will not charge the Employer for verification services performed under this MOU. The Employer is responsible for providing equipment needed to make inquiries. To access E-Verify, an Employer will need a personal computer with Internet access.

ARTICLE V
MODIFICATION AND TERMINATION

A. MODIFICATION

1. This MOU is effective upon the signature of all parties and shall continue in effect for as long as the SSA and DHS operates the E-Verify program unless modified in writing by the mutual consent of all parties.

2. Any and all E-Verify system enhancements by DHS or SSA, including but not limited to E-Verify checking against additional data sources and instituting new verification policies or procedures, will be covered under this MOU and will not cause the need for a supplemental MOU that outlines these changes.

B. TERMINATION

1. The Employer may terminate this MOU and its participation in E-Verify at any time upon 30 days prior written notice to the other parties.

2. Notwithstanding Article V, part A of this MOU, DHS may terminate this MOU, and thereby the Employer's participation in E-Verify, with or without notice at any time if deemed necessary because of the requirements of law or policy, or upon a determination by SSA or DHS that there has been a breach of system integrity or security by the Employer, or a failure on the part of the Employer to comply with established E-Verify procedures and/or legal requirements. The Employer understands that if it is a Federal contractor, termination of this MOU by any party for any reason may negatively affect the performance of its contractual responsibilities. Similarly, the Employer understands that if it is in a state where E-Verify is mandatory, termination of this by any party MOU may negatively affect the Employer's business.

3. An Employer that is a Federal contractor may terminate this MOU when the Federal contract that requires its participation in E-Verify is terminated or completed. In such cases, the Federal contractor must provide written notice to DHS. If an Employer that is a Federal contractor fails to provide such notice, then that Employer will remain an E-Verify participant, will remain bound by the terms of this MOU that apply to non-Federal contractor participants, and will be required to use the E-Verify procedures to verify the employment eligibility of all newly hired employees.

4. The Employer agrees that E-Verify is not liable for any losses, financial or otherwise, if the Employer is terminated from E-Verify.

ARTICLE VI
PARTIES

A. Some or all SSA and DHS responsibilities under this MOU may be performed by contractor(s), and SSA and DHS may adjust verification responsibilities between each other as necessary. By separate agreement with DHS, SSA has agreed to perform its responsibilities as described in this MOU.

B. Nothing in this MOU is intended, or should be construed, to create any right or benefit, substantive or procedural, enforceable at law by any third party against the United States, its agencies, officers, or employees, or against the Employer, its agents, officers, or employees.

C. The Employer may not assign, directly or indirectly, whether by operation of law, change of control or merger, all or any part of its rights or obligations under this MOU without the prior written consent of DHS, which consent shall not be unreasonably withheld or delayed. Any attempt to sublicense, assign, or transfer any of the rights, duties, or obligations herein is void.

D. Each party shall be solely responsible for defending any claim or action against it arising out of or related to E-Verify or this MOU, whether civil or criminal, and for any liability wherefrom, including (but not limited to) any dispute between the Employer and any other person or entity regarding the applicability of Section 403(d) of IIRIRA to any action taken or allegedly taken by the Employer.

E. The Employer understands that its participation in E-Verify is not confidential information and may be disclosed as authorized or required by law and DHS or SSA policy, including but not limited to,

Congressional oversight, E-Verify publicity and media inquiries, determinations of compliance with Federal contractual requirements, and responses to inquiries under the Freedom of Information Act (FOIA).

F. The individuals whose signatures appear below represent that they are authorized to enter into this MOU on behalf of the Employer and DHS respectively. The Employer understands that any inaccurate statement, representation, data or other information provided to DHS may subject the Employer, its subcontractors, its employees, or its representatives to: (1) prosecution for false statements pursuant to 18 U.S.C. 1001 and/or; (2) immediate termination of its MOU and/or; (3) possible debarment or suspension.

G. The foregoing constitutes the full agreement on this subject between DHS and the Employer.

To be accepted as an E-Verify participant, you should only sign the Employer's Section of the signature page. If you have any questions, contact E-Verify at 1-888-464-4218.

Company ID Number:

Approved by:

Employer	
Name (Please Type or Print)	Title
Signature	Date
Department of Homeland Security – Verification Division	
Name (Please Type or Print)	Title
Signature	Date

Company ID Number:

Information Required for the E-Verify Program **Information relating to your Company:**	
Company Name	
Company Facility Address	
Company Alternate Address	
County or Parish	
Employer Identification Number	
North American Industry Classification Systems Code	
Parent Company	
Number of Employees	
Number of Sites Verified for	

Company ID Number:

Are you verifying for more than 1 site? If yes, please provide the number of sites verified for in each State:

Company ID Number:

Information relating to the Program Administrator(s) for your Company on policy questions or operational problems:

Company ID Number:

Reset Form Print Form

MISSOURI DEPARTMENT OF REVENUE

Form 5060

Project Exemption Certificate

This form is to be completed and given to your contractor.

Exempt Entity and Project Information

Name of Exempt Entity Issuing the Certificate			Missouri Tax Exemption Number
Address	City	State	ZIP Code
E-mail Address			
Project Number	Project Begin Date (MM/DD/YYYY) ___ ___ / ___ ___ / ___ ___ ___ ___		Estimated Project End Date (MM/DD/YYYY) ___ ___ / ___ ___ / ___ ___ ___ ___
Description of Project			
Project Location			Certificate Expiration Date (MM/DD/YYYY) ___ ___ / ___ ___ / ___ ___ ___ ___

Provide a signed copy of this certificate, along with a copy of the exempt entity's Missouri Sales and Use Tax Exemption Letter to each contractor or subcontractor who will be purchasing tangible personal property for use in this project. It is the responsibility of the exempt entity to ensure the validity of the information on the certificate. The exempt entity must issue a new certificate if any of the information changes.

Signature of Authorized Exempt Entity	Printed Name of Authorized Exempt Entity	Date (MM/DD/YYYY) ___ ___ / ___ ___ / ___ ___ ___ ___

Contractor

The Missouri exempt entity named above hereby authorizes the purchase, without sales tax, of tangible personal property to be incorporated or consumed in the construction project identified herein and no other, pursuant to **Section 144.062, RSMo.** Under penalties of perjury, I declare that the above information and any attached supplement is true, complete, and correct.

Name of Purchasing Contractor	Signature of Contractor	Date (MM/DD/YYYY) ___ ___ / ___ ___ / ___ ___ ___ ___

Address	City	State	ZIP Code

Subcontractor

Contractors - Present this to your supplier in order to purchase the necessary materials tax exempt. Complete the Subcontractor portion if extending the certificate to your subcontractor. The contractor must sign the form in the space provided below.

Name of Purchasing Subcontractor			
Address	City	State	ZIP Code

Signature of Contractor	Contractor's Printed Name	Date (MM/DD/YYYY) ___ ___ / ___ ___ / ___ ___ ___ ___

Taxation Division
P.O Box 358
Jefferson City, MO 65105-0358

Phone: (573) 751-2836
Fax: (573) 522-1666
E-mail: salestaxexemptions@dor.mo.gov

Visit http://dor.mo.gov/business/sales/sales-use-exemptions.php for additional information.

State of Missouri

EXEMPTION FROM MISSOURI SALES AND USE TAX ON PURCHASES

Issued to:

CITY OF KANSAS CITY
414 E 12TH ST 3RD FLOOR
KANSAS CITY MO 64106

Missouri Tax ID Number: 12490466

Effective Date: 07/11/2002

Your application for sales/use tax exempt status has been approved pursuant to Section 144.030.1, RSMo. This letter is issued as documentation of your exempt status.

Purchases by your Agency are not subject to sales or use tax if within the conduct of your Agency's exempt functions and activities. When purchasing with this exemption, furnish all sellers or vendors a copy of this letter. This exemption may not be used by individuals making personal purchases.

A contractor may purchase and pay for construction materials exempt from sales tax when fulfilling a contract with your Agency only if your Agency issues a project exemption certificate and the contractor makes purchases in compliance with the provisions of Section 144.062, RSMo.

Sales by your Agency are subject to all applicable state and local sales taxes. If you engage in the business of selling tangible personal property or taxable services at retail, you must obtain a Missouri Retail Sales Tax License and collect and remit sales tax.

This is a continuing exemption subject to legislative changes and review by the Director of Revenue. If your Agency ceases to qualify as an exempt entity, this exemption will cease to be valid. This exemption is not assignable or transferable. It is an exemption from sales and use taxes only and is not an exemption from real or personal property tax.

Any alteration to this exemption letter renders it invalid.

If you have any questions regarding the use of this letter, please contact the Division of Taxation and Collection, P.O. Box 3300, Jefferson City, MO 65105-3300, phone 573-751-2836.

(DI6030)

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

PERFORMANCE AND MAINTENANCE BOND

Project/Contract Numbers: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrade

KNOW ALL MEN BY THESE PRESENTS: That _____, as PRINCIPAL (CONTRACTOR), and _____, (SURETY), licensed to do business as such in the State of Missouri, hereby bind themselves and their respective heirs, executors, administrators, successors, and assigns unto Kansas City, Missouri, a constitutionally chartered municipal corporation, (OWNER), as obligee, in the penal sum of _____ Dollars ($ _____) for the payment whereof CONTRACTOR and SURETY bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS,

CONTRACTOR has entered into a Contract with OWNER for Project/Contract Numbers 81000927/1698, Todd Creek WWTP Expansion & Major Upgrade, which Contract, including any present or future amendment thereto, is incorporated herein by reference and is hereinafter referred to as the Contract.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if CONTRACTOR shall promptly and faithfully perform said Contract including all duly authorized changes thereto, and including any maintenance requirements contained therein, according to all the terms thereof, including those under which CONTRACTOR agrees to pay legally required wage rates including the prevailing hourly rate of wages in the locality, as determined by the Department of Labor and Industrial Relations or by final judicial determination, for each craft or type of workman required to execute the Contract and, further, shall defend, indemnify, and hold harmless OWNER from all damages, including but not limited to, liquidated damages, loss and expense occasioned by any failure whatsoever of said CONTRACTOR and SURETY to fully comply with and carry out each and every requirement of the Contract, then this obligation shall be void; otherwise, it shall remain in full force and effect.

WAIVER. That SURETY, for value received, hereby expressly agrees that no change, extension of time, alteration or addition to the terms of the Contract or to the Work to be performed thereunder, shall in any way affect the obligations of this Bond; and it does hereby waive notice of any such change, extension of time, or alteration or addition to the terms of the Contract or the Work to be performed thereunder.

IN WITNESS WHEREOF, the above parties have executed this instrument the ____ day of _____, 20__.

CONTRACTOR
Name, address and facsimile number of Contractor

_____
_____
_____
_____

I hereby certify that I have authority to execute
this document on behalf of Contractor.

By: _____
Title: _____

(Attach corporate seal if applicable)

SURETY
Name, address and facsimile number of Surety:

_____
_____
_____
_____

I hereby certify that (1) I have authority to execute this document on behalf of Surety; (2) Surety has an A.M. Best rating of A-, V, or better; (3) Surety is named in the current list of "Companies Holding Certificates of Authority as Acceptable Reinsuring Companies: as published in Circular 570 (most current revision) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury; and (4) Surety is duly licensed to issue bonds in the State of Missouri and in the jurisdiction in which the Project is located.

By:_____
Title:_____
Date:_____

(Attach seal and Power of Attorney)

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

PAYMENT BOND

Project/Contract Numbers: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrade

KNOW ALL MEN BY THESE PRESENTS: That _____, as PRINCIPAL (CONTRACTOR), and_____, (SURETY), licensed to do business as such in the State of Missouri, hereby bind themselves and their respective heirs, executors, administrators, successors, and assigns unto Kansas City, Missouri, a constitutionally chartered municipal corporation, (OWNER), as obligee, in the penal sum of _____ Dollars ($_____) for the payment whereof CONTRACTOR and SURETY bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS,

CONTRACTOR has entered into a contract with OWNER for Project/Contract Numbers 81000927/1698, Todd Creek WWTP Expansion & Major Upgrade, which Contract, including any present or future amendment thereto, is incorporated herein by reference and is hereinafter referred to as the Contract.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if in connection with the Contract, including all duly authorized modifications thereto, prompt payment shall be made to all laborers, subcontractors, teamsters, truck drivers, owners or other suppliers or for equipment employed on the job, and other claimants, for all labor performed in such work whether done for CONTRACTOR, a subcontractor, SURETY, a completion contractor or otherwise (at the full wage rates required by any law of the United States or of the State of Missouri, where applicable), for services furnished and consumed, for repairs on machinery, for equipment, tools, materials, lubricants, oil, gasoline, water, gas, power, light, heat, oil, telephone service, grain, hay, feed, coal, coke, groceries and foodstuffs, either consumed, rented, used or reasonably required for use in connection with the construction of the work or in the performance of the Contract and all insurance premiums, both for compensation and for all other kinds of insurance on the work, for sales taxes and for royalties in connection with, or incidental to, the completion of the Contract, in all instances whether the claim be directly against CONTRACTOR, against SURETY or its completion contractor, through a subcontractor or otherwise, and, further, if CONTRACTOR shall defend, indemnify and hold harmless OWNER from all such claims, demands or suits by any such person or entity, then this obligation shall be void; otherwise, it shall remain in full force and effect.

Any conditions legally required to be included in a Payment Bond on this Contract, including but not limited to those set out in §107.170 RSMo.are included herein by reference.

SURETY agrees that, in the event that CONTRACTOR fails to make payment of the obligations covered by this Bond, it will do so and, further, that within forty-five (45) days of receiving, at the address given below, a claim hereunder stating the amount claimed and the basis for the claim in reasonable detail, it (a) will send an answer to the claimant, with a copy to OWNER stating the amounts that are undisputed and the basis for challenging any amounts that are disputed, and (b) will pay any amounts that are undisputed. The amount of this Bond shall be reduced by and to the extent of any payment or payments made in good faith hereunder.

While this Bond is in force, it may be sued on at the instance of any party to whom any such payment is due, in the name of OWNER to the use for such party. OWNER shall not be liable for the payment of any costs or expenses of any such suit.

No suit shall be commenced or pursued hereunder other than in a state court of competent jurisdiction in Jackson, Clay or Platte County, Missouri, or in the United States District Court for the Western District of Missouri.

WAIVER. That SURETY, for value received, hereby expressly agrees that no change, extension of time, alteration or addition to the terms of the Contract or to the Work to be performed thereunder, shall in any way affect the obligations of this Bond; and it does hereby waive notice of any such change, extension of time, or alteration or addition to the terms of the Contract or the Work to be performed thereunder.

IN WITNESS WHEREOF, the above parties have executed this instrument the _____ day of_____ _____, 20____.

CONTRACTOR
Name, address and facsimile number of Contractor

_____
_____
_____
_____

I hereby certify that I have authority to execute this document on behalf of Contractor.

By: _____
Title:_____

(Attach corporate seal if applicable)

SURETY
Name, address and facsimile number of Surety:

_____
_____
_____
_____

I hereby certify that (1) I have authority to execute this document on behalf of Surety; (2) Surety has an A.M. Best rating of A-. or better; (3) Surety is named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (most current revision) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury; and(4) Surety is duly licensed to issue bonds in the State of Missouri and in the jurisdiction in which the Project is located.

By:_____
Title:_____
Date:_____

(Attach seal and Power of Attorney)

ACORD®

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY)

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER	CONTACT NAME:
AGENT NAME AND ADDRESS	PHONE (A/C, No, Ext): / FAX (A/C, No):
	E-MAIL ADDRESS:
	INSURER(S) AFFORDING COVERAGE / NAIC #
	INSURER A : ABC INSURANCE COMPANY
INSURED	INSURER B :
CONTRACTOR NAME AND ADDRESS	INSURER C :
	INSURER D :
	INSURER E :
	INSURER F :

COVERAGES **CERTIFICATE NUMBER:** **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	GENERAL LIABILITY ☑ COMMERCIAL GENERAL LIABILITY ☐ CLAIMS-MADE ☑ OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: ☐ POLICY ☑ PRO-JECT ☐ LOC	Y	Y	POLICY NUMBER	1/1/2011	Current	EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurrence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG $	$ 1,000,000 $ 50,000 $ 10,000 $ 1,000,000 $ 2,000,000 $ 2,000,000 $
A	AUTOMOBILE LIABILITY ☑ ANY AUTO ALL OWNED AUTOS ☐ SCHEDULED AUTOS ☑ HIRED AUTOS ☑ NON-OWNED AUTOS	Y	Y	POLICY NUMBER	1/1/2011	Current	COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident) $	$ 1,000,000 $ $ $ $
A	☑ UMBRELLA LIAB ☑ OCCUR EXCESS LIAB ☐ CLAIMS-MADE DED ☑ RETENTION $ 10,000	Y	Y	POLICY NUMBER	1/1/2011	Current	EACH OCCURRENCE AGGREGATE $	$ 2,000,000 $ 2,000,000 $
A	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? Y/N [N] (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below	N/A	Y	POLICY NUMBER	1/1/2011	Current	☑ WC STATU-TORY LIMITS ☐ OTH-ER E.L. EACH ACCIDENT E.L. DISEASE - EA EMPLOYEE E.L. DISEASE - POLICY LIMIT	 $ 1,000,000 $ 1,000,000 $ 1,000,000
A	Leased/Rented/Equip. Owned Equipment Builders Risk/Installation Floater	N/A	Y	POLICY NUMBER	1/1/2011	Current	Limit; Deductible Limit; Deductible Limit; Deductible	

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)

Project No. _____ [Title]. Certholder (City) and _____ (Design Professional) and any other entities named in 00800 SCs are named as primary, noncontributing Additional Insureds including products and completed operations, excluding workers compensation, employers liability and professional liability. Waiver of subrogation applies as allowed by law. [The policies required above shall contain no exclusions for work expressly within the subcontractors scope of work.]

CERTIFICATE HOLDER

City of Kansas City, Missouri

_____ [Department]

_____ [Address]

Kansas City, MO _____ [Zip]

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

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FORM **RD-C1**
(12/20)

City of Kansas City, Missouri - Revenue Division

AUTHORIZATION TO RELEASE A REVENUE CLEARANCE LETTER

Phone: (816) 513-1120
Fax: (816) 513-1264

KANSAS CITY MISSOURI

I authorize the City of Kansas City, Missouri, Finance Department, Revenue Division, to release a Revenue Clearance Letter for:

Name of taxpayer: _____ FEIN or SSN: _____
(PRINT)
Address: _____

Check this box and complete this section to send the Clearance Letter to a contractor.

☐ **I authorize the City to provide a copy of the Taxpayer's Revenue Clearance Letter to the following:**

NAME (PRINT)		BUSINESS NAME	TITLE
ADDRESS		CITY, STATE, ZIP CODE	
PHONE NUMBER	FAX NUMBER	EMAIL ADDRESS	

☐ **I authorize the City to provide the Taxpayer's Revenue Clearance Letter to all City Departments to certify that the Taxpayer is in compliance with the tax ordinances administered by the Commissioner of Revenue.**

Please send my first Revenue Clearance Letter to: _____
(Print Name of City Department / Contact Person / Email / Fax Number)

This authorization shall expire one (1) year from the date on the bottom of this form.

The City, Commissioner of Revenue and the Revenue Division personnel (hereinafter "the City"), are hereby held harmless from any and all liability relating to unauthorized disclosure of confidential tax information resulting from release of information under all applicable confidentiality laws including federal, state, or local, including any damages sustained by wrongful transmission of confidential tax information to any other person.

UNDER PENALTIES OF PERJURY, I DECLARE THAT I HAVE EXAMINED THIS AUTHORIZATION, AND TO THE BEST OF MY KNOWLEDGE AND BELIEF, IT IS TRUE, CORRECT AND COMPLETE.

I hereby certify that I am the Taxpayer named herein or that I have the authority to execute this authorization on behalf of the Taxpayer and hold harmless agreement.

NAME (PRINT)	TITLE (IF APPLICABLE)	
SIGNATURE	PHONE NUMBER	DATE

A FACSIMILE OF THIS DOCUMENT SHALL CONSTITUTE AN ORIGINAL

Email completed form to business.license@kcmo.org or mail to:

City of Kansas City, Missouri, Business License Office, City Hall, 1st floor, 414 E. 12th St., Kansas City, MO 64106

KANSAS CITY
MISSOURI

Finance Department

Revenue Division

414 E 12th St. 1st Floor
Kansas City, MO 64106-2786

DO NOT MAIL
atL003

Phone: (816) 513-1120
Fax: (816) 513-1264
Email: revenue@kcmo.org
Website: kcmo.gov/tax

Letter Id: L0000143555
Date: 07-Feb-2024
Taxpayer Id: 0000161779

EXAMPLE TAXPAYER
414 E 12TH ST
KANSAS CITY MO 64106-2702

TAX CLEARANCE STATUS: APPROVED

As of this date, this notice is to inform you that EXAMPLE TAXPAYER is current with all taxes and license fees with the City of Kansas City, Mo., Finance Department/ Revenue Division.

Please note this could change if we perform a full review of your accounts in the future. We will let you know if we need to review your accounts. You will need to pay any amounts that are found due at that time.

Eric Davison
Commissioner of Revenue

Visit kcmo.gov/quicktax to view the status of your account and for online filing.

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

GENERAL CONDITIONS
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ARTICLE 1 DEFINITIONS AND TERMINOLOGY

1.01 Defined Terms

A. Wherever used in these General Conditions or in the other Contract Documents, the following terms have the meanings indicated which are applicable to both the singular and plural thereof:

1. Addenda - Written or graphic instruments issued prior to the opening of Bids that clarify, correct or change the Bidding Requirements or the Contract Documents.

2. Agreement—The written Contract between CITY and CONTRACTOR governing the Work to be performed; other Contract Documents are attached to the Agreement and made a part thereof as provided therein.

3. Application for Payment—The form accepted by CITY's Representative which is to be used by CONTRACTOR in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. Asbestos - Any material that contains more than one percent (1%) Asbestos and is friable or is releasing Asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.

5. Bid- The offer or proposal of the Bidder submitted on the Bid Form/Contract setting forth the prices for the Work to be performed. A Bidder's Bid becomes a Contract with CITY if the CITY executes the Bid Form/Contract submitted by Bidder. If the CITY executes the Bid Form/Contract submitted by Bidder, the term "Bidder" shall mean CONTRACTOR.

6. Bidder- One who submits a Bid directly to CITY, as distinct from a sub-bidder who submits a bid to a Bidder. If the CITY executes the Bid Form/Contract submitted by Bidder, the term "Bidder" shall mean CONTRACTOR in both the Bidding Documents and Contract Documents unless the context clearly indicates otherwise.

7. Bidding Documents- The advertisement or Invitation to Bid, Instructions to Bidders, the Bid Form/Contract, and the proposed Contract Documents (including all Addenda issued prior to receipt of Bids).

8. Bidding Requirements- The advertisement or invitation to bid, Instructions to Bidders, Bid security, and the Bid Form/Contract with any supplements.

9. Bonds- Payment Bond and Performance and Maintenance Bond and other instruments of security.

10. Calendar Day- Any day shown on the calendar, including Saturdays, Sundays, and holidays.

11. Change Order- A written document issued by CITY that authorizes an addition, deletion or revision in the Work, or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Contract.

12. CITY/OWNER- Kansas City, Missouri, a constitutionally chartered municipal corporation, with which CONTRACTOR has entered into the Contract and for whom the Work is to be provided**.**

13. CITY's Representative- Person or agency designated to act for the Director as provided in these Contract Documents.

14. Consultant- Person, firm or corporation having a contract with CITY or DESIGN PROFESSIONAL to furnish services as an independent professional associate or Consultant with respect to the Project and who's identified as such in the Supplementary Conditions.

The Consultant(s) is identified and their seals affixed on the Certification Page(s). The certifications describe the respective responsibilities for the Drawings and Specifications prepared by the Consultant(s) and are incorporated into this Contract.

15. Contract- The entire and integrated written agreement between CITY and CONTRACTOR concerning the Work that incorporates all Contract Documents. The Bid Form/Contract submitted by Bidder is the Contract between CITY and CONTRACTOR upon execution by CITY. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

16. Contract Documents- The Contract Documents establish the rights and obligations of the parties and include the Contract, Addenda (which pertain to the Contract Documents), CONTRACTOR's Bid Form/Contract (including documentation accompanying the Bid and any post Bid documentation submitted prior to the Notice of Intent to Contract), the Construction Project Instructions, the Contractor's Utilization Plan/Request for Waiver, the Notice to Proceed, the Bonds, these General Conditions, the Supplementary Conditions, the Specifications and the Drawings as the same are more specifically identified in the Project Manual and the certification page(s) of the DESIGN PROFESSIONAL and Consultant(s), together with approved project baseline schedule and amendments thereto and all Written Amendments, Change Orders, Work Change Directives, and DESIGN PROFESSIONAL's written interpretations and clarifications issued on or after the Effective Date of the Contract, and approved Shop Drawings. Reports and drawings of subsurface and physical conditions are not Contract Documents. Only printed or hard copies of the items listed in this Paragraph are Contract Documents. Files in electronic media format of text, data, graphics, and the like that may be furnished by CITY to CONTRACTOR are not Contract Documents, except project schedules submitted by CONTRACTOR and approved by CITY.

17. Contract Price- The money payable by CITY to CONTRACTOR for completion of the Work in accordance with the Contract Documents as stated in the Agreement.

18. Contract Times- The number of days or the dates stated in the Supplementary Conditions: (a) to achieve Substantial Completion, and (b) to complete the Work so that it is ready for final payment as evidenced by CITY's Representative's written recommendation of final payment.

19. CONTRACTOR- The person, firm, partnership, company, corporation or association licensed or otherwise authorized by law to do business in Missouri, with whom CITY has entered into the Agreement.

20. Day– Shall constitute a Calendar Day.

21. DESIGN PROFESSIONAL- Architect, Engineer or other licensed professional who is either employed by or has contracted with CITY to serve in a design capacity and whose Consultants, members, partners, employees or agents have prepared and sealed the Drawings and Specifications.

The DESIGN PROFESSIONAL(s) is identified and their seals affixed on the Certification Page(s). The certifications describe the respective responsibilities for the Drawings and Specifications prepared by the DESIGN PROFESSIONAL and are incorporated into this Contract.

22. DESIGN PROFESSIONAL's Project Representative- The authorized representative of DESIGN PROFESSIONAL who may be assigned to the Site or any part thereof.

23. Director- The term Director shall mean the duly appointed executive officer of a department of City who is empowered by the City Charter or by the City Council to enter into a contract on behalf of City, or to grant a permit for improvements to land owned by City. A Director is authorized to delegate this authority to a City employee so designated in writing.

24. Drawings- The drawings which graphically show the scope, extent and character of the Work to be furnished and performed by CONTRACTOR and which have been prepared by DESIGN PROFESSIONAL and are included in the Contract Documents. Shop Drawings are not Drawings as so defined.

25. Effective Date of the Contract- The date indicated in the Contract on which it becomes effective, but if no such date is indicated it means the date on which the Contract is fully executed by CITY.

26. General Requirements- Sections of Division 1 of the Specifications. The General Requirements pertain to all sections of the Specifications.

27. Hazardous Environmental Condition- The presence at the Site of Asbestos, Lead-Based Paint, PCBs, Petroleum, Hazardous Waste, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto in connection with the Work.

28. Hazardous Waste- The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.

29. Laws or Regulations- Any and all applicable laws, rules, regulations, ordinances, codes and orders of any and all governmental bodies, agencies, authorities and courts having jurisdiction.

30. Lead-Based Paint- Any paint, varnish, stain, or other applied coating that has one (1) mg or more of lead per square centimeter. The terms “leaded paint” and “lead-containing paint” are synonymous with Lead-Based Paint.

31. Liens- Liens, charges, security interests or encumbrances upon real property or personal property.

32. Milestone- A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.

33. Notice of Intent to Contract- The written notice by CITY to the apparent successful Bidder stating that upon compliance by that apparent successful Bidder with the conditions in the Bid Documents enumerated, within the time specified, and upon enactment of an appropriate ordinance or resolution, CITY will sign and deliver the Contract.

34. Notice to Proceed- A written notice given by CITY to CONTRACTOR fixing the date on which the Contract Times will commence to run and on which CONTRACTOR shall start to perform CONTRACTOR’s obligations under the Contract Documents.

35. Partial Utilization- Use by CITY of a substantially completed part of the Work for the purpose for which it is intended (or a related purpose) prior to Substantial Completion of all the Work.

36. PCBs- Polychlorinated biphenyls.

37. Petroleum- Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Wastes and crude oils.

38. Project- The total construction of which the Work to be provided under the Contract Documents may be the whole, or a part as indicated elsewhere in the Contract Documents.

39. Project Manual- The documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual may be issued in one or more volumes and is contained in the table(s) of contents.

40. Radioactive Material- Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.

41. Samples- Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.

42. Shop Drawings- All drawings, diagrams, illustrations, schedules and other data or information which are specifically prepared or assembled by or for CONTRACTOR and submitted by CONTRACTOR to illustrate some portion of the Work.

43. Site- Lands or areas indicated in the Contract Documents as being furnished by CITY upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by CITY which are designated for the use of CONTRACTOR.

44. Specifications- Those portions of the Contract Documents consisting of written technical descriptions of materials, equipment, construction systems, standards and workmanship as applied to the Work and certain administrative details applicable thereto.

45. Subcontractor- Any individual, firm, partnership, company, corporation or association licensed or otherwise authorized by law to do business in Missouri, to whom CONTRACTOR, with written notification to CITY, has entered into an agreement to perform a part of the Work.

46. Substantial Completion- When Work (or a specified part thereof) has progressed to the point where, in the opinion of DESIGN PROFESSIONAL as evidenced by DESIGN PROFESSIONAL's definitive certificate of Substantial Completion, it is sufficiently complete, in accordance with the Contract Documents, so that the Work (or specified part) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

47. Supplementary Conditions- The part of the Contract Documents which amends and/or supplements these General Conditions.

48. Supplier- A manufacturer, fabricator, supplier, distributor, materialman or vendor having a direct contract with CONTRACTOR or with any Subcontractor to furnish materials or equipment to be incorporated into the Work by CONTRACTOR or any Subcontractor.

49. Underground Facilities- All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels or other such facilities or attachments, and any encasements containing such facilities which have been installed underground to furnish any of the following services or materials: electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

50. Unit Price Work- Work to be paid for on the basis of unit prices.

51. Work- The entire completed construction or the various separately identifiable parts thereof required to be furnished under the Contract Documents. Work includes and is the result of performing or furnishing labor, and furnishing and incorporating material and equipment into the construction, and furnishing documents, all as required by the Contract Documents.

52. Work Change Directive- A written directive to CONTRACTOR, issued on or after the Effective Date of the Contract, signed by CITY and recommended by DESIGN PROFESSIONAL, ordering an addition, deletion or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed, or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times, but is evidence that the parties expect that the change directed or

documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

53. Work Day - Any day during which the CONTRACTOR is able to work a period of six (6) hours or more. Days that are not Work Days are days during which the CONTRACTOR is unable to work for a period of six (6) hours by reason of strikes, boycotts, labor disputes, embargoes, unusual delays in transportation or shortage of material, acts of God, acts of the public enemy, acts of superior governmental authority, weather conditions, riots, rebellion, sabotage, or any other circumstances for which CONTRACTOR is not responsible or which is not within its control. Saturdays, Sundays, and holidays on which the CONTRACTOR's forces engage in Work requiring the presence of an inspector, will be considered as Work Days.

54. Written Amendment- A written statement modifying the Contract Documents, signed by CITY and CONTRACTOR on or after the Effective Date of the Contract and normally dealing with the non-engineering or non-technical rather than strictly construction-related aspects of the Contract Documents.

1.02 Terminology

A. Intent of Certain Terms or Adjectives

1. Whenever in the Contract Documents the terms "as ordered," "as directed," "as required," "as allowed," "as approved," or terms of like effect or import are used, or the adjectives "reasonable," "suitable," "acceptable," "proper" or "satisfactory" or adjectives of like effect or import are used to describe a requirement, direction, review or judgment of DESIGN PROFESSIONAL as to the Work, it is intended that such requirement, direction, review or judgment will be solely to evaluate, in general, the completed Work for compliance with the requirements of and information in the Contract Documents and conformance with the design concept of the completed Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective shall not be effective to assign to DESIGN PROFESSIONAL any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of Paragraph 9.08 or any other provision of the Contract Documents.

B. Defective

1. The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty or deficient, in that it does not conform to the Contract Documents, or does not meet the requirements of any inspection, reference standard, test or approval referred to in the Contract Documents, or has been damaged prior to CITY 's Representative's recommendation of final payment (unless responsibility for the protection thereof has been assumed by CITY at Substantial Completion in accordance with Paragraph 14.04 or 14.05).

C. Furnish, Install, Perform, Provide

1. The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words "perform" or "provide," when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.

4. When “furnish,” “install,” “perform,” or “provide” is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of CONTRACTOR, “provide” is implied.

D. Unless stated otherwise in the Contract Documents, words and phrases which have a well-known technical or construction industry or trade meanings are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 PRELIMINARY MATTERS

2.01 Delivery of Bonds

A. CONTRACTOR shall deliver to CITY such Bonds as CONTRACTOR may be required to furnish.

2.02 Evidence of Insurance

A. CONTRACTOR shall deliver to CITY certificates of insurance or other evidence of insurance that CITY may request, which CONTRACTOR is required to purchase and maintain in accordance with Article 5 or any other applicable provision in the Contract Documents.

2.03 Copies of Documents

A. CITY shall furnish to CONTRACTOR one (1) copy of the Drawings and Specifications, including addenda.

2.04 Commencement of Contract Times; Notice to Proceed

A. The Contract Times will commence to run on the date indicated in the Notice to Proceed.

2.05 Starting the Work

A. CONTRACTOR shall start to perform the Work on the date when the Contract Times commence to run, but no Work shall be done at the Site prior to the date on which the Contract Times commence to run, unless otherwise indicated in the Notice to Proceed.

2.06 Before Starting Construction

A. CONTRACTOR's Review of Contract Documents: Before undertaking each part of the Work, CONTRACTOR shall carefully study and compare the Contract Documents and check and verify pertinent figures shown thereon and all applicable field measurements. CONTRACTOR shall promptly report in writing to DESIGN PROFESSIONAL any conflict, error, ambiguity or discrepancy which CONTRACTOR may discover and shall obtain a written interpretation or clarification from DESIGN PROFESSIONAL before proceeding with any Work affected thereby. CONTRACTOR shall not be liable to CITY or DESIGN PROFESSIONAL for failure to report any conflict, error, ambiguity or discrepancy in the Contract Documents, unless CONTRACTOR knew or reasonably should have known thereof.

B. Preliminary Schedules: Within ten (10) days after the Effective Date of the Contract, or on such later date as CITY's Representative shall provide in writing, CONTRACTOR shall submit to CITY's Representative for review:

1. Preliminary Project Schedule: CONTRACTOR shall submit a proposed project schedule for CITY’s acceptance. The proposed project schedule shall include a detailed and comprehensive construction schedule utilizing a critical path method diagram network that (a) shows all major procurement and construction elements and phases of the Project; (b) breaks down each element or phase by trade; (c) shows early and late starts so that all float time will be accurately identified; (d) all other activities necessary for the timely completion of the Project in accordance with the scheduled dates for Substantial and Final Completion; and (e) highlights the project’s critical path. CITY’s acceptance is expressly limited to CITY’s acknowledgement that, based upon CITY’s limited review, the dates of Substantial

Completion and Milestone dates are acceptable. After final acceptance of the preliminary project schedule by the CITY, it shall be considered the project baseline schedule pursuant to Paragraph 2.07(B).

2. Preliminary schedule of Shop Drawings and Sample submittals which will list each required submittal and the times for submitting, reviewing and processing such submittal; and

3. Preliminary 01290.02 Schedule of Values for all of the Work which will include quantities and prices of items which when added together equals the Contract Price and will subdivide the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

C. Preconstruction Conference: Before any Work at the Site may be started, a conference attended by CONTRACTOR, DESIGN PROFESSIONAL and others, as appropriate, will be scheduled by CITY's Representative to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.06 B, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, maintaining required records, Claims process, dispute resolution or any other applicable provisions of the Contract Documents.

2.07 Acceptable Schedules

A. Acceptable schedule: The Contractor shall update and submit to the CITY for review the preliminary schedule within seven (7) Calendar Days after the Notice to Proceed.

1. The CITY shall review and make any necessary comments and/or adjustments to the updated preliminary schedule. The Contractor shall incorporate the CITY's comments and resubmit the updated preliminary schedule within seven (7) Calendar Days from receipt of the CITY's comments.

B. Project Baseline Schedule: The accepted updated preliminary schedule shall be considered the project baseline schedule and shall be used by the CONTRACTOR for planning, scheduling, managing, and executing the Work. The project baseline schedule shall not be changed without the written consent of CITY. The project baseline schedule may be further modified by the Supplemental Conditions.

C. CONTRACTOR's schedule of values will be acceptable to CITY's Representative as to form and substance if it provides a reasonable allocation of the Contract Price to component parts of the Work.

ARTICLE 3 CONTRACT DOCUMENTS : INTENT, AMENDING, REUSE

3.01 Intent

A. The Contract Documents comprise the entire Contract between CITY and CONTRACTOR concerning the Work.

B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents. Any Work, materials or equipment that may reasonably be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the intended result will be furnished and performed whether or not specifically called for at no additional cost to CITY. Clarifications and interpretations of the Contract Documents shall be issued by DESIGN PROFESSIONAL as provided in Paragraph 9.03.

C. Correlation and intent of documents: The Drawings and Specifications are intended to supplement each other. Any Work shown on the Drawings and not mentioned in the Specifications (or vice versa) shall be as binding and shall be completed the same as if mentioned or shown on both. In the event of conflicts or discrepancies among the Contract Documents, interpretations will be based on the following priorities:

1. Change Orders and Written Amendments
2. Project Baseline Schedule Requirements
3. Approved Shop Drawings
4 Addenda, with those of later date having precedence over those of earlier date
5. The Supplementary Conditions
6. The General Conditions
7. Drawings and Specifications

D. In the case of an inconsistency between Drawings and Specifications, the requirements of the Specifications shall govern. If Drawings are in conflict, larger scale details shall govern over smaller or no-scale Drawings. If Specification sections are in conflict with each other, the conflict shall be resolved by DESIGN PROFESSIONAL in accordance with reasonable interpretation of such documents.

E. The general character of the detailed Work is shown on the Drawings, but minor modifications may be made in the full size or scale details. Where the word “similar” occurs on the Drawings, it shall be used in its general sense and not as meaning identical, and all details shall be worked out in relation to their location and their connection to the other parts of the Work. Where on any Drawings a portion of the Work is drawn out and the remainder is indicated in outline, the parts drawn out shall apply also to all other like portions of the Work. Where ornaments or other details are indicated by starting only, such details shall be continued throughout the courses or parts in which they occur and shall also apply to all other similar parts in the Work, unless otherwise indicated.

3.02 Reference to Standards and Specifications of Technical Societies

A. Reference to standards, specifications, manuals or codes of any technical society, organization or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the latest standard, specification, manual, code or Laws or Regulations in effect at the time of opening of Bids (or on the date of CONTRACTOR’s proposal if there are no Bids), except as may be otherwise specifically stated in the Contract Documents.

1. No provision of any such standard, specification, manual, code or instruction of Supplier shall be effective to change the duties or responsibilities of CITY, CONTRACTOR or DESIGN PROFESSIONAL, or any of their Subcontractors, Consultants, agents, or employees from those set forth in the Contract Documents, nor shall it be effective to assign to CITY or DESIGN PROFESSIONAL or any of their Consultants, agents or employees any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

3.03 Reporting and Resolving Discrepancies

A. Reporting Discrepancies: If, during the performance of the Work, CONTRACTOR discovers any conflict, error, ambiguity or discrepancy within the Contract Documents or between the Contract Documents and any provision of any Laws or Regulations applicable to the performance of the Work or of any standard, specification, manual, code or any instruction of any Supplier referred to in Paragraph 6.07, CONTRACTOR shall report it immediately to DESIGN PROFESSIONAL in writing. CONTRACTOR shall not proceed with the Work affected thereby (except in an emergency as authorized by Paragraph 6.17) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in Paragraph 3.04; provided, however, that CONTRACTOR shall not be liable to CITY or DESIGN PROFESSIONAL for failure to report any such conflict, error, ambiguity or discrepancy unless CONTRACTOR knew or reasonably should have known thereof.

B. Resolving Discrepancies. The provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity or discrepancy between the provisions of the Contract Documents and:

1. the provisions of any standard, specification, manual, code or instruction (whether or not specifically incorporated by reference in the Contract Documents); or

2. the provisions of any Laws or Regulations applicable to the performance of the Work.

3.04 Amending and Supplementing Contract Documents

A. The Contract Documents may be amended to provide for additions, deletions and revisions in the Work or to modify the terms and conditions thereof in one or more of the following ways:

1. a Written Amendment or

2. a Change Order (pursuant to Article 10), whether pursuant to a Work Change Directive or otherwise.

B. The requirements of the Contract Documents may be supplemented and minor variations and deviations in the Work may be authorized, in one or more of the following ways

1. DESIGN PROFESSIONAL's approval of a Shop Drawing or Sample (pursuant to Paragraph 6.18), or

2. DESIGN PROFESSIONAL's written interpretation or clarification (pursuant to Paragraph 9.03).

3.05 Reuse of Documents

A. CONTRACTOR and any Subcontractor or Supplier or other person or organization performing or furnishing any of the Work under this Contract:

1. shall not have or acquire any title to or ownership rights in any of the Drawings, Specifications or other documents (or copies of any thereof) prepared by or bearing the seal of DESIGN PROFESSIONAL or Consultant, and

2. shall not reuse any of such Drawings, Specifications, other documents or copies thereof on extensions of the Project or any other project without written consent of CITY, and of DESIGN PROFESSIONAL or Consultant, as applicable, and specific written verification or adaptation by DESIGN PROFESSIONAL or Consultant.

This prohibition will survive final payment, completion, and acceptance of the Work, or termination or completion of the Contract. Nothing herein shall preclude CONTRACTOR from retaining copies of the Contract Documents for record purposes.

ARTICLE 4 AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; REFERENCE POINTS

4.01 Availability of Lands

A. CITY shall furnish the Site. CITY shall identify any encumbrances or restrictions not of general application but specifically related to use of lands so furnished with which CONTRACTOR will have to comply in performing the Work. Easements for permanent structures or permanent changes in existing facilities will be obtained and paid for by CITY, unless otherwise provided in the Contract Documents. If CONTRACTOR and CITY are unable to agree on entitlement to or the amount or extent of any adjustments in the Contract Price or the Contract Times or both as a result of any delay in CITY's furnishing these lands, rights-of-way or easements, CONTRACTOR may make a Claim as provided in Article 16. CONTRACTOR shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

4.02 Subsurface and Physical Conditions

A. Reports and Drawings: Reference is made to the Supplementary Conditions for identification of:

1. Subsurface Conditions: Those reports of explorations and tests of subsurface conditions at or contiguous to the Site that have been utilized by DESIGN PROFESSIONAL in preparing the Contract Documents; and

2. Physical Conditions: Those drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) that have been utilized by DESIGN PROFESSIONAL in preparing the Contract Documents.

B. Limited Reliance by CONTRACTOR on Technical Data Authorized: CONTRACTOR may rely upon the general accuracy of the technical data contained in reports and drawings of subsurface or physical conditions, but such reports and drawings are not Contract Documents. The technical data is identified in the Supplementary Conditions. Except for reliance on such technical data, CONTRACTOR may not rely upon or make any Claim against CITY, DESIGN PROFESSIONAL or any Consultant with respect to:

1. the completeness of such reports and drawings for CONTRACTOR's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by CONTRACTOR and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings, or

3. any CONTRACTOR interpretation of or conclusion drawn from any technical data or any such other data, interpretations, opinions or information.

4.03 Differing Subsurface or Physical Conditions

A. Notice of Differing Subsurface or Physical Conditions. If CONTRACTOR believes that any subsurface or physical condition at or contiguous to the Site that is uncovered or revealed either:

1. is of such a nature as to establish that any technical data on which CONTRACTOR is entitled to rely as provided in Paragraphs 4.02 A and 4.02 B is materially inaccurate; or

2. is of such a nature as to require a change in the Contract Documents; or

3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents; then CONTRACTOR shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.17), notify CITY and DESIGN PROFESSIONAL in writing about such condition(s). CONTRACTOR shall not further disturb such conditions or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

B. DESIGN PROFESSIONAL's Review: After receipt of notice as required by Paragraph 4.03 A, DESIGN PROFESSIONAL will promptly review the pertinent conditions, determine the necessity for CITY to obtain additional exploration or tests with respect thereto and notify CITY in writing (with a copy to CONTRACTOR) of DESIGN PROFESSIONAL's findings and conclusions.

C. Possible Contract Documents Change: If CITY concludes that a change in the Contract Documents is required as a result of a condition that meets one or more of the categories in Paragraph 4.03 A, a Work Change Directive or a Change Order will be issued as provided in Article 10 to reflect and document the consequences of such change.

D. Possible Price or Times Adjustments: An equitable adjustment in the Contract Price or in the Contract Times, or both, will be allowed to the extent that the existence of a subsurface or physical condition causes an increase or decrease in CONTRACTOR's cost of, or time required for, performance of the Work; subject, however, to the following:

1. the condition must meet any one or more of the categories described in Paragraphs 4.03 A.1 through 4.03 A.4, inclusive;

2. a change in the Contract Documents pursuant to Paragraph 4.03 C will not be an automatic authorization of, nor a condition precedent to, entitlement to any such adjustments;

3. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraphs 9.06 and 11.04; and

4. CONTRACTOR shall not be entitled to any adjustment in the Contract Price or Contract Times if;

a. CONTRACTOR knew, or by the exercise of ordinary care could have known, of such conditions at the time CONTRACTOR made a final commitment to CITY with respect to Contract Price and Contract Times by the submission of a Bid; or

b. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test or study of the Site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for CONTRACTOR prior to CONTRACTOR's making such final commitment; or

c. CONTRACTOR failed to give the written notice as required by Paragraph 4.03 A.

E. If CITY and CONTRACTOR are unable to agree on entitlement to, or magnitude of, an equitable adjustment in the Contract Price pursuant to Article 11 and/or Contract Times pursuant to Article 12, a Claim may be made therefore as provided in Article 16. However, CITY, DESIGN PROFESSIONAL and Consultants shall not be liable to CONTRACTOR for any costs, losses or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all other dispute resolution costs) sustained by CONTRACTOR on or in connection with any other project or anticipated project.

4.04. Physical Conditions – Underground Facilities

A. Shown or Indicated: The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to CITY or DESIGN PROFESSIONAL by the owners of such Underground Facilities or by others.

1**.** CITY and DESIGN PROFESSIONAL shall not be responsible for the accuracy or completeness of any such information or data; and

2. The cost of all of the following will be included in the Contract Price and CONTRACTOR shall have full responsibility for:

a. reviewing and checking all such information and data,

b. locating all Underground Facilities shown or indicated in the Contract Documents,

c. coordination of the Work with the owners of such Underground Facilities during construction, and

d. the safety and protection of all such Underground Facilities as provided in Paragraph 6.14 and repairing any damage thereto resulting from the Work.

B. Not Shown or Indicated: If an Underground Facility is uncovered or revealed at or contiguous to the Site, and was not shown or indicated in the Contract Documents, or was

shown or indicated incorrectly in the Contract Documents, CONTRACTOR shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.17), identify the owner of such Underground Facility and give written notice to that owner and to CITY and DESIGN PROFESSIONAL.

C. DESIGN PROFESSIONAL's Review: After receipt of notice as required by Paragraph 4.04 B, DESIGN PROFESSIONAL will promptly review the consequences of the existence of the Underground Facility and notify CITY in writing (with a copy to CONTRACTOR) of DESIGN PROFESSIONAL's findings and conclusions.

D. Possible Contract Documents Change: If CITY concludes that a change in the Contract Documents is required as a result of the existence of an Underground Facility that either was not shown, or was shown incorrectly, in the Contract Documents, a Work Change Directive or Change Order will be issued as provided in Article 10 to reflect and document the consequences of such change.

E. Possible Price or Times Adjustments: An equitable adjustment in the Contract Price or in the Contract Times, or both, will be allowed to the extent that the existence of the Underground Facility causes an increase or decrease in CONTRACTOR's cost of, or time required for, performance of the Work; subject, however, to the following:

1. a change in the Contract documents pursuant to Paragraph 4.04 D will not be an automatic authorization of, nor a condition precedent to, entitlement to any such adjustments;

2. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraphs 9.06 and 11.04; and

3. CONTRACTOR shall not be entitled to any adjustment in the Contract Price or Contract Times if;

a. CONTRACTOR knew, or by the exercise of ordinary care could have known, of the existence of the Underground Facility at the time CONTRACTOR made a final commitment to CITY with respect to Contract Price and Contract Times by the submission of a Bid; or

b. the existence of the Underground Facility could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test or study of the Site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for CONTRACTOR prior to CONTRACTOR's making such final commitment; or

c. CONTRACTOR failed to give the written notice as required by Paragraph 4.04 B.

F. If CITY and CONTRACTOR are unable to agree on entitlement to, or magnitude of, an equitable adjustment in the Contract Price pursuant to Article 11 and/or Contract Times pursuant Article 12, a Claim may be made therefore as provided in Article 16. However, CITY, DESIGN PROFESSIONAL and Consultants shall not be liable to CONTRACTOR for any costs, losses or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all other dispute resolution costs) sustained by CONTRACTOR on or in connection with any other project or anticipated project.

4.05 Reference Points

A. CITY shall provide engineering surveys to establish reference points for construction that in DESIGN PROFESSIONAL's judgment are necessary to enable CONTRACTOR to proceed with the Work. CONTRACTOR shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of CITY. CONTRACTOR shall report to DESIGN PROFESSIONAL whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be

responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.06 Asbestos, Lead-Based Paint, PCBs, Petroleum, Hazardous Waste or Radioactive Material

A. Reports and Drawings: Reference is made to the Supplementary Conditions for the identification of those reports and drawings relating to a Hazardous Environmental Condition identified at the Site, if any, that have been utilized by the DESIGN PROFESSIONAL in the preparation of the Contract Documents.

B. Limited Reliance by CONTRACTOR on Technical Data Authorized: CONTRACTOR may rely upon the general accuracy of the technical data contained in reports and drawings relating to a Hazardous Environmental Condition at the Site, but such reports and drawings are not Contract Documents. Such technical data is identified in the Supplementary Conditions. Except for such reliance on such technical data, CONTRACTOR may not rely upon or make any Claim against CITY, DESIGN PROFESSIONAL or any Consultant with respect to:

1. the completeness of such reports and drawings for CONTRACTOR's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by CONTRACTOR and safety precautions and programs incident thereto; or

2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or

3. any CONTRACTOR interpretation of or conclusion drawn from any technical data or any such other data, interpretations, opinions or information.

C. CONTRACTOR shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. CONTRACTOR shall be responsible for all Hazardous Environmental Conditions created with any materials brought to the Site by CONTRACTOR, Subcontractors, Suppliers, or anyone else for whom CONTRACTOR is responsible. CONTRACTOR shall not be entitled to an extension of the Contract Times or an increase in the Contract Price if CONTRACTOR, Subcontractor, Supplier or anyone for whom CONTRACTOR is responsible created any Hazardous Environmental Condition at the Site or in connection with the Work.

D. If CONTRACTOR encounters a Hazardous Environmental Condition at the Site or if CONTRACTOR or anyone for whom CONTRACTOR is responsible creates a Hazardous Environmental Condition at the Site, CONTRACTOR shall immediately:

1. secure or otherwise isolate such condition;

2. stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 6. 15); and

3. notify CITY and DESIGN PROFESSIONAL (and promptly thereafter confirm such notice in writing). CITY shall promptly consult with DESIGN PROFESSIONAL concerning the necessity for CITY to retain a qualified expert to evaluate such condition or take corrective action, if any.

E. CONTRACTOR shall neither resume Work nor be required to resume Work in connection with such condition or in any affected area until after CITY has obtained any required permits related thereto and delivered to CONTRACTOR written notice:

1. specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or

2. specifying any special conditions under which such Work may be resumed safely. If CITY and CONTRACTOR cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price pursuant to Article 11and/or Contract Times to

pursuant to Article 12 as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by CONTRACTOR, a Claim may be made therefore as provided in Article 16.

F. If after receipt of written notice as required in Paragraph 4.06 E, CONTRACTOR does not agree to resume Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under special conditions specified in the notice, then CITY may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. If CITY and CONTRACTOR cannot agree as to entitlement to or magnitude of an equitable adjustment in Contract Price pursuant to Article 11and/or Contract Times pursuant to Article 12 as a result of deleting such portion of the Work, then a Claim may be made therefore as provided in Article 16. CITY may have such deleted portion of the Work performed by CITY's own forces or others in accordance with Article 7.

G. The provisions of Paragraphs 4.02, 4.03, and 4.04 are not intended to apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

H. All materials used, whether new or salvaged, shall be asbestos-free materials. CONTRACTOR shall immediately call to the attention of the CITY's Representative any specified material or product which the CONTRACTOR knows or suspects to contain asbestos, whether new or salvaged.

ARTICLE 5 BONDS AND INSURANCE

5.01 Performance, Payment and Other Bonds

A. CONTRACTOR shall furnish Performance and Maintenance and Payment Bonds, each in an amount at least equal to the Contract Price, as set out in the Contract Documents, as security for the faithful performance and payment of all CONTRACTOR's obligations under the Contract Documents. These Bonds shall remain in effect at least until one (1) year after the date when final payment of the Contract becomes due, except as provided otherwise by Laws or Regulations or by the Contract Documents. CONTRACTOR shall also furnish such other Bonds as are required by the Supplementary Conditions.

B. All Bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations. A certified copy of the agent's authority to act must accompany all Bonds signed by an agent.

C. If the surety on any Bond furnished by CONTRACTOR is declared bankrupt or becomes insolvent, or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirement of Paragraph 5.01 B, CONTRACTOR shall within twenty (20) days thereafter substitute another Bond and surety, both of which must be acceptable to CITY.

5.02 Licensed Sureties and Insurers

A. All Bonds and insurance required by the Contract Documents to be purchased and maintained by CITY or CONTRACTOR shall be obtained from surety or insurance companies that are duly licensed in the State of Missouri and in the jurisdiction in which the Project is located, if not in Missouri, to issue Bonds or insurance policies for the limits and coverages so required. All surety and insurance companies shall hold an A.M. Best rating of A-, V, or better.

5.03 Certificates of Insurance

A. CONTRACTOR shall deliver to CITY and DESIGN PROFESSIONAL, prior to the start of any Work at the Project Site, properly completed certificates of insurance or other evidence that the required insurance is in full force and effect, in a form acceptable to CITY. The receipt or acceptance of a certificate of insurance that does not incorporate the required terms and coverage shall not constitute a waiver by the City of the insurance requirements contained in the Contract Documents.

B. All policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained by CONTRACTOR in accordance with Paragraphs 5.04 and 5.06 will contain waiver provisions in accordance with Paragraph 5.07 A. The certificates of insurance will contain a provision stating that should any of the policies described in the certificate be cancelled before the expiration date thereof, notice will be delivered in accordance with the policy provisions.

C. If the coverage afforded is cancelled or changed or its renewal is refused, CONTRACTOR shall give at least thirty (30) days prior written notice to CITY and to each other additional insured to whom a certificate of insurance has been issued.

5.04 CONTRACTOR's Liability Insurance

A. CONTRACTOR shall purchase and maintain such liability and other insurance as is appropriate for the Work being performed and furnished, and will provide protection from claims set forth below which may arise out of or result from CONTRACTOR's performance and furnishing of the Work and CONTRACTOR's other obligations under the Contract Documents, whether it is to be performed or furnished by CONTRACTOR, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform or furnish any of the Work, or by anyone for whose acts any of them may be liable:

1. claims under workers' compensation, disability benefits and other similar employee benefit acts;

2. claims for damages because of bodily injury, occupational sickness or disease, or death of CONTRACTOR's employees;

3. claims for damages because of bodily injury, sickness or disease, or death of any person other than CONTRACTOR's employees;

4. claims for damages insured by customary personal injury liability coverage;

5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefore; and

6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.

B. The policies of insurance so required by Paragraph 5.04 A, to be purchased and maintained shall:

1. with respect to insurance required by Paragraphs 5.04 A.3 through 5.04 A.5 inclusive, include as additional insureds (subject to any customary exclusion for professional liability) CITY, DESIGN PROFESSIONAL, Consultants and any other individuals or entities identified in the Supplementary Conditions to be listed as additional insureds, and include coverage for the respective officers, directors, partners, employees, agents, and other consultants and subcontractors of each and any of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;

2. include at least the specific coverages and be written for not less than the limits of liability provided in Paragraph 5.04 C or required by Laws or Regulations, whichever is greater;

3. include completed operations insurance;

4. include contractual liability insurance covering CONTRACTOR's indemnity obligations;

5. remain in effect at least until final payment and at all times thereafter when CONTRACTOR may be correcting, removing or replacing defective Work in accordance with Paragraphs 13.06 and 13.07;

6. with respect to completed operations insurance, and any insurance coverage written on a claims-made basis, remain in effect for at least two (2) years after final payment (and CONTRACTOR shall furnish CITY and each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued evidence satisfactory to CITY and any such additional insured of continuation of such insurance);

7. contain a cross-liability or severability of interest clause or endorsement. Insurance covering the specified additional insureds shall be primary insurance, and all other insurance carried by the additional insureds shall be excess insurance;

8. with respect to commercial automobile liability, commercial general liability, and umbrella liability insurance, CONTRACTOR shall require its insurance carrier(s) to waive all rights of subrogation against CITY, and CITY's officers, directors, partners, employees and agents; and

9. contain a provision or endorsement that the costs of providing the insureds a defense and appeal, including attorneys' fees, as insureds, shall be supplementary and shall not be included as part of the policy limits but shall remain the insurer's responsibility.

C. Specific policies of insurance required by this Paragraph 5.04 shall include:

1. Workers' Compensation and Employers' Liability Insurance. This insurance shall protect CONTRACTOR against all claims under applicable state workers''' compensation laws, including coverage as necessary for the benefits provided under the United States Longshoremen's and Harbor Workers' Act and the Jones Act. CONTRACTOR shall also be protected against claims for injury, disease, or death of employees which, for any reason, may not fall within the provisions of workers' compensation laws. This policy shall include an "all states" or "other states" endorsement. The liability limits shall be not less than:

Workers' Compensation: Statutory

Employers' liability: $1,000,000 each occurrence

2. Commercial Automobile Liability Insurance. This insurance shall be occurrence type written in comprehensive form and shall protect CONTRACTOR, and CITY, DESIGN PROFESSIONAL and Consultants against all claims for injuries to members of the public and damage to property of others arising from the use of motor vehicles, either on or off the Project Site, whether they are owned, non-owned, or hired.

   The liability limits shall be not less than: $2,000,000

3. Commercial General Liability Insurance. This insurance shall be occurrence type written in comprehensive form acceptable to CITY. This insurance shall protect CONTRACTOR, and CITY, DESIGN PROFESSIONAL and Consultants as additional insureds, against claims arising from injuries, sickness, disease, or death of any person or damage to property arising out of performance of the Work. The policy shall also include coverage for personal injury liability; contractual liability; completed operations and products liability; and for blasting, explosion, and collapse of buildings; and damage to underground property. The liability limits for bodily injury and property damage shall be not less than:

$2,000,000 combined single limit for each occurrence

$2,000,000 general aggregate.

4. The insurer's costs of providing the insureds a defense and appeal as additional insureds, including attorney's fees, shall be supplementary and shall not be included as part of the policy limits but shall remain the insurer's separate responsibility.

5.05 CITY's Liability Insurance

A. In addition to the insurance required to be provided by CONTRACTOR under Paragraph 5.04, CITY, at CITY's option, may purchase and maintain at CITY's expense liability insurance

that will protect CITY against claims which may arise from operations under the Contract Documents.

5.06 Property Insurance

A. Unless otherwise provided in the Supplementary Conditions, CONTRACTOR shall purchase and maintain property insurance on the Work at the Site in the amount of the full replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws or Regulations). This insurance shall:

1. include the interests of CITY, CONTRACTOR, Subcontractors, and any other persons or entities identified in the Supplementary Conditions, each of whom is deemed to have an insurable interest and shall be listed as an insured or additional insured;

2. be written on a Builder's Risk "all-risk" or open peril or special causes of loss policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, tornado, collapse, debris removal, demolition occasioned by enforcement of Laws or Regulations, water damage, damage caused by frost and freezing, and acts of God;

3. be maintained in effect until final payment is made unless otherwise agreed to in writing by CITY with thirty (30) days written notice to each other additional insured to whom a certificate of insurance has been issued.

B. CITY shall not be responsible for purchasing and maintaining any property insurance to protect the interests of CONTRACTOR, Subcontractors or others involved in the Work to the extent of any deductible amounts. The risk of loss within the deductible amounts will be borne by CONTRACTOR, Subcontractor or others suffering any such loss and if any of them wishes property insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser's own expense.

5.07 Waiver of Rights

A. CITY and CONTRACTOR intend that all policies purchased in accordance with Paragraphs 5.04 and 5.06 will protect CITY, CONTRACTOR, DESIGN PROFESSIONAL Consultants, Subcontractors, and all other persons or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds in such policies and will provide primary coverage for all losses and damages caused by the perils covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insureds or additional insureds thereunder. CITY and CONTRACTOR waive all rights against each other and their respective officers, directors, partners, employees and agents for all losses and damages caused by, arising out of or resulting from any of the perils covered by such policies and any other property insurance applicable to the Work, but only to the extent of insurance coverage; and, in addition, waive all such rights against DESIGN PROFESSIONAL, Consultants, Subcontractors, and all other persons or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, partners, employees, agents, and other consultants and subcontractors of any and each of them) under such policies for losses and damages so caused and covered by insurance. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by CITY as trustee or otherwise payable under any policy so issued. None of the above waivers shall apply if specifically in conflict with Laws and Regulations.

5.08 Receipt and Application of Insurance Proceeds

A. Any insured loss under the property insurance will be adjusted with CITY and made payable to CITY as fiduciary for the insureds, as their interests may appear, subject to the requirements of any indentures of indebtedness entered into by CITY.

B. CITY as fiduciary shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object to CITY's exercise of this power in writing within fifteen (15) days after the occurrence of loss. If such objection is made, CITY as fiduciary shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement among the parties in interest is reached, CITY as fiduciary shall adjust and settle the loss with the insurers.

5.09 Partial Utilization – Property Insurance

A. If CITY finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, such use or occupancy may be accomplished in accordance with Paragraph 14.05; provided that no such use or occupancy shall commence before the insurers providing the property insurance have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy.

ARTICLE 6 CONTRACTOR'S RESPONSIBILITIES

6.01 Indemnification

A. For purposes of this Paragraph 6.01 only, the following terms shall have the meanings listed:

1. Claims means all claims, damages, liability, losses, costs and expenses, including court costs and reasonable attorneys'" fees, including attorney's fees incurred by the City in the enforcement of this indemnity obligation.

2. CONTRACTOR'S Agents means CONTRACTOR's officers, employees, sub-consultants, subcontractors, successors, assigns, invitees, and other agents.

3. CITY means CITY, its Program Manager/Construction Advisor and any of their agents, officials, officers, employees and program managers or construction advisors.

B. CONTRACTOR's obligations under this Paragraph with respect to indemnification for acts or omissions, including negligence, of CITY, shall be limited to the coverage and limits of insurance that CONTRACTOR is required to procure and maintain under this Contract. CONTRACTOR affirms that it has had the opportunity to recover the costs of the liability insurance required in this Contract in its contract price.

C. CONTRACTOR shall defend, indemnify and hold harmless CITY from and against all Claims arising out of or resulting from all acts or omissions in connection with this Contract caused in whole or in part by CONTRACTOR or CONTRACTOR's Agents, regardless of whether or not caused in part by any act or omission, including negligence, of OWNER.

D. In any and all Claims against CITY, DESIGN PROFESSIONAL, CONSULTANT, or any of their respective agents, officers, directors or employees by any employee (or the survivor or personal representative of such employee) of CONTRACTOR, any Subcontractor, any Supplier, any person or organization directly or indirectly employed by any of them to perform or furnish any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 6.01 C shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for CONTRACTOR or any such Subcontractor, Supplier or other person or organization under workers' compensation acts, disability benefit acts or other employee benefit acts.

E. The indemnification obligations of CONTRACTOR under Paragraph 6.01 C shall not extend to liability arising out of, resulting from, or caused by the professional negligence, errors or omissions of DESIGN PROFESSIONAL, CONSULTANT, or any of their respective agents, officers, directors or employees.

6.02 Supervision and Superintendence

A. CONTRACTOR shall supervise, inspect and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences and procedures of construction, but CONTRACTOR shall not be responsible for the negligence of others in the design or specification of a specific means, method, technique, sequence or procedure of construction which is shown or indicated in and expressly required by the Contract Documents. CONTRACTOR shall be responsible to see that the completed Work complies accurately with the Contract Documents.

B. At all times during the progress of the Work, CONTRACTOR shall assign a competent resident superintendent of the Work, who shall not be replaced without written request to and approval by CITY except under extraordinary circumstances. The superintendent will be CONTRACTOR's representative at the Site and shall have authority to act on behalf of CONTRACTOR. All communications given to or received from the superintendent shall be binding on CONTRACTOR.

C. If it is determined to be in the best interest of the Work, CONTRACTOR shall replace the project manager, resident superintendent or any other employee of the CONTRACTOR, Subcontractors, Suppliers or other persons or organizations performing or furnishing any of the Work on the project upon written request by the CITY.

6.03 Services, Working Hours, Labor, Materials and Equipment

A. CONTRACTOR shall provide competent, suitably qualified personnel to survey, lay out and construct or perform the Work as required by the Contract Documents. CONTRACTOR shall at all times maintain good discipline and order at the Site. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise indicated in the Contract Documents, all Work at the Site shall be performed during regular working hours. CONTRACTOR shall not permit overtime work or the performance of Work on Saturday, Sunday or any legal holiday without CITY's written consent given after prior written notice to DESIGN PROFESSIONAL.

B. Unless otherwise specified in Division 1, General Requirements, CONTRACTOR shall furnish and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities and all other facilities and incidentals necessary for the furnishing, performance, testing, start-up and completion of the Work.

C. All materials and equipment shall be of good quality and new, except as otherwise provided in the Contract Documents. All warranties and guarantees specifically called for by the Specifications shall expressly run to the benefit of CITY. If required by DESIGN PROFESSIONAL, CONTRACTOR shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment. All materials and equipment shall be stored, applied, installed, connected, erected, used, cleaned and conditioned in accordance with instructions of the applicable Supplier, except as otherwise provided in the Contract Documents.

D. It is the policy of the CITY that any manufactured goods or commodities used or supplied in the performance of this Contract and any subcontract hereto shall be manufactured or produced in the United States whenever possible.

6.04 Progress Schedule

A. CONTRACTOR shall adhere to the progress schedule established in accordance with Article 2 as it may be adjusted from time to time as provided below:

1. CONTRACTOR shall provide, at least once every thirty (30) calendar days, updated information on the project schedule, including thirty (30) day look ahead schedules, projected variances per event category and per Subcontractor, identification of all variances and calculation of the number of Days difference between the as-built critical path and the project schedule critical path

2. CONTRACTOR shall, with each application for payment, provide completed monthly updated status report for the previous month on the project schedule and updated information indicating as-built and as-planned conditions. The updated information on the project schedule shall not modify any Milestone dates in the project schedule that CITY has previously approved. The updated information required is a condition precedent to payment pursuant to paragraph 14.02 and shall include at a minimum:

a. a concise statement of the outlook for meeting project schedule dates and the reasons for any change in outlook from the previous report;

b. a review of any significant technical problems encountered during the month;

c. an explanation of any corrective action taken or proposed; and

d. a summary of any Claims anticipated by CONTRACTOR with respect to the Work, including the anticipated costs and schedule impacts of any such Claims.

6.05 Recovery Schedules

A. If the CONTRACTOR should:

1. fail, refuse or neglect to supply a sufficient number of workers or to deliver the materials or equipment with such promptness as to prevent the delay in the progress of the Work;

2. fail in any respect to commence and diligently prosecute the Work in accordance with the approved baseline project schedule in order to achieve substantial completion;

3. fail to commence, prosecute, finish, deliver or install the different portions of the Work on time as specified in the approved baseline project schedule; or

4. fail in the performance of any of the material covenants of the Contract Documents;

CITY shall have the right to direct the CONTRACTOR, upon seven (7) calendar days notice, to prepare a written recovery plan, for CITY's approval, to accelerate the Work in order to conform to the approved baseline project schedule, including, without limitation, providing additional labor or expediting delivery of materials, performing overtime or re-sequencing the Work without adjustments to the Contract value. Upon CITY's approval of the recovery plan, CONTRACTOR shall accelerate the Work in accordance with the plan.

B. Proposed recovery schedules shall be submitted to the CITY as a separate project plan for review and approval by CITY prior to incorporation into the approved baseline schedule. The recovery schedule shall be submitted in a format compatible with the baseline schedule format. Each proposed revision shall be submitted as a separate schedule, with the following minimum requirements:

1. A critical path method diagram showing revised and affected activities or Milestones.

2. An activity report for all revised and affected activities or Milestones.

C. Upon acceptance of the recovery schedule by CITY, data shall be added or revised for all new or revised activities and incorporated into the approved baseline project schedule.

6.06 Substitutes and "Or-Equal" Items

A. Materials or equipment: Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance and quality required. Unless the specification or description contains, or is followed by, words reading that no like, equivalent or "or-equal" item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be submitted to CITY for review by CITY's Representative under the following circumstances:

1. "Or-Equal": If, prior to receipt of Bids, Bidder proposes an item of material or equipment as functionally equal to that named and sufficiently similar so that no change in related Work will be required, CITY's Representative may request DESIGN PROFESSIONAL to consider it as an "or-equal" item. DESIGN PROFESSIONAL will review and recommend the acceptance, or rejection, of the proposed item to the CITY's Representative. For the purposes of this Paragraph, a proposed item of material or equipment will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment DESIGN PROFESSIONAL determines that:

(1) it is at least equal in quality, durability, appearance, strength, and design characteristics; and

(2) it will reliably perform at least equally well the function imposed by the design concept of the completed Project as a functioning whole; and

b. Bidder certifies that:

(1) there is no increase in cost to the CITY; and

(2) it will conform substantially, even with deviations, to the detailed requirements of the item named in the Contract Documents.

If the CITY's Representative approves the proposed item, it may be accepted by CITY.

2. Substitute Items: If CONTRACTOR proposes an item of material or equipment as a substitute item, then CONTRACTOR shall submit sufficient information as provided below to allow CITY's Representative to determine that the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefore. The procedure for review by the CITY's Representative will include the following as supplemented in the General Requirements and as CITY's Representative may determine is appropriate under the circumstances:

a. Requests for review of proposed substitute items of material or equipment will not be accepted by CITY's Representative from anyone other than CONTRACTOR.

b. If CONTRACTOR wishes to furnish or use a substitute item of material or equipment, CONTRACTOR shall first make written application to CITY's Representative for acceptance thereof.

c. In the application, CONTRACTOR shall certify that the proposed substitute will perform adequately the functions and achieve the results called for by the general design, be similar in substance to that specified and be suited to the same use as that specified. The application will state the extent, if any, to which the evaluation and acceptance of the proposed substitute will impact CONTRACTOR's achievement of Substantial Completion, whether or not acceptance of the substitute for use in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with CITY for work on the Project) to adapt the design to the proposed substitute and whether or not incorporation or use of the substitute in connection with the Work is subject to payment of any license fee or royalty.

d. All variations of the proposed substitute from that specified will be identified in the application and available maintenance, repair and replacement service will be indicated. The application will also contain an itemized estimate of all costs or credits that will result directly or indirectly from acceptance of such substitute, including costs of redesign and claims of other contractors affected by the resulting change, all of which will be considered by CITY's Representative in evaluating the proposed substitute. CITY's Representative may require CONTRACTOR to furnish additional data about the proposed substitute.

If the CITY's Representative approves the proposed item, CITY may accept it.

B. Substitute Construction Methods or Procedures: If a specific means, method, technique, sequence or procedure of construction is shown or indicated in and expressly required by the Contract Documents, CONTRACTOR may furnish or utilize a substitute means, method, technique, sequence or procedure of construction acceptable to DESIGN PROFESSIONAL. CONTRACTOR shall notify CITY and submit sufficient information to allow DESIGN PROFESSIONAL, in DESIGN PROFESSIONAL's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents.

C. Expenses: Bidder shall provide all data in support of any "or equal" at Bidder's expense, and CONTRACTOR shall provide all data in support of any proposed substitute at CONTRACTOR's expense.

D. Evaluation: DESIGN PROFESSIONAL and CITY's Representative will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to Paragraphs 6.06 A, and 6.06 B. CITY will be the sole judge of acceptability. No "or-equal" or substitute will be ordered, installed or utilized without CITY's prior written acceptance which will be evidenced by either a Change Order or an approved Shop Drawing. CITY may require CONTRACTOR to furnish at CONTRACTOR's expense, a special performance guarantee or other surety with respect to any "or-equal' substitute. DESIGN PROFESSIONAL will record time required by DESIGN PROFESSIONAL and Consultants in evaluating substitutes proposed or submitted by CONTRACTOR pursuant to Paragraphs 6.06 A and 6.06 B and in making changes in the Contract Documents (or in the provisions of any other direct contract with CITY for work on the Project) occasioned thereby. Whether or not CITY accepts a substitute so proposed or submitted by CONTRACTOR, CONTRACTOR shall reimburse CITY for the reasonable charges of DESIGN PROFESSIONAL and Consultants for evaluating each such proposed substitute.

6.07 Concerning Subcontractors, Suppliers and Others

A. CONTRACTOR shall not employ or retain any Subcontractor, Supplier or other person or organization (including those acceptable to CITY as indicated in Paragraph 6.07 B), whether initially or as a substitute, against whom CITY has a reasonable objection, including but not limited to debarment by City or another governmental entity or decertification of the Subcontractor from the City's Minority and Women's Business Enterprise Program as a result of the Subcontractor's failure to comply with any of the requirements of the provisions of Chapter 3 of the City's Code as determined by the Director of the Civil Rights and Equal Opportunity Department. Contractor shall insert this provision in any subcontractor agreement associated with this Contract. CONTRACTOR shall not be required to employ any Subcontractor, Supplier or other person or organization to furnish or perform any of the Work against whom CONTRACTOR has reasonable objection. CONTRACTOR shall submit required information for all Subcontractors on Form 01290.09 - Subcontractor and Major Material Suppliers List, provided in these Contract Documents, prior to Subcontractor beginning Work at the Site.

B. The Supplementary Conditions require the identity of certain Subcontractors, Suppliers or other persons or organizations (including those who are to furnish the principal items of materials or equipment) to be submitted to CITY on or before the date specified in the Supplementary Conditions, for acceptance by CITY. If CONTRACTOR has submitted a list

thereof in accordance with the Supplementary Conditions, CITY may accept (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Contract Documents) any such Subcontractor, Supplier or other person or organization so identified, or may reject same on the basis of reasonable objection after due investigation, in which case CONTRACTOR shall submit an acceptable replacement for the rejected Subcontractor, Supplier or other person or organization. The Contract Price will be adjusted by the difference in the cost occasioned by such substitution, and an appropriate Change Order will be issued or Written Amendment signed. No acceptance by CITY of any such Subcontractor, Supplier or other person or organization shall constitute a waiver of any right of CITY or DESIGN PROFESSIONAL to reject defective Work.

C. CONTRACTOR shall be fully responsible to CITY for all acts and omissions of the Subcontractors, Suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect contract with CONTRACTOR just as CONTRACTOR is responsible for CONTRACTOR's own acts and omissions. Nothing in the Contract Documents shall create for the benefit of any such Subcontractor, Supplier or other person or organization any contractual relationship between CITY or DESIGN PROFESSIONAL and any such Subcontractor, Supplier or other person or organization, nor shall it create any obligation on the part of CITY or DESIGN PROFESSIONAL to pay or to see to the payment of any moneys due any such Subcontractor, Supplier or other person or organization except as may otherwise be required by Laws or Regulations.

D. CONTRACTOR shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect contract with CONTRACTOR.

E. CONTRACTOR shall contractually require all Subcontractors, Suppliers and such other persons and organizations performing or furnishing any of the Work to communicate with CITY and DESIGN PROFESSIONAL through CONTRACTOR.

F. The divisions and sections of the Specifications and the identifications of any Drawings shall not control CONTRACTOR in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

G. All Work performed for CONTRACTOR by a Subcontractor or Supplier shall be pursuant to an appropriate written agreement between CONTRACTOR and the Subcontractor or Supplier that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of CITY. Whenever any such agreement is with a Subcontractor or Supplier who is listed as an additional insured on the property insurance provided in Paragraph 5.06, the agreement between the CONTRACTOR and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against CITY, CONTRACTOR, DESIGN PROFESSIONAL, Consultants and all other additional insureds for all losses and damages caused by, arising out of or resulting from any perils, to the extent covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, CONTRACTOR will obtain the same.

H. Except as otherwise provided in this subsection H and in accordance with the provisions of subsection C hereof, the agreement between CONTRACTOR and the Subcontractor or Supplier referred to in subsection G, shall provide that the CONTRACTOR and the Subcontractor or Supplier agree not to request CITY or CITY's Representative to intervene in or facilitate the resolution of claims or contract disputes arising out of or related to the agreement between CONTRACTOR and the Subcontractor or Supplier. Furthermore, the Contracts between CONTRACTOR and Subcontractors or Suppliers shall provide that all unresolved claims and disputes between CONTRACTOR and the Subcontractor or Supplier that remain unresolved after thirty (30) calendar days from the notice of claim, shall be subject to mediation as a condition precedent to the institution of legal proceedings by either party. Any such mediation shall be conducted in accordance with the CITY's Code Section 3-467.

I. CONTRACTOR shall not insert any provision in any subcontractor agreement associated with this Contract that explicitly states or implies that the subcontractor shall only be paid for work performed if or when the general CONTRACTOR is paid by the CITY . Contractor's compliance with this provision is a material term of this Contract.

J. CONTRACTORS shall not deny any Subcontractor subcontracting opportunities solely because the Subcontractor is not a signatory to collective bargaining agreements with organized labor.

6.08 Patent Fees and Royalties

A. CONTRACTOR shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation into the Work of any invention, design, process, product or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product or device is specified in the Contract Documents for use in the performance of the Work, and if to the actual knowledge of CITY or DESIGN PROFESSIONAL its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by CITY in the Contract Documents. To the fullest extent permitted by Laws or Regulations, CONTRACTOR shall defend, indemnify and hold harmless CITY, DESIGN PROFESSIONAL, Consultants and the officers, directors, employees, agents and other consultants of each and any of them from and against all claims, costs, losses and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or resulting from any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation into the Work of any invention, design, process, product or device not specified in the Contract Documents.

6.09 Permits

A. Unless otherwise provided in the Supplementary Conditions, CONTRACTOR shall obtain and pay for all construction permits and licenses. CITY shall assist CONTRACTOR, when necessary, in obtaining such permits and licenses. CONTRACTOR shall pay all governmental charges and inspection fees necessary for the prosecution of the Work, which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Contract. CONTRACTOR shall pay all charges of utility owners for connections to the Work.

B. CONTRACTOR, at its own expense, shall comply with all Federal, State and local laws and regulations, including, but not limited to the Missouri Clean Water Law (Chapter 644 RSMo) together with any accompanying regulation(s) contained in the Missouri Code of State Regulations (CSR Title 10), as well as any implementing permits, together with any CITY Provisions during the life of this Contract including but not limited to:

1. Approvals and permits as required for construction or land disturbance activities.

2. Compliance with the State of Missouri – Department of Natural Resources ("MDNR") Missouri State Operating Permit ("Land Disturbance Permit"), MO-R100006 for all construction or land disturbance activity.

3. Development and implementation of a Storm Water Pollution Prevention Plan (SWPPP).

(a) Contractor shall not commence land disturbance activity until the initial SWPPP has been finalized.

(b) Preparation and submittal of all applications, documentation and exhibits required to obtain MDNR approvals for uninterrupted Work at the Site.

(c) Amending/Updating SWPPP.

(d) Site Inspections and submittal of Inspection Reports

(e) Proper Operation and Maintenance to achieve compliance with the terms of the Permit.

(f) Maintenance of required records in accordance with MDNR requirements and requirements included in Article 6 of these Contract Documents.

4. In addition to requirements of Article 6, Contractor shall also provide record access to Missouri Department of Natural Resources (MDNR).

5. Failure to control erosion and water pollution is a permit violation. CONTRACTOR shall have 24 hours after receiving notice of the violation to correct the problem. If the CONTRACTOR fails to correct the problem after the time prescribed, the City will hire a remediation expert to fix the problem. In such an event, the CONTRACTOR shall be liable to the City for the remediation costs plus a 10% mark-up of the total contract price. If the CONTRACTOR receives three (3) notices of violation of the erosion control plan and the City's MS4 permit, the Director may issue a stop work order and delay any payment until control measures are properly functioning and stream damage has been mitigated. In such an event, any delay to the project schedule will result in liquidated damages assessed against the CONTRACTOR.

6.10 Compliance with Laws and Regulations

A. CONTRACTOR shall comply with all federal, state and local laws, ordinances and regulations applicable to the work and this Contract. CONTRACTOR shall give all notices and comply with all Laws or Regulations applicable to furnishing and performing the Work. Except where otherwise expressly required by applicable Laws or Regulations, neither CITY nor DESIGN PROFESSIONAL shall be responsible for monitoring CONTRACTOR's compliance with any Laws or Regulations. The Laws or Regulations included in this Paragraph shall include, but not be limited to, those set forth in the Supplementary Conditions.

B. **Failure to Comply**. If CONTRACTOR performs any Work in violation of applicable Laws or Regulations, CONTRACTOR shall bear all claims, costs, losses and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) caused by, arising out of or resulting therefrom; however, it shall not be CONTRACTOR's primary responsibility to make certain that the Specifications and Drawings are in accordance with Laws or Regulations, but this shall not relieve CONTRACTOR of CONTRACTOR's obligations under Paragraph 3.03.

C. **Conflicts of Interest**. The provisions of City's Code Sections 2-2001 and 3-301, prohibiting City officers and employees from having a financial or personal interest in any contract with City, and Code Sections 3-307, and 3-309, imposing sanctions for violations, shall apply to this Contract. CONTRACTOR certifies that no officer or employee of City has, or will have, a direct or indirect financial or personal interest in this Contract, and that no officer or employee of City, or member of such officer's or employee's immediate family, either has negotiated, or has or will have an arrangement concerning employment to perform services on behalf of CONTRACTOR on this Contract.

D. **Licenses and Permits**. CONTRACTOR, at its own expense, shall secure or cause to be secured all licenses and permits from public or private sources necessary for the fulfillment of its obligations under this Contract. All references in this Contract to the "Code" shall mean City's Code of Ordinances, including any amendments thereto or re-codification thereof unless the context clearly indicates otherwise. CONTRACTOR shall obtain copies of all necessary licenses and permits from Subcontractors required for the Work before Subcontractors begin Work at the Site. CONTRACTOR shall retain such evidence in its files and make available to CITY within ten (10) days after CITY's written request.

E. Americans with Disabilities Act. CONTRACTOR agrees to comply, during the course of this Contract, with all provisions of Title II of the 2010 ADA Standards for Accessible Design as amended from time to time.

F. Affirmative Action. If the Contract Price exceeds $300,000.00 and CONTRACTOR employs fifty (50) or more people, CONTRACTOR shall comply with City's Affirmative Action requirements in accordance with the provisions of Chapter 3 of City's Code, the rules and regulations relating to those sections, and any additions or amendments thereto. CONTRACTOR shall not discriminate against any employee or applicant for employment because of race, color, sex, religion, national origin or ancestry, disability, sexual orientation, gender identity or age in a manner prohibited by Chapter 3 of City's Code.

CONTRACTOR shall:

1. Submit, in print or electronic format, a copy of CONTRACTOR'S current certificate of compliance to the City's Civil Rights and Equal Opportunity Department (CREO) prior to receiving the first payment under the contract, unless a copy has already been submitted to CREO at any point within the previous two calendar years. If, and only if, CONTRACTOR does not possess a current certification of compliance, CONTRACTOR shall submit, in print or electronic format, a copy of its affirmative action program to CREO prior to receiving the first payment under the contract, unless a copy has already been submitted to CREO at any point within the previous two calendar years.

2. Require any Subcontractor awarded a subcontract exceeding $300,000.00 to affirm that Subcontractor has an affirmative action program in place and will maintain the affirmative action program in place for the duration of the subcontract.

3. Obtain from any Subcontractor awarded a subcontract exceeding $300,000.00 a copy of the Subcontractor's current certificate of compliance and tender a copy of the same, in print or electronic format, to CREO within thirty (30) days from the date the subcontract is executed. If, and only if, Subcontractor does not possess a current certificate of compliance, CONTRACTOR shall obtain a copy of the Subcontractor's affirmative action program and tender a copy of the same, in print or electronic format, to CREO within thirty (30) days from the date the subcontract is executed.

City has the right to take action as directed by City's Civil Rights and Equal Opportunity Department to enforce this provision. If CONTRACTOR fails, refuses or neglects to comply with the provisions of Chapter 3 of City's Code, then such failure shall be deemed a total breach of this Contract and this Contract may be terminated, canceled or suspended, in whole or in part, and CONTRACTOR may be declared ineligible for any further contracts funded by City for a period of one (1) year. This is a material term of this Contract.

G. **Minority and Women Business Enterprises and Workforce**. City is committed to ensuring that minorities and women participate to the maximum extent possible in the performance of City's construction contracts. If minority and women business enterprise (M/WBE) goals have been set for this Contract, CONTRACTOR agrees to comply with all requirements of City's Minority and Women's Business Enterprise Program as enacted in City's Code, Sections 3-421 through 3-469 and as hereinafter amended. CONTRACTOR shall meet or exceed both the MBE and WBE goals set forth in its Contractor Utilization Plan/Request for Waiver. If workforce utilization goals are applicable to this Contract, CONTRACTOR agrees to comply with all requirements of City's Construction Employment Program as enacted in City's Code, Sections 3-501 through 3-527 and as hereinafter amended. CONTRACTOR shall meet or exceed the construction employment goals unless the same shall have been waived in the manner provided by law. CONTRACTOR's compliance with this provision is a material part of this Contract.

H. **Records.**

1. For purposes of this section:

(a) "City" shall mean the City Auditor, the City's Internal Auditor, the City's Director of Civil Rights and Equal Opportunity, the City Manager, the City department administering this Contract and their delegates and agents.

(b) “Record” shall mean any document, book, paper, photograph, map, sound recordings or other material, regardless of physical form or characteristics, made or received in connection with this Contract and all Contract amendments and renewals.

2. CONTRACTOR shall maintain and retain all Records for a term of five (5) years that shall begin after the expiration or termination of this Contract and all Contract amendments. City shall have a right to examine or audit all Records and CONTRACTOR shall provide access to City of all records upon ten (10) days written notice from the City.

I. **Prevailing Wage.**

1. CONTRACTOR shall comply and require its Subcontractors to comply with;

a. sections 290.210 to 290.340, RSMO the State of Missouri Prevailing Wage Law (the “Law”); and

b. 8 CSR 30-3.010 to 8 CSR 30-3.060, the Prevailing Wage Law Rules (the “Rules”); and

c. the Annual Wage Order (Wage Order) issued by the State of Missouri’s Department of Labor and Industrial Relations; and

d. any applicable Annual Incremental Wage Increase (Wage Increase) to the Annual Wage Order.

2. The Law, Rules, Annual Wage Order and any Wage Increase are incorporated into and made part hereof this Contract and shall be collectively referred to in this Section as the “Prevailing Wage Requirements.”

3. CONTRACTOR shall pay and require its Subcontractors to pay to all workers performing work under this Contract not less than the prevailing hourly rate of wages for the class or type of work performed by the worker in accordance with the Law, Rules, Wage Order and any applicable Wage Increase. CONTRACTOR shall take whatever steps are necessary to insure that the prevailing hourly wage rates are paid and that all workers for CONTRACTOR and each of its Subcontractors are paid for the class or type of work performed by the worker in accordance with the Prevailing Wage Requirements. If CONTRACTOR shall fail to start to perform CONTRACTOR’s obligations under the Contract Documents within sixty (60) days from the Effective Date of the Contract, CONTRACTOR and each of its subcontractors shall be obligated to pay all workers in accordance with any new Wage Order, as subsequently amended by any applicable Wage Increase, issued by the Department of Labor and Industrial Relations within the aforementioned sixty (60) day period. The new Wage Order and any applicable Wage Increase shall govern notwithstanding the fact that the Wage Order being replaced might be physically attached or incorporated in the Contract Documents.

4. Prior to each of its Subcontractors beginning Work on the Site, CONTRACTOR shall require each Subcontractor to complete CITY’s Form 00490 entitled “Pre-contract Certification” that sets forth the Subcontractor’s prevailing wage and tax compliance history for the two (2) years prior to the bid. CONTRACTOR shall retain one (1) year and make the Pre-contract Certifications available to CITY within five (5) days after written request.

5. CONTRACTOR shall:

a. Keep and require each of its Subcontractors engaged in the construction of public works in performance of the Contract to keep full and accurate records on City’s “Daily Labor Force Report” Form indicating the worker’s name, occupational title or classification group & skill and the workers’ hours. City shall furnish blank copies of the Daily Labor Force Report Form to Contractor for its use and for distribution to Subcontractors. Contractor shall submit its and its Subcontractors Daily Labor Force Reports to City each day; and

b. Submit, and require each of its Subcontractors engaged in the construction of public works in performance of the Contract to submit electronically, in a format prescribed by the City, Certified Payroll Report Information indicating the worker's name, address, social security number, occupation(s), craft(s) of every worker employed in connection with the public work together with the number of hours worked by each worker and the actual wages paid in connection with the Project and other pertinent information as requested by the City; and

c. Submit, and require each of its Subcontractors engaged in the construction of public works in performance of the Contract to submit, electronically, in format prescribed by the City, a Payroll Certification. The Payroll Certification must be signed by the employee or agent who pays or supervises the payment of the workers employed under the Contract for the Contractor and each Subcontractor; and

d. The Daily Labor Force Report, documents used to compile information for the Certified Payroll Report, and Payroll Certification are collectively referred to in this Section as the "Records."

6. CONTRACTOR shall submit its and its Subcontractors Daily Labor Force Reports to CITY each day. CONTRACTOR shall make all of CONTRACTOR's and Subcontractors' Records open to inspection by any authorized representatives of OWNER and the Missouri Department of Labor and Industrial Relations at any reasonable time and as often as they may be necessary and such Records shall not be destroyed or removed from the State of Missouri for a period of one (1) year following the completion of the public work in connection with which the Records are made. CONTRACTOR shall have its and its Subcontractors Certified Payroll Reports and Payroll Certifications available at the CONTRACTOR's office and shall provide the Records to the City electronically at City's sole discretion. In addition, all Records shall be considered a public record and CONTRACTOR shall provide the Records to the CITY in the format required by the CITY within three (3) working days of any request by CITY at the CONTRACTOR's cost. CITY, in its sole discretion, may require CONTRACTOR to send any of the Records directly to the person who requested the Record at CONTRACTOR's expense.

7. CONTRACTOR shall post and keep posted a clearly legible statement of all prevailing hourly wage rates to be paid to all workers employed by CONTRACTOR and each of its Subcontractors in the performance of this Contract in a prominent and easily accessible place at the Site of the Work by all workers.

8. If the Contract Price exceeds $250,000.00, CONTRACTOR shall and shall require each Subcontractor engaged in any construction of public works to have its name, acceptable abbreviation or recognizable logo and the name of the city and state of the mailing address of the principal office of the company, on each motor vehicle and motorized self-propelled piece of equipment which is used in connection with the Project during the time the CONTRACTOR or Subcontractor is engaged on the project. The sign shall be legible from a distance of twenty (20') feet, but the size of the lettering need not be larger than two (2") inches. In cases where equipment is leased or where affixing a legible sign to the equipment is impractical, the CONTRACTOR may place a temporary stationary sign, with the information required pursuant to this section, at the main entrance of the Project in place of affixing the required information on the equipment so long as such sign is not in violation of any state or federal statute, rule or regulation. Motor vehicles which are required to have similar information affixed thereto pursuant to requirements of a regulatory agency of the state or federal government are exempt from the provisions of this subsection.

9. CONTRACTOR must correct any errors in CONTRACTOR's or any Subcontractors' Records, or CONTRACTOR's or any Subcontractors' violations of the Law, Rules, Annual Wage Order and any Wage Increase within fourteen (14) calendar days after notice from CITY.

10. CONTRACTOR shall and shall require its Subcontractors to cooperate with the CITY and the Department of Labor and Industrial Relations in the enforcement of this Section, the Law, Rules, Annual Wage Order and any Wage Increase. Contractor shall and shall require its Subcontractors to permit CITY and the Department of Labor and Industrial Relations to interview any and all workers during working hours on the Project at CONTRACTOR's sole cost and expense.

11. CONTRACTOR shall file with CITY, upon completion of the Project and prior to final payment therefore, affidavits from CONTRACTOR and each of its Subcontractors, stating that each has fully complied with the provisions and requirements of the Missouri Prevailing Wage Law. CITY shall not make final payment until the affidavits, in proper form and order, from CONTRACTOR and each of its Subcontractors, are filed by CONTRACTOR.

12. CONTRACTOR shall forfeit as a statutory penalty to the CITY one hundred dollars ($100.00) for each worker employed, for each calendar day, or portion thereof, such worker is paid less than the prevailing hourly rates for any work done under this Contract, by CONTRACTOR or by any of CONTRACTOR's Subcontractors. If CONTRACTOR or any of its Subcontractors have violated any section(s) of 290.210 to 290.340, RSMo, in the course of the execution of the Contract, CITY shall when making payments to the CONTRACTOR becoming due under this Contract, withhold and retain therefrom all sums and amounts due and owing as a result of any violation of sections 290.210 to 290.340, RSMo.

J. **Prevailing Wage Damages**. CONTRACTOR acknowledges and agrees that, based on the experience of CITY, violations of the Missouri Prevailing Wage Act, whether by CONTRACTOR or its Subcontractors, commonly result in additional costs to CITY. CONTRACTOR agrees that additional costs to CITY for any particular violation are difficult to establish and include but are not limited to: costs of construction delays, additional work for CITY, additional interest expenses, investigations, and the cost of establishing and maintaining a special division working under the City Manager to monitor prevailing wage compliance.

1. In the event of the failure by CONTRACTOR or any of its Subcontractors to pay wages as provided in the Missouri Prevailing Wage Act, CITY shall be entitled to deduct from the Contract Price, and shall retain as liquidated damages, one hundred dollars ($100.00) per day, per worker who is paid less than the prevailing hourly rate of wages, to approximate the additional costs. The sum shall be deducted, paid or owed whether or not the Contract Times have expired.

2. CITY shall give written notice to CONTRACTOR setting forth the workers, who have been underpaid, the amount of the statutory penalty and the amount of the liquidated damages as provided for in this Subparagraph J**.** CONTRACTOR shall have fourteen (14) calendar days to respond, which time may be extended by CITY upon written request. If CONTRACTOR fails to respond within the specified time, the CITY's original notice shall be deemed final. If CONTRACTOR responds to CITY's notice, CITY will furnish CONTRACTOR a final decision in writing within five (5) days of completing any investigation.

K. **Missouri Secretary of State Business Entity Registration**. CONTRACTOR shall obtain from all Subcontractors for the Project, a copy of their current certificate of good standing or fictitious name registration from the Missouri Secretary of State before they begin work on the Site. CONTRACTOR shall retain such documents in its files and make available to CITY within ten (10) days after written request.

L. **Tropical Hardwoods**. The provisions of Code Section 2-1872, restricting the use of tropical hardwoods, shall apply to this Contract.

M. **Preference for Missouri Products**. Pursuant to Section 71.140 RSMo., preference shall be given to materials, products, supplies and all other articles produced, manufactured, made or grown within the State of Missouri.

N. **Guidelines for Open Excavations**.

1. CONTRACTOR shall restore required excavations to the level of the adjacent surfaces as soon as practicable. Unsupervised open excavations on public properties are discouraged at all times. If CONTRACTOR, in performance of the Work, makes or causes to be made any excavation in, upon, under, through or adjoining any street, sidewalk, alley, park, boulevard, parkway or any other public properties, and shall leave any part or portion thereof open, CONTRACTOR shall provide effective protection to the public.

2. CONTRACTOR shall protect and secure all excavations in roadways in compliance with existing federal, state and local codes and standards, including, but not limited to the most current edition of the Manual of Uniform Traffic Control Devices. CONTRACTOR shall protect and secure all unsupervised excavations not within roadways, either by covering or fencing.

a. Covering. A protective cover that can sustain the weight of persons or of objects that are placed upon it may be installed over an unsupervised excavation. The cover shall be secured to the ground to prevent movement. Protective covers shall have no opening(s) or protuberance(s) of sufficient size to cause a fall and/or injury. Advance warning devices shall be installed as necessary.

b. Fencing. Fencing to prevent entry may be installed surrounding an unsupervised excavation not protectively covered in its entirety. The fencing shall be a minimum of 42" in height. The fencing shall be constructed in such a manner that it is adequately secured and will remain upright at all times under normal Site conditions. All protective coverings and fences over and around excavations shall be inspected at least daily to assure integrity. Protective coverings and/or fences in heavily trafficked areas shall be inspected more often as necessary.

O. **Notification of Utilities**. CONTRACTOR shall adhere to the provisions of Sections 319.010 et seq., RSMo., which requires that a person or firm making an excavation in any public street, road or alley, right of way dedicated to public use, utility easement of record, or within any private street or private property do so only after giving notice to, and obtaining information from, owners of Underground Facilities. The 24-hour, toll-free accident prevention hotline number in Missouri is 1-800-344-7483 (1-800-Digrite).

P. Employee Eligibility Verification. CONTRACTOR shall adhere to the provisions of Sections 285.525 et seq., RSMo., which requires that for any contract exceeding five thousand dollars ($5,000.00), CONTRACTOR shall execute and submit an affidavit, in a form prescribed by CITY, affirming that CONTRACTOR does not knowingly employ any person in connection with the contracted services who does not have the legal right or authorization under federal law to work in the United States as defined in 8 U.S.C.§ 1324a(h)(3). CONTRACTOR shall attach to the affidavit documentation sufficient to establish CONTRACTOR'S enrollment and participation in an electronic verification of work program operated by the United States Department of Homeland Security (E-Verify) or an equivalent federal work authorization program operated by the United States Department of Homeland Security to verify information of newly hired employees, under the Immigration Reform and Control Act of 1986. CONTRACTOR may obtain additional information about E-Verify and enroll at https://e-verify.uscis.gov/enroll/StartPage.aspx?JS=YES. For those Contractors enrolled in E-Verify, the first and last pages of the E-Verify Memorandum of Understanding that CONTRACTOR will obtain upon successfully enrolling in the program shall constitute sufficient documentation for purposes of complying with this Section. CONTRACTOR shall submit the affidavit and attachments to CITY prior to execution of the Contract, or at any point during the term of the Contract if requested by City.

Q. **OSHA 10-Hour Training Requirement**. CONTRACTOR and any subcontractor working under this Contract shall require every employee on the Site to complete a ten-hour construction safety program which meets the requirements of Section 292.675, RSMo, except for those employees who shall have previously completed the required program and hold documentation to that effect. CONTRACTOR shall remove or require the removal of any

person from the Site who is subject to this requirement and who does not complete or is unable to produce documentation of their successful completion of the required program within the time limitations prescribed by Section 292.675, RSMo. CONTRACTOR shall forfeit the sum of two thousand five hundred dollars ($2,500.00), in addition to one hundred dollars ($100.00) per employee each calendar day, or portion thereof, the employee(s) shall continue to be employed without having completed the required program within the time limitations prescribed by Section 292.675, RSMo. CITY shall be entitled to withhold and retain any amounts due and owing hereunder when making payment to CONTRACTOR.

R. Clean Air Act and Clean Water Act. CONTRACTOR shall comply with requirements of the Clean Air Act (42 U.S.C. 7401 *et seq*.); Clean Water Act (33 U.S.C. 1251 *et seq*.), Missouri Clean Water Law (Chapter 644 RSMo), Code of Federal regulations (Title 40: Protection of Environment, Title 33: Navigation and Navigable Waters) and the rules of the Missouri Code of State Regulations (CSR Title 10).

S. Contract information Management System. If applicable, CONTRACTOR shall comply with CITY's Contract Information Management System requirements. CONTRACTOR shall use CITY's Internet web based Contract Information Management System/Project Management Communications Tool provided by CITY and protocols included in that software during the term of this Contract. CONTRACTOR shall maintain user applications to CITY's provided system for all personnel, subcontractors or suppliers as applicable and shall require subcontractors/subconsultants to maintain same.

T. Anti-Discrimination Against Israel. If this Contract exceeds $100,000.00 and CONTRACTOR employs at least ten employees, pursuant to Section 34.600, RSMo., by executing this Contract, CONTRACTOR certifies it is not currently engaged in and shall not, for the duration of this contract, engage in a boycott of goods or services from the State of Israel; companies doing business in or with Israel or authorized by, licensed by, or organized under the laws of the State of Israel; or persons or entities doing business in the State of Israel.

U. Ban the Box in Hiring and Promotion

a. Pursuant to Section 38-104, City Code Ordinances, CONTRACTOR shall not base a hiring or promotional decision on an applicant's criminal history or sentence related thereto, unless the employer can demonstrate that the employment-related decision was based on all information available including consideration of the frequency, recentness and severity of a criminal record and that the record was reasonably related to the duties and responsibilities of the position.

b. Notwithstanding subsection (a), CONTRACTOR may inquire about an applicant's criminal history after it has been determined that the individual is otherwise qualified for the position, and only after the applicant has been interviewed for the position. Any such inquiry may be made of all applicants who are within the final selection pool of candidates from which a job will be filled.

c. This provision shall not apply to positions where employers are required to exclude applicants with certain criminal convictions from employment due to local, state or federal law or regulation.

V. Title VI of the Civil Rights Act of 1964

a. Title VI of the Civil Rights Act of 1964 requires that no person in the United States shall, on the grounds of race, color, or national or origin (including limited English proficient individuals), be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance. The City of Kansas City, Missouri requires compliance with the requirements of Title VI in all of its programs and activities regardless of the funding source.

b. CONTRACTOR shall not discriminate on the grounds of race, color, or national or origin (including limited English proficient individuals).

W. Non-discrimination in Employment

CONTRACTOR shall not discriminate against any employee or candidate for employment on the basis of an individual's race, hair texture or hair style associated with an individual's race, color, sex, religion, national origin, or ancestry, disability, sexual orientation, gender identity or age in a manner prohibited by Chapter 38 of the City Code. CONTRACTOR shall not engage in any discrimination as prohibited by Chapter 3 of the City Code.

X. Quality Services Assurance Act

If this Contract exceeds $160,000.00, CONTRACTOR certifies that CONTRACTOR will pay all employees who will work on this Contract in the city limits of Kansas City, Missouri at least $15.00 per hour in compliance with the City's Quality Services Assurance Act, Section 3-66, Code of Ordinances unless City has granted CONTRACTOR an exemption pursuant to the Quality Services Assurance Act.

6.11 Taxes

A. CONTRACTOR shall pay all sales, consumer, use and other similar taxes required to be paid by CONTRACTOR in accordance with the Laws or Regulations of the place of the Project which are applicable during the performance of the Work.

B. **Tax Compliance**.

1. As a condition precedent to CITY making its first payment to CONTRACTOR under this Contract, CONTRACTOR shall furnish to CITY sufficient proof from City's Commissioner of Revenue, dated not more than one (1) year prior to the date provided to CITY, verifying that CONTRACTOR is in compliance with the license and tax ordinances administered by City's Revenue Division of the Finance Department.

2. As a condition precedent to Subcontractors performing any Work under this Contract, CONTRACTOR shall obtain from Subcontractor sufficient proof from City's Commissioner of Revenue, dated not more than one (1) year before the date Subcontractor begins Work, verifying that the Subcontractor is in compliance with the license and tax ordinances administered by City's Revenue Division of the Finance Department. CONTRACTOR shall retain such documentation in its files and make available to CITY within ten (10) days after a written request.

3. As a condition precedent to CITY making final payment under this Contract, if this Contract is longer than one (1) year and exceeds the dollar threshold established by ordinance and included in the Supplementary Conditions, CONTRACTOR shall furnish to CITY sufficient proof from City's Commissioner of Revenue, dated not more than one (1) year before the filing of a final Application for Payment, verifying that CONTRACTOR is in compliance with the license and tax ordinances administered by City's Revenue Division of the Finance Department.

4. If this Contract is longer than one (1) year and exceeds the dollar threshold established by ordinance and included in the Supplementary Conditions, CONTRACTOR shall obtain from Subcontractors sufficient proof from City's Commissioner of Revenue, dated not more than one (1) year before the date of CONTRACTOR's final payment to the Subcontractor, that the Subcontractor was or is in compliance with the license and tax ordinances administered by City's Revenue Division of the Finance Department. CONTRACTOR shall retain such documentation in its files and make available to CITY within ten (10) days after written request.

5. If, at the time of final payment to CONTRACTOR, CONTRACTOR is unable to obtain from all its Subcontractors, if any, and furnish to CITY sufficient proof from City's Commissioner of Revenue that all its Subcontractors are in compliance with the license and tax ordinances administered by City's Revenue Division of the Finance Department, CITY may approve final payment to CONTRACTOR if CITY determines that CONTRACTOR has made a good faith effort to furnish evidence or that there are other extenuating circumstances which make it impossible for CONTRACTOR to furnish sufficient proof.

C. **Missouri Sales Tax Exemption**. Pursuant to Section 144.062, RSMo, CITY is a Missouri exempt entity and tangible personal property to be incorporated or consumed in the construction of this Project may be purchased without sales tax. CITY shall furnish CONTRACTOR a Missouri Project Exemption Certificate for Sales Tax at the time of issuance of the Notice to Proceed.

6.12 Use of Site and Other Areas

A. CONTRACTOR shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas identified in and permitted by the Contract Documents and other areas permitted by Laws or Regulations. CONTRACTOR shall not unreasonably encumber the Site and the other areas with construction equipment or other materials or equipment. CONTRACTOR shall assume full responsibility for any damage to the Site or the other areas, or to the owner or occupant thereof, or of any adjacent land or areas, resulting from the performance of the Work.

B. Should any claim be made by any such owner or occupant because of the performance of the Work, CONTRACTOR shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law. In case of a failure on the part of the CONTRACTOR to restore such property or to make good such damage or injuries, the CITY may, upon forty-eight (48) hours written notice to the CONTRACTOR, repair, rebuild or otherwise restore such property as the CITY may deem necessary, and the cost thereof will be deducted from any moneys due or which may become due the CONTRACTOR under this Contract.

C. CONTRACTOR shall, to the fullest extent permitted by Laws or Regulations, defend, indemnify and hold harmless CITY, DESIGN PROFESSIONAL, Consultants and the officers, directors, employees, agents and other consultants of each and any of them from and against all claims, costs, losses and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or resulting from any claim or action, legal or equitable, brought by any such owner or occupant against CITY, DESIGN PROFESSIONAL or any other party indemnified hereunder to the extent caused by or based upon CONTRACTOR's performance of the Work.

D. During the progress of the Work, CONTRACTOR shall keep the Site and the other areas free from accumulations of waste materials, rubbish and other debris resulting from the Work. At the completion of the Work CONTRACTOR shall remove all waste materials, rubbish and debris from Site and other areas as well as all tools, appliances, construction equipment and machinery and surplus materials. CONTRACTOR shall leave the Site clean and ready for utilization or occupancy by CITY at Substantial Completion of the Work. CONTRACTOR shall restore to all property not designated for alteration by the Contract Documents to its pre-Work condition.

E. CONTRACTOR shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall CONTRACTOR subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

6.13 Record Documents

A. CONTRACTOR shall maintain in a safe place at the Site one record copy of all Drawings, Specifications, Addenda, the Contract, Written Amendments, Change Orders, Work

Change Directives, and written interpretations and clarifications in good order and annotated to show all changes made during construction. These record documents, together with all approved Samples and a counterpart of all approved Shop Drawings, will be available to CITY and DESIGN PROFESSIONAL for reference. Upon completion of the Work, these record documents, Samples and Shop Drawings will be delivered to DESIGN PROFESSIONAL for CITY.

6.14 Safety and Protection

A. CONTRACTOR shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. CONTRACTOR shall comply with all applicable Laws or Regulations relating to the safety of persons or property to protect them from damage, injury or loss; and shall erect and maintain all necessary safeguards for safety and protection. CONTRACTOR shall deliver to CITY a copy of CONTRACTOR'S Health and Safety Plan as provided in the Notice of Intent to Contract.

B. CONTRACTOR shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation and replacement of their property. All damage, injury or loss to any property referred to in Paragraph 6.14 B.2 or 6.14 B.3 caused, directly or indirectly, in whole or in part, by CONTRACTOR, any Subcontractor, Supplier or any other person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, shall be remedied by CONTRACTOR (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of CITY, DESIGN PROFESSIONAL, Consultant, or anyone employed by any of them or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of CONTRACTOR, Subcontractor, Supplier or other person or organization directly or indirectly employed by any of them). CONTRACTOR's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and DESIGN PROFESSIONAL has issued a notice to CONTRACTOR in accordance with Paragraph 14.07 that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion). CONTRACTOR shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and Underground Facilities not designated for removal, relocation or replacement in the course of the Work.

6.15 Safety Representative

A. In accordance with OSHA standards, CONTRACTOR shall designate a qualified and experienced safety representative whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs. CONTRACTOR's safety representative shall remain at the Site whenever there is Work in progress and shall immediately notify CITY of any emergencies or accidents occurring at the Site

6.16 Hazard Communication Programs

A. CONTRACTOR shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

6.17 Emergencies

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, CONTRACTOR, without special instruction or authorization from CITY or DESIGN PROFESSIONAL, is obligated to act to prevent threatened damage, injury or loss. CONTRACTOR shall give CITY and DESIGN PROFESSIONAL prompt written notice if CONTRACTOR believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If CITY determines that a change in the Contract Documents is required because of the action taken by CONTRACTOR in response to an emergency, a Work Change Directive or Change Order will be issued.

B. A change in the Contract Documents pursuant to Paragraph 6.15 A will not be an automatic authorization of, nor a condition precedent to, entitlement to adjustment in the Contract Price or Contract Times. If CITY and CONTRACTOR are unable to agree on entitlement to, or magnitude of, an equitable adjustment in the Contract Price or Contract Times, a Claim may be made therefore as provided in Article 16. However, OWNER, DESIGN PROFESSIONAL and Consultants shall not be liable to CONTRACTOR for any costs, losses or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all other dispute resolution costs) sustained by CONTRACTOR on or in connection with any other project or anticipated project.

6.18 Shop Drawings and Samples

A. CONTRACTOR shall submit Shop Drawings to DESIGN PROFESSIONAL for review and approval in accordance with the accepted schedule of Shop Drawings and Sample submittals (see Paragraph 2.07). All submittals shall be identified as DESIGN PROFESSIONAL may require and in the number of copies specified in the General Requirements. The data shown on the Shop Drawings shall be complete with respect to quantities, dimensions, specified performance and design criteria, materials and similar data to show DESIGN PROFESSIONAL the services, materials and equipment CONTRACTOR proposes to provide and to enable DESIGN PROFESSIONAL to review the information for the limited purposes required by Paragraph 6.18 D.

B. CONTRACTOR shall also submit Samples to DESIGN PROFESSIONAL for review and approval in accordance with said accepted schedule of Shop Drawings and Sample submittals. Each Sample shall be identified clearly as to material, Supplier, pertinent data such as catalog numbers and the use for which intended and otherwise as DESIGN PROFESSIONAL may require to enable DESIGN PROFESSIONAL to review the submittal for the limited purposes required by Paragraph 6.18 D. The numbers of each Sample to be submitted will be as specified in the Specifications.

C. **Submittal Procedures**:

1. Before submitting each Shop Drawing or Sample, CONTRACTOR shall have determined and verified:

a. all field measurements, quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers and similar information with respect thereto;

b. all materials with respect to intended use, fabrication, shipping, handling, storage, assembly and installation pertaining to the performance of the Work;

c. all information relative to means, methods, techniques, sequences and procedures of construction and safety precautions and programs incident thereto; and

d. CONTRACTOR shall also have reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents.

2. Each submittal shall bear a stamp or specific written indication that CONTRACTOR has satisfied CONTRACTOR's obligations under the Contract Documents with respect to CONTRACTOR's review and approval of that submittal.

3. At the time of each submission, CONTRACTOR shall give DESIGN PROFESSIONAL specific written notice of such variations, if any, that the Shop Drawing or Sample submitted may have from the requirements of the Contract Documents, the notice to be in a written communication separate from the submittal, and, in addition, shall cause a specific notation to be made on each Shop Drawing and Sample submitted to DESIGN PROFESSIONAL for review and approval of each such variation.

D. **DESIGN PROFESSIONAL's Review**:

1. DESIGN PROFESSIONAL will review and approve Shop Drawings and Samples in accordance with the schedule of Shop Drawings and Sample submittals accepted by DESIGN PROFESSIONAL as required by Paragraph 2.06. DESIGN PROFESSIONAL's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation into the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. DESIGN PROFESSIONAL's review and approval will not extend to means, methods, techniques, sequences or procedures of construction (except where a particular means, method, technique, sequence or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

3. DESIGN PROFESSIONAL's review and approval of Shop Drawings or Samples shall not relieve CONTRACTOR from responsibility for any variation from the requirements of the Contract Documents unless CONTRACTOR has in writing called DESIGN PROFESSIONAL's attention to each such variation at the time of submission as required by Paragraph 6.18 C.3, and DESIGN PROFESSIONAL has given written approval of each such variation by specific written notation thereof incorporated into or accompanying the Shop Drawing or Sample approval; nor will any approval by DESIGN PROFESSIONAL relieve CONTRACTOR from responsibility for complying with the requirements of Paragraph 6.18 C.1.

E. Where a Shop Drawing or Sample is required by the Contract Documents or the schedule of Shop Drawings and Sample submissions accepted by DESIGN PROFESSIONAL as required by Paragraph 2.06, any related Work performed prior to DESIGN PROFESSIONAL's review and approval of the pertinent submittal will be at the sole expense and responsibility of CONTRACTOR.

F. CONTRACTOR shall make corrections required by DESIGN PROFESSIONAL and shall return the required number of corrected copies of Shop Drawings and submit as required new Samples for review and approval. CONTRACTOR shall direct specific attention in writing to revisions other than the corrections called for by DESIGN PROFESSIONAL on previous submittals.

6.19 Continuing the Work

A. CONTRACTOR shall carry on the Work and adhere to the progress schedule during all disputes or disagreements with CITY No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by Paragraph 15.04 or as CITY and CONTRACTOR may otherwise agree in writing.

6.20 CONTRACTOR's General Warranty and Guarantee

A. CONTRACTOR warrants and guarantees to CITY, DESIGN PROFESSIONAL and Consultants that all Work will be in accordance with the Contract Documents and will not be

defective. CONTRACTOR's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, modification or improper maintenance or operation by persons other than CONTRACTOR, Subcontractors, Suppliers or any other individual or entity for whom CONTRACTOR is responsible; or

2. normal wear and tear under normal usage.

B. CONTRACTOR's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of CONTRACTOR's obligation to perform the Work in accordance with the Contract Documents:

1. observations by DESIGN PROFESSIONAL;

2. recommendation of any progress or final payment by DESIGN PROFESSIONAL;

3. the issuance of a certificate of Substantial Completion or any payment related thereto by CITY to CONTRACTOR;

4. use or occupancy of the Work or any part thereof by OWNER;

5. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by DESIGN PROFESSIONAL;

6. any inspection, test or approval by others; or

7. any correction of defective Work by CITY.

C. Nonconforming Work is rejected unless expressly accepted in writing by the CITY's Representative.

ARTICLE 7 OTHER WORK

7.01 Related Work at Site

A. CITY may perform other work related to the Project at the Site by CITY's own forces, or let other direct contracts therefore, or have other work performed by utility owners. If such other work is to be performed and such fact was not noted in the Contract Documents, then:

1. Written notice thereof will be given to CONTRACTOR prior to starting any such other work, and

2. CONTRACTOR may make a Claim therefore as provided in Article 16 if CONTRACTOR believes that such performance involves additional expense to CONTRACTOR or requires additional time and the parties are unable to agree as to the amount or extent thereof.

B. CONTRACTOR shall afford each other contractor who is a party to such a direct contract, and each utility owner (and CITY, if CITY is performing the additional work with CITY's employees) proper and safe access to the Site and a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work and shall properly connect and coordinate the Work with theirs. Unless otherwise provided in the Contract Documents, CONTRACTOR shall do all cutting, fitting and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. CONTRACTOR shall not endanger any work of others by cutting, excavating or otherwise altering their work and will only cut or alter their work with the written consent of CITY and the others whose work will be affected. The duties and responsibilities of CONTRACTOR under this Paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of CONTRACTOR in said direct contracts between CITY and such utility owners and other contractors.

C. If the proper execution or results of any part of CONTRACTOR's Work depends upon work performed by others under this Article 7, CONTRACTOR shall inspect such other work and promptly report to CITY and DESIGN PROFESSIONAL in writing any delays, defects or deficiencies in such other work that render it unavailable or unsuitable for the proper execution or results of CONTRACTOR's Work. CONTRACTOR's failure to report same will constitute an acceptance of such other work as fit and proper for integration with CONTRACTOR's Work, except for latent or non-apparent defects and deficiencies in such other work.

7.02 Coordination

A. If CITY contracts with others for the performance of other work on the Project at the Site, the following will be set forth in Supplementary Conditions:

1. the person, firm or corporation who will have authority and responsibility for coordination of the activities among the various prime contractors will be identified;
2. the specific matters to be covered by such authority and responsibility will be itemized; and
3. the extent of such authority and responsibilities will be provided.

B. Unless otherwise provided in the Supplementary Conditions, CITY shall have sole authority and responsibility in respect of such coordination.

ARTICLE 8 CITY'S RESPONSIBILITIES

8.01 Communications to CONTRACTOR

A. Except as otherwise provided in these General Conditions, CITY shall issue all communications to CONTRACTOR.

8.02 Replacement of DESIGN PROFESSIONAL

A. In case of termination of the employment of DESIGN PROFESSIONAL, CITY shall appoint a DESIGN PROFESSIONAL whose status under the Contract Documents shall be that of the former DESIGN PROFESSIONAL.

8.03 Furnish Data and Prompt Payment

A. CITY shall promptly furnish the data required of OWNER under the Contract Documents and shall make payments to CONTRACTOR when they are due.

8.04 Lands and Easements; Reports and Tests

A. CITY's duties in respect of providing lands and easements and providing engineering surveys to establish reference points are set forth in Paragraphs 4.01 and 4.05. Paragraph 4.02 refers to CITY's duty to identify and make available to CONTRACTOR copies of reports of explorations and tests of subsurface conditions at the Site and drawings of physical conditions in existing structures at or contiguous to the Site that have been utilized by DESIGN PROFESSIONAL in preparing the Contract Documents.

8.05 Insurance

A. CITY's responsibilities, if any, for purchasing and maintaining liability and property insurance are set forth in Article 5 and the Supplementary Conditions.

8.06 Change Orders

A. CITY is obligated to execute Change Orders as indicated in Paragraph 10.03.

8.07 Inspections, Tests and Approvals

A. CITY's responsibility for certain inspections, tests and approvals is set forth in Paragraph 13.02 F.

8.08 Limitations on CITY's Responsibilities

A. The CITY shall not supervise, direct or have control or authority over, nor be responsible for, CONTRACTOR's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws or Regulations applicable to the furnishing or performance of the Work. CITY will not be responsible for CONTRACTOR's failure to perform or furnish the Work in accordance with the Contract Documents.

8.09 Undisclosed Hazardous Environmental Condition

A. CITY's responsibility for an undisclosed Hazardous Environmental Condition uncovered or revealed at the Site is set forth in Paragraph 4.06.

8.10 Evidence of Financial Arrangements

A. CITY will furnish CONTRACTOR reasonable evidence that financial arrangements have been made to satisfy OWNER's obligations under the Contract.

8.11 CITY's Representative

A. CITY will provide a representative during the construction period. The duties, responsibilities and the limitations of authority of the CITY '"s Representative during construction are set forth in the Contract Documents.

8.12 Visits to Site

A. CITY's Representative will make visits to the Site at intervals appropriate to the various stages of construction as CITY's Representative deems necessary in order to observe the progress that has been made and the quality of the various aspects of CONTRACTOR's executed Work. Based on information obtained during such visits and observations, CITY's Representative will endeavor to determine, in general, if the Work is proceeding in accordance with the Contract Documents. CITY's Representative will not be required to make exhaustive or continuous on-Site inspections to check the quality or quantity of the Work.

ARTICLE 9 DESIGN PROFESSIONAL's STATUS DURING CONSTRUCTION

9.01 General Scope of DESIGN PROFESSIONAL's Duties

A. DESIGN PROFESSIONAL's efforts will be directed toward providing for CITY a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of visits to the Site and on-Site observations, DESIGN PROFESSIONAL will keep CITY informed of the progress of the Work and will endeavor to guard CITY against defective Work. DESIGN PROFESSIONAL's visits to the Site and on-Site observations are subject to all the limitations on DESIGN PROFESSIONAL's authority and responsibility set forth in Paragraph 9.08.

9.02 Resident Project Representative

A. If CITY and DESIGN PROFESSIONAL agree, DESIGN PROFESSIONAL will furnish a resident Project representative to assist DESIGN PROFESSIONAL in providing more extensive observation of the Work. The responsibilities, authority and limitations thereon of any such resident Project representative and assistants will be as provided in Paragraph 9.08 and in the Supplementary Conditions.

9.03 Clarifications and Interpretations

A. DESIGN PROFESSIONAL will issue with reasonable promptness written clarifications or interpretations (which may be in the form of Drawings) of the requirements of the Drawings and Specifications prepared by the DESIGN PROFESSIONAL as DESIGN PROFESSIONAL may determine necessary, which shall be consistent with the intent of and reasonably inferable from the Contract Documents. Such written clarifications and interpretations will be binding on CITY and CONTRACTOR. If CITY or CONTRACTOR believes that a written clarification or

interpretation justifies an adjustment in the Contract Price pursuant to Article 11 and/ or the Contract Times pursuant to Article 12 and the parties are unable to agree to the amount or extent thereof, if any, a Claim may be made therefore as provided in Article 16.

9.04 Rejecting Defective Work

A. DESIGN PROFESSIONAL will have authority to disapprove or reject Work which DESIGN PROFESSIONAL believes to be defective, that DESIGN PROFESSIONAL believes will not produce a completed Project that conforms to the Contract Documents, or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. DESIGN PROFESSIONAL will also have authority to require special inspection or testing of the Work as provided in Paragraph 13.04 B, whether or not the Work is fabricated, installed or completed.

9.05 Shop Drawings, Change Orders and Payments

A. In connection with DESIGN PROFESSIONAL's authority as to Shop Drawings and Samples, see Paragraph 6.18.

B. In connection with DESIGN PROFESSIONAL's authority as to Change Orders, see Article 10.

C. In connection with DESIGN PROFESSIONAL's authority as to Applications for Payment, see Article 14.

9.06 Determinations for Unit Prices

A. DESIGN PROFESSIONAL will initially determine the actual quantities and classifications of Unit Price Work performed by CONTRACTOR. DESIGN PROFESSIONAL will review with CONTRACTOR the DESIGN PROFESSIONAL's preliminary determinations on such matters before rendering a written opinion thereon (by recommendation of an Application for Payment or otherwise to the CITY). CITY reserves the right to make a final determination of the actual quantities and classifications of Unit Price Work in reviewing an Application for Payment. Within ten (10) days after the date of receipt of any such decision, CONTRACTOR may deliver to CITY and to DESIGN PROFESSIONAL written notice of intention to appeal CITY's decision pursuant to Article 16.

9.07 Decisions on Requirements of Contract Documents and Acceptability of Work

A. DESIGN PROFESSIONAL will be the initial interpreter of the requirements of the Drawings and Specifications prepared by DESIGN PROFESSIONAL and judge of the acceptability of the Work thereunder.

B. When functioning as interpreter and judge under this Paragraph 9.07, DESIGN PROFESSIONAL will not show partiality to OWNER or CONTRACTOR.

C. Claims, disputes and other matters relating to the acceptability of the Work, quantities and classifications of Unit Price Work, or the interpretation of the requirements of the Contract Documents pertaining to the performance and furnishing of the Work will be referred initially to CITY's Representative in writing with a request for a formal decision in accordance with Article 16.

9.08 Limitations on DESIGN PROFESSIONAL's Authority and Responsibilities

A. Neither DESIGN PROFESSIONAL's authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by DESIGN PROFESSIONAL in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise or performance of any authority or responsibility by DESIGN PROFESSIONAL shall create, impose or give rise to any duty owed by DESIGN PROFESSIONAL to CONTRACTOR, any Subcontractor, any Supplier, any other person or organization, or to any surety for or employee or agent of any of them.

B. DESIGN PROFESSIONAL will not supervise, direct, control or have authority over or be responsible for CONTRACTOR's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws or Regulations applicable to the furnishing or performance of the Work. DESIGN PROFESSIONAL will not be responsible for CONTRACTOR's failure to perform or furnish the Work in accordance with the Contract Documents.

C. DESIGN PROFESSIONAL will not be responsible for the acts or omissions of CONTRACTOR or of any Subcontractor, any Supplier, or of any other person or organization performing or furnishing any of the Work.

D. DESIGN PROFESSIONAL's review of the final Application for Payment and accompanying documentation, and all maintenance and operating instructions, schedules, guarantees, Bonds and certificates of inspection, tests and approvals and other documentation required to be delivered by Paragraph 14.07 will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests and approvals, that the results certified indicate compliance with, the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 9.08 shall also apply to DESIGN PROFESSIONAL's Consultants, resident Project representative and assistants as identified in the Supplementary Conditions.

ARTICLE 10 CHANGES IN THE WORK

10.01 Authorized Changes in the Work

A. Without invalidating the Contract and without notice to any surety, CITY may, at any time or from time to time, order additions, deletions or revisions in the Work. Such additions, deletions or revisions will be authorized by a Written Amendment, a Change Order, or a Work Change Directive. Upon receipt of any such document, CONTRACTOR shall promptly proceed with the Work involved that will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).

B. If CITY and CONTRACTOR are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price pursuant to Article 11 or an adjustment of the Contract Times pursuant to Article 12 or both that should be allowed as a result of a Work Change Directive, a Claim may be made therefore as provided in Article 16.

10.02 Unauthorized Changes in the Work

A. CONTRACTOR shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents as amended, modified or supplemented as provided in Paragraph 3.04, except in the case of an emergency as provided in Paragraph 6.17 or in the case of uncovering Work as provided in Paragraph 13.04.

10.03 Signing of Change Orders

A. CITY and CONTRACTOR, and DESIGN PROFESSIONAL shall sign appropriate Change Orders covering:

1. changes in the Work which are:

   a. ordered by CITY pursuant to Paragraph 10.01 A; or

   b. required because of acceptance of defective Work under Paragraph 13.08 or correcting defective Work under Paragraph 13.09; or

   c. agreed to by the parties;

2. changes in the Contract Price or Contract Times or both which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive; and

3. changes in the Contract Price or Contract Times or both which embody the substance of any written decision recommended by DESIGN PROFESSIONAL and approved by CITY pursuant to Paragraph 9.06, provided that, in lieu of signing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws or Regulations, but during any such appeal, CONTRACTOR shall carry on the Work and adhere to the progress schedule as provided in Paragraph 6.19.

10.04 Notification to Surety

A. If notice of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times or both) is required by the provisions of any Bond to be given to a surety, the giving of any such notice will be CONTRACTOR's responsibility, and the amount of each applicable Bond will be adjusted accordingly.

ARTICLE 11 CHANGE OF CONTRACT PRICE

11.01 Change of Contract Price

A. The Contract Price constitutes the total compensation (subject to authorized adjustments) payable to CONTRACTOR for performing the Work. All duties, responsibilities and obligations assigned to or undertaken by CONTRACTOR shall be at CONTRACTOR's expense without change in the Contract Price.

B. The Contract Price may only be changed by a Change Order. Any request for an adjustment in the Contract Price shall be based on written notice delivered within fourteen (14) calendar days after occurrence of the event giving rise to the request or within fourteen (14) calendar days after first recognition of the conditions giving rise to the request. Prior notice is not required for requests or claims relating to an emergency endangering life or property as described in Paragraph 6.16. Thereafter, the CONTRACTOR shall submit written documentation of its request, including appropriate supporting documentation, within ten (10) calendar days after giving notice, unless the CITY grants an extension based on good cause shown by the CONTRACTOR that such additional time is warranted.

C. The value of any Work covered by a Change Order or of any request for an adjustment in the Contract Price will be determined as follows:

1. where the Work involved is covered by Unit Prices contained in the Contract Documents, by application of such Unit Prices to the quantities of the items involved (subject to the provisions of Paragraph 11.04); or

2. where the Work involved is not covered by Unit Prices contained in the Contract Documents, by a mutually agreed lump sum; or

3. where the Work involved is not covered by Unit Prices contained in the Contract Documents and agreement to a lump sum is not reached under Paragraph 11.01 C.2, on the basis of the Cost of the Work (determined as provided in Paragraphs 11.02 A and B) plus a CONTRACTOR's fee for overhead and profit (determined as provided in Paragraph 11.01 D).

D. The CONTRACTOR's fee allowed to CONTRACTOR for overhead and profit shall be determined as follows:

1. a mutually acceptable fixed fee; or

2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

a. for costs incurred under Paragraphs 11.02 A.1 and 11.02 A.2, the CONTRACTOR's fee shall be ten percent (10%);

b. for costs incurred under Paragraph 11.02 A.3, the CONTRACTOR's fee shall be five percent (5%);

c. where one or more tiers of subcontracts are on the basis of the Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.01 D.2 and 11.02 A.1 through A.3 is that the Subcontractor who actually performs or furnishes the Work, at whatever tier, will be a paid a fee of ten percent (10%) of the costs incurred by such Subcontractor under Paragraphs 11.02 A.1 and 11.02 A.2 and that any higher tier Subcontractor and CONTRACTOR will each be paid a fee of five percent (5%) of the amount paid to the next lower tier Subcontractor;

d. no fee shall be payable on the basis of costs itemized under Paragraphs 11.02 A.4, 11.02 A.5 and 11.02 B;

e. the amount of credit to be allowed by CONTRACTOR to CITY for any change which results in a net decrease in cost will be the amount of the actual net decrease in costs plus a deduction in CONTRACTOR's fee by an amount equal to five percent (5%) of such net decrease; and

f. when both additions and credits are involved in any one change, the adjustment in CONTRACTOR's fee shall be computed on the basis of the net change in accordance with Paragraphs 11.01 D.2.a through 11.01 D.2.e, inclusive.

E. Whenever the Cost of the Work is to be determined pursuant to Paragraphs 11.02 A and B, CONTRACTOR shall establish and maintain records thereof in accordance with generally accepted accounting practices and submit in form acceptable to CITY an itemized cost breakdown together with supporting data.

11.02 Cost of the Work

A. The term "Cost of the Work" means the sum of all costs necessarily incurred and paid by CONTRACTOR in the proper performance of the Work. When the value of any Work covered by a Change Order or when a request for an adjustment in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to CONTRACTOR will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the request. Except as otherwise agreed to in writing by CITY, costs covered by Change Orders or requests shall be in amounts no higher than those prevailing in the locality of the Project, shall include only the following items and shall not include any costs itemized in 11.02 B:

1. Payroll costs for employees in the direct employ of CONTRACTOR in the performance of the Work, using occupational titles and job classifications agreed upon by CITY and CONTRACTOR. Such employees shall include, without limitation, job Site superintendents, foremen and other personnel employed full time at the Site. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits which shall include social security contributions, unemployment, excise and payroll taxes, workers'" compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing the Work after regular working hours, on Saturdays, Sundays or legal holidays, shall be included in the above to the extent authorized by OWNER.

2. Cost of all materials and equipment furnished and incorporated into the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to CONTRACTOR unless CITY deposits funds with CONTRACTOR with which to make payments, in which case the cash discounts shall accrue to CITY. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to CITY, and CONTRACTOR shall make provisions so that they may be obtained.

3. Payments made by CONTRACTOR to Subcontractors for Work performed or furnished by Subcontractors. If required by CITY, CONTRACTOR shall obtain competitive bids from Subcontractors acceptable to OWNER and CONTRACTOR and shall deliver such bids to CITY who will then determine, with the advice of DESIGN PROFESSIONAL, which bids, if any, will be accepted. If any subcontract provides that the Subcontractor is to be paid on the basis of the Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as CONTRACTOR's Cost of the Work and fee as provided in Paragraphs 11.01 D and E and 11.02 A and B. All subcontracts shall be subject to the other provisions of the Contract Documents insofar as applicable.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys and accountants) employed for services specifically related to the Work when such services are approved in advance by CITY in writing.

5. Other costs including the following:

a. The proportion of necessary transportation, travel and subsistence expenses of CONTRACTOR's employees incurred in discharge of duties connected with the Work.

b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office and temporary facilities at the Site and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value of such items used but not consumed which remain the property of CONTRACTOR.

c. Rentals of all construction equipment and machinery and the parts thereof whether rented from CONTRACTOR or others in accordance with rental agreements approved by CITY with the advice of DESIGN PROFESSIONAL, and the costs of transportation, loading, unloading, installation, assembly, dismantling and removal thereof, all in accordance with the terms of said rental agreements. The rental of any such equipment, machinery or parts shall cease when the use thereof is no longer necessary for the Work.

d. Applicable sales, consumer, use or similar taxes related to the Work**,** and for which CONTRACTOR is liable, imposed by Laws or Regulations.

e. Deposits lost for causes other than negligence of CONTRACTOR, any Subcontractor or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses required to perform the Work.

f. Losses and damages (and related expenses) caused by damage to the Work**,** not compensated by insurance or otherwise, sustained by CONTRACTOR in connection with the performance and furnishing of the Work (except losses and damages within the deductible amounts of property insurance established by CITY in accordance with Article 5), provided they have resulted from causes other than the negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of CITY. No such losses, damages and expenses shall be included in the Cost of the Work for the purpose of determining CONTRACTOR's fee. If, however, any such loss or damage requires reconstruction and CONTRACTOR is placed in charge thereof, CONTRACTOR shall be paid for those services a fee proportionate to that stated in Paragraph 11.01 D.2.

g. The cost of utilities, fuel and sanitary facilities at the Site.

h. Minor expenses such as telegrams, long distance telephone calls, telephone service at the Site, expressage and similar petty cash items in connection with the Work.

i. Cost of premiums for additional or increased Bonds, or for insurance required because of approved changes in the Work.

B. Costs excluded: The term “Cost of the Work” shall not include any of the following:

1. Payroll costs and other compensation of CONTRACTOR’s officers, executives, principals (of partnership and sole proprietorships), general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks and other personnel employed by CONTRACTOR whether at the Site or in CONTRACTOR’s principal or a branch office for general administration of the Work (if not specifically included in the agreed upon occupational titles and job classifications referred to in Paragraph 11.02 A.1 or specifically covered by Paragraph 11.02 A.4), all of which are to be considered administrative costs covered by the CONTRACTOR’s fee.

2. Expenses of CONTRACTOR’s principal and branch offices other than CONTRACTOR’s office at the Site.

3. Any part of CONTRACTOR’s capital expenses, including interest on CONTRACTOR’s capital employed for the Work and charges against CONTRACTOR for delinquent payments.

4. Costs due to the negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials, or equipment wrongly supplied, and making good any damage to property.

5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 11.02 A.

11.03 Cash Allowances

A. It is understood that CONTRACTOR has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be furnished and performed for such sums as may be acceptable to CITY. CONTRACTOR agrees that:

1. the allowances include the cost to CONTRACTOR (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. CONTRACTOR’s costs for unloading and handling on the Site, labor, installation costs, overhead, profit and other expenses contemplated for the allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.

B. Prior to final payment, an appropriate Change Order will be issued by CITY to reflect actual amounts due CONTRACTOR on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

11.04 Unit Price Work

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the established unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Contract. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by CONTRACTOR will be made in accordance with Paragraph 9.06.

B. Each unit price will be deemed to include an amount considered by CONTRACTOR to be adequate to cover CONTRACTOR’s overhead and profit for each separately identified item.

C. CITY or CONTRACTOR may negotiate an adjustment of the price per unit of Unit Price Work stated in the Contract if:

1. the quantity of any item of Unit Price Work performed by CONTRACTOR differs by twenty percent (20%) or more from the estimated quantity of such item indicated in the Contract; and

2. there is no corresponding adjustment with respect to any other item of Work; and

3. CONTRACTOR believes that CONTRACTOR is entitled to an increase in Contract Price as a result of having incurred additional expense or CITY believes that CITY is entitled to a decrease in Contract Price.

11.05 Dispute Resolution

A. If CITY and CONTRACTOR are unable to agree on entitlement to, or magnitude of, an equitable adjustment in the Contract Price in accordance with Article 11 within fourteen (14) calendar days from the receipt of supporting documentation of the request pursuant to 11.01.B., unless the CITY grants an extension based on good cause shown by the CONTRACTOR that such additional time is warranted, then a Claim for such adjustment may be made pursuant to Article 16.

ARTICLE 12 CONTRACT TIMES

12.01 Time of the Essence

A. All times stated in the Contract Documents are of the essence of the Contract.

12.02 Change of Contract Times

A. The Contract Times (or Milestones) may only be changed by a Change Order. Any request for an adjustment in the Contract Times shall be based on written notice delivered within fourteen (14) calendar days after occurrence of the event giving rise to the request or within fourteen (14) calendar days after first recognition of the conditions giving rise to the request. Thereafter, the CONTRACTOR shall submit written documentation of its requests, including appropriate supporting documentation, within ten (10) days after giving notice, unless the CITY grants an extension based on good cause shown by the CONTRACTOR that such additional time is warranted.

12.03 Proof Required To Justify an Extension of Time For Excusable and Compensable Delays

A. In support of any request for an extension of the Contract Times pursuant to this Article, CONTRACTOR must demonstrate to the reasonable satisfaction of the CITY that the critical path of the approved baseline project schedule was delayed. CONTRACTOR shall be entitled to an increase in contract time for the number of days that the critical path was delayed solely as a result of the compensable or excusable event. A compensable or excusable event includes, but is not limited to:

1. unreasonable delay of issuance of Notice to Proceed by CITY;
2. CITY's unreasonable delay of delivery furnished materials, equipment, or work;
3. unreasonable delay responding to shop drawings and submittals;
4. CITY's unreasonable delay in issuing a Change Order;
5. an order by the CITY to stop the Work where the CONTRACTOR was not at fault; and
6. other reasonable grounds as determined by the City in its sole discretion.

B. CONTRACTOR shall compare the critical path of the approved baseline project schedule to the actual critical path of the Work, identifying the specific impact of the compensable or excusable event.

C. CONTRACTOR shall submit to the CITY a written time impact analysis illustrating the influence of each compensable or excusable event on the date of Substantial Completion. The

time impact analysis shall demonstrate the time impact based on the date of the delay in time and the event time computations or all affected activities.

D. If the critical path of the Work is delayed by "Force Majeure", the CONTRACTOR shall be entitled only to an extension of the Contract Times for the number of days of delay to the critical path. For purposes of this paragraph, "Force Majeure" shall mean fire, tornado, flood, earthquake, war, act of terrorism, civil disturbance, or labor strikes away from the project site.

E. Extensions of contract time pursuant to the this section will be granted only to the extent that the time adjustments exceed the total float time available when the event causing the delay occurred.

12.04 Delays Within CONTRACTOR's Control

A. The Contract Times (or Milestones) will not be extended due to delays within the control of CONTRACTOR. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of CONTRACTOR.

12.05 Delays Beyond the CITY's and CONTRACTOR's Control

A. Where CONTRACTOR is prevented from completing any part of the Work within the Contract Times (or Milestones) due to delay beyond the control of both CITY and CONTRACTOR, an extension of the Contract Times (or Milestones) in an amount equal to the time lost due to such delay shall be CONTRACTOR's sole and exclusive remedy for such delay.

12.06 Delay Damages

A. In no event shall CITY be liable to CONTRACTOR, any Subcontractor, any Supplier, any other person or organization, or to any surety for or employee or agent of any of them, for damages arising out of or resulting from:

1. delays caused by or within the control of CONTRACTOR, or

2. delays beyond the control of CITY or CONTRACTOR including but not limited to fires, floods, epidemics, abnormal weather conditions, acts of God or acts or neglect by utility owners or other contractors performing other work as contemplated by Article 7.

B. Nothing in this Paragraph 12.06 bars a change in Contract Price pursuant to this Article 12 to compensate CONTRACTOR due to delay, interference, or disruption directly attributable to actions or inaction of CITY, DESIGN PROFESSIONAL, Consultant or anyone for whom CITY, DESIGN PROFESSIONAL or Consultant is responsible.

12.07 Dispute Resolution

A. If CITY and CONTRACTOR are unable to agree on entitlement to, or magnitude of, an equitable adjustment in the Contract Time in accordance with Article 12 within fourteen (14) calendar days from the receipt of supporting documentation of the request pursuant to 12.02, unless the CITY grants an extension based on good cause shown by the CONTRACTOR that such additional time is warranted, then a Claim for such adjustment may be made pursuant to Article 16.

ARTICLE 13 TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.01 Access to Work

A. CITY, DESIGN PROFESSIONAL, Consultants, other representatives and personnel of CITY, independent testing laboratories and governmental agencies with jurisdictional interests will have access to the Site and Work at reasonable times for their observation, inspecting and testing. CONTRACTOR shall provide them proper and safe conditions for such access and advise them of CONTRACTOR's Site safety procedures and programs so that they may comply therewith as applicable.

13.02 Tests and Inspections

A. CONTRACTOR shall give DESIGN PROFESSIONAL and CITY's Representative timely notice of readiness of the Work for all required inspections, tests or approvals, and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

B. If any Work (or the work of others at the Site) that is to be inspected, tested or approved is covered by CONTRACTOR without written approval required by Paragraphs 13.02 D or 13.02 E, it must, if requested by CITY's Representative, be uncovered for observation.

C. Uncovering Work as provided in Paragraph 13.02 B, shall be at CONTRACTOR's expense unless CONTRACTOR has given DESIGN PROFESSIONAL and CITY's Representative timely notice of CONTRACTOR's intention to cover the same and DESIGN PROFESSIONAL and CITY's Representative have not acted with reasonable promptness in response to such notice.

D. If Laws or Regulations of any public body (including City) having jurisdiction require any Work (or part thereof) specifically to be inspected, tested or approved by an employee or other representative of such public body, CONTRACTOR shall assume full responsibility for arranging and obtaining such inspections, tests or approvals, pay all costs in connection therewith, and furnish DESIGN PROFESSIONAL and CITY's Representative the required certificates of inspection or approval.

E. CONTRACTOR shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests or approvals required for CITY's and DESIGN PROFESSIONAL's acceptance of materials or equipment to be incorporated into the Work, or acceptance of materials, mix designs, or equipment submitted for approval prior to CONTRACTOR's purchase thereof for incorporation into the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to CITY and DESIGN PROFESSIONAL.

F. CITY shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:

1. for inspections, tests or approvals covered by Paragraph 13.02 D and E;

2. that costs incurred in connection with tests or inspections conducted pursuant to Paragraph 13.04 B shall be paid as provided in said Paragraph 13.04 B; and

3. as otherwise specifically provided in the Contract Documents.

13.03 Notice of Defects

A. Prompt notice of all defective Work of which either CITY or DESIGN PROFESSIONAL has actual knowledge will be given to CONTRACTOR. Defective Work may be rejected, corrected or accepted as provided in this Article 13.

13.04 Uncovering Work

A. If any Work (or the work of others at the Site) is covered contrary to the written request of DESIGN PROFESSIONAL or CITY's Representative, it must, if requested by CITY's Representative, be uncovered for DESIGN PROFESSIONAL's or CITY's Representative's observation and replaced at CONTRACTOR's expense.

B. If CITY considers it necessary or advisable that covered Work be observed by DESIGN PROFESSIONAL or CITY's Representative or be inspected or tested by others, CONTRACTOR, at CITY's request, shall uncover, expose or otherwise make available for observation, inspection or testing as may be required, that portion of the Work in question, furnishing all necessary labor, material and equipment. If it is found that such Work is defective, CONTRACTOR shall pay all costs, losses and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) caused by, arising out of or resulting from such uncovering, exposure, observation, inspection and testing and of satisfactory replacement or reconstruction

(including but not limited to all costs of repair or replacement of work of others); and CITY shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, CITY may make a Claim therefore as provided in Article 16. If, however, such Work is not found to be defective, CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Times (or Milestones), or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement and reconstruction. If the parties are unable to agree as to the amount or extent thereof, CONTRACTOR may make a Claim therefore as provided in Article 16.

13.05 CITY May Stop the Work

A. If the Work is defective, or CONTRACTOR fails to supply sufficient skilled workers or suitable materials or equipment, or fails to furnish or perform the Work in such a way that the completed Work will conform to the Contract Documents, CITY may order CONTRACTOR to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of CITY to stop the Work shall not give rise to any duty on the part of CITY to exercise this right for the benefit of CONTRACTOR, any Subcontractor, Supplier, other individual or entity or any surety or employee or agent of any of them.

13.06 Correction or Removal of Defective Work

A. If required by CITY, CONTRACTOR shall promptly, as directed, either correct all defective Work, whether or not fabricated, installed or completed, or, if the Work has been rejected by either DESIGN PROFESSIONAL or CITY's Representative, remove it and replace it with Work that is not defective. CONTRACTOR shall pay all costs, losses and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) caused by or resulting from such correction or removal (including but not limited to all costs of repair or replacement of work of others).

13.07 Correction Period

A. If within one (1) year after the date of Substantial Completion, or such longer period of time as may be prescribed by Laws or Regulations, by the terms of any applicable special guarantee required by the Contract Documents, or by any specific provision of the Contract Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for CONTRACTOR's use by CITY or permitted by Laws and Regulations as contemplated in Paragraph 6.10 is found to be defective, CONTRACTOR shall promptly, without cost to CITY and in accordance with CITY's written instructions:

1. correct the repair of damages to such land or areas; or

2. correct such defective Work, or if it has been rejected by CITY, remove it from the Site and replace it with Work that is not defective; and

3. satisfactorily correct or remove and replace any damage to other Work or to the work of others or damage to other lands or areas resulting therefrom. If CONTRACTOR does not promptly comply with the terms of such instructions, or in the event of an emergency where delay by CONTRACTOR would cause serious risk of loss or damage, CITY may have the defective Work corrected or the rejected Work removed and replaced, and all costs, losses and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) caused by or resulting from such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by CONTRACTOR.

B. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications or by Written Amendment.

C. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this Paragraph 13.07, the correction period hereunder

with respect to such Work will be extended for an additional period of one (1) year, or such longer period of time as may be prescribed within Paragraph 13.07 A, after such correction or removal and replacement has been satisfactorily completed.

D. CONTRACTOR's obligations under this Paragraph 13.07 are in addition to any other obligation or warranty. The provisions of this Paragraph 13.07 shall not be construed as a substitute for or waiver of the provisions of any applicable statute of limitation or repose.

13.08 Acceptance of Defective Work

A. If, instead of requiring correction or removal and replacement of defective Work, CITY prefers to accept it, CITY may do so. CONTRACTOR shall pay all costs, losses and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) attributable to CITY's evaluation of and determination to accept such defective Work and shall pay OWNER for the diminished value of the Work. If any such acceptance occurs prior to DESIGN PROFESSIONAL's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions into the Contract Documents with respect to the Work and, due to the diminished value of the Work, CITY shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, CITY may make a Claim therefore as provided in Article 16. If the acceptance of defective Work occurs after such recommendation, an appropriate amount shall be paid by CONTRACTOR to CITY.

13.09 CITY May Correct Defective Work

A. If CONTRACTOR fails within a reasonable time after written notice from DESIGN PROFESSIONAL or CITY's Representative to correct defective Work or to remove and replace rejected Work as required by CITY in accordance with Paragraph 13.06, or if CONTRACTOR fails to perform the Work in accordance with the Contract Documents, or if CONTRACTOR fails to comply with any other provision of the Contract Documents, CITY may, after seven (7) days written notice to CONTRACTOR, correct and remedy any such deficiency.

B. CITY shall proceed expeditiously when exercising the rights and remedies under this Paragraph 13.09. In connection with such corrective and remedial action, CITY may exclude CONTRACTOR from all or part of the Site; take possession of all or part of the Work and suspend CONTRACTOR's services related thereto; take possession of CONTRACTOR's tools, appliances, construction equipment and machinery at the Site; and incorporate into the Work all materials and equipment stored at the Site or for which CITY has paid CONTRACTOR but which are stored elsewhere. CONTRACTOR shall allow CITY, CITY's Representative, agents and employees, CITY's other contractors, DESIGN PROFESSIONAL and Consultants access to the Site to enable CITY to exercise the rights and remedies under this Paragraph 13.09.

C. All costs, losses and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred or sustained by CITY in exercising such rights and remedies will be charged against CONTRACTOR and a Change Order will be issued incorporating the necessary revisions into the Contract Documents with respect to the Work; and CITY shall be entitled to an appropriate decrease in the Contract Price. If CITY and CONTRACTOR are unable to agree as to the amount thereof, CITY may make a Claim therefore as provided in Article 16. Such Claims for costs, losses and damages will include but not be limited to all costs of repair or replacement of work of others destroyed or damaged by correction, removal and replacement of CONTRACTOR's defective or rejected Work.

D. CONTRACTOR shall not be allowed an extension of the Contract Times (or Milestones) because of any delay in the performance of the Work attributable to the exercise by CITY of CITY's rights and remedies under Paragraphs 13.06 and 13.09.

ARTICLE 14 PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 Schedule of Values

A. 01290.02 Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into form 01290.01 Application for Payment acceptable to DESIGN PROFESSIONAL and CITY. Progress payments for Unit Price Work will be based on the number of units completed.

14.02 Application for Progress Payments

A. Application for Payment

1. At least twenty (20) days before the date stipulated in the Supplementary Conditions for each progress payment (but not more often than once a month), CONTRACTOR shall submit to DESIGN PROFESSIONAL for review an Application for Payment filled out and signed by CONTRACTOR covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated into the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, paid invoice or other documentation warranting that CITY has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance and other arrangements to protect CITY'''s interest therein, all of which will be subject to CITY's approval.

2. Beginning with the second Application for Payment, each Application shall include:

a. an affidavit of CONTRACTOR stating that all previous progress payments received for the Work have been applied to discharge CONTRACTOR's legitimate obligations associated with prior Applications for Payment, and

b. a copy of the most recent 00485.01 M/WBE Monthly Utilization Report CONTRACTOR has submitted to the CITY's Civil Rights and Equal Opportunity Department.

c. a copy of the most recent 00485.02 Project Workforce Monthly Report and 00485.03 Company-Wide Workforce Monthly Report CONTRACTOR has submitted to the OWNER's Civil Rights and Equal Opportunity Department.

d. an update to the approved schedule pursuant to paragraphs 6.04 and 6.05.

3. The amount of retainage with respect to progress payments will be stated in the Supplementary Conditions.

B. Review of Applications

1. DESIGN PROFESSIONAL will, within ten (10) days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to CITY, or return the Application to CONTRACTOR indicating in writing DESIGN PROFESSIONAL's reasons for refusing to recommend payment. In the latter case, CONTRACTOR shall make the necessary corrections and resubmit the Application.

a. After presentation of the Application for Payment to CITY, and if CITY's Representative agrees with DESIGN PROFESSIONAL's recommendation, the amount recommended will (subject to the provisions of Paragraph 14.02 B.4) become due and will be paid by CITY to CONTRACTOR, subject to the provisions of Laws or Regulations.

b. No payment shall be approved until the CONTRACTOR has submitted with the Application accompanying documentation as required by the Contract Documents, including, but not limited to, the documentation required by paragraphs 6.04 and 6.05.

2. DESIGN PROFESSIONAL's recommendation of any payment requested in an Application for Payment will constitute a representation by DESIGN PROFESSIONAL to CITY, based on DESIGN PROFESSIONAL's observations of the executed Work as an experienced and qualified DESIGN PROFESSIONAL and on DESIGN PROFESSIONAL's

review of the Application for Payment and the accompanying data and schedules, that to the best of DESIGN PROFESSIONAL's knowledge, information and belief:

a. the Work has progressed to the point indicated;

b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, to the results of any subsequent tests called for in the Contract Documents, to a final determination of quantities and classifications for Unit Price Work under Paragraph 9.06, and to any other qualifications stated in the recommendation); and

c. the conditions precedent to CONTRACTOR being entitled to such payment appear to have been fulfilled in so far as it is DESIGN PROFESSIONAL's responsibility to observe the Work.

3. DESIGN PROFESSIONAL's recommendation of any payment, including final payment, shall not mean that DESIGN PROFESSIONAL is responsible for CONTRACTOR's means, methods, techniques, sequence or procedures of construction, safety precautions and programs incident thereto, or any failure of CONTRACTOR to comply with Laws or Regulations applicable to the furnishing or performance of Work.

4. DESIGN PROFESSIONAL may refuse to recommend the whole or any part of any payment if, in DESIGN PROFESSIONAL's opinion, it would be incorrect to make the representations to CITY referred to in Paragraph 14.02 B.2. DESIGN PROFESSIONAL may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, nullify any such payment previously recommended, to such extent as may be necessary in DESIGN PROFESSIONAL's opinion to protect CITY from loss because:

a. the Work is defective, or completed Work has been damaged requiring correction or replacement;

b. the Contract Price has been reduced by Written Amendment or Change Orders;

c. CITY has been required to correct defective Work or complete Work in accordance with Paragraph 13.09; or

d. DESIGN PROFESSIONAL has actual knowledge of the occurrence of any of the events enumerated in Paragraph 15.02.

C. Reduction in Payment

1. CITY may refuse to make payment of the full amount recommended by DESIGN PROFESSIONAL because:

a. Claims have been made by third parties against CITY on account of CONTRACTOR's performance or furnishing of the Work; or

b. Claims have been made by CITY against CONTRACTOR in connection with the Work, except where CONTRACTOR has delivered a specific Bond satisfactory to CITY to secure the satisfaction and discharge of such Claims;

c. there are other items entitling CITY to a set-off against the amount recommended; or

d. CITY has actual knowledge of the occurrence of any of the events enumerated in Paragraphs 14.02 B.4.a through c or 15.02 A.1 through 4; but CITY must give CONTRACTOR written notice (with a copy to DESIGN PROFESSIONAL) stating the reasons for such action and promptly pay CONTRACTOR the amount so withheld, or any adjustment thereto agreed to by CITY and CONTRACTOR, when CONTRACTOR corrects to CITY's satisfaction the reasons for such action; or

e. CITY has made a different determination of the actual quantities and classifications of Unit Price Work.

14.03 CONTRACTOR's Warranty of Title

A. CONTRACTOR warrants and guarantees that title to all Work, materials and equipment covered by any Application for Payment, whether incorporated into the Project or not, will pass to CITY no later than the time of payment, free and clear of all Liens.

14.04 Substantial Completion

A. When CONTRACTOR considers the entire Work ready for its intended use CONTRACTOR shall notify CITY and DESIGN PROFESSIONAL in writing that the entire Work is substantially complete (except for items specifically listed by CONTRACTOR as incomplete) and request that CITY issue a certificate of Substantial Completion. Within a reasonable time thereafter, CITY, together with CONTRACTOR and DESIGN PROFESSIONAL, shall make an inspection of the Work to determine the status of completion. If DESIGN PROFESSIONAL does not consider the Work substantially complete, DESIGN PROFESSIONAL will notify CONTRACTOR and CITY in writing giving the reasons therefore. If DESIGN PROFESSIONAL considers the Work substantially complete, DESIGN PROFESSIONAL will prepare and deliver to CITY a recommended certificate of Substantial Completion that shall establish the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. CITY shall have seven (7) days after receipt of the recommended certificate during which to make written objection to DESIGN PROFESSIONAL as to any provisions of the certificate or attached list. At the time of delivery of the recommended certificate of Substantial Completion, DESIGN PROFESSIONAL will deliver to CITY and CONTRACTOR a written recommendation as to division of responsibilities pending final payment between CITY and CONTRACTOR with respect to security, operation, safety, protection of the Work, maintenance, heat, utilities, insurance and warranties and guarantees.

B. CITY shall have the right to exclude CONTRACTOR from the Site after the date of Substantial Completion, but CITY shall allow CONTRACTOR reasonable access to complete or correct items on the tentative list.

14.05 Partial Utilization

A. Use by CITY at CITY's option of any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which CITY, DESIGN PROFESSIONAL and CONTRACTOR agree constitutes a separately functioning and usable part of the Work that can be used by CITY for its intended purpose without significant interference with CONTRACTOR's performance of the remainder of the Work, may be accomplished prior to Substantial Completion of all the Work subject to the following:

1. CITY at any time may request CONTRACTOR in writing to permit CITY to use any such part of the Work which CITY believes to be ready for its intended use and substantially complete. If CONTRACTOR agrees that such part of the Work is substantially complete, CONTRACTOR will certify to CITY and DESIGN PROFESSIONAL that such part of the Work is substantially complete and request CITY to issue a certificate of Substantial Completion for that part of the Work. CONTRACTOR at any time may notify CITY and DESIGN PROFESSIONAL in writing that CONTRACTOR considers any such part of the Work ready for its intended use and substantially complete and request CITY to issue a certificate of Substantial Completion for that part of the Work. Within a reasonable time after either such request, CITY, together with CONTRACTOR and DESIGN PROFESSIONAL, shall make an inspection of that part of the Work to determine its status of completion. If DESIGN PROFESSIONAL does not consider that part of the Work to be substantially complete, DESIGN PROFESSIONAL will notify CITY and CONTRACTOR in writing, giving the reasons therefore. If DESIGN PROFESSIONAL considers that part of the Work to be substantially complete, the provisions of Paragraph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

2. No occupancy or separate operation of part of the Work will be accomplished prior to compliance with the requirements of Paragraph 5.09 with respect to property insurance.

14.06 Final Inspection

A. Upon written notice from CONTRACTOR that the entire Work or an agreed portion thereof is complete, DESIGN PROFESSIONAL will make a final inspection with CITY and CONTRACTOR and will notify CONTRACTOR in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. CONTRACTOR shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

14.07 Final Payment

A. Application for Payment

1. After CONTRACTOR has completed all corrections required by Paragraph 14.06 to the satisfaction of DESIGN PROFESSIONAL and CITY's Representative and delivered in accordance with the Contract Documents all maintenance and operating instructions, schedules, guarantees, Bonds, certificates or other evidence of insurance required by Paragraph 5.04, certificates of inspection, marked-up record documents (as provided in Paragraph 6.13) and other documents, CONTRACTOR may make application for final payment following the procedure for progress payments.

2. The final Application for Payment shall be accompanied (except as previously delivered) by:

a. all documentation required by the Contract Documents, including but not limited to the evidence of insurance required by Subparagraph 5.04 B.7; and

b. 01290.14 "Contractor Affidavit for Final Payment" from CONTRACTOR and 01290.15 "Subcontractor Affidavit for Final Payment" from all Subcontractors, regardless of tier.

B. Review of Application and Acceptance

1. If, on the basis of DESIGN PROFESSIONAL's and CITY's Representative's observation of the Work during construction and final inspection, and DESIGN PROFESSIONAL's and CITY's Representative's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, DESIGN PROFESSIONAL and CITY's Representative are satisfied that the Work has been completed and CONTRACTOR's other obligations under the Contract Documents have been fulfilled, DESIGN PROFESSIONAL will, within ten (10) days after receipt of the final Application for Payment, indicate in writing DESIGN PROFESSIONAL's and CITY's Representative's recommendation of payment and present the Application to CITY for payment. At the same time DESIGN PROFESSIONAL will also give written notice to CITY and CONTRACTOR that the Work is acceptable subject to the provisions of Paragraph 14.09.

2. Otherwise, DESIGN PROFESSIONAL will return the Application to CONTRACTOR, indicating in writing the reasons for refusing to recommend final payment, in which case CONTRACTOR shall make the necessary corrections and resubmit the Application to DESIGN PROFESSIONAL. After the presentation to CITY of the Application and accompanying documentation, in appropriate form and substance, including applicable federal and state prevailing wage provisions, and with DESIGN PROFESSIONAL's recommendation and notice of acceptability, the amount recommended by DESIGN PROFESSIONAL will become due and will be paid by CITY to CONTRACTOR in accordance with Laws and Regulations.

14.08 Final Completion Delayed

A. If, through no fault of CONTRACTOR, final completion of the Work is significantly delayed and if DESIGN PROFESSIONAL so recommends and CITY concurs, CITY shall, upon

receipt of CONTRACTOR's final Application for Payment and recommendation of DESIGN PROFESSIONAL, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by CITY for Work not fully completed or corrected is less than the retainage stipulated in the Supplementary Conditions, and if Bonds have been furnished as required in Paragraph 5.01, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by CONTRACTOR to DESIGN PROFESSIONAL with the Application for Payment. Payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

14.09 Waiver of Claims

A. The making and acceptance of final payment will constitute:

1. a waiver of all claims by CITY against CONTRACTOR, except claims previously made in writing and still unsettled, or claims arising from defective Work appearing after final inspection pursuant to Paragraph 14.06, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from CONTRACTOR's continuing obligations under the Contract Documents; and

2. a waiver of all Claims by CONTRACTOR against CITY other than those previously made in writing pursuant to Paragraphs 16.02 and 16.03 and still unsettled.

14.10 Completion of Work by CITY

A. If CITY must complete the Work, all costs and charges incurred by CITY, together with the cost of completing the Work under the Contract, will be deducted from any monies due or which may become due CONTRACTOR. If such expense exceeds the sum which would have been payable under the Contract, then CONTRACTOR and the surety shall be liable and shall pay to CITY the amount of such excess.

ARTICLE 15 SUSPENSION OF WORK AND TERMINATION

15.01 CITY May Suspend Work

A. Notwithstanding any other provision of this Contract, at any time and without cause, and at is sole and absolute discretion, CITY, may suspend the Work or any portion of the Work by written notice to CONTRACTOR, which will initially fix the date on which Work will be resumed. CONTRACTOR shall resume the Work on the date so fixed in the notice unless the date is changed by a subsequent written notice from CITY. CONTRACTOR may be allowed an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any suspension if CONTRACTOR makes a Claim therefore in accordance with Article 16.

B. CONTRACTOR will not be allowed an adjustment in the Contract Price or an extension of the Contract Times if CITY suspends the Work because CONTRACTOR's acts or omissions create or cause an emergency that CITY believes affects the safety or protection of persons, the Work, or property at the Site or adjacent thereto. CITY may order CONTRACTOR to stop the Work, or any portion thereof, until the cause for such order has been adequately addressed by CONTRACTOR; however, this right of CITY to stop the Work shall not give rise to any duty on the part of CITY to exercise this right for the benefit of CONTRACTOR, any Subcontractor, Supplier, other individual or entity or any surety or employee or agent of any of them.

15.02 CITY May Terminate for Default

A. CONTRACTOR may be deemed in default and CITY may terminate the services of CONTRACTOR upon the occurrence of any one or more of the following events:

1. CONTRACTOR fails to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the progress schedule established under Paragraph 2.06 and 2.07 as adjusted from time to time pursuant to Paragraphs 6.04, 6.05, 12.02 and 12.03);

2. CONTRACTOR abandons the Work or declares its intention to abandon the Work;

3. CONTRACTOR assigns or attempts to assign its rights or obligations under this Contract or any part thereof to any third party without the prior written consent of CITY;

4. CONTRACTOR fails to make prompt payment duly owing to any subcontractor for Work completed in accordance to the Contract Documents or material supplier for materials delivered for incorporation into the Work within thirty (30) calendar days after payment was due;

5. CONTRACTOR fails to achieve the required dates of substantial and final completion;

6. CONTRACTOR disregards Laws or Regulations of any public body having jurisdiction;

7. CONTRACTOR disregards the authority of DESIGN PROFESSIONAL or OWNER; or

8. CONTRACTOR otherwise violates in any substantial way any provisions of the Contract Documents.

B. CITY may, after giving CONTRACTOR (and the surety) seven (7) days written notice and to the extent permitted by Laws or Regulations, terminate the services of CONTRACTOR, exclude CONTRACTOR from the Site and take possession of the Work and of all CONTRACTOR's tools, appliances, construction equipment and machinery at the Site and use the same to the full extent they could be used by CONTRACTOR (without liability to CONTRACTOR for trespass or conversion), incorporate into the Work all materials and equipment stored at the Site or for which CITY has paid CONTRACTOR but which are stored elsewhere, and finish the Work as CITY may deem expedient. In such case, CONTRACTOR shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds all costs, losses and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by CITY arising out of or resulting from completing the Work, such excess may be paid to CONTRACTOR. If such costs, losses and damages exceed such unpaid balance, CONTRACTOR shall pay the difference to CITY within fourteen (14) calendar days of CITY'S demand for payment. When exercising any rights or remedies under this Paragraph CITY shall not be required to competitively bid this work unless required by law.

C. Where CONTRACTOR's services have been so terminated by CITY, the termination will not affect any rights or remedies of CITY against CONTRACTOR then existing or which may thereafter accrue. Any retention or payment of moneys due CONTRACTOR by CITY will not release CONTRACTOR from liability.

D. If, after a default termination, it is determined that the CONTRACTOR was not in default, the rights and obligations of the parties shall be the same as if the termination had been issued for the convenience of the CITY. The CITY shall then be liable to CONTRACTOR for only those costs enumerated in paragraph 15.03.

15.03 CITY May Terminate for Convenience

A. Notwithstanding any other provision of this Contract, upon seven (7) calendar days written notice to CONTRACTOR, CITY may, at its sole and absolute discretion, without cause and without prejudice to any other right or remedy of CITY, elect to terminate the Contract. In such case, CONTRACTOR shall, with thirty (30) calendar days of receiving notice of termination under this paragraph, submit to CITY its statement of costs and expenses and shall be paid:

1. for completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. for expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;

3. for all costs, losses and damages incurred in settlement of terminated contracts with Subcontractors, Suppliers and others; and

4. for reasonable expenses directly attributable to termination if approved in advance by CITY.

B. CONTRACTOR shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

C. CONTRACTOR waives any costs not submitted to CITY pursuant to paragraph 15.03.A.

D. CITY shall, within thirty (30) calendar days after receipt of CONTRACTOR's statement, pay CONTRACTOR all amounts it determines are properly determined.

ARTICLE 16 CLAIMS AND DISPUTES

16.01 Definition

A. A Claim is a demand or assertion by the CONTRACTOR seeking, as a matter of right, the adjustment of Contract price and/or times with respect to the terms of the Contract.

16.02 Written Notice and Burden of Proof

A. Claims must be made by written notice pursuant to Paragraph 17.01. The written notice shall clearly indicate that the CONTRACTOR is making a claim. The responsibility to substantiate Claims shall rest with the CONTRACTOR. No Claim may be made under this Contract except as provided in this Article.

B. Certification of Claim: The written notice of Claim shall include the following statement signed by the CONTRACTOR's representative: "The CONTRACTOR certifies that all statements made and the facts set out in this claim are true and correct and that no false records have been submitted in support of this claim." **Strict compliance with this paragraph shall be a condition precedent to the creation, existence or validity of any Claim**.

16.03 Time Limits on Claims

A. The CONTRACTOR must give notice to the CITY within fourteen (14) calendar days after the denial of a request for or failure to reach an agreement on a change in Contract Price and/or change in Contract Time pursuant to Article 11 and Article 12 respectively. After the fourteen (14) day period for making Claims has expired, the Claim shall be considered waived.

B. The CONTRACTOR shall submit the Claim to the CITY's Representative.

16.04 Continuing Contract Performance

A. Pending final resolution of a Claim, unless otherwise agreed in writing, the CONTRACTOR shall proceed diligently with performance of the Work and the CITY shall continue to make payments in accordance with the Contract Documents. The CITY may, but is not obligated to, notify the Surety of the nature and amount of the Claim.

16.05 Injury or Damage to Person or Property

A. If either party to the Contract suffers injury or damage to person or property because of an act or omission of the other party, of any of the other party's employees or agents, or of others for whose acts that party is legally liable, written notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding thirty (30) days after first observance. The notice shall provide sufficient detail to enable the other party to investigate the matter.

16.06 Initial Resolution of Claims and Disputes

A. After the CONTRACTOR has submitted the Claim to the CITY's Representative, the CITY'S Representative and CONTRACTOR'S Representative shall conduct a settlement conference within fourteen (14) calendar days from the date of receipt of the Claim. If the Claim is not settled within seven (7) calendar days following the date of the settlement conference, the CITY'S Representative and the CONTRACTOR's Representative shall state, in writing, following the conclusion of the seven (7) calendar day period, their respective position as to the matters in dispute.

B. The CITY'S and CONTRACTOR'S statement of positions shall state all known factual grounds for each party's position. If the dispute remains unresolved at the end of the seven (7) calendar days from submission of the parties' written position statements, the CONTRACTOR shall have the right to proceed with the pursuit of Claims pursuant to paragraph 16.07.

C. If a Claim has been resolved, the OWNER will prepare or obtain appropriate documentation.

16.07 Final Resolution of Claims and Disputes

A. All administrative procedures set forth in this contract must first be exhausted before suit is filed.

B. If the CITY'S Representative and the CONTRACTOR'S Representative are unable to resolve the dispute pursuant to 16.06, the parties must submit their statements of position to the Director, who shall review the Claim and make a decision within fourteen (14) calendar days.

C. Absent fraud, gross mistake or bad faith, the Director's decision shall be final and binding on CITY and CONTRACTOR within fourteen (14) calendar days after issuance. The CONTRACTOR shall give written notice to the CITY stating its intent to submit its Claim to a court of law pursuant to paragraph 17.05.A. within thirty (30) calendar days after notice of Director's decision.

D. The time frames for the Director's decision and for CONTRACTOR'S written notice of intent may be tolled by participation in voluntary mediation. Mediator selection and the procedures to be employed in voluntary mediation shall be mutually acceptable to the parties. Costs of the mediator shall be shared equally among the parties participating in the mediation. In no event shall any time frame be tolled more than 30 days for mediation. However, mediation may be employed at any time at the discretion and mutual agreement of the parties.

E. If the dispute is not resolved during voluntary mediation, The CONTRACTOR agrees that it will file no suit based on facts or evidentiary materials that were not presented for consideration to the CITY during the mediation process or of which the CONTRACTOR had knowledge and failed to present during the administrative procedures.

ARTICLE 17 MISCELLANEOUS

17.01 Giving Notice

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be given by personal delivery, by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice or by confirmed electronic facsimile transmission. Notice is effective on the date of personal delivery, deposit of registered or certified mail, postage prepaid, or confirmed electronic facsimile transmission.

17.02 Computation of Times

A. When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last calendar day of such period. If the last day of such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

17.03 Cumulative Remedies

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto, and, in particular but without limitation, the

warranties, guarantees and obligations imposed upon CONTRACTOR and all of the rights and remedies available to CITY and DESIGN PROFESSIONAL hereunder are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee or by other provisions of the Contract Documents, and the provisions of this Paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right and remedy to which they apply.

17.04 Survival of Obligations

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract.

17.05 Controlling Law

A. This Contract shall be construed and governed in accordance with the laws of the State of Missouri without giving effect to Missouri's choice of law provisions. The CITY and CONTRACTOR: (1) shall submit exclusively to the jurisdiction of the state and federal courts located in Jackson County, Missouri and no other; (2) shall waive any and all objections to jurisdiction and venue; and (3) shall not raise forum non conveniens as an objection to the location of any litigation.

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

SUPPLEMENTARY CONDITIONS

Project Number 81000927/1698

Project Title Todd Creek WWTP Expansion & Major Upgrade

These Supplementary Conditions amend or supplement the General Conditions of the Construction Contract and other provisions of the Contract Documents as indicated below. All provisions that are not so amended or supplemented remain in full force and effect.

SC-2.03 A. Article 2, Paragraph 2.03, Copies of Documents, is amended by deleting Paragraph 2.03 A and replacing it with the following:

A. CITY shall furnish to CONTRACTOR up to three (3) copies of the Drawings and Specifications, including Addenda.

SC-4.02 Article 4, Paragraph 4.02, Subsurface and Physical Conditions; Subparagraphs A and B are supplemented as follows:

In the preparation of the Contract Documents, the following reports of explorations and tests of subsurface conditions at or contiguous to the Site of the Work were utilized:

1. Phase 1 Environmental Site Assessment Report – Alternate Site, January 2024, which may be reviewed at https://www.kcwater.us/todd-creek/.
2. Cultural Resources Investigation Report, May 2024, which may be reviewed at https://www.kcwater.us/todd-creek/.
3. Report dated May 28, 2024, prepared by TSI Geotechnical, Inc.; entitled Report of Subsurface Exploration and Geotechnical Engineering Evaluation, which may be reviewed at https://www.kcwater.us/todd-creek/. The technical data contained in such report upon which CONTRACTOR may rely is: boring logs at their specific location.

In the preparation of the Contract Documents, the following drawings of physical conditions in or relating to existing surface or subsurface structures (except Underground Facilities) which are at or contiguous to the Site of the Work were utilized:

4. Drawings dated as listed below and prepared as listed below, which may be reviewed upon request. The technical data contained in such drawings upon which CONTRACTOR may rely is general arrangement and location of infrastructure. Exact location, dimensions, and condition are to be field verified by CONTRACTOR.

Item No	Name/Title	Year	Produced By
1	D-1072.03 Todd Creek Original Plant 1968	1968	Black & Veatch
2	D-1072.05 Todd Creek Expansion 1990	1990	E.T. Archer
3	D-1072.13 Todd Creek WWTP Effluent Disinfection 2013	2013	CH2MHill
4	Todd Creek Polishing Lagoon Contract 105	1971	Black & Veatch

SC-4.06 Article 4, Paragraph 4.06, Asbestos, Lead-Based Paint, PCBs, Petroleum Waste or Radioactive Material, Subparagraphs A and B are supplemented as follows:

In the preparation of the Contract Documents, the following reports and drawings relating to a Hazardous Environmental Condition identified at the Site of the Work were utilized:

1. Report dated March 31, 2023 prepared by Burns & McDonnel; entitled Asbestos, Lead Paint, and Hazardous Materials Survey, which can be provided upon request. The technical data contained in such report upon which CONTRACTOR may rely is Results and Recommendations.

SC- 5.01 A. Article 5, Paragraph 5.01, Performance, Payment and Other Bonds, Subparagraph A, second sentence, is revised as follows:

These Bonds shall remain in effect at least until three (3) years after the date when final payment becomes due, except as provided otherwise by Laws or Regulations or by the Contract Documents.

SC-5.03 A. Article 5, Paragraph 5.03 Certificates of Insurance, Subparagraph A is amended by adding the following Subparagraph 1:

1. CONTRACTOR shall obtain evidence that all Subcontractors have in force the required coverage in the amounts required by these Contract Documents, and evidence that each is current on its unemployment insurance payments before Subcontractors begin Work at the Site. CONTRACTOR shall retain such evidence in its files and make available to CITY within ten (10) days after written request.

SC-5.04 C. Article 5, Paragraph 5.04, CONTRACTOR's Liability Insurance, Subparagraph C is amended as follows:

The following additional policies of insurance are required:

6. Environmental Liability Insurance. This insurance shall protect CONTRACTOR, and CITY, DESIGN PROFESSIONAL and Consultants as additional insureds, against claims for injuries to members of the public and damage to the property of others resulting from environmental impairment. The liability limits of the environmental policy shall not be less than $2,000,000.

7. Asbestos Liability Insurance. This insurance shall be an "occurrence" policy and shall protect CONTRACTOR, and CITY, DESIGN PROFESSIONAL and Consultants as additional insureds, against all claims arising from bodily injury, sickness, disease or death of any person other than the CONTRACTOR's employees arising out of any act related to asbestos abatement work. The liability limits for bodily injury and property damage shall be not less than:

   $1,000,000 each occurrence
   $2,000,000 general aggregate

If CONTRACTOR provides Environmental or Asbestos Liability Insurance through a Subcontractor, CONTRACTOR shall contractually require the Subcontractor to include CITY, Design Professional and Consultants as additional insureds in the Subcontractor's policy. CONTRACTOR shall deliver to CITY, prior to the start of any Work at the Project Site, properly completed certificates of insurance or other evidence that the required insurance is in full force and effect, in a form acceptable to CITY. CONTRACTOR shall contractually require its Subcontractor to defend, indemnify and hold harmless CITY from and against all Claims arising out of or resulting from all acts or omissions in connection with this Contract caused in whole or

in part by Subcontractor or Subcontractor's agents, regardless of whether or not caused in part by any act or omission, including negligence, of CITY. CONTRACTOR must provide evidence that this requirement has been complied in accordance with the provisions of Paragraphs 6.01 B and 6.06 G.

SC-6.06 A.1 Article 6, Paragraph 6.06 Substitutes and "Or-Equal" Items, Paragraph A is amended by adding the following at the end of Paragraph A.1:

Proposed "or-equal" items must be submitted to CITY at least 14 days prior to Bid date at the following address: shawn.cross@kcmo.org.

Only Bidders may submit proposed "or-equal" items and such items must require no change in related Work. Acceptance by CITY of any proposed "or-equal" items will be made by Addendum only.

SC-6.06 A.2. Article 6, Paragraph 6.06 Substitutes and "Or-Equal" Items, Paragraph A is amended by adding the following at the end of Paragraph A.2:

Proposed substitute items must be submitted to CITY's Representative not later than 60 days prior to the time the item is to be incorporated into the Work. Only CONTRACTOR may submit proposed substitute items, and such items must be submitted to CITY's Representative on the standard City form 01630 - Substitution Request. Acceptance by CITY of any proposed substitute item will be made by Change Order.

SC-6.07 J Article 6, Paragraph 6.07, concerning Subcontractors, Suppliers and Others, is supplemented by adding the following at the end of Subparagraph J as follows:

CONTRACTOR shall perform with its own organization Work amounting to not less than 35% of the total Contract Price. “Its own organization” shall be construed to include only workers employed and paid by the CONTRACTOR and equipment owned or rented by the CONTRACTOR, with or without operators. Such term does not include employees or equipment of a subcontractor, assignee, or agent of the CONTRACTOR.

SC-6.10. Article 6, Paragraph 6.10, Compliance with Laws and Regulations, is amended by adding the following new Subparagraphs immediately following Subparagraph 6.10 I 2:

a. CONTRACTOR will be required to comply with wage rates as follows:

County –Platte

Work Type:	Federal –	Heavy
	Federal –	Building
	State -	Heavy
	State –	Building

Article 6, Paragraph 6.10, Compliance with Laws and Regulations, is amended by adding the following new Subparagraph 6.10 T:

Contract Information Management System. CONTRACTOR shall comply with CITY’s Contract Information Management System requirements. CONTRACTOR shall use CITY’s Internet web based Contract Information Management System/Project Management Communications Tool provided by CITY and protocols included in that software during the term of this Contract. CONTRACTOR shall maintain user applications to CITY’s provided system for all personnel, subcontractors or suppliers as applicable.

SC-6.11. Article 6, Paragraph 6.11, Taxes, is amended by adding the following sentence to Subparagraph 6.11 B:

B. Tax Compliance. The following subparagraphs apply if the Contract is over $150,000.00.

SC-12.01 Article 12, Paragraph 12.01, Time of the Essence is amended by adding the following new Subparagraphs immediately following Subparagraph 12.01 A:

B. Starting and Completion

1. The Work to be performed under this Contract shall begin on the date specified in the written Notice to Proceed issued by the Director of Water Services, and the Work shall be substantially complete, in accordance with Paragraph 14.04, on or before within one thousand, thirty five (1,035) Calendar Days thereafter. Once the Work starts, CONTRACTOR shall continuously pursue completion of the Work.

2. The Work shall be completed and ready for final payment in accordance with Paragraph 14.07 within 60 Calendar Days after the date of Substantial Completion of the Work.

C. Liquidated Damages

1. If the Work is not substantially completed, in accordance with Paragraph 14.04, within the period stated in Paragraph 12.01 B.1, CONTRACTOR shall pay to CITY the amount of ***three thousand dollars*** ($ 3000.000) as liquidated damages and not as a penalty for each Calendar Day until the Work is substantially complete. The amount of liquidated damages shall be deducted from any payments due or to become due CONTRACTOR.

SC-13.07 Article 13, Paragraph 13.07, Correction Period, Subparagraph A is amended as follows:

The correction period set forth in Paragraph 13.07 A shall be _three_ (3) years instead of one (1) year, which longer period of time shall also be applicable to the correction period set forth in Paragraph 13.07 C. All other provisions of Paragraph 13.07 remain unchanged except as necessary to accommodate the revised length of the correction period.

SC-14.02 A. Article 14, Paragraph 14.02, Application for Progress Payments, Subparagraph A is amended by deleting Item 3 and adding the following:

3. CITY shall make payments to CONTRACTOR monthly on or about the 10th day of each month. Payments to CONTRACTOR will be made on the basis of ninety-five percent (95%) of the value of the Work satisfactorily completed plus ninety-five percent (95%) of the value of properly stored and insured, unused materials on hand on the Site of the Work. CITY shall retain five percent (5%) of each partial payment until completion and acceptance of the Work covered by the Contract and final payment is due. All Work covered by a payment becomes CITY's property, provided that the Work paid for remains the sole responsibility of CONTRACTOR until all terms and conditions of the Contract have been met.

SC-14.04. Article 14, Paragraph 14.04, Substantial Completion, Subparagraph A is supplemented as follows:

A. To be considered substantially complete, the following items of the Work must be operational and ready for CITY's continuous use as intended:
   a. All structures, mechanical and electrical Work required for successful and continuous operation of the new treatment system, including instrumentation and control systems.

b. Tie-ins and interconnections to the existing sanitary sewer and treatment facilities.
c. Process control and laboratory space within the Administration Building
d. Physical and cyber-security elements of the project
e. Roads, parking areas and gutters per the contract documents
f. Signage to interior and exterior spaces
g. Demolition work for the bridge, sludge holding cells, and existing WWTP

SC-14.05 Article 14, Paragraph 14.05, Partial Utilization is amended by adding the following new Subparagraph A.3. immediately following Subparagraph 14.05 A.2:

3. CITY at any time may make a written request to CONTRACTOR to permit CITY to take over operation of any part of the Work although it is not substantially complete. A copy of the request will be sent to DESIGN PROFESSIONAL, and within a reasonable time thereafter CITY, CONTRACTOR and DESIGN PROFESSIONAL shall make an inspection of that part of the Work to determine its status of completion and will prepare a list of the items remaining to be completed or corrected thereon before final payment. If CONTRACTOR does not make written objection to CITY and DESIGN PROFESSIONAL that such part of the Work is not ready for separate operation by CITY, DESIGN PROFESSIONAL will finalize the list of items to be completed or corrected and will deliver such lists to CITY and CONTRACTOR. DESIGN PROFESSIONAL will also make a written recommendation as to the division of responsibilities pending final payment between CITY and CONTRACTOR with respect to security, operation, safety, maintenance, utilities, insurance, warranties and guarantees for that part of the Work, which recommendation will become binding upon CITY and CONTRACTOR at the time when CITY takes over such operation (unless they shall have otherwise agreed in writing and so informed DESIGN PROFESSIONAL). During such operation and prior to Substantial Completion of such part of the Work, CITY shall allow CONTRACTOR reasonable access to complete or correct items on said list and to complete other related Work.

SECTION 00830

PREVAILING WAGE

1. Annual Wage Order No. 32 – Platte County
2. **0830.03 Division of Labor Standards Rules & Regulations** are incorporated into and made part of this Contract and are available at http://s1.sos.mo.gov/cmsimages/adrules/csr/current/8csr/8c30-3.pdf

Missouri
Division of Labor Standards
WAGE AND HOUR SECTION

MIKE KEHOE, Governor

Annual Wage Order No. 32

Section 083
PLATTE COUNTY

In accordance with Section 290.262 RSMo 2000, within thirty (30) days after a certified copy of this Annual Wage Order has been filed with the Secretary of State as indicated below, any person who may be affected by this Annual Wage Order may object by filing an objection in triplicate with the Labor and Industrial Relations Commission, P.O. Box 599, Jefferson City, MO 65102-0599. Such objections must set forth in writing the specific grounds of objection. Each objection shall certify that a copy has been furnished to the Division of Labor Standards, P.O. Box 449, Jefferson City, MO 65102-0449 pursuant to 8 CSR 20-5.010(1). A certified copy of the Annual Wage Order has been filed with the Secretary of State of Missouri.

Original Signed by
Logan Hobbs, Director
Division of Labor Standards

Filed With Secretary of State: **March 10, 2025**

Last Date Objections May Be Filed: **April 9, 2025**

Prepared by Missouri Department of Labor and Industrial Relations

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Asbestos Worker	$71.19
Boilermaker	$34.28*
Bricklayer-Stone Mason	$64.62
Carpenter	$66.80
Lather	
Linoleum Layer	
Millwright	
Pile Driver	
Cement Mason	$57.71
Plasterer	
Communication Technician	$65.55
Electrician (Inside Wireman)	$75.86
Electrician Outside Lineman	$34.28*
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Elevator Constructor	$34.28*
Glazier	$34.28*
Ironworker	$71.57
Laborer	$50.93
General Laborer	
First Semi-Skilled	
Second Semi-Skilled	
Mason	$54.93
Marble Mason	
Marble Finisher	
Terrazzo Worker	
Terrazzo Finisher	
Tile Setter	
Tile Finisher	
Operating Engineer	$65.88
Group I	
Group II	
Group III	
Group III-A	
Group IV	
Group V	
Painter	$55.19
Plumber	$82.42
Pipe Fitter	
Roofer	$61.62
Sheet Metal Worker	$79.11
Sprinkler Fitter	$70.76
Truck Driver	$34.28*
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

*The Division of Labor Standards received fewer than 1,000 reportable hours for this occupational title The public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center
**The Prevailing Hourly Rate includes any applicable fringe benefit amounts for each occupational title as defined in RSMo Section 290 210

Heavy Construction Rates for
PLATTE County

Section 083

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Carpenter	$67.97
Millwright	
Pile Driver	
Electrician (Outside Lineman)	$34.28*
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Laborer	$52.48
General Laborer	
Skilled Laborer	
Operating Engineer	$61.20
Group I	
Group II	
Group III	
Group IV	
Truck Driver	$53.30
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

Use Heavy Construction Rates on Highway and Heavy construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(3).

Use Building Construction Rates on Building construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(2).

If a worker is performing work on a heavy construction project within an occupational title that is not listed on the Heavy Construction Rate Sheet, use the rate for that occupational title as shown on the Building Construction Rate Sheet.

*The Division of Labor Standards received fewer than 1,000 reportable hours for this occupational title. Public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center.

**The Prevailing Hourly Rate includes any applicable fringe benefit amounts for each occupational title.

OVERTIME
and
HOLIDAYS

OVERTIME

For all work performed on a Sunday or a holiday, not less than twice (2x) the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed or the public works contracting minimum wage, whichever is applicable, shall be paid to all workers employed by or on behalf of any public body engaged in the construction of public works, exclusive of maintenance work.

For all overtime work performed, not less than one and one-half (1½) the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed or the public works contracting minimum wage, whichever is applicable, shall be paid to all workers employed by or on behalf of any public body engaged in the construction of public works, exclusive of maintenance work or contractual obligation. For purposes of this subdivision, **"overtime work"** shall include work that exceeds ten hours in one day and work in excess of forty hours in one calendar week; and

A thirty-minute lunch period on each calendar day shall be allowed for each worker on a public works project, provided that such time shall not be considered as time worked.

HOLIDAYS

January first;
The last Monday in May;
July fourth;
The first Monday in September;
November eleventh;
The fourth Thursday in November; and
December twenty-fifth;

If any holiday falls on a Sunday, the following Monday shall be considered a holiday.

"General Decision Number: MO20250001 11/21/2025

Superseded General Decision Number: MO20240001

State: Missouri

Construction Types: Heavy and Highway

Counties: Missouri Statewide.

HEAVY AND HIGHWAY CONSTRUCTION PROJECTS

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least $17.75 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2025.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	. Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least $13.30 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2025.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the

Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at http://www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/03/2025
1	01/31/2025
2	02/07/2025
3	02/21/2025
4	04/11/2025
5	05/16/2025
6	06/13/2025
7	07/18/2025
8	08/15/2025
9	08/29/2025
10	09/05/2025
11	11/21/2025

CARP0002-002 05/01/2024

ST. LOUIS COUNTY AND CITY

	Rates	Fringes
Carpenters.....	$ 41.71	21.85

CARP0005-006 05/01/2024

CASS (Richards-Gebauer AFB ONLY), CLAY, JACKSON, PLATTE AND RAY COUNTIES

	Rates	Fringes
Carpenters:		
CARPENTERS & LATHERS.....	$ 44.63	22.40
MILLWRIGHTS & PILEDRIVERS...	$ 44.63	22.40

CARP0011-001 05/01/2024

	Rates	Fringes
Carpenter and Piledriver		
ADAIR, AUDRAIN (West of		

Hwy 19), BOONE, CALLAWAY, CHARITON, COLE, COOPER, HOWARD, KNOX,LINN, MACON, MILLER, MONITEAU,MONROE, OSAGE, PUTNAM, RANDOLPH, SCHUYLER, SHELBY AND SULLIVAN COUNTIES.....	$ 35.61	22.40
ATCHISON, ANDREW, BATES, CALDWELL, CARROLL,DAVIESS, DEKALB,GENTRY, GRUNDY, HARRISON, HENRY, HOLT, LIVINGSTON, MERCER, NODAWAY,ST. CLAIR, SALINE AND WORTH COUNTIES.....	$ 34.98	22.40
AUDRAIN (East of Hwy.19), RALLS, MARION, LEWIS, CLARK AND SCOTLAND COUNTIES.	$ 35.61	22.40
BARRY, BARTON, CAMDEN, CEDAR, CHRISTIAN, DADE, DALLAS, DOUGLAS, GREENE, HICKORY,JASPER, LACLEDE, LAWRENCE, MCDONALD, NEWTON, OZARK, POLK, STONE, TANEY, VERNON, WEBSTER AND WRIGHT COUNTIES.	$ 33.25	22.40
BENTON, MORGAN AND PETTIS...	$ 34.98	22.40
BOLLINGER, BUTLER, CAPE GIRARDEAU, DUNKLIN, MISSISSIPPI, NEW MADRID, PEMISCOT, PERRY, STE. GENEVIEVE, SCOTT, STODDARD AND WAYNE COUNTIES.....	$ 35.37	22.40
BUCHANAN, CLINTON, JOHNSON AND LAFAYETTE COUNTIES.....	$ 34.98	22.40
CARTER, HOWELL, OREGON AND RIPLEY COUNTIES.....	$ 34.04	22.40
CRAWFORD, DENT, GASCONADE, IRON, MADISON, MARIES, MONTGOMERY, PHELPS, PULASKI, REYNOLDS, SHANNON AND TEXAS COUNTIES.....	$ 35.37	22.40
FRANKLIN COUNTY.....	$ 42.19	22.40
JEFFERSON AND ST. CHARLES COUNTIES.....	$ 42.19	22.40
LINCOLN COUNTY.....	$ 38.04	22.40
PIKE, ST. FRANCOIS AND WASHINGTON COUNTIES.....	$ 36.13	22.40
WARREN COUNTY.....	$ 38.04	22.40

BOLLINGER, BUTLER, CAPE GIRARDEAU, CARTER, DUNKLIN, FRANKLIN, IRON, JEFFERSON, LINCOLN, MADISON, MISSISSIPPI, NEW MADRID, PEMISCOT, PERRY,REYNOLDS, RIPLEY, ST. CHARLES, ST. FRANCOIS, ST. LOUIS (City and County), STE. GENEVIEVE, SCOTT, STODDARD, WARREN, WASHINGTON AND WAYNE COUNTIES

	Rates	Fringes
Electricians	$ 49.29	33.642

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* ELEC0002-001 08/31/2025

ADAIR, AUDRAIN, BOONE, CALLAWAY, CAMDEN, CARTER, CHARITON, CLARK, COLE, COOPER, CRAWFORD, DENT, FRANKLIN, GASCONADE, HOWARD, HOWELL, IRON, JEFFERSON, KNOX, LEWIS, LINCON, LINN, MACON, MARIES, MARION, MILLER, MONITEAU, MONROE, MONTGOMERY, MORGAN, OREGON, OSAGE, PERRY, PHELPS, PIKE, PULASKI, PUTNAM, RALLS, RANDOLPH, REYNOLDS, RIPLEY, ST. CHARLES, ST. FRANCOIS, ST. LOUIS (City and County), STE. GENEVIEVE, SCHUYLER, SCOTLAND, SHANNON, SHELBY, SULLIVAN, TEXAS, WARREN AND WASHINGTON COUNTIES

	Rates	Fringes
Line Construction:		
Equipment Operator	$ 49.68	36.5%+7.50
Groundman & Truck Driver	$ 37.95	36.5%+7.50
Lineman & Cable Splicer	$ 57.88	36.5%+7.50

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* ELEC0053-005 08/31/2025

ANDREW, ATCHINSON, BARRY, BARTON, BATES, BENTON, BUCHANAN, CALDWELL, CARROLL, CASS, CEDAR, CHRISTIAN, CLAY, CLINTON, DADE, DALLAS, DAVIES, DEKALB, DOUGLAS, GENTRY, GREENE, GRUNDY, HARRISON, HENRY, HICKORY, HOLT, LAFAYETTE, JACKSON, JASPER, LACLEDE, LAWRENCE, LIVINGSTON, JOHNSON, MCDONALD, MERCER, NEWTON, NODAWAY, OZARK, PETTIS, PLATTE, POLK, RAY, SALINE, ST. CLAIR, STONE, TANEY, VERNON, WEBSTER, WORTH AND WRIGHT COUNTIES

	Rates	Fringes
Line Construction:		
Groundman Powderman	$ 38.44	1.5%+20.18
Groundman	$ 35.86	1.5%+25.34
Lineman Operator	$ 52.45	1.5%+19.34
Lineman	$ 58.15	1.5%+26.69

ELEC0095-001 06/01/2025

BARRY, BARTON, CEDAR, DADE, JASPER, LAWRENCE, MCDONALD, NEWTON, ST CLAIR, AND VERNON COUNTIES

	Rates	Fringes
Electricians:		
Cable Splicers	$ 25.40	12.19
Electricians	$ 32.25	20.81

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* ELEC0124-007 09/01/2025

BATES, BENTON, CARROLL, CASS, CLAY, COOPER, HENRY, JACKSON, JOHNSON, LAFAYETTE, MORGAN, PETTIS, PLATTE, RAY AND SALINE COUNTIES:

	Rates	Fringes
Electricians	$ 54.01	27.85

ELEC0257-003 03/01/2025

AUDRAIN (Except Cuivre Township), BOONE, CALLAWAY, CAMDEN, CHARITON, COLE, CRAWFORD, DENT, GASCONADE, HOWARD, MARIES, MILLER, MONITEAU, OSAGE, PHELPS AND RANDOLPH COUNTIES

	Rates	Fringes
Electricians:		
Cable Splicers	$ 30.42	16.085
Electricians	$ 40.50	23.26

ELEC0350-002 12/01/2024

ADAIR, AUDRAIN (East of Highway 19), CLARK, KNOX, LEWIS, LINN, MACON, MARION, MONROE, MONTGOMERY, PIKE, PUTNAM, RALLS, SCHUYLER, SCOTLAND, SHELBY AND SULLIVAN COUNTIES

	Rates	Fringes
Electricians	$ 37.60	22.145

ELEC0453-001 09/01/2024

	Rates	Fringes
Electricians:		
CHRISITAN, DALLAS, DOUGLAS, GREENE, HICKORY, HOWELL, LACLEDE, OREGON, OZARK, POLK, SHANNON, WEBSTER and WRIGHT COUNTIES.	$ 32.40	19.11
PULASKI and TEXAS COUNTIES..	$ 39.70	19.84
STONE and TANEY COUNTIES....	$ 28.65	18.34

ELEC0545-003 06/01/2025

ANDREW, BUCHANAN, CLINTON, DEKALB, ATCHISON, HOLT, MERCER, GENTRY, HARRISON, DAVIESS, GRUNDY, WORTH, LIVINGSTON, NODAWAY, AND CALDWELL COUNTIES

	Rates	Fringes
Electricians:.....	$ 43.20	21.50

ELEC0702-004 01/06/2025

BOLLINGER, BUTLER, CAPE GIRARDEAU, DUNKLIN, MADISON, MISSISSIPPI, NEW MADRID, PEMISCOT, SCOTT, STODDARD AND WAYNE COUNTIES

	Rates	Fringes
Line Construction:		
Groundman - Class A.....	$ 38.18	29%+8.85
Groundman-Equipment Operator Class II (all other equipment).....	$ 46.49	29%+8.85
Heavy-Equipment Operator Class I (all crawler type equipment D-4 and larger)...	$ 52.13	29%+8.85
Lineman.....	$ 74.55	29%+8.85

ENGI0101-001 05/01/2025

AREA 1
ANDREW, ATCHISON, BATES, BENTON, BUCHANAN, CALDWELL, CARROLL, CHARITON, CLINTON, COOPER, DAVIESS, DEKALB, GENTRY, GRUNDY, HARRISON, HENRY, HOLT, HOWARD, JOHNSON, LAFAYETTE, LINN, LIVINGSTON, MERCER, NODAWAY, PETTIS, SALINE, SULLIVAN AND WORTH COUNITES

	Rates	Fringes
Power equipment operators:		
GROUP 1	$ 38.83	21.87
GROUP 2	$ 38.43	21.87
GROUP 3	$ 36.43	21.87

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Asphalt roller operator, finish; asphalt paver and spreader; asphalt plant operator; auto grader or trimmer or sub-grader; backhoe; blade operator (all types); boilers - 2; booster pump on dredge; bulldozer operator; boring machine (truck or crane mounted); clamshell operator; concrete mixer paver; concrete plant operator; concrete pump operator; crane operator; derrick or derrick trucks; ditching machine; dragline operator; dredge engineman; dredge operator; drill cat with compressor mounted (self-contained) or similar type self- propelled rotary drill (not air tract); drilling or boring machine (rotary-self-propelled); finishing machine operator; greaser; high loader-fork lift-skid loader (all types); hoisting engineer (2 active drums); locomotive operator (standard guage); mechanics and welders (field and plants); mucking machine operator; pile drive operator; pitman crane or boom truck (all types); push cat; quad track; scraper operators (all types); shovel operator; sideboom cats; side discharge spreader; skimmer scoop operators; slip form paver operator (CMI, Rex, Gomeco or equal); la tourneau rooter (all tiller types); tow boat operator; truck crane; wood and log chippers (all types).

GROUP 2: A-frame truck operator; articulated dump truck; back filler operator; boilers (1); chip spreader; churn drill operator; compressor; concrete mixer operator, skip loader; concrete saws (self-propelled); conveyor operator; crusher operator; distributor operator; elevating grader operator; farm tractor (all attachments); fireman rig; float operator; form grade operator; hoisting engine (one drum); maintenance operator; multiple compactor; pavement breaker, self-propelled hydra-hammer (or similar type); paymill operator; power shield; pumps; roller operator (with or without blades); screening and washing plant; self-propelled street broom or sweeper; siphons and jets; straw blower; stump cutting machine; siphons and jets; tank car heater operator (combination boiler and booster); welding machine; vibrating machine operator (not hand held); welding machine.

GROUP 3: (a) Oiler;

(b) Oiiler driver
(c) Mechanic.

HOURLY PREMIUMS:
THE FOLLOWING CLASSIFICATIONS SHALL RECEIVE ($ .25) ABOVE GROUP 1 RATE: Dragline operator - 3 yds. & over; shovel 3 yds. & over; clamshell 3 yds. & over; Crane, rigs or piledrivers, 100' of boom or over (incl. jib.), hoist - each additional active drum over 2 drums

THE FOLLOWING CLASSIFICATIONS SHALL RECEIVE ($ .50) ABOVE GROUP 1 RATE: Tandem scoop operator; crane, rigs or piledrivers 150' to 200' of boom (incl. jib.)

THE FOLLOWING CLASSIFICATIONS SHALL RECEIVE ($ .75) ABOVE GROUP 1 RATE: Crane rigs, or piledrivers 200 ft. of boom or over (including jib.)

ENGI0101-005 04/01/2025

CASS, CLAY, JACKSON,PLATTE AND RAY COUNTIES

	Rates	Fringes
Power equipment operators:		
GROUP 1	$ 40.17	22.29
GROUP 2	$ 39.13	22.29
GROUP 3	$ 34.66	22.29
GROUP 4	$ 38.01	22.29

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Asphalt roller operator, finish; asphalt paver and spreader; asphalt plant operator; auto grader or trimmer or sub-grader; backhoe; blade operator (all types); boilers-2; booster pump on dredge; boring machine (truck or crane mounted); bulldozer operator; clamshell operator; concrete cleaning decontamination machine operator; concrete mixer paver; concrete plant operator; concrete pump operator; crane operator; derrick or derrick trucks; ditching machine; dragline operator; dredge engineman; dredge operator; drillcat with compressor mounted (self-contained) or similar type self propelled rotary drill (not air tract); drilling or boring machine (rotary - self-propelled); finishing machine operator; greaser; heavy equipment robotics operator/mechanic; horizontal directional drill operator; horizontal directional drill locator; loader-forklift - skid loader (all types);

hoisting engineer (2 active drums); locomotive operator (standard guage); master environmental maintenance mechanic; mechanics and welders (field and plants); mucking machine operator; piledrive operator; pitman crane or boom truck (all types); push cat; quad-track; scraper operators (all types); shovel operator; side discharge spreader; sideboom cats; skimmer scoop operator; slip-form paver (CMI, REX, Gomaco or equal); la tourneau rooter (all tiller types); tow boat operator; truck crane; ultra high perssure waterjet cutting tool system operator/mechanic; vacuum blasting machine operator/mechanic; wood and log chippers (all types)

GROUP 2: ""A"" Frame truck operator; back filler operator; boilers (1); chip spreader;churn drill operator; concrete mixer operator, skip loader; concrete saws (self-propelled); conveyor operator; crusher operator; distributor operator; elevating grader operator; farm tractor (all attachments); fireman rig; float operator; form grader operator; hoisting engine (1 drum); maintenance operator; multiple compactor; pavement breaker, self-propelled hydra- hammer (or similar type); power shield; paymill operator; pumps; siphons and jets; stump cutting machine; tank car heater operator (combination boiler and booster); compressor; roller operator (with or without blades); screening and washing plant; self-propelled street broom or sweeper; straw blower; tank car heater operator (combination boiler and booster); vibrating machine operator (not hand held)

GROUP 3: Oilers

GROUP 4: Oiler Driver (All Types)

FOOTNOTE:
HOURLY PREMIUMS FOLLOWING CLASSIFICATIONS SHALL RECEIVE ($1.00) ABOVE GROUP 1 RATE:
Clamshells - 3 yd. capacity or over; Cranes or rigs, 80 ft. of boom or over (including jib); Draglines, 3 yd. capacity or over;
Piledrivers 80 ft. of boom or over (including jib);
Shovels & backhoes, 3 yd. capacity or over.

ENGI0101-022 05/01/2025

BARRY, BARTON, CAMDEN, CEDAR, CHRISTIAN, DADE, DALLAS, DOUGLAS, GREENE, HICKORY, JASPER, LACLEDE, LAWRENCE, MCDONALD, NEWTON, OZARK, POLK, ST. CLAIR, STONE, TANEY, VERNON, WEBSTER AND WRIGHT COUNTIES and CITY OF SPRINGFIELD

	Rates	Fringes
Power equipment operators:		
GROUP 1	$ 36.60	19.32
GROUP 2	$ 36.25	19.32
GROUP 3	$ 36.05	19.32
GROUP 4	$ 34.00	19.32

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Asphalt finishing machine & trench widening spreader; asphalt plant console operator; autograder; automatic slipform paver; backhoe; blade operator - all types; boat operator - tow; boilers-2; central mix concrete plant operator; clamshell operator; concrete mixer paver; crane operator; derrick or derrick trucks; ditching machine; dozer operator; dragline operator; dredge booster pump; dredge engineman; dredge operator; drill cat with compressor mounted on cat; drilling or boring machine rotary self-propelled; highloader; hoisting engine - 2 active drums; launch hammer wheel; locomotive operator; - standard guage; mechanic and welders; mucking machine; off-road trucks; piledriver operator; pitman crane operator; push cat operator; quad trac; scoop operator - all types; shovel operator; sideboom cats; skimmer scoop operators; trenching machine operator; truck crane.

GROUP 2: A-frame; asphalt hot-mix silo; asphalt plant fireman (drum or boiler); asphalt plant man; asphalt plant man; asphalt plant mixer operator; asphalt roller operator; backfiller operator; barber-greene loader; boat operator (bridges and dams); chip spreader; concrete mixer operator - skip loader; concrete plant operator; concrete pump operator; crusher operator; dredge oiler; elevating grader operator; fork lift; greaser-fleet; hoisting engine - 1; locomotive operator - narrow gauge; multiple compactor; pavement breaker; powerbroom - self-propelled; power shield; rooter; side discharge concrete spreader; slip form finishing machine; stumpcutter machine; throttle man; tractor operator (over 50 h.p.); winch truck.

GROUP 3: Boilers - 1; chip spreader (front man); churn drill operator; clef plane operator; concrete saw operator (self-propelled); curb finishing machine; distributor operator; finishing machine operator; flex plane operator; float operator; form grader operator; pugmill operator; roller operator, other than high type asphalt; screening & washing plant operator; siphons & jets; sub-grading machine

operator; spreader box operator, self-propelled (not asphalt); tank car heater operator (combination boiler & booster); tractor operator (50 h.p. or less); Ulmac, Ulric or similar spreader; vibrating machine operator, not hand;

GROUP 4: Grade checker; Oiler; Oiler-Driver

HOURLY PREMIUMS:

The following classifications shall receive $ .25 above GROUP 1 rate:
Clamshells - 3 yds. or over; Cranes - Rigs or Piledrivers, 100 ft. of boom or over (including jib); Draglines - 3 yds. or over; Hoists - each additional active drum over 2 drums; Shovels - 3 yds. or over;

The following classifications shall receive $ .50 above GROUP 1 rate:
Tandem scoop operator; Cranes - Rigs or Piledrivers, 150 ft. to 200 ft. of boom (including jib); Tandem scoop.

The following classifications shall receive $ .75 above GROUP 1 rate:
Cranes - Rigs or Piledrivers, 200 ft. of boom or over (including jib.).

ENGI0513-004 05/05/2025

FRANKLIN, JEFFERSON, LINCOLN, ST CHARLES, AND WARREN COUNTIES

	Rates	Fringes
Power equipment operators:		
GROUP 1	$ 45.96	30.96
GROUP 2	$ 45.96	30.96
GROUP 3	$ 44.66	30.96
GROUP 4	$ 44.22	30.96

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Backhoe, Cable; Backhoe, Hydraulic (2 cu yds bucket and under regardless of attachment, one oiler for 2 or 3, two oilers for 4 through 6); Backhoe, Hydraulic over 2 cu yds; Cableway; Crane, Crawler or Truck; Crane, Hydraulic - Truck or Cruiser mounted, 16 tons and over; Crane, Locomotive; crane with boom including jib over 100 ft from pin to pin; Crane using rock socket tool; Derrick, Steam; Derrick Car and Derrick Boat; Dragline, 7 cu yds and over; Dredge; Gradall, Crawler or tire mounted; Locomotive, Gas,

Steam & other powers; Pile Driver, Land or Floating; Scoop, Skimmer; Shovel, Power (Electric, Gas, Steam or other powers); Shovel, Power (7 cu yds and over); Switch Boat; Whirley; Air Tugger with air compressor; Anchor Placing Barge; Asphalt Spreaker; Athey Force Feeder Loader, self-propelled; Backfilling Machine; Boat Operator - Push Boat or Tow Boat (job site); Boiler, High Pressure Breaking in Period; Boom Truck, Placing or Erecting; Boring Machine, Footing Foundation; Bullfloat; Cherry Picker; Combination Concrete Hoist and Mixer (such as Mixermobile); Compressor, Two 125 CFM and under; Compressor, Two through Four over 125 CFM; Compressor when operator runs throttle; Concrete Breaker (Truck or Tractor mounted); Concrete Pump (such as Pumpcrete machine); Concrete Saw (self-propelled); Concrete Spreader; Conveyor, Large (not selfpropelled) hoisting or moving brick and concrete into, or into and on floor level, one or both; Crane, Cimbing (such as Linden); Crane, Hydraulic - Rough Terrain, self-propelled; Crane, Hydraulic - Truck or Cruiser mounted - under 16 tons; Drilling machine - Self-powered, used for earth or rock drilling or boring (wagon drills and any hand drills obtaining power from other souces including concrete breakers, jackhammers and Barco equipmnet no engineer required); Elevating Grader; Engine Man, Dredge; Excavator or Powerbelt Machine; Finishing Machine, self- propelled oscillating screed; Forklift; Generators, Two through Six 30 KW or over; Grader, Road with power blade; Greaser; Highlift; Hoist, Concrete and Brick (Brick cages or concrete skips operating or on tower, Towermobile, or similar equipment); Hoist, Three or more drums in use; Hoist, Stack; Hydro-Hammer; Lad-A-Vator, hoisting brick or concrete; Loading Machine such as Barber-Greene; Mechanic on job site

GROUP 2: Air Tugger with plant air; Boiler (for power or heating shell of building or temporary enclosures in connection with construction work); Boiler, Temporary; Compressor, One over 125 CFM; Compressor, truck mounted; Conveyor, Large (not self- propelled); Conveyor, Large (not self- propelled) moving brick and concrete (distributing) on floor level; Curb Finishing Machine; Ditch Paving Machine; Elevator (outside); Endless Chain Hoist; Fireman (as required); Form Grader; Hoist, One Drum regardless of size (except brick or concrete); Lad-A-Vator, other hoisting; Manlift; Mixer, Asphalt, over 8 cu ft capacity; Mixer, one bag capacity or less; Mixer, without side loader, two bag capacity or more; Mixer, with side loader, regardless of size, not Paver; Mud Jack (where mud jack is used in conjenction with an air compressor, operator shall be paid $ .55 per hour in addition to his basic hourly rate for covering both operations); Pug Mill operator; Pump,

Sump - self powered, automatic controlled over 2""; Scissor Lift (used for hoisting); Skid Steer Loader; Sweeper, Street; Tractor, small wheel type 50 HP and under with grader blade and similar equipment; Welding Machine, One over 400 amp; Winch, operating from truck

GROUP 3: Boat operator - outboard motor, job site; Conveyors (such as Con-Vay-It) regardless of how used; Elevator (inside); Heater operator, 2 through 6; Sweeper, Floor

GROUP 4: Crane type

HOURLY PREMIUMS:

Backhoe, Hydraulic 2 cu yds or less without oiler - $2.00;
Crane,climbing (such as Linden) - $.50;
Crane, Pile Driving and Extracting - $ .50
Crane with boom (including job) over
100 ft from pin to pin - add $.01 per foot
to maximum of $4.00);
Crane, using rock socket tool - $ .50;
Derrick, diesel, gas or electric hoisting material
and erecting steel (150 ft or more above ground) - $ .50;
Dragline, 7 cu yds and over - $ .50;
Hoist, Three or more drums in use - $ .50;
Scoop, Tandem - $.50;
Shovel, Power - 7 cu yds and over - $ .50;
Tractor, Tandem Crawler - $ .50;
Tunnel, man assigned to work in tunnel or
tunnel shaft - $ .50;
Wrecking, when machines are working on
second floor or higher - $ .50

ENGI0513-006 05/01/2025

ADAIR, AUDRAIN, BOLLINGER, BOONE, BUTLER, CALLAWAY, CAPE GIRARDEAU, CARTER, CLARK, COLE, CRAWFORD, DENT, DUNKLIN, GASCONADE, HOWELL, IRON, KNOX, LEWIS, MACON, MADISON, MARIES, MARION, MILLER, MISSISSIPPI, MONITEAU, MONROE, MONTGOMERY, MORGAN, NEW MADRID, OREGON, OSAGE, PEMISCOT, PERRY, PHELPS, PIKE, PULASKI, PUTNAM, RALLS, RANDOLPH, REYNOLDS, RIPLEY, ST. FRANCOIS, STE. GENEVIEVE, SCHUYLER, SCOTLAND, SCOTT, SHANNON, SHELBY, STODDARD, TEXAS, WASHINGTON, AND WAYNE COUNTIES

	Rates	Fringes
Power equipment operators:		
GROUP 1.....	$ 40.39	30.33

GROUP 2.....	$ 40.04	30.33
GROUP 3.....	$ 39.84	30.33
GROUP 4.....	$ 36.19	30.33

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Asphalt finishing machine & trench widening spreader, asphalt plant console operator; autograder; automatic slipform paver; back hoe; blade operator - all types; boat operator tow; boiler two; central mix concrete plant operator; clam shell operator; concrete mixer paver; crane operator; derrick or derrick trucks; ditching machine; dozer operator; dragline operator; dredge booster pump; dredge engineman; dredge operator; drill cat with compressor mounted on cat; drilling or boring machine rotary self-propelled; highloader; hoisting engine 2 active drums; launchhammer wheel; locomotive operator standrad guage; mechanics and welders; mucking machine; piledriver operator; pitman crane operator; push cat operator; guad-trac; scoop operator; sideboom cats; skimmer scoop operator; trenching machine operator; truck crane, shovel operator.

GROUP 2: A-Frame; asphalt hot-mix silo; asphalt roller operator asphalt plant fireman (drum or boiler); asphalt plant man; asphalt plant mixer operator; backfiller operator; barber-greene loader; boat operator (bridge & dams); chip spreader; concrete mixer operator skip loader; concrete plant operator; concrete pump operator; dredge oiler; elevating graded operator; fork lift; grease fleet; hoisting engine one; locomotive operator narrow guage; multiple compactor; pavement breaker; powerbroom self-propelled; power shield; rooter; slip-form finishing machine; stumpcutter machine; side discharge concrete spreader; throttleman; tractor operator (over 50 hp); winch truck; asphalt roller operator; crusher operator.

GROUP 3: Spreader box operator, self-propelled not asphalt; tractor operator (50 h.p. or less); boilers one; chip spreader (front man); churn drill operator; compressor over 105 CFM 2-3 pumps 4"" & over; 2-3 light plant 7.5 KWA or any combination thereof; clef plane operator; compressor maintenance operator 2 or 3; concrete saw operator (self-propelled); curb finishing mancine; distributor operator; finishing machine operator; flex plane operator; float operator; form grader operator; pugmill operator; riller operator other than high type asphalt; screening & washing plant operator; siphons & jets; subgrading machine operator; tank car heater (combination boiler & booster); ulmac, ulric or similar spreader; vibrating machine

operator; hydrobroom.

GROUP 4: Oiler; grout machine; oiler driver; compressor over 105 CFM one; conveyor operator one; maintenance operator; pump 4"" & over one.

FOOTNOTE: HOURLY PREMIUMS

Backhoe hydraulic, 2 cu. yds. or under Without oiler - $2.00
Certified Crane Operator - $1.50;
Certified Hazardous Material Operator $1.50;
Crane, climbing (such as Linden) - $0.50;
Crane, pile driving and extracting - $0.50;
Crane, with boom (including jib) over 100' from pin to pin add $0.01 per foot to maximum of $4.00;
Crane, using rock socket tool - $0.50;
Derrick, diesel, gas or electric, hoisting material and erecting steel (150' or more above the ground) - $0.50;
Dragline, 7 cu. yds, and over - $0.50;
Hoist, three or more drums in use - $0.50; Scoop, Tandem - $0.50;
Shovel, power - 7 cu. yds. or more - $0.50;
Tractor, tandem crawler - $0.50;
Tunnel, man assigned to work in tunnel or tunnel shaft - $0.50;
Wrecking, when machine is working on second floor or higher - $0.50;

ENGI0513-007 05/05/2025

ST. LOUIS CITY AND COUNTY

	Rates	Fringes
Power equipment operators:		
GROUP 1	$ 45.96	30.96
GROUP 2	$ 45.96	30.96
GROUP 3	$ 44.66	30.96
GROUP 4	$ 44.22	30.96

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Backhoe, cable or hydraulic; cableway; crane crawler or truck; crane, hydraulic-truck or cruiser mounted 16 tons & over; crane locomotive; derrick, steam; derrick car & derrick boat; dragline; dredge; gradall, crawler or tire mounted; locomotive, gas, steam & other powers; pile driver, land or floating; scoop, skimmer; shovel, power (steam, gas, electric or other powers); switch boat;

whirley.

GROUP 2: Air tugger w/air compressor; anchor-placing barge; asphalt spreader; athey force feeder loader (self-propelled); backfilling machine; backhoe-loader; boat operator-push boat or tow boat (job site); boiler, high pressure breaking in period; boom truck, placing or erecting; boring machine, footing foundation; bull- float; cherry picker; combination concrete hoist & mixer (such as mixer mobile); compressor (when operator runs throttle); concrete breaker (truck or tractor mounted); concrete pump, such as pump-crete machine; concrete saw (self-propelled), concrete spreader; conveyor, large (not self-propelled), hoisting or moving brick and concrete into, or into and on floor level, one or both; crane, hydraulic-rough terrain, self-propelled; crane hydraulic-truck or cruiser mounted-under 16 tons; drilling machines, self-powered use for earth or rock drilling or boring (wagon drills nd any hand drills obtaining power from other sources including concrete breakers, jackhammers and barco equipment-no engineer required); elevating grader; engineman, dredge; excavator or powerbelt machine; finishing machine, self-propelled oscillating screed; forklift; grader, road with power blade; highlift. greaser; hoist, stack, hydro-hammer; loading machine (such as barber-greene); machanic, on job site; mixer, pipe wrapping machines; plant asphalt; plant, concrete producing or ready-mix job site; plant heating-job site; plant mixing-job site; plant power, generating-job site; pumps, two through six self-powered over 2""; pumps, electric submersible, two through six, over 4""; quad-track; roller, asphalt, top or sub-grade; scoop, tractor drawn; spreader box; sub-grader; tie tamper; tractor-crawler, or wheel type with or without power unit, power take-offs and attachments regardless of size; trenching machine; tunnel boring machine; vibrating machine automatic, automatic propelled; welding machines (gasoline or diesel) two through six; well drilling machine

GROUP 3: Conveyor, large (not self-propelled); conveyor, large (not self-propelled) moving brick and concrete distributing) on floor level; mixer two or more mixers of one bag capacity or less; air tugger w/plant air; boiler, for power or heating on construction projects; boiler, temporary; compressor (mounted on truck; curb finishing machine; ditch paving machine; elevator; endless chain hoist; form grader; hoist, one drum regardless of size; lad-a-vator; manlift; mixer, asphalt, over 8 cu. ft. capacity, without side loader, 2 bag capacity or more; mixer, with side loader, regardless of size; pug mill operator; pump, sump-self-powered, automatic controlled

over 2"" during use in connection with construction work; sweeper, street; welding machine, one over 400 amp.; winch operating from truck; scissor lift (used for hoisting); tractor, small wheel type 50 h.p. & under with grader blade & similar equipment; Oiler on dredge and on truck crane.

GROUP 4: Boat operator-outboard motor (job site); conveyor (such as con-vay-it) regardless of how used; sweeper, floor

HOURLY PREMIUMS:

Backhoe, hydraulic 2 cu. yds. or under without oiler	$2.00
Certified Crane Operator	1.50
Certified Hazardous Material Operator	1.50
Crane, climbing (such as Linden)	.50
Crane, pile driving and extracting	.50
Crane, with boom (including jib) over 100' (from pin to pin) add $.01 per foot to maximum of	4.00
Crane, using rock socket tool	.50
Derrick, diesel, gas or electric, hoisting material and erecting steel (150' or more above ground)	.50
Dragline, 7 cu. yds. and over	.50
Hoist, three (3) or more drums in use	.50
Scoop, Tandem	.50
Shovel, power - 7 cu. yds. or more	.50
Tractor, tandem crawler	.50
Tunnel, man assigned to work in tunnel or tunnel shaft	.50
Wrecking, when machine is working on second floor or higher	.50

IRON0010-012 04/01/2025

	Rates	Fringes
Ironworkers:		
ANDREW, BARTON, BENTON, CAMDEN, CEDAR, CHARITON, CHRISTIAN, COOPER, DADE, DALLAS, DAVIESS, DE KALB, GENTRY, GREENE, GRUNDY, HARRISON, HICKORY, HOLT, HOWARD, LACLEDE, LINN, LIVINGSTON, MERCER, MONITEAU, MORGAN, NODAWAY, PETTIS, POLK, PUTNAM, RANDLOPH, ST. CLAIR,		

SULLIVAN, TANEY, VERNON,
WEBSTER, WRIGHT and WORTH
Counties and portions of
ADAIR, BOONE, MACON,
MILLER and RANDOLPH
Counties.....$ 36.00 34.25
ATCHISON, BATES, BUCHANAN,
CALDWELL, CARROLL, CASS,
CLAY, CLINTON, HENRY,
JACKSON, JOHNSON,
LAFAYETTE, PETTIS, PLATTE,
SALINE, AND RAY COUNTIES....$ 39.00 34.25

IRON0010-020 04/01/2025

BARRY, JASPER, LAWRENCE, MCDONALD, NEWTON AND STONE Counties

	Rates	Fringes
Ironworkers:.....	$ 36.00	34.25

IRON0321-002 08/01/2023

DOUGLAS, HOWELL and OZARK COUNTIES

	Rates	Fringes
Ironworker.....	$ 27.00	20.96

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* IRON0396-004 08/06/2025

ST. LOUIS (City and County), ST. CHARLES, JEFFERSON, IRON, FRANKLIN, LINCOLN, WARREN, WASHINGTON, ST. FRANCOIS, STE. GENEVIEVE, and REYNOLDS Counties; and portions of MADISON, PERRY, BOLLINGER, WAYNE, and CARTER Counties

	Rates	Fringes
Ironworker.....	$ 44.27	31.65

IRON0396-009 08/07/2024

AUDRAIN, CALLAWAY, COLE, CRAWFORD, DENT, GASCONADE, MARIES, MONTGOMERY, OSAGE, PHELPS, PIKE, PULASKI, TEXAS and WRIGHT Counties; and portions of BOONE, CAMDEN, DOUGLAS, HOWELL, LACLEDE, MILLER, MONROE, OREGON, SHANNON and RALLS Counties

	Rates	Fringes

Ironworker.....$ 41.67 31.25

IRON0577-005 06/01/2024

ADAIR, CLARK, KNOX, LEWIS, MACON, MARION, MONROE, RALLS, SCHUYLER, SCOTLAND, AND SHELBY COUNTIES

	Rates	Fringes
Ironworker	$ 34.05	25.30

IRON0782-003 08/01/2023

CAPE GIRARDEAU, MISSISSIPPI, NEW MADRID, SCOTT, & STODDARD Counties; and portions of BOLLINGER, BUTLER, CARTER, DUNKLIN, MADISON, PEMISCOT, PERRY, RIPLEY, and WAYNE Counties

	Rates	Fringes
Ironworkers:		
Locks, Dams, Bridges and other major work on the Mississippi and Ohio River only	$ 38.77	29.51
All Other Work	$ 33.47	24.12

LABO0042-003 06/04/2025

ST. LOUIS (City and County)

	Rates	Fringes
LABORER		
Plumber Laborer	$ 40.82	17.56

LABO0042-005 06/04/2025

ST. LOUIS (City and County)

	Rates	Fringes
LABORER		
Dynamiter, Powderman	$ 40.82	17.56
Laborers, Flaggers	$ 40.82	17.56
Wrecking	$ 40.82	17.56

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* LABO0110-005 05/01/2025

Jefferson and Washington Counties

	Rates	Fringes
LABORER (Jefferson County)		
GROUP 1	$ 40.36	15.96
GROUP 2	$ 40.36	15.96
LABORER (Washington County)		
GROUP 1	$ 37.25	15.96
GROUP 2	$ 37.25	15.96

LABORERS CLASSIFICATIONS

GROUP 1 - General laborer-flagman, carpenter tenders; salamander Tenders; Dump Man; Ticket Takers; loading trucks under bins, hoppers, and conveyors; track man; cement handler; dump man on earth fill; georgie buggie man; material batch hopper man; spreader on asphalt machine; material mixer man (except on manholes); coffer dams; riprap pavers rock, block or brick; scaffolds over ten feet not self-supported from ground up; skip man on concrete paving; wire mesh setters on concrete paving; all work in connection with sewer, water, gas, gasoling, oil, drainage pipe, conduit pipe, tile and duct lines and all other pipe lines; power tool operator; all work in connection with hydraulic or general dredging operations; form setters, puddlers (paving only); straw blower nozzleman; asphalt plant platform man; chuck tender; crusher feeder; men handling creosote ties or creosote materials; men working with and handling epoxy material; topper of standing trees; feeder man on wood pulverizers, board and willow mat weavers and cabelee tiers on river work; deck hands; pile dike and revetment work; all laborers working on underground tunnels less than 25 ft. where compressed air is not used; abutement and pier hole men working six (6) ft. or more below ground; men working in coffer dams for bridge piers and footing in the river; barco tamper; jackson or any other similar tamp; cutting torch man; liners, curb, gutters, ditch lines; hot mastic kettlemen; hot tar applicator; hand blade operator; mortar men or brick or block manholes; rubbing concrete, air tool operator under 65 lbs.; caulker and lead man; chain or concrete saw under 15 h.p.; signal Gan; Guard rail and sign erectors.

GROUP 2 - Skilled laborers - Vibrator man; asphalt raker; head pipe layer on sewer work; batterboard man on pipe and ditch work; cliff scalers working from bosun's chairs; scaffolds or platforms on dams or power plants over 10 ft.

high; air tool operator over 65 lbs.; stringline man on concrete paving; sandblast man; laser beam man; wagon drill; churn drill; air track drill and all other similar type drills, gunite nozzle man; pressure grout man; screed man on asphalt; concrete saw 15 h.p. and over; grade checker; strigline man on electronic grade control; manhole builder; dynamite man; powder man; welder; tunnel man; waterblaster - 1000 psi or over; asbestos and/or hazardous waste removal and/or disposal

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LABO0579-005 05/01/2023

	Rates	Fringes
LABORER (ANDREW, ATCHISON, BUCHANAN, CALDWELL, CLINTON, DAVIESS, DEKALB, GENTRY, GRUNDY, HARRISON, HOLT, LIVINGSTON, MERCER, NODAWAY and WORTH COUNTIES.)		
GROUP 1	$ 29.04	16.59
GROUP 2	$ 29.39	16.59
LABORER (BARRY, BARTON, BATES, BENTON, CAMDEN, CARROLL, CEDAR, CHRISTIAN, DADE, DALLAS, DOUGLAS, GREENE, HENRY. HICKORY, JASPER, JOHNSON, LACLEDE, LAWRENCE, MCDONALD, MORGAN, NEWTON, OZARK, PETTIS, POLK, ST.CLAIR, SALINE, STONE, TANEY, VERNON, WEBSTER and WRIGHT COUNTIES)		
GROUP 1	$ 28.23	15.60
GROUP 2	$ 28.78	15.60
LABORER (LAFAYETTE COUNTY)		
GROUP 1	$ 29.78	15.85
GROUP 2	$ 30.13	15.85

LABORERS CLASSIFICATIONS

GROUP 1: General Laborers - Carpenter tenders; salamander tenders; loading trucks under bins; hoppers & conveyors; track men & all other general laborers; air tool operator; cement handler-bulk or sack; dump man on earth fill; georgie buggie man; material batch hopper man; material mixer man (except on manholes); coffer dams; riprap pavers - rock, block or brick; signal man; scaffolds over ten feet not self-supported from ground up; skipman on concrete

paving; wire mesh setters on concrete paving; all work in connection with sewer, water, gas, gasoline, oil drainage pipe, conduit pipe, tile and duct lines and all other pipe lines; power tool operator, all work in connection with hydraulic or general dredging operations; puddlers (paving only); straw blower nozzleman; asphalt plant platform man; chuck tender; crusher feeder; men handling creosote ties or creosote materials; men working with and handling epoxy material or materials (where special protection is required); rubbing concrete; topper of standing trees; batter board man on pipe and ditch work; feeder man on wood pulverizers; board and willow mat weavers and cable tiers on river work; deck hands; pile dike and revetment work; all laborers working on underground tunnels less than 25 feet where compressed air is not used; abutment and pier hole men working six (6) feet or more below ground; men working in coffer dams for bridge piers and footings in the river; ditchliners; pressure groutmen; caulker; chain or concrete saw; cliffscalers working from scaffolds, bosuns' chairs or platforms on dams or power plants over (10) feet above ground; mortarmen on brick or block manholes; toxic and hazardous waste work.

GROUP 2: Skilled Laborers - Head pipe layer on sewer work; laser beam man; Jackson or any other similar tamp; cutting torch man; form setters; liners and stringline men on concrete paving, curb, gutters; hot mastic kettleman; hot tar applicator; sandblasting and gunite nozzlemen; air tool operator in tunnels; screed man on asphalt machine; asphalt raker; barco tamper; churn drills; air track drills and all similar drills; vibrator man; stringline man for electronic grade control; manhole builders-brick or block; dynamite and powder men; grade checker.

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* LABO0660-004 05/01/2025

Clark, Knox, Lewis, Marion, Pike, Ralls, Scotland, Shelby Counties

	Rates	Fringes
LABORER		
GROUP 1	$ 37.25	15.96
GROUP 2	$ 37.25	15.96

LABORERS CLASSIFICATIONS

GROUP 1 - General laborer-flagman, carpenter tenders;

salamander Tenders; Dump Man; Ticket Takers; loading trucks under bins, hoppers, and conveyors; track man; cement handler; dump man on earth fill; georgie buggie man; material batch hopper man; spreader on asphalt machine; material mixer man (except on manholes); coffer dams; riprap pavers rock, block or brick; scaffolds over ten feet not self-supported from ground up; skip man on concrete paving; wire mesh setters on concrete paving; all work in connection with sewer, water, gas, gasoling, oil, drainage pipe, conduit pipe, tile and duct lines and all other pipe lines; power tool operator; all work in connection with hydraulic or general dredging operations; form setters, puddlers (paving only); straw blower nozzleman; asphalt plant platform man; chuck tender; crusher feeder; men handling creosote ties or creosote materials; men working with and handling epoxy material; topper of standing trees; feeder man on wood pulverizers, board and willow mat weavers and cabelee tiers on river work; deck hands; pile dike and revetment work; all laborers working on underground tunnels less than 25 ft. where compressed air is not used; abutement and pier hole men working six (6) ft. or more below ground; men working in coffer dams for bridge piers and footing in the river; barco tamper; jackson or any other similar tamp; cutting torch man; liners, curb, gutters, ditch lines; hot mastic kettlemen; hot tar applicator; hand blade operator; mortar men or brick or block manholes; rubbing concrete, air tool operator under 65 lbs.; caulker and lead man; chain or concrete saw under 15 h.p.; signal Gan; Guard rail and sign erectors.

GROUP 2 - Skilled laborers - Vibrator man; asphalt raker; head pipe layer on sewer work; batterboard man on pipe and ditch work; cliff scalers working from bosun's chairs; scaffolds or platforms on dams or power plants over 10 ft. high; air tool operator over 65 lbs.; stringline man on concrete paving; sandblast man; laser beam man; wagon drill; churn drill; air track drill and all other similar type drills, gunite nozzle man; pressure grout man; screed man on asphalt; concrete saw 15 h.p. and over; grade checker; strigline man on electronic grade control; manhole builder; dynamite man; powder man; welder; tunnel man; waterblaster - 1000 psi or over; asbestos and/or hazardous waste removal and/or disposal

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LABO0660-006 06/02/2025

Lincoln, Montgomery, St Charles and Warren Counties

	Rates	Fringes
LABORER (Common or General).....	$ 36.91	15.62
Lincoln, Monntomery, and Warrner Counties.....	$ 39.76	15.96
St. Charles County.....	$ 41.18	15.96

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* LABO0662-001 05/01/2025

Callaway, Cole, Miller and Moniteau Counties

	Rates	Fringes
LABORER		
GROUP 1.....	$ 37.25	15.96
GROUP 2.....	$ 37.25	15.96

LABORERS CLASSIFICATIONS

GROUP 1 - General laborer-flagman, carpenter tenders; salamander Tenders; Dump Man; Ticket Takers; loading trucks under bins, hoppers, and conveyors; track man; cement handler; dump man on earth fill; georgie buggie man; material batch hopper man; spreader on asphalt machine; material mixer man (except on manholes); coffer dams; riprap pavers rock, block or brick; scaffolds over ten feet not self-supported from ground up; skip man on concrete paving; wire mesh setters on concrete paving; all work in connection with sewer, water, gas, gasoling, oil, drainage pipe, conduit pipe, tile and duct lines and all other pipe lines; power tool operator; all work in connection with hydraulic or general dredging operations; form setters, puddlers (paving only); straw blower nozzleman; asphalt plant platform man; chuck tender; crusher feeder; men handling creosote ties or creosote materials; men working with and handling epoxy material; topper of standing trees; feeder man on wood pulverizers, board and willow mat weavers and cabelee tiers on river work; deck hands; pile dike and revetment work; all laborers working on underground tunnels less than 25 ft. where compressed air is not used; abutement and pier hole men working six (6) ft. or more below ground; men working in coffer dams for bridge piers and footing in the river; barco tamper; jackson or any other similar tamp; cutting torch man; liners, curb, gutters, ditch lines; hot mastic kettlemen; hot tar applicator; hand blade operator; mortar men or brick or block manholes; rubbing concrete, air tool operator under 65 lbs.; caulker and lead man; chain or concrete saw under 15 h.p.; signal Gan; Guard rail and sign erectors.

GROUP 2 - Skilled laborers - Vibrator man; asphalt raker; head pipe layer on sewer work; batterboard man on pipe and ditch work; cliff scalers working from bosun's chairs; scaffolds or platforms on dams or power plants over 10 ft. high; air tool operator over 65 lbs.; stringline man on concrete paving; sandblast man; laser beam man; wagon drill; churn drill; air track drill and all other similar type drills, gunite nozzle man; pressure grout man; screed man on asphalt; concrete saw 15 h.p. and over; grade checker; strigline man on electronic grade control; manhole builder; dynamite man; powder man; welder; tunnel man; waterblaster - 1000 psi or over; asbestos and/or hazardous waste removal and/or disposal

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LABO0663-002 04/01/2025

CASS, CLAY, JACKSON, PLATTE AND RAY COUNTIES

	Rates	Fringes
LABORER		
GROUP 1	$ 36.24	15.87
GROUP 2	$ 37.45	15.87

LABORERS CLASSIFICATIONS

GROUP 1: General laborers, Carpenter tenders, salamander tenders, loading trucks under bins, hoppers and conveyors, track men and all other general laborers, air tool operator, cement handler (bulk or sack), chain or concrete saw, deck hands, dump man on earth fill, Georgie Buggies man, material batch hopper man, scale man, material mixer man (except on manholes), coffer dams, abutments and pier hole men working below ground, riprap pavers rock, black or brick, signal man, scaffolds over ten feet not self-supported from ground up, skipman on concrete paving, wire mesh setters on concrete paving, all work in connection with sewer,water, gas, gasoling, oil, drainage pipe, conduit pipe, tile and duct lines and all other pipelines, power tool operator, all work in connection with hydraulic or general dredging operations, straw blower nozzleman,asphalt plant platform man, chuck tender, crusher feeder, men handling creosote ties on creosote materials, men working with and handling epoxy material or materials (where special protection is required), topper of standing trees, batter board man on pipe and ditch work, feeder man on wood pulverizers, board and willow mat weavers and cable tiers on river work, deck hands, pile dike and revetment

work, all laborers working on underground tunnels less than 25 feet where compressed air is not used, abutment and pier hole men working six (6) feet or more below ground, men working in coffer dams for bridge piers and footings in the river, ditchliners, pressure groutmen, caulker and chain or concrete saw, cliffscalers working from scaffolds, bosuns' chairs or platforms on dams or power plants over (10) feet above ground, mortarmen on brick or block manholes, signal man.

GROUP 2: Skilled Laborer - spreader or screed man on asphalt machine, asphalt raker, grade checker, vibrator man, concrete saw over 5 hp., laser beam man, barco tamper, jackson or any other similar tamp, wagon driller, churn drills, air track drills and other similar drills, cutting torch man, form setters, liners and stringline men on concrete paving, curb, gutters and etc., hot mastic kettleman, hot tar applicator, hand blade operators, mortar men on brick or block manholes, sand blasting and gunnite nozzle men, rubbing concrete, air tool operator in tunnels, head pipe layer on sewer work, manhole builder (brick or block), dynamite and powder men.

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* LABO0840-011 05/01/2025

Crawford, Dent, Franklin, Gasconade, Howell, Maries, Oregon, Osage, Phelps, Pulaski, Shannon and Texas Counties

	Rates	Fringes
LABORER (Crawford, Dent, Gasconade, Howell, Maries, Oregon, Osage, Phelps, Pulaski, Shannon and Texas Counties)		
GROUP 1	$ 37.25	15.96
GROUP 2	$ 37.25	15.96
LABORER (Franklin County)		
GROUP 1	$ 40.31	15.96
GROUP 2	$ 40.31	15.96

LABORERS CLASSIFICATIONS

GROUP 1 - General laborer-flagman, carpenter tenders; salamander Tenders; Dump Man; Ticket Takers; loading trucks under bins, hoppers, and conveyors; track man; cement handler; dump man on earth fill; georgie buggie man; material batch hopper man; spreader on asphalt machine;

material mixer man (except on manholes); coffer dams; riprap pavers rock, block or brick; scaffolds over ten feet not self-supported from ground up; skip man on concrete paving; wire mesh setters on concrete paving; all work in connection with sewer, water, gas, gasoling, oil, drainage pipe, conduit pipe, tile and duct lines and all other pipe lines; power tool operator; all work in connection with hydraulic or general dredging operations; form setters, puddlers (paving only); straw blower nozzleman; asphalt plant platform man; chuck tender; crusher feeder; men handling creosote ties or creosote materials; men working with and handling epoxy material; topper of standing trees; feeder man on wood pulverizers, board and willow mat weavers and cabelee tiers on river work; deck hands; pile dike and revetment work; all laborers working on underground tunnels less than 25 ft. where compressed air is not used; abutement and pier hole men working six (6) ft. or more below ground; men working in coffer dams for bridge piers and footing in the river; barco tamper; jackson or any other similar tamp; cutting torch man; liners, curb, gutters, ditch lines; hot mastic kettlemen; hot tar applicator; hand blade operator; mortar men or brick or block manholes; rubbing concrete, air tool operator under 65 lbs.; caulker and lead man; chain or concrete saw under 15 h.p.; signal Gan; Guard rail and sign erectors.

GROUP 2 - Skilled laborers - Vibrator man; asphalt raker; head pipe layer on sewer work; batterboard man on pipe and ditch work; cliff scalers working from bosun's chairs; scaffolds or platforms on dams or power plants over 10 ft. high; air tool operator over 65 lbs.; stringline man on concrete paving; sandblast man; laser beam man; wagon drill; churn drill; air track drill and all other similar type drills, gunite nozzle man; pressure grout man; screed man on asphalt; concrete saw 15 h.p. and over; grade checker; strigline man on electronic grade control; manhole builder; dynamite man; powder man; welder; tunnel man; waterblaster - 1000 psi or over; asbestos and/or hazardous waste removal and/or disposal

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* LABO0955-012 05/01/2025

Adair, Audrain, Boone, Chariton, Cooper, Howard, Linn, Macon, Monroe, Putnam, Randolph, Schuyler and Sullivan Counties

	Rates	Fringes

LABORER

GROUP 1.....	$ 37.25	15.96
GROUP 2.....	$ 37.25	15.96

LABORERS CLASSIFICATIONS

GROUP 1 - General laborer-flagman, carpenter tenders; salamander Tenders; Dump Man; Ticket Takers; loading trucks under bins, hoppers, and conveyors; track man; cement handler; dump man on earth fill; georgie buggie man; material batch hopper man; spreader on asphalt machine; material mixer man (except on manholes); coffer dams; riprap pavers rock, block or brick; scaffolds over ten feet not self-supported from ground up; skip man on concrete paving; wire mesh setters on concrete paving; all work in connection with sewer, water, gas, gasoling, oil, drainage pipe, conduit pipe, tile and duct lines and all other pipe lines; power tool operator; all work in connection with hydraulic or general dredging operations; form setters, puddlers (paving only); straw blower nozzleman; asphalt plant platform man; chuck tender; crusher feeder; men handling creosote ties or creosote materials; men working with and handling epoxy material; topper of standing trees; feeder man on wood pulverizers, board and willow mat weavers and cabelee tiers on river work; deck hands; pile dike and revetment work; all laborers working on underground tunnels less than 25 ft. where compressed air is not used; abutement and pier hole men working six (6) ft. or more below ground; men working in coffer dams for bridge piers and footing in the river; barco tamper; jackson or any other similar tamp; cutting torch man; liners, curb, gutters, ditch lines; hot mastic kettlemen; hot tar applicator; hand blade operator; mortar men or brick or block manholes; rubbing concrete, air tool operator under 65 lbs.; caulker and lead man; chain or concrete saw under 15 h.p.; signal Gan; Guard rail and sign erectors.

GROUP 2 - Skilled laborers - Vibrator man; asphalt raker; head pipe layer on sewer work; batterboard man on pipe and ditch work; cliff scalers working from bosun's chairs; scaffolds or platforms on dams or power plants over 10 ft. high; air tool operator over 65 lbs.; stringline man on concrete paving; sandblast man; laser beam man; wagon drill; churn drill; air track drill and all other similar type drills, gunite nozzle man; pressure grout man; screed man on asphalt; concrete saw 15 h.p. and over; grade checker; strigline man on electronic grade control; manhole builder; dynamite man; powder man; welder; tunnel man; waterblaster - 1000 psi or over; asbestos and/or hazardous

waste removal and/or disposal

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* LABO1104-005 05/01/2025

Bollinger, Butler, Cape Girardeau, Carter, Dunklin, Iron, Madison, Mississippi, New Madrid, Pemiscot, Perry, Reynolds, Ripley, Scott, St Francois, Ste Genevieve, Stoddard and Wayne Counties

	Rates	Fringes
LABORER		
GROUP 1	$ 37.25	15.96
GROUP 2	$ 37.25	15.96

LABORERS CLASSIFICATIONS

GROUP 1 - General laborer-flagman, carpenter tenders; salamander Tenders; Dump Man; Ticket Takers; loading trucks under bins, hoppers, and conveyors; track man; cement handler; dump man on earth fill; georgie buggie man; material batch hopper man; spreader on asphalt machine; material mixer man (except on manholes); coffer dams; riprap pavers rock, block or brick; scaffolds over ten feet not self-supported from ground up; skip man on concrete paving; wire mesh setters on concrete paving; all work in connection with sewer, water, gas, gasoling, oil, drainage pipe, conduit pipe, tile and duct lines and all other pipe lines; power tool operator; all work in connection with hydraulic or general dredging operations; form setters, puddlers (paving only); straw blower nozzleman; asphalt plant platform man; chuck tender; crusher feeder; men handling creosote ties or creosote materials; men working with and handling epoxy material; topper of standing trees; feeder man on wood pulverizers, board and willow mat weavers and cabelee tiers on river work; deck hands; pile dike and revetment work; all laborers working on underground tunnels less than 25 ft. where compressed air is not used; abutement and pier hole men working six (6) ft. or more below ground; men working in coffer dams for bridge piers and footing in the river; barco tamper; jackson or any other similar tamp; cutting torch man; liners, curb, gutters, ditch lines; hot mastic kettlemen; hot tar applicator; hand blade operator; mortar men or brick or block manholes; rubbing concrete, air tool operator under 65 lbs.; caulker and lead man; chain or concrete saw under 15 h.p.; signal Gan; Guard rail and sign erectors.

GROUP 2 - Skilled laborers - Vibrator man; asphalt raker; head pipe layer on sewer work; batterboard man on pipe and ditch work; cliff scalers working from bosun's chairs; scaffolds or platforms on dams or power plants over 10 ft. high; air tool operator over 65 lbs.; stringline man on concrete paving; sandblast man; laser beam man; wagon drill; churn drill; air track drill and all other similar type drills, gunite nozzle man; pressure grout man; screed man on asphalt; concrete saw 15 h.p. and over; grade checker; strigline man on electronic grade control; manhole builder; dynamite man; powder man; welder; tunnel man; waterblaster - 1000 psi or over; asbestos and/or hazardous waste removal and/or disposal

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PAIN0002-002 09/01/2007

CLARK, FRANKLIN, JEFFERSON, LEWIS, LINCOLN, MARION, PIKE, RALLS, ST. CHARLES, ST. LOUIS (CITY & COUNTY), AND WARREN COUNTIES

	Rates	Fringes
Painters:		
Brush and Roller; Taper	$ 28.61	10.24
High work over 60 feet	$ 29.11	10.24
Lead Abatement	$ 29.36	10.24
Pressure Roller; High work under 60 ft	$ 28.86	10.24
Spray & Abrasive Blasting; Water Blasting (Over 5000 PSI)	$ 30.61	10.24
Taper (Ames Tools & Bazooka)	$ 30.21	10.24

PAIN0002-006 04/01/2023

ADAIR, AUDRAIN, BOONE, CALLAWAY, CHARITON, COLE, GASCONADE, HOWARD, KNOX, LINN, MACON, MONROE, MONTGOMERY, OSAGE, PUTNAM, RANDOLPH, SCHUYLER, SCOTLAND, SHELBY AND SULLIVAN COUNTIES and the City of Booneville.

	Rates	Fringes
Painters:		
Bridges, Dams, Locks or Powerhouses	$ 28.49	15.03

Brush and Roll; Taping, Paperhanging	$ 26.49	15.03
Epoxy or Any Two Part Coating; Sandblasting; Stage or other Aerial Work - Platforms over 50 feet high; Lead Abatement	$ 27.49	15.03
Spray; Structural Steel (over 50 feet)	$ 27.49	15.03
Tapers using Ames or Comparable Tools	$ 27.24	15.03

PAIN0003-004 04/01/2019

CASS, CLAY, CLINTON, JACKSON, JOHNSON, LAFAYETTE, PLATTE & RAY COUNTIES

	Rates	Fringes
Painters:		
Bridgeman; Lead Abatement; Sandblast; Storage Bin & Tanks	$ 33.41	17.76
Brush & Roller	$ 30.54	17.76
Drywall	$ 31.74	17.76
Paper Hanger	$ 31.04	17.76
Stageman; Beltman; Steelman; Elevator Shaft; Bazooka, Boxes and Power Sander; Sprayman; Dipping	$ 32.41	17.76
Steeplejack	$ 36.98	17.76

PAIN0003-011 04/01/2019

BATES, BENTON, CALDWELL, CARROLL, COOPER, DAVIESS, GRUNDY, HARRISON, HENRY, LIVINGSTON, MERCER, MONITEAU, MORGAN, PETTIS & SALINE COUNTIES

	Rates	Fringes
Painters:		
Bridgeman; Lead Abatement; Sandblast; Storage Bin & Tanks	$ 26.73	17.76
Brush & Roller	$ 24.43	17.76
Drywall	$ 25.39	17.76
Paper Hanger	$ 24.83	17.76
Stageman; Beltman;		

Steelman; Elevator Shaft; Bazooka, Boxes and Power Sander; Sprayman; Dipping	$ 26.35	17.76
Steeplejack	$ 29.58	17.76

PAIN1185-008 04/01/2025

CAMDEN, CRAWFORD, DENT, LACLEDE, MARIES, MILLER, PHELPS, PULASKI AND TEXAS COUNTIES

	Rates	Fringes
Painters:		
Brush and Roller	$ 33.90	17.21
Floor Work	$ 34.90	17.21
Lead Abatement	$ 33.25	17.21
Spray	$ 34.90	17.21
Structural Steel, Sandblasting and All Tank Work	$ 35.90	17.21
Taping, Paperhanging	$ 34.90	17.21

PAIN1292-002 09/01/2024

BOLLINGER, BUTLER, CAPE GIRARDEAU, CARTER, DUNKLIN, MISSISSIPPI, NEW MADRID, OREGON, PEMISCOT, PERRY, REYNOLDS, RIPLEY, SCOTT, SHANNON, STODDARD and WAYNE COUNTIES

	Rates	Fringes
Painters:		
Bridges, Stacks & Tanks	$ 35.30	17.65
Brush & Roller	$ 29.80	17.65
Spray & Abrasive Blasting; Waterblasting (over 5000 PSI)	$ 31.80	17.65

Height Rates (All Areas):
Over 60 ft. $0.50 per hour.
Under 60 ft. $0.25 per hour.

PAIN1292-003 09/01/2024

IRON, MADISON, ST. FRANCOIS, STE. GENEVIEVE and WASHINGTON COUNTIES

	Rates	Fringes
Painters:		
Bridges, Stacks & Tanks	$ 35.30	17.65
Brush & Roller	$ 30.95	17.65
Spray & Abrasive Blasting; Waterblasting (Over 5000 PSI)	$ 32.95	17.65

Height Rates (All Areas):
0ver 60 ft. $0.50 per hour
Under 60 ft. $0.25 per hour.

PAIN2012-001 04/01/2025

ANDREW, ATCHISON, BUCHANAN, DE KALB, GENTRY, HOLT, NODAWAY & WORTH COUNTIES

	Rates	Fringes
Painters:		
Brush & Roller	$ 36.18	19.97
Sandblaster	$ 40.76	19.97
Steeplejack	$ 44.33	19.97

PAIN2015-001 04/01/2012

BARRY, BARTON, CEDAR, CHRISTIAN, DADE, DALLAS, DOUGLAS, GREENE, HICKORY, HOWELL, JASPER, LAWRENCE, MCDONALD, NEWTON, OZARK, POLK, ST. CLAIR, STONE, TANEY, VERNON, WEBSTER, and WRIGHT COUNTIES

	Rates	Fringes
Painters:		
Finisher	$ 20.18	11.33
Painter	$ 19.75	11.76
Sandblaster, High Man, Spray Man, Vinyl Hanger, Tool Operator	$ 21.18	11.33

PLAS0518-006 03/01/2025

BARRY, BARTON, CEDAR, CHRISTIAN, DADE, DALLAS, DOUGLAS, GREENE, HICKORY, JASPER, LACLEDE, LAWRENCE, MCDONALD, NEWTON, OZARK, POLK, ST. CLAIR, STONE, TANEY, VERNON, WEBSTER, AND WRIGHT COUNTIES

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER	$ 30.37	12.43

PLAS0518-007 04/01/2025

CASS (Richards-Gebaur AFB only), CLAY, JACKSON, PLATTE AND RAY COUNTIES

	Rates	Fringes
Cement Masons:	$ 39.06	18.71

PLAS0518-011 04/01/2025

ANDREW, ATCHISON, BATES, BUCHANNAN, CLINTON, DEKALB, GENTRY, HENRY, HOLT, JOHNSON, LAFAYETTE, NODAWAY & WORTH COUNTIES

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER	$ 40.13	20.50

PLAS0518-019 03/01/2025

Adair, Audrain, Benton, Boone, Callaway, Caldwell, Camden, Carroll, Chariton, Cole, Cooper, Daviess, Gasconade, Grundy, Harrison, Howard, Linn, Livingston, Macon, Maries, Mercer, Miller, Moniteau, Monroe, Montgomery, Morgan, Osage, Pettis, Putnam, Randolph, Saline, Schuyler, Shelby and Sullivan Counties

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER	$ 33.52	15.88

PLAS0527-001 04/01/2023

	Rates	Fringes
CEMENT MASON		
FRANKLIN, LINCOLN AND WARREN COUNTIES	$ 37.29	20.23
JEFFERSON, ST. CHARLES COUNTIES AND ST.LOUIS (City and County)	$ 38.46	20.13

PLAS0527-004 06/01/2023

CRAWFORD, DENT, IRON, MADISON, MARION, PHELPS, PIKE, PULASKI, RALLS, REYNOLDS, ST. FRANCOIS, STE. GENEVIEVE, SHANNON, TEXAS, WASHINGTON COUNTIES

	Rates	Fringes
CEMENT MASON	$ 32.00	19.72

PLAS0908-001 05/01/2025

BOLLINGER, BUTLER, CAPE GIRARDEAU, CARTER, DUNKLIN, HOWELL, MISSISSIPPI, NEW MADRID, OREGON, PEMISCOT, PERRY, RIPLEY, SCOTT, STODDARD, AND WAYNE COUNTIES

	Rates	Fringes
CEMENT MASON	$ 35.10	18.78

PLUM0008-003 06/01/2024

CASS, CLAY, JACKSON, JOHNSON, AND PLATTE COUNTIES

	Rates	Fringes
Plumbers	$ 56.63	24.54

PLUM0008-017 06/01/2024

BATES, BENTON, CARROLL, HENRY, LAFAYETTE, MORGAN, PETTIS, RAY, ST. CLAIR, SALINE AND VERNON COUNTIES

	Rates	Fringes
Plumbers	$ 56.63	24.54

PLUM0045-003 08/01/2024

ANDREW, ATCHISON, BUCHANAN, CALDWELL, CLINTON, DAVIESS, DEKALB, GENTRY, HARRISON, HOLT, NODAWAY AND WORTH COUNTIES

	Rates	Fringes
Plumbers and Pipefitters	$ 47.45	26.15

PLUM0178-003 11/01/2024

BARRY, CEDAR, CHRISTIAN, DADE, DALLAS, DOUGLAS, GREENE, HICKORY, LACLEDE, LAWRENCE, POLK, STONE, TANEY, WEBSTER AND WRIGHT COUNTIES

	Rates	Fringes
Plumbers and Pipefitters	$ 39.35	15.72

PLUM0178-006 11/01/2022

BARTON, JASPER, MCDONALD AND NEWTON COUNTIES

	Rates	Fringes
Plumbers and Pipefitters		
Projects $750,000 & under	$ 32.78	15.32
Projects over $750,000	$ 35.75	15.32

PLUM0533-004 06/01/2024

BATES, BENTON, CARROLL, CASS, CLAY, HENRY, HICKORY, JACKSON, JOHNSON, LAFAYETTE, MORGAN, PETTIS, PLATTE, RAY, SALINE, ST. CLAIR AND VERNON COUNTIES

	Rates	Fringes
Pipefitters	$ 55.56	25.80

PLUM0562-004 07/01/2023

ADAIR, AUDRAIN, BOLLINGER, BOONE, BUTLER, CALLAWAY,CAMDEN, CAPE GIRARDEAU,CARTER, CHARITON, CLARK, COLE, COOPER, CRAWFORD, DENT, DUNKLIN, FRANKLIN, GASCONADE, GRUNDY, HOWARD, HOWELL, IRON, JEFFERSON, KNOX, LEWIS, LINCOLN, LINN, LIVINGSTON, MACON, MADISON, MARIES, MARION, MERCER, MILLER, MISSISSIPPI, MONITEAU, MONROE, MONTGOMERY, NEW MADRID, OREGON, OSAGE, PEMISCOTT, PERRY, PHELPS, PIKE, PULASKI, PUTNAM, RALLS, RANDOLPH, REYNOLDS, RIPLEY, ST. CHARLES, ST.FRANCOIS, STE. GENEVIEVE, ST. LOUIS, SCHUYLER, SCOTLAND, SCOTT, SHANNON, SHELBY, STODDARD, SULLIVAN, TEXAS, WARREN, WASHINGTON,AND WAYNE COUNTIES.

	Rates	Fringes
Plumbers and Pipefitters		
Mechanical Contracts		

including all piping and temperature control work $7.0 million & under	$ 46.66	21.99
Mechanical Contracts including all piping and temperature control work over $7.0 million	$ 46.66	21.99

PLUM0562-016 07/01/2023

CAMDEN, COLE, CRAWFORD, FRANKLIN, JEFFERSON, MARIES, MILLER, MONITEAU, OSAGE, PHELPS, PULASKI, ST. CHARLES, ST. LOUIS (City and County), WARREN and WASHINGTON COUNTIES

	Rates	Fringes
Plumbers		
Mechanical Contracts including all piping and temperature control work $7.0 million & under	$ 46.66	21.99
Mechanical Contracts including all piping and temperature control work over $7.0 million	$ 46.66	21.99

TEAM0013-001 05/01/2025

	Rates	Fringes
Truck drivers (ADAIR, BUTLER, CLARK, DUNKIN, HOWELL, KNOX, LEWIS, OREGON, PUTNAM, RIPLEY, SCHUYLER AND SCOTLAND COUNTIES)		
GROUP 1	$ 35.84	15.85
GROUP 2	$ 35.99	15.85
GROUP 3	$ 36.11	15.85
GROUP 4	$ 35.74	15.85
Truck drivers (AUDRAIN, BOLLINGER, BOONE, CALLAWAY, CAPE GIRARDEAU, CARTER, COLE, CRAWFORD, DENT, GASCONADE, IRON, MACON, MADISON, MARIES, MARION, MILLER, MISSISSIPPI, MONROE, MONTGOMERY, NEW MADRID, OSAGE, PEMISCOT, PERRY, PHELPS, PIKE, PULASKI, RALLS, REYNOLDS, ST.		

FRANCOIS, STE. GENEVIEVE,
SCOTT, SHANNON, SHELBY,
STODDARD, TEXAS, WASHINGTON
AND WAYNE COUNTIES)

GROUP 1	$ 36.57	15.85
GROUP 2	$ 36.72	15.85
GROUP 3	$ 36.84	15.85
GROUP 4	$ 36.73	15.85

Truck drivers (FRANKLIN,
JEFFERSON and ST. CHARLES
COUNTIES)

GROUP 1	$ 38.93	15.85
GROUP 2	$ 39.08	15.85
GROUP 3	$ 39.15	15.85
GROUP 4	$ 39.04	15.85

Truck drivers (LINCOLN and
WARREN COUNTIES)

GROUP 1	$ 37.58	15.85
GROUP 2	$ 38.73	15.85
GROUP 3	$ 37.80	15.85
GROUP 4	$ 37.69	15.85

TRUCK DRIVERS CLASSIFICATIONS:

GROUP 1: Flat Bed Trucks, Single Axle; Station Wagons; Pickup Trucks; Material Trucks, Single Axle; Tank Wagon, Single Axle

GROUP 2: Agitator and Transit Mix Trucks

GROUP 3: Flat Bed Trucks, Tandem Axle; Articulated Dump Trucks; Material Trucks, Tandem Axle; Tank Wagon, Tandem Axle

GROUP 4: Semi and/or Pole Trailers; Winch, Fork & Steel Trucks; Distributor Drivers and Operators; Tank Wagon, Semi-Trailer; Insley Wagons, Dumpsters, Half-Tracks, Speedace, Euclids and other similar equipment; A-Frame and Derrick Trucks; Float or Low Boy

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TEAM0056-001 05/01/2025

	Rates	Fringes

Truck drivers (ANDREW,
BARTON, BATES, BENTON,
CALDWELL, CAMDEN, CARROLL,
CEDAR, CHARITON, CHRISTIAN,
CLINTON, COOPER, DADE,

DALLAS, DAVIESS, DEKALB,
DOUGLAS, GREENE, HENRY,
HICHKORY, HOWARD, JASPER,
LACLEDE, LAWRENCE, LINN,
LIVINGSTON, MONITEAU, MORGAN,
NEWTON, PETTIS, POLK,
RANDOLPH, ST. CLAIR, SALINE,
VERNON, WEBSTER AND WRIGHT
COUNTIES)

GROUP 1	$ 36.27	15.85
GROUP 2	$ 36.43	15.85
GROUP 3	$ 36.42	15.85
GROUP 4	$ 36.54	15.85

Truck drivers: (ATCHISON,
BARRY, GENTRY, GRUNDY,
HARRISON, HOLT, MCDONALD,
MERCER, NODAWAY, OZARK,
STONE, SULLIVAN, TANEY AND
WORTH COUNTIES)

GROUP 1	$ 35.54	15.85
GROUP 2	$ 35.70	15.85
GROUP 3	$ 35.69	15.85
GROUP 4	$ 35.81	15.85

Truck drivers; (BUCHANAN,
JOHNSON AND LAFAYETTE
COUNTIES)

GROUP 1	$ 35.93	15.75
GROUP 2	$ 36.04	15.75
GROUP 3	$ 36.08	15.75
GROUP 4	$ 36.08	15.75

TRUCK DRIVER CLASSIFICATIONS

GROUP 1: Flat bed trucks single axle; station wagons; pickup trucks; material trucks single axle; tank wagons single axle.

GROUP 2: Agitator and transit mix-trucks.

GROUP 3: Flat bed trucks tandem axle; articulated dump trucks; material trucks tandem axle; tank wagons tandem axle.

GROUP 4: Semi and/or pole trailers; winch, fork & steel trucks; distributor drivers & operators; tank wagons semi-trailer; insley wagons, dumpsters, half-tracks, speedace, euclids & other similar equipment; A-frames and derrick trucks; float or low boy.

TEAM0245-001 03/26/2012

BARRY, BARTON, CAMDEN, CEDAR, CHRISTIAN, DALLAS, DENT, DOUGLAS, GREENE, HICKORY, HOWELL, JASPER, LACLEDE, LAWRENCE, MCDONALD, MILLER, NEWTON, OZARK, PHELPS, POLK, PULASKI, SHANNON, STONE, TANEY, TEXAS, VERNON, WEBSTER AND WRIGHT COUNTIES

	Rates	Fringes
Truck drivers:		
Traffic Control Service Driver	$ 20.45	0.00

PAID HOLIDAYS: New Year's Day, Decoration Day, July 4th, Labor Day, Thanksgiving Day, Christmas Day, employee's birthday and 2 personal days.

TEAM0541-001 04/01/2025

CASS, CLAY, JACKSON, PLATTE AND RAY COUNTIES

	Rates	Fringes
Truck drivers:		
GROUP 1	$ 38.61	15.85
GROUP 2	$ 38.04	15.85
GROUP 3	$ 37.52	15.85

TRUCK DRIVERS CLASSIFICATIONS

GROUP 1: Mechanics and Welders, Field; A-Frame Low Boy-Boom ruck Driver.

GROUP 2: Articulated Dump Truck; Insley Wagons: Dump Trucks, Excavating, 5 cu yds and over; Dumpsters; Half-Tracks: Speedace: Euclids & similar excavating equipment Material trucks, Tandem Two teams; Semi-Trailers; Winch trucks-Fork trucks; Distributor Drivers and Operators; Agitator and Transit Mix; Tank Wagon Drivers, Tandem or Semi; One Team; Station Wagons; Pickup Trucks; Material Trucks, Single Axle; Tank Wagon Drivers, Single Axle

GROUP 3: Oilers and Greasers - Field

TEAM0682-002 05/01/2025

ST LOUIS CITY AND COUNTY

	Rates	Fringes
Truck drivers:		
GROUP 1	$ 37.83	9.85+a+b+c
GROUP 2	$ 37.83	9.85+a+b+c
GROUP 3	$ 37.83	9.85+a+b+c

a. PENSION: 5/1/2012 - $182.20 per week.

b. HAZMAT PREMIUM: If Hazmat certification on a job site is required by a state or federal agency or requested by project owner or by the employer, employees on that job site shall receive $1.50 premium pay.

TRUCK DRIVERS CLASSIFICATIONS

GROUP 1 - Pick-up trucks; forklift, single axle; flatbed trucks; job site ambulance, and trucks or trailers of a water level capacity of 11.99 cu. yds. or less

GROUP 2 - Trucks or trailers of a water level capacity of 12.0 cu yds. up to 22.0 cu yds. including euclids, speedace and similar equipment of same capacity and compressors

GROUP 3 - Trucks or trailers of a water level capacity of 22.0 cu. yds & over including euclids, speedace & all floats, flatbed trailers, boom trucks, winch trucks, including small trailers, farm wagons tilt-top trailers, field offices, tool trailers, concrete pumps, concrete conveyors & gasoline tank trailers and truck mounted mobile concrete mixers

FOOTNOTE FOR TRUCK DRIVERS:

c. PAID HOLIDAYS: Christmas Day, Independence Day, Labor Day, Memorial Day, Veterans Day, New Years Day, Thanksgiving Day

d. PAID VACATION: 3 days paid vacation for 600 hours of service in any one contract year; 4 days paid vacation for 800 hours of service in any one contract year; 5 days paid vacation for 1,000 hours of service in any one contract year. When such an employee has completed 3 years of continuous employment with the same employer and then works the above required number of hours, he shall receive double the number of days of vacation specified above. When such an employee has completed 10 years of continuous employment with the same employer and then works the above required number of hours, he shall receive triple the number of days

of vacation specified above. When such an employee has completed 15 years of continuous employment with the same employer and then works the above required number of hours, he shall receive 4 times the number of days of vacation specified above.

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than ""SU"", ""UAVG"", ?SA?, or ?SC? denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The ""SU"" identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date,

6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

?SU? wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The ""SA"" identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

a) a survey underlying a wage determination
b) an existing published wage determination
c) an initial WHD letter setting forth a position on a wage determination matter
d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations.

Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION"

"General Decision Number: MO20250079 11/21/2025

Superseded General Decision Number: MO20240079

State: Missouri

Construction Type: Building

County: Platte County in Missouri.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	· Executive Order 14026 generally applies to the contract. · The contractor must pay all covered workers at least $17.75 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2025.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	· Executive Order 13658 generally applies to the contract. · The contractor must pay all covered workers at least $13.30 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours performing on that contract in 2025.

The applicable Executive Order minimum wage rate will be

adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at http://www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/03/2025
1	01/31/2025
2	02/07/2025
3	02/14/2025
4	03/14/2025
5	04/04/2025
6	05/16/2025
7	05/23/2025
8	06/06/2025
9	06/13/2025
10	07/18/2025
11	11/21/2025

ASBE0027-006 10/07/2024

	Rates	Fringes
HEAT & FROST INSULATOR (Includes Duct, Pipe and Mechanical Systems)	$ 43.60	33.52

BRMO0015-021 06/01/2023

	Rates	Fringes
BRICKLAYER	$ 40.53	16.69

BRMO0018-003 07/05/2023

	Rates	Fringes
TILE SETTER	$ 34.09	20.36

CARP1011-005 05/01/2024

	Rates	Fringes
CARPENTER	$ 44.63	22.40

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* ELEC0124-012 09/01/2025

	Rates	Fringes
ELECTRICIAN	$ 54.01	27.85

ELEC0124-013 11/25/2024

	Rates	Fringes
ELECTRICIAN (Communication Technician)	$ 48.23	25.35

ELEV0012-005 01/01/2025

	Rates	Fringes
ELEVATOR MECHANIC	$ 60.69	38.435+a+b

a. VACATION: Employer contributes 8% of basic hourly rate to vacation pay credit for employee who has worked in business more than 5 years and 6% for 6 months to 5 years as Vacation Pay Credit.

b. PAID HOLIDAYS: New Year's Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day, Friday after Thanksgiving Day and Christmas Day.

ENGI0101-052 04/01/2025

	Rates	Fringes
OPERATOR: Forklift	$ 44.14	22.42

ENGI0101-053 04/01/2025

	Rates	Fringes
OPERATOR: Crane	$ 47.29	22.42

ENGI0101-054 04/01/2025

	Rates	Fringes
OPERATOR: Backhoe/Excavator/Trackhoe	$ 45.48	22.42
OPERATOR: Bobcat/Skid Steer/Skid Loader	$ 45.48	22.42

ENGI0513-026 05/01/2025

	Rates	Fringes
POWER EQUIPMENT OPERATOR:		
Oiler	$ 39.06	30.38

ENGI0513-027 05/07/2025

	Rates	Fringes
POWER EQUIPMENT OPERATOR:		
Bulldozer	$ 45.96	30.57

IRON0010-003 04/01/2025

	Rates	Fringes
IRONWORKER	$ 39.00	34.25

LABO0110-007 06/04/2025

	Rates	Fringes
LABORER: Pipelayer	$ 40.82	17.56

LABO0264-009 04/01/2023

	Rates	Fringes
LABORER: Common or General	$ 31.60	18.25

LABO1104-007 03/01/2025

	Rates	Fringes
LABORER: Mason Tender - Cement/Concrete	$ 31.80	14.91

PLAS0518-015 04/01/2025

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER	$ 40.13	20.50

PLUM0008-021 06/01/2025

	Rates	Fringes

PLUMBER.....$ 58.38 25.29

PLUM0533-014 06/01/2025

	Rates	Fringes
PIPEFITTER.....	$ 57.51	28.35

ROOF0020-023 06/01/2024

	Rates	Fringes
ROOFER.....	$ 38.45	22.29

SFMO0314-002 10/01/2024

	Rates	Fringes
SPRINKLER FITTER.....	$ 45.85	25.50

SHEE0002-036 07/01/2023

	Rates	Fringes
SHEET METAL WORKER.....	$ 50.43	26.45

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* UAVG-MO-0001 01/01/2025

	Rates	Fringes
LABORER: Mason Tender - Brick...	$ 34.05	15.73

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* UAVG-MO-0002 01/01/2025

	Rates	Fringes
OPERATOR: Roller.....	$ 39.61	30.15

SUMO2020-008 10/10/2023

	Rates	Fringes
OPERATOR: Loader.....	$ 38.39	17.55
PAINTER.....	$ 24.14	9.67

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

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example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

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A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The ""SU"" identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

?SU? wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The ""SA"" identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were

adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

a) a survey underlying a wage determination
b) an existing published wage determination
c) an initial WHD letter setting forth a position on a wage determination matter
d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

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Wage and Hour Division
U.S. Department of Labor
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Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the

decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
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The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION"

CITY OF FOUNTAINS
HEART OF THE NATION
KANSAS CITY
MISSOURI

ADDENDUM NUMBER 1

Project/Contract Number: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrade

ISSUE DATE: **1/7/2026**

Bidders are hereby notified that the Bidding and Contract Documents for the above project, for which Bids are to be received on **February 3rd, 2026, at 2pm**, are amended as follows:

Information to Bidders The following is provided to Bidders for information only:

1. **DBE Partnering Session Meeting information:** Meeting will have two sessions for In-Person and Teams. In-person meeting will take place January 13th, 2026, from 2-3pm at the Blue River Annex (950 N Century Ave, Kansas City, MO 64120). The Teams meeting will take place on January 13th, 2026, from 3-4pm link below:

   Microsoft Teams Need help?

   Join the meeting now

   Meeting ID: 272 055 564 429 81
   Passcode: M8dG3Up9

   Dial in by phone
   +1 872-212-5076,,176798771# United States, Chicago
   Find a local number
   Phone conference ID: 176 798 771#
   For organizers: Meeting options | Reset dial-in PIN

Bidding Requirements

1. Add the following section(s):
   a. Appendix Cover Sheets Document C-G
2. Delete and replace the following section(s):
   a. Delete 00210 Instructions to Bidders, Sec. 24, Page 6 and replace with the following paragraph:

      24. Pre-Bid Conference The Water Services Department will hold a pre-Bid conference on January 15th, 2026, at 2:00 PM on Microsoft Teams and in-person at Kansas City Water Services Department. Contact the Project Manager prior to the meeting for the link to attend. Attendance at the pre-Bid conference is mandatory for all Bidders on this Project. For this Project, the City shall not contract with a Bidder who has not attended the entire pre-Bid conference for this Project. See "00130 - Invitation to Bid" for teams link.

b. Delete 00010 Table of Contents 042914, Page 7-8, APPENDIX A through E and replace with the following information:

APPENDIX C
Asbestos, Lead-Containing Paint, & Hazardous Materials Survey Report

APPENDIX D
Report of Subsurface Exploration & Geotechnical Engineering Evaluation
(To be provided upon request to Project Manager)

APPENDIX E
SKM electrical One Line Models WAITING ON B&M
(To be provided upon request to Project Manager)

APPENDIX F
F.1- Cut Fill Summary PDF File
F.2 - TC Existing Grade 3D Base File .dwg File
F.3 – TC Finished Grade 3D Base File .dwg File
(To be provided upon request to Project Manager)

APPENDIX G
125460 TC Site Coordination .NWD File
(To be provided upon request to Project Manager)

Drawings: Reuploaded the corrupted drawings listed below.

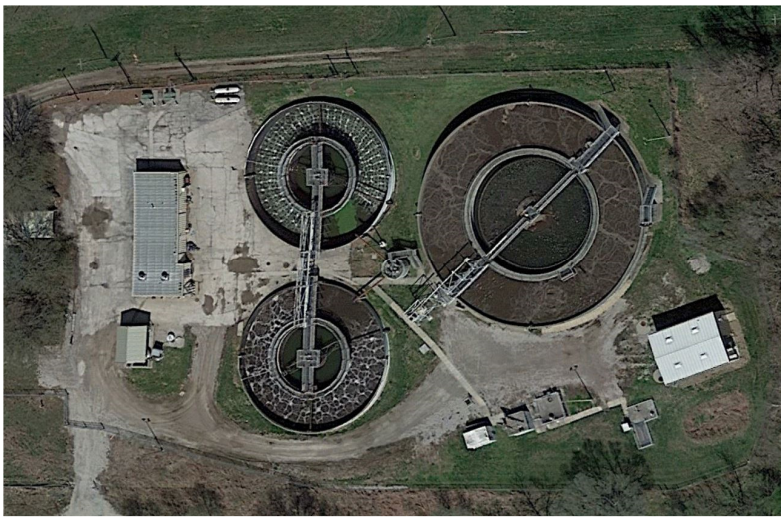
1. E205
2. E206
3. E212
4. E232
5. E242
6. E251
7. E252
8. E291
9. E292
10. E293
11. S009
12. S010
13. S202
14. S203
15. S206
16. S210
17. S215

NOTE: Bidders must acknowledge receipt of this Addendum by listing the number and date, where provided, on the Bid Form - Document 00410.

APPENDIX C

Asbestos, Lead-Containing Paint, & Hazardous Materials Survey Report

Asbestos, Lead Paint, and Hazardous Materials Survey



City of Kansas City, Missouri

Todd Creek Wastewater Treatment Plant
Project No. 125460

Revision 0
3/31/2023

Asbestos, Lead Paint, and Hazardous Materials Survey

prepared for

City of Kansas City, Missouri
Todd Creek Wastewater Treatment Plant

Project No. 125460

Revision 0
3/31/2023

prepared by

Burns & McDonnell
Kansas City, Missouri

CERTIFICATION

Asbestos, Lead Paint, and Hazardous Materials Survey
Project No. 125460

I hereby certify that the information in this document was assembled under my direct personal charge. This report is not intended or represented to be suitable for reuse by the City of Kansas City, Missouri or others without specific verification or adaptation by the Consultant.

MDNR Certified Asbestos Inspector:
No. 7011070722MOIR16187

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LIST OF ABBREVIATIONS

Abbreviation	Term/Phrase/Name
ACM	asbestos-containing material
AHERA	Asbestos Hazard Emergency Response Act
AIHA	American Industrial Hygiene Association
ASTM	American Standards and Testing Methods
CFR	Code of Federal Regulations
COC	chain-of-custody
C&D	construction and demolition
DOT	U.S. Department of Transportation
EHS	Environmental Hazard Services Laboratory
EPA	U.S. Environmental Protection Agency
HUD	Housing and Urban Development
HWPM	Hazardous waste program manager
LBP	lead-based paint
LCP	lead-containing paint
MAP	Model Accreditation Program for Asbestos, training
mg/cm^2	milligram per centimeter squared
mg/kg	milligram per kilogram
MSW	municipal solid waste
NAAQS	National Ambient Air Quality Standards
NESHAP	National Emission Standards for Hazardous Air Pollutants
OSHA	Occupational Safety and Health Administration
PCB	polychlorinated biphenyl
PLM	polarized light microscopy
ppm	parts per million
RCRA	Resource Conservation and Recovery Act
SDS	safety data sheet
TCLP	toxic characteristic leaching procedure
TEM	transmission electron microscopy
TSDF	Treatment, storage, and disposal facility
TSI	thermal-system insulation
%	percent

1.0 INTRODUCTION

This report summarizes the results of a survey for asbestos-containing materials (ACM), lead-containing paint (LCP), and other miscellaneous hazardous materials at the Todd Creek Wastewater Treatment Plant (TC WTP) which is scheduled for demolition. The survey was completed by Burns & McDonnell on February 21, 2023.

1.1 Inspector Credentials

This survey was conducted by Burns & McDonnell employee Mr. Matt Crawford who is an asbestos inspector accredited by the U.S. Environmental Protection Agency (EPA) and certified by the Missouri Department of Natural Resources (MDNR).

1.2 Locations Included in Survey

The inspector identified, located, and sampled suspect homogenous materials from functional spaces, which are used for a specific purpose and are specifically included in the scope of work. Interior and exterior spaces of the following structures were included in this survey:

- Administration Building,
- Clarifying basins and associated piping,
- Sludge Pumping Building,
- Ultraviolet (UV) Building.

The Headworks/Influent Pump Station was not included in this survey.

1.3 Historical Records Review

No information was provided to Burns & McDonnell concerning any previous inspections for ACM, LCP, or hazardous materials in the locations covered by this survey.

1.4 Limitations of Survey

The survey was limited to the structures identified in Section 1.2. Professional judgment was used to determine survey methods, procedures, and report format, particularly regarding the location and number of collected samples, with procedures described in the following chapters. Although efforts were made to follow customary practices of environmental and/or industrial hygiene sciences to identify all suspect hazardous materials, no guarantee or warranty is provided regarding the existence or absence of such materials, and a possibility remains for the presence of additional suspect materials that were inaccessible, including above ceilings, roofs, behind walls and mirrors, underground, etc. Therefore, prior to renovation

or demolition activities, contractors must first verify locations and amounts of materials identified in this report, then be alert to isolate any newly discovered, ACM, LCP, and/or other suspect hazardous materials and promptly communicate the discovery to the owner, manager, and/or general contractor as appropriate. In addition, the contractor should seek further direction to properly protect occupants, workers, and the public. Semi-destructive sampling methods were used, causing unavoidable blemishes or damage to facility structures and finishes. Findings in this report are based on conditions at the time of the survey and results rely on third-party laboratory analyses.

In addition, this survey was limited as follows:

1. This asbestos survey is considered a project design survey, following the EPA National Emission Standards for Hazardous Air Pollutants (NESHAP) prior to demolition or renovation, and the Occupational Safety and Health Administration (OSHA) directives to identify asbestos in the workplace vs. an Asbestos Hazard Emergency Response Act (AHERA) inspection, which would also require assessing friable asbestos among other aspects.

2. Lead and other hazardous materials were identified according to the OSHA directives to identify hazards, and this is not considered a detailed lead inspection according to requirements of EPA and Department of Housing and Urban Development (HUD) for child-occupied, target housing.

3. Additional suspect materials may be inaccessible and not discovered until building demolition.

* * * * *

2.0 ASBESTOS SURVEY PROCEDURES

The purpose of this asbestos survey was to identify whether ACM is present in areas that may be disturbed by anticipated renovation or demolition activities.

2.1 Asbestos Requirements

This survey was based on the EPA NESHAP for asbestos in 40 Code of Federal Regulations (CFR) 61, Subpart M, combined with applicable portions of the Occupational OSHA asbestos standard 29 CFR 1926.1101 for Construction, or 29 CFR 1910.1001 for General Industry. NESHAP requires the owner to "thoroughly inspect" for the presence of asbestos prior to demolition or renovation of a structure, installation or building, and OSHA requires building owners to determine the presence, location, and quantity of ACM at the work site, as well as to protect workers from over-exposure to asbestos.

Other guidelines, including the American Standards and Testing Methods (ASTM) E2356-18, *Standard Practice for Comprehensive Building Asbestos Surveys*, were reviewed and utilized as applicable and noted in this report, but were not followed as the basis of this survey.

An inspector can group suspect materials from various areas into homogeneous areas that are uniform in color, texture, and apparent or known date of installation, as defined by ASTM.

Suspect materials are commonly grouped into one of three classifications:

- Thermal-system insulation (TSI);
- Surfacing materials; and
- Miscellaneous materials.

ASTM defines non-suspect materials to include fiberglass, foam glass, rubber, glass, steel, concrete, porcelain, and wood. In addition, natural stone and bare metal were not considered suspect. Typically, an accredited inspector is not required to sample non-suspect materials, unless they are observed to have a suspect layer, mastic, or coating.

NESHAP and OSHA consider materials to be ACM if they contain greater than one percent (1%) asbestos, and NESHAP requires the inspector to categorize ACM as either:

- Friable (when dry, can be crumbled, pulverized, or reduced to powder by hand pressure);
- Category I non-friable (packings, gaskets, resilient floor covering, and asphalt roofing products); and EPA has a letter of interpretation to include mastics; or

- Category II non-friable (any other non-friable ACM).

OSHA states in an April 17, 1997, letter of interpretation that a material containing trace amounts of asbestos, i.e. less than 1%, are regulated as "unclassified" asbestos. Though not considered "ACM" by OSHA or EPA NESHAP definition, unclassified asbestos-work operations require that the employer follow OSHA asbestos requirements for engineering, work practice, and protective equipment controls to limit worker exposure.

According to OSHA, certain materials can be considered as "Presumed Asbestos Containing Material." These materials include TSI and surfacing materials found in buildings constructed prior to 1981. In addition, an inspector can "assume" a suspect material is ACM even if no sampling or analysis are performed, but the inspector cannot assume a suspect material to be asbestos-free without sampling results. Assumed asbestos is typically limited to materials on live or energized systems, and suspect materials not safe or not accessible for sampling. OSHA also considers asphalt and vinyl flooring material installed prior to 1981 to be asbestos-containing unless proven otherwise.

2.2 State & City Asbestos Regulations

The Health Department of Kansas City, Missouri Air Quality Program (Department) administers asbestos projects within the City. Follow asbestos regulations in City of Kansas City Ordinance 8, Air Quality Control Code, particularly notification and abatement work practices required in Section 8-9. An asbestos project notification form must be submitted at least 20-working days prior to an asbestos project. A demolition notification must also be submitted. Missouri regulates disposal of asbestos. The record of asbestos inspection must be kept within internal project files for the purpose of identifying asbestos and eliminating worker exposures. Depending on the type or category of the ACM identified from the inspection and the forces that will eventually act upon them during demolition or renovation, the materials may or may not be regulated. In order to determine the applicability of the City's asbestos requirements, the ACM must first be determined whether or not it meets their definition of regulated asbestos-containing materials (RACM). RACM includes:

- Friable;
- Category I non-friable that have become or will become friable, or have been subject to sanding, grinding, cutting, burning, or abrading; and
- Category II non-friable that have a high probability of becoming, or have become, crumbled, pulverized or reduced to powder by the work practices used during the course of demolition or renovation.

Asbestos removal projects are involving at least 10-square feet, or 16 linear feet of RACM are regulated by the Department. Asbestos waste from regulated projects involving threshold quantities of RACM must be handled in strict accordance with the Department and MDNR's requirements for asbestos waste disposal. Wastes from these projects must be transferred to an approved sanitary landfill or transfer station by registered asbestos abatement contractors, who are trained in the provisions for proper waste disposal. Non-friable asbestos can go to a construction/demolition (C&D) landfill if the landfill provides pre-approval. Friable asbestos must be disposed in a regulated landfill.

2.3 Asbestos Sampling Methods

According to OSHA 29 CFR 1926.1101(K)(5)(B), which for bulk sampling refers to 40 CFR 763.86, and EPA-MAP bulk sampling methods, the inspector(s) collected a sample(s) from each homogeneous area. An exception from the standard bulk sampling methods is the use of 'convenience sampling' vs. 'randomly distributed' sampling, allowed under the EPA-MAP in non-school buildings, particularly for TSI.

An effort was made to collect at least the minimum required number of samples representing each suspect, homogeneous area. For suspect, non-friable homogeneous areas, the accredited inspector determined the appropriate number of samples to characterize the material, as allowed under 40 CFR 763.86(d). Per ASTM E2356, 6.4.6.3, a single sample may suffice for small, manufactured items such as heating, ventilation, and air conditioning vibration dampeners, gaskets, and friction products. Also, where it was not feasible to collect multiple samples and for non-regulated or non-suspect materials that were sampled for verification, one sample can be adequate, depending on the situation.

Sampling did not include 'live' systems such as cloth-like casing of electric wiring, which, if found, may be assumed positive; however, none of that type of wiring was observed during the survey.

Burns & McDonnell conducted the survey of suspect asbestos materials. At a minimum, amended water spray was used during sample collection to control dust and fiber release, with additional controls used by the inspector(s) if necessary. Wetted bulk samples were placed into individual, sealable containers, and retained by the sampler until delivered to the laboratory for analysis.

Samples were delivered for asbestos analysis to Environmental Hazards Services Laboratory (EHS), located in Richmond, Virginia. This laboratory is accredited by the American Industrial Hygiene Association (AIHA) and is also certified for bulk asbestos analysis through the National Voluntary Laboratory Accreditation Program under the National Institute for Standards & Technology program, respective laboratory numbers #100420 and #101882-0.

Bulk samples were analyzed using polarized light microscopy (PLM) by EPA Method 600/R-93/116. The laboratory provided approximate percentage of asbestos fibers in the sample and identified the crystal form of the asbestos. In cases where collected samples had two or more layers (i.e., material with adhesive, or drywall and joint compound), all layers were analyzed. Federal regulations require that each layer of suspect material be analyzed separately for asbestos content. In addition, federal regulations state that if any sample from a homogeneous area contains asbestos, then the entire homogeneous area must be considered asbestos-containing, regardless of the results from the remaining samples from that area.

Under certain conditions, the EPA recommends subsequent confirmation analysis, in addition to PLM, using transmission electron microscopy (TEM). TEM is recommended by the EPA for materials with trace levels of asbestos up to 10%, and/or for non-friable organically bound materials that consist of fibers and other particulate matter embedded in a solid matrix of asphaltic, vinyl or other organic substances, such as floor tile. If used, the TEM method is typically the New York State ELAP Method #198.4. EPA states that if either TEM or PLM analysis provide results greater than 1% asbestos, then the material must be considered ACM.

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3.0 LEAD PAINT SURVEY PROCEDURES

The purpose of this lead survey was to identify whether lead is present in the paint coatings in the areas that may be disturbed by anticipated renovation or demolition activities.

3.1 Lead Paint Requirements

Since trace levels of lead can be detected by the laboratory, the following definitions are provided for consistency of terms:

- LBP is dried paint having a lead content exceeding 1 milligram per square centimeter (mg/cm^2) by x-ray fluorescence analysis, or a lead concentration exceeding 0.5%, or 5,000 parts per million (ppm) by mass, using paint-chip collection and laboratory analysis, per ASTM, EPA, and HUD.
- LCP: Paint or other similar surface coating materials exceeding 0.06% by mass (which is approximately >600 ppm total lead or >0.7 mg/cm^2) of dried paint film as defined by ASTM.
- The Consumer Product Safety Commission, 16 CFR 1303, has set a limit for LCP in consumer products at 0.009% (90 ppm) by weight of dried paint film, as of August 14, 2009, reduced from previously limit set at 600 ppm.
- OSHA states that their 29 CFR 1926.62 lead-in-construction regulation was intended to apply to any detectable concentration of lead in paint, including trace lead levels, per a March 1, 1999, letter of interpretation.

EPA and HUD define a lead inspection as a surface-by-surface investigation to determine the presence of LBP in target (pre-1978) housing and child-occupied facilities. Since this facility is not target housing or child-occupied, the lead survey conducted on this project is not required to adhere to the EPA/HUD lead 'inspection' method but was modified and limited, the lead survey conducted is better described as an 'assessment' or 'survey' conducted primarily to obtain information to pass along to employers to protect their workers from lead exposure.

OSHA regulates worker lead exposure under the lead-in-construction standard, 29 CFR 1926.62. If the lead disturbance is a result of on-staff maintenance work, then the OSHA lead-in-general industry standard would apply, per 29 CFR 1910.1025. When detectable lead and metal concentrations are found at a worksite, contractors and workers must be provided with a copy of the sample results so they can make proper decisions on engineering, work practice, and personal protective equipment controls. When planning to disturb lead coatings and materials, the employer must develop a written lead compliance program for worker protection.

The EPA's National Ambient Air Quality Standards NAAQS regulation includes lead. NAAQS requires certain controls to prevent lead contamination into the environment, including the directive to have 'no visible emissions' into the environment from a lead activity.

Waste disposal options for lead materials may vary based on state and local regulations. A determination of whether a material is hazardous waste due to lead, cadmium, or chromium and other metal content can be made by sending representative samples of waste streams to an accredited laboratory for toxicity characteristic leaching procedure (TCLP) analysis. The material is considered to be hazardous waste if the leachable content of the waste exceeds 5.0 ppm for lead, as well as exceeding applicable hazardous limits for other metals.

In lieu of laboratory waste analysis, it is acceptable to employ "Use of Knowledge," which means analyzing the waste using existing information. A generally accepted approach is the "Rule of Twenty" which states that if a waste is 100% solid, as defined by the TCLP method, then the results of the total constituent analysis may be divided by twenty to convert the total results into the maximum leachable concentration. This factor is derived from the 20:1 liquid-to-solid ratio employed in the TCLP method and is conservative.

3.2 State Lead Regulations

Follow OSHA lead regulations 29 CFR 1926.62 or 1910.1025 to protect workers from lead exposure.

The Missouri Department of Natural Resources (MDNR) has requirements and guidance for disposal of lead waste, including the MDNR Fact Sheet #2002, titled "Disposal of Demolition Waste Contaminated with Lead or Other Heavy Metals". If the paint is no longer attached to the substrate (painted metal, wood, etc.) and is in the form of paint chips or dust, the paint is subject to hazardous waste determination testing by the Owner, or contractor [i.e. TCLP for toxic lead, cadmium, and chromium]. This fact sheet assumes that the lead waste originates in Missouri and, if found to be non-hazardous, is also disposed in Missouri.

However, if the leachable content [TCLP] exceeds the hazardous waste limits for either of the metals, the waste must be transported by a hazardous waste transporter to a hazardous waste landfill (which may be out of state) or, if allowed by MDNR, to a recycling company. If the lead material is not hazardous waste, it can be disposed in a Subtitle D, municipal solid waste landfill; however, the landfill must be notified of the lead content of the waste and has the opportunity to determine whether to accept the waste. If paint with lead stays on a building material, there is no need for further testing prior to disposal (e.g.

TCLP not required), but landfill notification is still necessary based on screening results from this lead assessment (bulk paint-chip).

3.3 Paint Sampling Methods

Field sampling of paint coatings for laboratory analysis was used to provide information on concentrations of lead in paint to meet OSHA requirements for worker protection and to provide information to meet EPA NESHAP and/or waste disposal requirements during future demolition. Bulk paint-chip samples were placed into containers for shipment to the laboratory for analysis. Hand tools, cleaned prior to each sample collection, were used to remove the paint-chips.

For this assessment, paint coatings were observed and grouped together by similar color, substrate, and painting history (if known). Then from each unique paint-substrate combination, approximately one location was sampled. Approximate locations of samples were noted, and each sample number was logged onto a chain-of-custody (COC) form. Bulk paint-chip samples were sent to EHS in Richmond, Virginia and were analyzed for percent lead by weight and/or ppm using atomic absorption spectroscopic analysis per EPA Method SW846 7000B. This laboratory is recognized under EPA's National Lead Laboratory Accreditation Program and is accredited by AIHA.

In addition to paint-chip sampling, visual observations were made to determine whether other suspect, lead-containing materials were readily observable; however, no such materials were found.

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4.0 HAZARDOUS MATERIAL INVENTORY

The Burns & McDonnell inspectors walked through the areas included in this survey and conducted visual observations to identify and catalogue other suspect, miscellaneous hazardous materials. Proper handling and disposal or recycling during renovation or demolition for any such hazardous materials will need to be accounted for. No sampling occurred for these miscellaneous hazardous materials. The quantity and locations of visible materials were noted. Safety Data Sheets (SDS) were not provided, so certain assumptions were made regarding these materials. If SDSs become available in the future, they should be reviewed, and product knowledge applied. No analytical sampling was performed on any materials or units for purposes of determining hazardous characteristics or presence of hazardous constituents for disposal.

Miscellaneous materials, such as small quantity commercial container chemicals typically stored in a designated chemical cabinet or storage area, were not included in the inventory.

4.1 Mercury

Efforts were made to visually identify mercury-containing items in the areas to be impacted by the planned demolition in or on the buildings. Electrical lamps including fluorescent tubes, neon, compact fluorescent lamps, high-pressure sodium, mercury vapor, metal halide, and high-intensity discharge lamps may contain mercury at levels classifying tube disposal as hazardous waste according to the EPA. However, no sampling occurred.

4.2 PCBs

PCBs are no longer commercially produced in the United States. However, PCBs are still present in products where PCBs have been used including electrical transformers, electrical lamp ballasts, hydraulic fluids, etc. Each building was inspected for the potential presence of such materials. According to the EPA, suspect materials, including transformers and lighting ballasts, must be considered positive for PCBs unless the product is clearly marked with a label stating “NO PCBs” in the product.

5.0 RESULTS

Results of the surveys are representative of conditions on the days of sampling. There is a possibility that other materials may be discovered during future activities or demolition.

Appendix A provides summary tables of results, with Table 1 providing a listing of all suspect materials and homogenous areas that were sampled for asbestos. Table 2 provides a summary of the location, amount, type, and NESHAP category of ACM found during this survey. Table 3 provides a summary of all the paint samples and lead concentration results. Table 4 provides a summary of the major components reported to have LCP coatings.

Photos of the buildings are in Appendix B. Inspector credentials can be found in Appendix C, and all laboratory reports and COC forms are in Appendix D.

5.1 Asbestos Results

ACM was identified in the following homogenous materials/areas (HAs):

- HA#13 - Black lab counter tops located within the Administration Building lab room were labeled as ACM and are assumed to be Category II non-friable.

Additionally, the drywall/joint compound system (HA#11) was found to contain <1% asbestos and is considered unclassified.

5.2 Lead Paint Results

Sample results are summarized in Tables 3 and 4. As indicated in Table 3 and 4, all paint coatings with the exception of the gray paint on the concrete sludge pumping building, black/red paint on Basin 1 piping, blue paint on Administration Building door frames were found to contain concentrations of lead in the paint.

5.3 Mercury Results

Ceiling light fixtures were observed to be 3-foot fluorescent tubes. All fluorescent light tubes and metal-halide lamps were noted to contain mercury. Fluorescent bulbs and metal-halide lamps contain a low-pressure mercury vapor. Please note, there is a possibility that there are light fixtures or thermostats within the building that were not visually observed.

5.4 PCB Results

Light ballasts were observed as fluorescent ballasts which are not expected to contain PCB; however, there is a possibility that light ballasts containing PCBs may be present that were not visually observed.

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6.0 RECOMMENDATIONS

Provide a copy of this report to contractors in bid documents and/or contractors planning to conduct renovation/demolition at the facility to review prior to starting work.

Retain a copy of this survey report for future reference and update by the building owner.

Contractors and employers must identify, characterize, and profile potentially hazardous materials prior to demolition and disposal/recycling and handle materials in accordance with applicable local, state, and federal guidelines

6.1 Asbestos Recommendations

This survey has identified the presence of approximately 80 square feet of black laboratory countertop, Category II non-friable ACM. If removal of this ACM can be conducted using manual methods that prevent the countertops from being rendered friable, then it is not regulated by the Department, MDNR, or NESHAP. However, OSHA asbestos regulations still apply and the waste material must be handled and disposed as asbestos waste. Therefore, using a Missouri-licensed asbestos abatement contractor is the best approach for removing the ACM. If the countertops will be rendered friable during removal, then the Department must be notify at least 20-working days prior to start of abatement and abatement must be conducted by a Missouri-licensed asbestos abatement contractor.

Additionally, drywall/joint compound system was found to contain <1% asbestos. Materials containing <1% asbestos are not considered “ACM” by OSHA or EPA NESHAP definition and are therefore not regulated by the Department, MDNR, or NESHAP. However, work operations disturbing materials containing asbestos require that the employer follow OSHA asbestos requirements for engineering, work practice, and protective equipment controls to limit worker exposure and the waste material must be handled and disposed as asbestos waste. As a result, the best approach would be removing the drywall/joint compound from the structure prior to gross demolition activities utilizing methods that would leave the materials substantially intact. Removal activities should be conducted by asbestos trained workers under the supervision of an asbestos competent person.

While not regulated, non-friable ACM that is not rendered friable during abatement or demolition activities and materials containing <1% asbestos must be properly disposed in an approved landfill in accordance with solid waste laws. The disposal facility should be contacted prior to disposal for information on packaging and delivery requirements.

Recommend contacting the Department prior to disturbing asbestos to confirm removal methods will not generate friable ACM that might require notification and Department/NESHAP regulation requirements. If additional suspect materials are identified prior to demolition activities, they need to be isolated and sampled for asbestos content.

6.2 Lead Paint Recommendations

A number of paint coatings contain lead; however, in most cases there does not appear to be an exposure hazard to occupants since no loose paint chips in the immediate working/walking areas were observed and most of the lead paint was observed to be in good condition. When conducting renovation/demolition work that disturbs paint containing lead, follow OSHA's lead regulations, 29 CFR 1926.62 for Construction, or 1910.1025 for General Industry, and allow "no visible emissions" into the environment for demolition activities.

Construction/demolition contractors should follow applicable OSHA and EPA lead regulations, use lead-trained personnel, and develop a lead compliance program. The lead compliance plan should include exposure monitoring for lead during demolition that impacts lead paint, in compliance with OSHA's 29 CFR 1926.62, especially if there is a reasonable possibility that employees may be exposed to lead at or above the OSHA action level of 30 micrograms per cubic meter. Prior to disturbing LCP such as by scraping, sanding, blasting, welding, cutting, torching, etc., make an initial written determination as to whether portions of the paint coating(s) require pre-removal and of expected employee exposures, based on intended means and methods of disturbing LCP. Whether LCP is required to be removed prior to renovation/demolition depends on the construction methods and exposure controls, which must be described in the written lead compliance program. In general, any required pre-removed LCP, as well as LCP in poor condition that no longer adheres to building material substrates should be removed managed as loose LCP chips as detailed below.

Follow OSHA and EPA regulations and use lead-trained personnel. Building materials with intact lead paint may be eligible for disposal at a recycling facility, or a construction and demolition (C&D) or municipal solid waste (MSW) pending landfill notification and pre-approval by the facility accepting the lead-containing waste.

Loose LCP chips and materials contaminated with loose LCP chips (i.e., personal protective equipment (PPE) and plastic sheathing, etc.) will need to be collected for hazardous waste determination. TCLP testing must be performed on the material to determine if the waste is hazardous. If the waste is hazardous, the waste will be required to be containerized and disposed as hazardous waste.

6.3 Mercury Recommendations

Assume all fluorescent light tubes and metal-halide lamps throughout the buildings to be mercury-containing, even at low concentrations. Fluorescent bulbs and metal-halide lamps contain a low-pressure mercury vapor which should be handled and disposed of appropriately. If lamp removal is necessary as part of demolition, remove and handle the lamps carefully, without breaking, and pack and dispose of the lamps as universal waste. Any additional mercury items that may be discovered during demolition, such as mercury vials in wall-mounted thermostats must also be removed and handled as universal waste without breaking. Mercury vials in thermostats are classified as universal waste by federal universal waste regulations set forth in 40 CFR.273 and should be recycled appropriately. Contractor should have a mercury spill kit with trained personnel available in the event that a light tube or vial breaks.

6.4 PCB Recommendations

During removal of light fixtures, check the label on each lighting ballast. If the ballast was manufactured prior to 1979 and is not labeled as “non-PCB”, it should be segregated from the non-PCB electronic ballasts and sent to a reputable recycler for disposal as PCB-containing waste.

According to the EPA, suspect materials, including transformers and lighting ballasts (unless they are electronic), must be considered positive for PCBs unless the product is clearly marked with a label stating, “NO PCBs.”

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APPENDIX A – TABLES

BURNS McDONNELL

Table 1
Asbestos Bulk Samples
Todd Creek Wastewater Treatment Plant
Sampling Date: 2/21/2023 3/28/2023

Sample No.	Bld. Name or No.	Homog. Area	Description of Material	Location of Sample	Results (PLM)	NESHAP Category
1A	Basin 3	1	Black paint/coating	Basin 3	NAD	NA
1B	Basin 2	1	Black paint/coating	Basin 2	NAD	NA
1C	Basin 3	1	Black paint/coating	Basin 3	NAD	NA
2A	Basin 1	2	Gray caulk	Basin 1	NAD	NA
2B	Basin 1	2	Gray caulk	Basin 1	NAD	NA
2C	Basin 1	2	Gray caulk	Basin 1	NAD	NA
3A	Basin 1	3	Concrete	Basin 1	NAD	NA
3B	Basin 1	3	Concrete	Basin 1	NAD	NA
3C	Basin 1	3	Concrete	Basin 1	NAD	NA
4A	Basin 3	4	Gasket on silver pipe	Basin 3	NAD	NA
4B	Basin 3	4	Gasket on silver pipe	Basin 3	NAD	NA
6A	Basin 2	6	Gasket on silver pipe	Basin 2	NAD	NA
5A	Basin 1	5	Gray caulk around base	Basin 1	NAD	NA
5B	Basin 1	5	Gray caulk around base	Basin 1	NAD	NA
5C	Basin 1	5	Gray caulk around base	Basin 1	NAD	NA
6B	Basin 2	6	Gasket on silver pipe	Basin 2	NAD	NA
7A	Sludge pump	7	Caulk gray	Sludge pump	NAD	NA
7B	Sludge pump	7	Caulk gray	Sludge pump	NAD	NA
3D	Sludge pump	3	Concrete	Sludge pump	NAD	NA
8A	UV Bldg.	8	Fiber concrete mold	UV Bldg.	NAD	NA
8B	UV Bldg.	8	Fiber concrete mold	UV Bldg.	NAD	NA
9A	Admin	9	12x12 off-white tile	Admin	NAD^	NA
9B	Admin	9	12x12 off-white tile	Admin	NAD^	NA
9C	Admin	9	12x12 off-white tile	Admin	NAD^	NA
10A	Admin	10	2x4 ceiling tile	Admin	NAD	NA
10B	Admin	10	2x4 ceiling tile	Admin	NAD	NA

BURNS McDONNELL

Table 1
Asbestos Bulk Samples
Todd Creek Wastewater Treatment Plant
Sampling Date: 2/21/2023 3/28/2023

Sample No.	Bld. Name or No.	Homog. Area	Description of Material	Location of Sample	Results (PLM)	NESHAP Category
10C	Admin	10	2x4 ceiling tile	Admin	NAD	NA
11A	Admin	11	Drywall/Joint compound System	Admin	<1% Chrysotile	Unclassified
11B	Admin	11	Drywall	Admin	NAD	Unclassified
11C	Admin	11	Joint compound	Admin	2% Chrysotile*	Unclassified*
11D	Admin	11	Drywall/Joint compound System	Admin	T<1% Chrysotile	Unclassified
11E	Admin	11	Drywall	Admin	NAD	Unclassified
11F	Admin	11	Drywall/Joint compound System		<1% Chrysotile	Unclassified
12A	Admin	12	Cove base	Admin	NAD	NA
12B	Admin	12	Cove base	Admin	NAD	NA
12C	Admin	12	Cove base	Admin	NAD	NA
NA	Admin	13	Black lab counter	NA	Assumed ACM	Category II

Definitions:

ACM - Asbestos containing material

NESHAP - National Emission Standard for Hazardous Air Pollutants

NA - not applicable

NAD - no asbestos detected

** - Per U.S. Environmental Protection Agency guidance the drywall/joint compound system is assessed based on composite of whole system. Sample 11C represents only the joint compound; however, the drywall/joint compound system is <1% asbestos.*

% - percent

^ - Results confirmed by transmission electron microscopy

Table 2
ACM Summary
Todd Creek Wastewater Treatment Plant
Sampling Date: 2/21/2023 3/28/2023

Homog. Area	Description of Material	Results (PLM)	Estimated Quantity of ACM	NESHAP Category
13	Administration Building black lab counter	Assumed ACM	80 SF	Category II
11	Drywall/Joint compound system	<1% Chrysotile	1,500 SF	Unclassified

Definitions:
ACM - Asbestos containing material
NESHAP - National Emission Standard for Hazardous Air Pollutants
SF - Square feet
% - percent

Table 3
Lead Paint Bulk Samples
Todd Creek Wastewater Treatment Plant
Sampling Date: 2/21/2023

Sample No.	Bld. Name or No.	Room or Space	Component	Color	Substrate	Paint Condition	Results (ppm)
P1	**Admin**	**Exterior**	**Siding**	**Tan**	**Metal**	**Good**	**170**
P2	**Admin**	**Exterior**	**Door frame**	**Cream**	**Metal**	**Fair**	**1,400**
P3	**Admin**	**Exterior**	**Piping/doors**	**Pink**	**Metal**	**Fair**	**700**
P4	**Admin**	**Exterior**	**Piping**	**Blue green**	**Metal**	**Fair**	**54**
P5	**Basin 2**	**Exterior**	**Tank**	**Gray/green/black**	**Metal**	**Fair**	**1.0***
P6	**Basin 3**	**Exterior**	**Tank interior**	**Black**	**Metal**	**Fair**	**<0.50*^**
P7	**Basin 3**	**Exterior**	**Catwalk**	**Gray on reddish brown**	**Metal**	**Fair**	**880**
P8/Insta	Basin 1	Exterior	Piping	Red on black	Metal	Fair	Insta-Check Negative
P9	Sludge pump	Exterior	Foundation	Gray	Concrete	Fair	<35
P10	**UV Building**	**Exterior**	**Steal column**	**White**	**Metal**	**Fair**	**<0.50*^**
P11	**Admin**	**Interior**	**Walls**	**Light blue**	**Drywall**	**Good**	**350**
P12/insta	Admin	Interior	Door/door frame	Dark ble	Metal	Good	Insta-Check Negative

Notes:

Bold indicates paint contains lead.

**Sample analyzed using EPA SW846 TCLP methodology. Concentration result is the analytically determined leachable concentration and is presented in milligrams per liter = ppm.*

^Insufficient sample mass to analyze for total lead; however, paint assumed to contain lead.

Definitions:

ppm - parts per million

EPA - United States Environmental Protection Agency

TCLP - toxicity characteristic leaching procedure

Table 4
Lead Paint Summary
Todd Creek Wastewater Treatment Plant
Sampling Date: 2/21/2023

Sample No.	Material	Paint Condition	Results (ppm)	Estimated Amount of Material (SF)
P1	Tan paint on Administration Building siding	Good	170	2,800
P2	Cream paint on administration door frames	Fair	1,400	200
P3	Pink paint on Administration Building doors and piping	Fair	700	200
P4	Blue green paint on administration building piping	Fair	54	50
P5	Gray/green/black paint on Basin 2 & 3 exterior	Fair	1.0*	5,000
P6	Black paint on Basin 2 & 3 interior	Fair	<0.50*^	15,000
P7	Gray on reddish brown paint on Basin 1, 2, & 3 catwalks and structural steel	Fair	880	unknown
P10	White paint on Ultraviolet Facility columns	Fair	<0.50*^	100
P11	Light blue paint on Administration building lab walls	Good	350	1,400

Table 4
Lead Paint Summary
Todd Creek Wastewater Treatment Plant
Sampling Date: 2/21/2023

Notes:

1. Typically for disposal, if the paint is no longer attached to the substrate (painted metal, wood, etc.) and is in the form of paint chips or dust, the paint is subject to hazardous waste determination testing by the Owner, or contractor [i.e. TCLP for toxic lead and other metals].

2. Paint listed as "poor" may no longer be attached to the substrate and is subject to hazardous waste determination testing.

2. 0-10% of paint listed as "fair" may no longer be attached to the substrate and is subject to hazardous waste determination testing.

5. When hot cutting methods are used, such as cutting with a heat torch, lead paint debris generated is subject to hazardous waste determination sampling.

6. The maximum leachable concentration is defined by the "Rule of Twenty" which states that if a waste is 100% solid, as defined by the TCLP method, then the results of the total constituent analysis may be divided by twenty to convert the total results into the maximum concentration. This factor is derived from the 20:1 liquid-to-solid ratio employed in the TCLP method and is conservative.

7. The material is considered to be hazardous waste if the maximum leachable concentration of the waste exceeds 5.0 ppm for lead.

**Sample analyzed using EPA SW846 TCLP methodology. Concentration result is the analytically determined leachable concentration and is presented in milligrams per liter = ppm.*

^Insufficient sample mass to analyze for total lead; however, paint assumed to contain lead.

Definitions:

EPA - United States Environmental Protection Agency

ppm - parts per million

TCLP - toxicity characteristic leaching procedure

SF - Square feet

APPENDIX B – PHOTO LOG

ASBESTOS, LEAD PAINT, AND HAZARDOUS MATERIALS SURVEY PHOTO LOG
Todd Creek Wastewater Treatment Plant
City of Kansas City, Missouri

Photograph	Description
	Photo 1 – Administration Building Exterior. Note: yellow-gray paint on walls and ceilings exceeds RCRA TCLP lead limit of 5 ppm. Photo Date: February 21, 2023
	Photo 2 – Administration Building lab. Note: Black lab counter (Category II non-friable) is asbestos containing material. The blue drywall/joint compound is considered “unclassified asbestos” because it contains <1% asbestos. Photo Date: February 21, 2023

ASBESTOS, LEAD PAINT, AND HAZARDOUS MATERIALS SURVEY PHOTO LOG
Todd Creek Wastewater Treatment Plant
City of Kansas City, Missouri

Photograph	Description
	Photo 3 – Administration Building garage area. Photo Date: February 21, 2023
	Photo 4 – Basin 2 (left), Basin 3, right, and Administration Building (background). Photo Date: February 21, 2023

ASBESTOS, LEAD PAINT, AND HAZARDOUS MATERIALS SURVEY PHOTO LOG
Todd Creek Wastewater Treatment Plant
City of Kansas City, Missouri

Photograph	Description
	Photo 5 – Basin 1. Photo Date: February 21, 2023
	Photo 6 – Sludge Pump Building (foreground) & Ultraviolet Facility (background) Photo Date: February 21, 2023

APPENDIX C - CREDENTIALS

CERTIFICATION NUMBER:

7011070722MOIR16187

THIS CERTIFIES

Mathew D. Crawford

HAS COMPLETED THE CERTIFICATION

REQUIREMENTS FOR

Inspector

APPROVED: 02/06/2023

EXPIRES: 07/07/2023

TRAINING DATE: 07/07/2022

Director of Air Pollution Control Program

M·E·T·A

Mayhew Environmental Training Associates

INCORPORATED

Certificate # 7ME06181201AI00004

This is to certify that

Mathew Crawford

has on 06/20/2012, in Lawrence, KS
completed the requirements for asbestos accreditation under Section 206 of TSCA Title II, 15 U.S.C. 2646

AHERA Asbestos Inspector Training

as approved by the State of Missouri and the U.S.E.PA. under 40 C.F.R. 763 (AHERA)
on 06/18/2012 - 06/20/2012 and passed the associated examination on 06/20/2012
with a score of 70% or better

KANSAS MAYHEW INC. 1987 EST. 1985 ENVIRONMENTAL TRAINING ASSOCIATES SAFETY IN GOD ALONE

Instructor
Thomas Mayhew

President
Thomas Bradford Mayhew

Soc. Sec #: XXX-XX-3467
Accreditation Expires: 6/20/13

M E T A - P.O. Box 786 - Lawrence KS 66044 - 800-444-6382

M·E·T·A

Mayhew Environmental Training Associates

INCORPORATED

Certificate # IE3RFX12Q9

Mathew Crawford

has on 7/7/2022, in Lawrence, KS
completed the requirements for asbestos accreditation under Section 206 of TSCA Title II, 15 USC 2646

Asbestos Inspector Refresher

as approved by MO & the US EPA under 40 CFR 763 (AHERA) from 7/7/2022 to 7/7/2022
and
passed the associated exam on 7/7/2022 with a score of at least 70%

KANSAS MAYHEW INC. 1987 EST. 1985 ENVIRONMENTAL TRAINING ASSOCIATES SAFETY IN GOD ALONE

Thomas Mayhew
Instructor

Thomas Mayhew
President

SSN: XXX-XX-3467
Expiration: 7/7/2023

P.O. Box 786 - Lawrence, KS. 66044 - 800.444.6382
www.metaenvironmental.net

APPENDIX D – LABORATORY REPORTS

AmeriSci Richmond
13635 GENITO ROAD
MIDLOTHIAN, VIRGINIA 23112
TEL: 8047631200 FAX: 8047631800

March 20, 2023

Environmental Hazards Services, Inc.
Attn: Howard Varner
7469 Whitepine Road
Richmond, VA 23237

RE: Environmental Hazards Services, Inc.
Job Number 123031592
P.O. #23-03-02400
26-3514; 125460; KCMO/Todd Creek WTP; EHS# 23-02-03939

Dear Howard Varner:

Enclosed are the results of Asbestos Analysis - Bulk TEM Protocol of the following Environmental Hazards Services, Inc. samples, received at AmeriSci on Wednesday, March 15, 2023, for a 3 day turnaround:

9A, 9B, 9C

The 6 samples, placed in zip lock bag, were shipped to AmeriSci via Hand Delivered. Environmental Hazards Services, Inc. requested TEM Bulk (Semi-quantitative) analysis of these samples.

The EPA/600/R-93/116 method was used to prepare (Sec 2.3) and analyze (Sec 2.5) using the Semi-Quantitative TEM quantification procedure (previously refered to as the similar Chatfield VAT method, SOP-1988-02). After gravimetric matrix reduction the total percent asbestos present is determined by visual area estimation calibrated against standards with known weight percentages of asbestos. This report relates ONLY to the TEM analysis and matrix reduction processes expressed as percent by weight and percent asbestos material. This report must not be used to claim product endorsement or approval by AmeriSci, NVLAP, ELAP or any other associated AmeriSci certifying agency. The National Institute of Standards and Technology accreditation requirements, mandate that this report must not be reproduced, except in full without the approval of the laboratory.

AmeriSci appreciates this opportunity to serve your organization. Please contact us for any further assistance or with any questions.

Sincerely,

Glenn F. Massey

QA Manager | Authorized Signatory

Client Name: Environmental Hazards Services, Inc.

Table I
Summary of Bulk Asbestos Analysis Results

26-3514; 125460; KCMO/Todd Creek WTP; EHS# 23-02-03939

AmeriSci Sample #	Client Sample#	HG Area	Sample Weight (gram)	Heat Sensitive Organic %	Acid Soluble Inorganic %	Insoluble Non-Asbestos Inorganic %	** Asbestos % by PLM/DS	** Asbestos % by TEM
01	9A		0.712	18.3	36.7	45.0	NA	NAD
Location: Tile Only								
02	9A		----	----	----	----	NA	NA
Location: Mastic Only "Insufficient Material Submitted For Preparation"								
03	9B		0.325	17.4	40.4	42.2	NA	NAD
Location: Tile Only								
04	9B		----	----	----	----	NA	NA
Location: Mastic Only "Insufficient Material Submitted For Preparation"								
05	9C		0.890	18.6	28.2	53.2	NA	NAD
Location: Tile Only								
06	9C		----	----	----	----	NA	NA
Location: Mastic Only "Insufficient Material Submitted For Preparation"								

Analyzed by: Glenn F. Massey

Reviewed by: Glenn F. Massey

Date: 3/20/2023

Semi-Quantitative Analysis: NAD = no asbestos detected; NA = not analyzed; NA/PS = not analyzed due to positive stop; Trace = <1%; PLM analysis by EPA 600/R-93/116 per 40 CFR 763 (NVLAP Lab Code 101904-0) or NY ELAP 198.1 for New York friable samples which includes quantitation of any vermiculite observed (198.6 for NOB samples) or EPA 400 pt ct by EPA 600/M4-82-020 (NY ELAP Lab # 10984); TEM prep by EPA 600/R-93/116 Section 2.3 (analysis by Section 2.5, not covered by NVLAP Bulk accreditation); or NY ELAP 198.4 for New York NOB samples (NY ELAP Lab # 10984). Analysis using Jeol, Model JEM-100CX II microscope, Serial #156147-247. ** Warning Notes: Consider PLM fiber diameter limitation, only TEM will resolve fibers <0.25 micrometers in diameter. TEM bulk analysis is representative of the fine grained matrix material and may not be representative of non-uniformly dispersed debris, soils or other heterogeneous materials for which a combination PLM/TEM evaluation is recommended; Quantitation for beginning weights of <0.1 grams should be considered as qualitative only.

TEM Bulk 3-Day

Environmental Hazards Services, L.L.C.
7469 Whitepine Rd
Richmond, VA 23237
Telephone: 800.347.4010

123031592

Received Date: 03/15/2023

Due Date: 03/20/2023

EHS Client #: 26-3514

Report Number: 23-03-02400

Project/Test Address: 125460; KCMO/Todd Creek WTP; EHS# 23-02-03939

3-Day

Analysis Requested: TEM Bulk 3-Day

Sample #	Sample Type	Sample Location and/or Comments	Volume (liters)
9A	TEM BULK	Tile Only	
9A		Mastic Only	
9B		Tile Only	
9B		Mastic Only	
9C		Tile Only	
9C		Mastic Only	

Date/Time	Released By:	Date/Time	Received By:
3/15/23 4:49 pm			
			Received

MAR 15 2023
@5:50

Environmental Hazards Services, L.L.C.
7469 Whitepine Rd
Richmond, VA 23237
Telephone: 800.347.4010

Asbestos Bulk Analysis Report

Report Number: 23-02-03939

Client: Burns & McDonnell Engineering
9400 Ward Pkwy.
Kansas City, MO 64114

Received Date: 02/23/2023
Analyzed Date: 03/01/2023
Reported Date: 03/02/2023

Project/Test Address: 125460; KCMO/Todd Creek WTP

Client Number:
26-3514

Fax Number:
816-822-3494

Laboratory Results

Lab Sample Number	Client Sample Number	Layer Type	Lab Gross Description	Asbestos	Other Materials
23-02-03939-001	1A		Black Brittle; Rust Orange to Dark Gray Metallic; Inhomogeneous	NAD	100% Non-Fibrous
23-02-03939-002	1B		Black Brittle; Rust Orange to Dark Gray Metallic; Inhomogeneous	NAD	100% Non-Fibrous
23-02-03939-003	1C		Black Brittle; Rust Orange to Dark Gray Metallic; Inhomogeneous	NAD	100% Non-Fibrous
23-02-03939-004	2A		Pale Gray Brittle; Homogeneous	NAD	3% Cellulose 97% Non-Fibrous
23-02-03939-005	2B		Pale Gray Brittle; Homogeneous	NAD	4% Cellulose 96% Non-Fibrous

Environmental Hazards Services, L.L.C

Client Number: 26-3514 Report Number: 23-02-03939

Project/Test Address: 125460; KCMO/Todd Creek WTP

Lab Sample Number	Client Sample Number	Layer Type	Lab Gross Description	Asbestos	Other Materials
23-02-03939-006	2C		Pale Gray Brittle; Homogeneous	NAD	4% Cellulose 96% Non-Fibrous
23-02-03939-007	3A		Pale Gray Cementitious; Homogeneous	NAD	100% Non-Fibrous
23-02-03939-008	3B		Pale Gray Cementitious; Homogeneous	NAD	100% Non-Fibrous
23-02-03939-009	3C		Pale Gray Cementitious; Homogeneous	NAD	100% Non-Fibrous
23-02-03939-010	4A		Pale Green Fibrous; Homogeneous	NAD	45% Cellulose 55% Non-Fibrous
23-02-03939-011	4B		Pale Green Fibrous; Homogeneous	NAD	45% Cellulose 55% Non-Fibrous
23-02-03939-012	6A		Pale Green Fibrous; Homogeneous	NAD	45% Cellulose 55% Non-Fibrous
23-02-03939-013	5A		Pale Gray Pliable to Brittle; Homogeneous	NAD	1% Cellulose 99% Non-Fibrous

Environmental Hazards Services, L.L.C

Client Number: 26-3514 Report Number: 23-02-03939

Project/Test Address: 125460; KCMO/Todd Creek WTP

Lab Sample Number	Client Sample Number	Layer Type	Lab Gross Description	Asbestos	Other Materials
23-02-03939-014	5B		Pale Gray Pliable to Brittle; Homogeneous	NAD	1% Cellulose 99% Non-Fibrous
23-02-03939-015	5C		Pale Gray Pliable to Brittle; Homogeneous	NAD	100% Non-Fibrous
23-02-03939-016	6B		Pale Green Fibrous; Homogeneous	NAD	45% Cellulose 55% Non-Fibrous
23-02-03939-017	7A		Dark Gray Pliable; Homogeneous	NAD	15% Cellulose 85% Non-Fibrous
23-02-03939-018	7B		Dark Gray Pliable; Homogeneous	NAD	15% Cellulose 85% Non-Fibrous
23-02-03939-019	3D		Pale Gray Cementitious; Pale Gray Pliable to Brittle; Inhomogeneous	NAD	1% Cellulose 99% Non-Fibrous
23-02-03939-020	8A		Pale Gray Cementitious; Off-White Pliable; White Fibrous; Inhomogeneous	NAD	10% Fibrous Glass 90% Non-Fibrous
23-02-03939-021	8B		Off-White Pliable; White Fibrous; Pale Gray Cementitious; Inhomogeneous	NAD	8% Fibrous Glass 92% Non-Fibrous

Environmental Hazards Services, L.L.C

Client Number: 26-3514 Report Number: 23-02-03939

Project/Test Address: 125460; KCMO/Todd Creek WTP

Lab Sample Number	Client Sample Number	Layer Type	Lab Gross Description	Asbestos	Other Materials
23-02-03939-022A	9A	Flooring	Off-White Granular; Homogeneous	NAD	1% Cellulose 99% Non-Fibrous
23-02-03939-022B	9A	Other *	Yellow Adhesive; Gray Brittle; Inhomogeneous	NAD	4% Cellulose 1% Fibrous Glass 95% Non-Fibrous
* Mastic/Embedded Leveling Compound-Type Substrate Material					
23-02-03939-023A	9B	Flooring	Off-White Granular; Homogeneous	NAD	100% Non-Fibrous
23-02-03939-023B	9B	Mastic	Yellow Adhesive; Homogeneous	NAD	3% Cellulose 97% Non-Fibrous
23-02-03939-024A	9C	Flooring	Off-White Granular; Homogeneous	NAD	1% Cellulose 99% Non-Fibrous
23-02-03939-024B	9C	Other *	Yellow Adhesive; Gray Brittle; Inhomogeneous	NAD	5% Cellulose 1% Fibrous Glass 1% Synthetic 93% Non-Fibrous
* Mastic/Embedded Leveling Compound-Type Substrate Material					
23-02-03939-025	10A		Pale Gray Fibrous; White Brittle; Inhomogeneous	NAD	45% Cellulose 30% Fibrous Glass 25% Non-Fibrous
23-02-03939-026	10B		Pale Gray Fibrous; White Brittle; Inhomogeneous	NAD	45% Cellulose 30% Fibrous Glass 25% Non-Fibrous

Environmental Hazards Services, L.L.C

Client Number: 26-3514 Report Number: 23-02-03939

Project/Test Address: 125460; KCMO/Todd Creek WTP

Lab Sample Number	Client Sample Number	Layer Type	Lab Gross Description	Asbestos	Other Materials
23-02-03939-027	10C		Pale Gray Fibrous; White Brittle; Inhomogeneous	NAD	45% Cellulose 30% Fibrous Glass 25% Non-Fibrous
23-02-03939-028	11A		White/Off-White Brittle; Tan/Light Beige Fibrous; White Pliable to Brittle; Inhomogeneous	Trace <1% Chrysotile	22% Cellulose 78% Non-Fibrous
			Total Asbestos:	Trace <1%	
Chrysotile present in off-white brittle joint compound-type layer; this material alone contains 3% chrysotile.					
23-02-03939-029	11B		White Brittle; Tan Fibrous; Off-White Pliable to Brittle; Inhomogeneous	NAD	35% Cellulose 65% Non-Fibrous
23-02-03939-030	11C		Pale Beige/White Brittle; Light Beige/Tan Fibrous; Teal Pliable to Brittle; Inhomogeneous	2% Chrysotile	30% Cellulose 68% Non-Fibrous
			Total Asbestos:	2%	
Chrysotile present in pale beige brittle joint compound-type (predominant) material.					
23-02-03939-031A	12A	Cove Base	Black Vinyl-Like; Homogeneous	NAD	100% Non-Fibrous
23-02-03939-031B	12A	Mastic	Light Yellow Adhesive; Homogeneous	NAD	2% Synthetic 98% Non-Fibrous
23-02-03939-032A	12B	Cove Base	Black Vinyl-Like; Homogeneous	NAD	100% Non-Fibrous

Environmental Hazards Services, L.L.C

Client Number: 26-3514 Report Number: 23-02-03939

Project/Test Address: 125460; KCMO/Todd Creek WTP

Lab Sample Number	Client Sample Number	Layer Type	Lab Gross Description	Asbestos	Other Materials
23-02-03939-032B	12B	Mastic	Light Yellow Adhesive; Homogeneous	NAD	2% Synthetic 98% Non-Fibrous
23-02-03939-033A	12C	Cove Base	Black Vinyl-Like; Homogeneous	NAD	100% Non-Fibrous
23-02-03939-033B	12C	Mastic	Light Yellow Adhesive; Homogeneous	NAD	2% Cellulose 1% Synthetic 97% Non-Fibrous

QC Sample: 52-M12010-4

QC Blank: SRM 1866 Fiberglass

Reporting Limit: 1% Asbestos

Method: EPA Method 600/R-93/116, EPA Method 600/M4-82-020

Analyst: Mark Case

Reviewed By Authorized Signatory: Tasha Eaddy

Tasha Eaddy
QA/QC Clerk

These results are based on a comparative visual estimate. The condition of the samples analyzed was acceptable upon receipt per laboratory protocol unless otherwise noted on this report. Each distinct component in an inhomogeneous sample was analyzed separately and reported as a composite. Results represent the analysis of samples submitted by the client. Sample location, description, area, volume, etc., was provided by the client. This report cannot be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government. This report shall not be reproduced except in full, without the written consent of the Environmental Hazards Service, L.L.C. California Certification #2319 NY ELAP #11714 NVLAP #101882-0 VELAP 460172. All information concerning sampling location, date, and time can be found on Chain-of-Custody. Environmental Hazards Services, L.L.C. does not perform any sample collection.

Environmental Hazards Services, L.L.C. recommends reanalysis by point count (for more accurate quantification) or Transmission Electron Microscopy (TEM), (for enhanced detection capabilities) for materials regulated by EPA NESHAP (National Emission Standards for Hazardous Air Pollutants) and found to contain less than ten percent (<10%) asbestos by polarized light microscopy (PLM). Both services are available for an additional fee.

400 Point Count Analysis, where noted, performed per EPA Method 600/R-93/116 with a Reporting Limit of 0.25%.

* All California samples analyzed by Polarized Light Microscopy, EPA Method 600/M4-82-020, Dec. 1982.

LEGEND: NAD = no asbestos detected

BURNS McDONNELL

Request for Analysis and Chain of Custody Record

Company: Burns & McDonnell			Laboratory: EHS		Project No. & Task: 125460	
9400 Ward Pkwy, Kansas City, MO 64114			7469 White Pine Road		Client/Location: KCMO/Todd Creek WTP	
Phone: (816) 333-9400			Richmond, VA 23237		PO: 125460	
Contact: Mathew Crawford Email: mdcrawford@burnsmcd.com			Phone: 800-347-4010		Sample Dates: 2/21/23	
Sample ID	**Location**	**Desription**	**Sample Matrix***	**Analyte**	**Sampling/ Analytical Method**	**Notes**
1A	Basin 3	Black paint/coating	Bulk	Asbestos	PLM	
1B	Basin 2	Black paint/coating	Bulk	Asbestos	PLM	
1C	Basin 3	Black paint/coating	Bulk	Asbestos	PLM	
2A	Basin 1	Gray caulk	Bulk	Asbestos	PLM	
2B	Basin 1	Gray caulk	Bulk	Asbestos	PLM	
2C	Basin 1	Gray caulk	Bulk	Asbestos	PLM	
3A	Basin 1	Concrete	Bulk	Asbestos	PLM	
3B	Basin 1	Concrete	Bulk	Asbestos	PLM	
3C	Basin 1	Concrete	Bulk	Asbestos	PLM	
4A	Basin 3	Gasket on silver pipe	Bulk	Asbestos	PLM	
4B	Basin 3	Gasket on silver pipe	Bulk	Asbestos	PLM	
6A	Basin 2	Gasket on silver pipe	Bulk	Asbestos	PLM	
5A	Basin 1	Gray caulk around base	Bulk	Asbestos	PLM	
5B	Basin 1	Gray caulk around base	Bulk	Asbestos	PLM	
5C	Basin 1	Gray caulk around base	Bulk	Asbestos	PLM	
Special Instuctions: Standard Turnaround Time			Sampler (Print and Sign): Matt Crawford			
Relinquished By (Signature): Date/Time:			Relinquished By (Signature): Date/Time: 2/22/2023 1330			
Relinquished By (Signature): Date/Time:			Relinquished By (Signature): Tahan Date/Time: 2/23/23 11:24			
Lab Reference No.			Sample Condition:		Lab Comments:	

23-02-03939

Due Date:
03/02/2023
(Thursday)
EL MM-L
MSE 3:30pm

BURNS McDONNELL

Request for Analysis and Chain of Custody Record

7939

Company: Burns & McDonnell			Laboratory: EHS		Project No. & Task: 125460	
9400 Ward Pkwy, Kansas City, MO 64114			7469 White Pine Road		Client/Location: KCMO/Todd Creek WTP	
Phone: (816) 333-9400			Richmond, VA 23237		PO: 125460	
Contact: Mathew Crawford Email: mdcrawford@burnsmcd.com			Phone: 800-347-4010		Sample Dates: 2/21/23	
Sample ID	**Location**	**Desription**	**Sample Matrix***	**Analyte**	**Sampling/ Analytical Method**	**Notes**
6B	Basin 2	Gasket on silver pipe	Bulk	Asbestos	PLM	
7A	Sludge pump	Caulk gray	Bulk	Asbestos	PLM	
7B	Sludge pump	Caulk gray	Bulk	Asbestos	PLM	
3D	Sludge pump	Concrete	Bulk	Asbestos	PLM	
8A	UV Bldg	Fiber concrete mold	Bulk	Asbestos	PLM	
8B	UV Bldg	Fiber concrete mold	Bulk	Asbestos	PLM	
9A	Admin	12x12 off-white tile	Bulk	Asbestos	PLM	
9B	Admin	12x12 off-white tile	Bulk	Asbestos	PLM	
9C	Admin	12x12 off-white tile	Bulk	Asbestos	PLM	
10A	Admin	2x4 ceiling tile	Bulk	Asbestos	PLM	
10B	Admin	2x4 ceiling tile	Bulk	Asbestos	PLM	
10C	Admin	2x4 ceiling tile	Bulk	Asbestos	PLM	
11A	Admin	Drywall/compound	Bulk	Asbestos	PLM	
11B	Admin	Drywall/compound	Bulk	Asbestos	PLM	
11C	Admin	Drywall/compound	Bulk	Asbestos	PLM	
Special Instuctions: Standard Turnaround Time			Sampler (Print and Sign): Matt Crawford			
Relinquished By (Signature): Date/Time:			Relinquished By (Signature): Date/Time: 2/22/2023 1330			
Relinquished By (Signature): Date/Time:			Relinquished By (Signature): Date/Time: 2/23/23 11.30			
Lab Reference No.			Sample Condition:		Lab Comments:	

3939

BURNS McDONNELL

Request for Analysis and Chain of Custody Record

Company: Burns & McDonnell			Laboratory: EHS		Project No. & Task: 125460	
9400 Ward Pkwy, Kansas City, MO 64114			7469 White Pine Road		Client/Location: KCMO/Todd Creek WTP	
Phone: (816) 333-9400			Richmond, VA 23237		PO: 125460	
Contact: Mathew Crawford Email: mdcrawford@burnsmcd.com			Phone: 800-347-4010		Sample Dates: 2/21/23	
Sample ID	**Location**	**Desription**	**Sample Matrix***	**Analyte**	**Sampling/ Analytical Method**	**Notes**
12A	Admin	Covebase	Bulk	Asbestos	PLM	
12B	Admin	Covebase	Bulk	Asbestos	PLM	
12C	Admin	Covebase	Bulk	Asbestos	PLM	
Special Instuctions: Standard Turnaround Time			Sampler (Print and Sign): Matt Crawford			
Relinquished By (Signature): Date/Time:			Relinquished By (Signature): Date/Time: 2/22/23 1330			
Relinquished By (Signature): Date/Time:			Relinquished By (Signature): Date/Time: 2/23/23 11:3			
Lab Reference No.			Sample Condition:		Lab Comments:	

ACT

14953 W. 101st Terrace
Lenexa, Kansas 66215
913-492-1337

March 29, 2023

Burns & McDonnell
9400 Ward Parkway
Kansas City, MO

PROJECT: Todd Creek WTP
REPORT NO. B-80506

Enclosed please find results for bulk samples submitted to our laboratory for asbestos analysis from the above referenced project.

The asbestos analysis was performed using Polarized Light Microscopy (PLM) with dispersion staining in accordance with the required EPA Interim Method for the Determination of Asbestos in Bulk Insulation Samples, as found in 40 CFR, Part 763, Subpart E, Appendix E.
The asbestos fiber type and percentage are reported.The method of measurement is based on calibrated visual estimation. The data provided herein is related only to those samples submitted for analysis. Samples comprised of **greater than one percent (1%) asbestos** are to be considered an asbestos containing material.

Verification by PLM point counting is available upon request. Due to limitations of the PLM microscope and the matrix of floor tile, any floor tile sample found to contain NO asbestos may be verified by TEM analysis upon the client's request. An additional fee will apply.

If samples submitted are not homogeneous, sub-samples of the components are analyzed separately as layers. A composite result may be requested.

This report may not be used by the client to claim product endorsement by NIST, NVLAP or any agency of the U.S. Government. This report shall not be reproduced, except in full, without the written approval of ACT.

If you have any questions, please contact me at 913-492-1337.

Respectfully submitted,

Tami Van

Tami L. Van
Laboratory Director

NVLAP
TESTING
NVLAP Lab Code: 101649-0

Asbestos Bulk Analysis Laboratory Report

Client Name: Burns & McDonnell
Project Name: Todd Creek WTP

REPORT NO.: B-80506
RUSH TAT

Date collected: 3/28/2023
Collected by: Matt Crawford
ANALYST: Tami Van

Submitted by: Matt Crawford
Date sample submitted: 3/28/2023
Analysis date: 3/29/2023

Sample No./Lab ID: 1 / B80506-1
Layer No.: 1
Location of Material: Drywall
Description of Material: White chalky / brown fibrous

Asbestos Fiber Type	Percentage	Non-Asbestos Fiber Type	Percentage	Non-Fibrous Percentage	
NONE DETECTED		Cellulose	15	Bulk/Binder	85

Sample No./Lab ID: 1 / B80506-1
Layer No.: 2
Location of Material: Joint compound
Description of Material: White shiny chalky

Asbestos Fiber Type	Percentage	Non-Asbestos Fiber Type	Percentage	Non-Fibrous Percentage	
CHRYSOTILE	**2**			Bulk/Binder	98

Sample No./Lab ID: 1 / B80506-1
Layer No.:
Location of Material: Drywall / Joint compound - COMPOSITE
Description of Material: White chalky/brown fibrous/white shiny chalky

Asbestos Fiber Type	*Percentage*	*Non-Asbestos Fiber Type*	*Percentage*	*Non-Fibrous Percentage*	
CHRYSOTILE	***<1***	*Cellulose*	*10*	*Bulk/Binder*	*89.9*

Sample No./Lab ID: 2 / B80506-2
Layer No.:
Location of Material: Drywall
Description of Material: White chalky / brown fibrous/paint

Asbestos Fiber Type	Percentage	Non-Asbestos Fiber Type	Percentage	Non-Fibrous Percentage	
NONE DETECTED		Cellulose	10	Bulk/Binder	98

***No joint compound present**

Sample No./Lab ID: 3 / B80506-3
Layer No.: 1
Location of Material: Drywall
Description of Material: White chalky / brown fibrous

Asbestos Fiber Type	Percentage	Non-Asbestos Fiber Type	Percentage	Non-Fibrous Percentage	
NONE DETECTED		Cellulose	15	Bulk/Binder	85

Asbestos Bulk Analysis Laboratory Report

Client Name: Burns & McDonnell
Project Name: Todd Creek WTP

REPORT NO.: **B-80506**
RUSH TAT

Date collected: 3/28/2023
Collected by: Matt Crawford

Submitted by: Matt Crawford
Date sample submitted: 3/28/2023

ANALYST: Tami Van

Analysis date: 3/29/2023

Sample No./Lab ID: 3 / B80506-3
Layer No.: 2
Location of Material: Joint compound
Description of Material: White shiny chalky

Asbestos Fiber Type	Percentage	Non-Asbestos Fiber Type	Percentage	Non-Fibrous Percentage	
CHRYSOTILE	**2**			Bulk/Binder	98

Sample No./Lab ID: 3 / B80506-3
Layer No.:
Location of Material: Drywall / Joint compound - COMPOSITE
Description of Material: White chalky/brown fibrous/white shiny chalky

Asbestos Fiber Type	*Percentage*	*Non-Asbestos Fiber Type*	*Percentage*	*Non-Fibrous Percentage*	
CHRYSOTILE	***<1***	*Cellulose*	*10*	*Bulk/Binder*	*89.9*

Sample No./Lab ID:
Layer No.:
Location of Material:
Description of Material:

Asbestos Fiber Type	Percentage	Non-Asbestos Fiber Type	Percentage	Non-Fibrous Percentage
				Bulk/Binder

Sample No./Lab ID:
Layer No.:
Location of Material:
Description of Material:

Asbestos Fiber Type	Percentage	Non-Asbestos Fiber Type	Percentage	Non-Fibrous Percentage
				Bulk/Binder

Sample No./Lab ID:
Layer No.:
Location of Material:
Description of Material:

Asbestos Fiber Type	Percentage	Non-Asbestos Fiber Type	Percentage	Non-Fibrous Percentage
				Bulk/Binder

Environmental Hazards Services, L.L.C.
7469 Whitepine Rd
Richmond, VA 23237
Telephone: 800.347.4010

Lead TCLP Analysis Report

Report Number: 23-02-04073

Client: Burns & McDonnell Engineering
9400 Ward Pkwy.
Kansas City, MO 64114

Received Date: 02/23/2023
Analyzed Date: 03/01/2023
Reported Date: 03/01/2023

Project/Test Address: 125460; KCMO/Todd Creek TWP

Client Number: 26-3514

Fax Number: 816-822-3494

Laboratory Results

Lab Sample Number	Client Sample Number	Sample Description	Sample Weight (g)	Concentration ppm (mg/L)	Narrative ID
23-02-04073-001	P5	Paint Chips	19	1.0	
23-02-04073-002	P6	Paint Chips	81	<0.50	
23-02-04073-003	P10	Paint Chips	31	<0.50	

Reporting Limit: 0.50 mg/L

Method: EPA SW846 1311/3010A/7000B

Analyst: Elaine King

Reviewed By Authorized Signatory: Tasha Eaddy

Tasha Eaddy
QA/QC Clerk

Method EPA SW846 1311 recommends 100g for analysis.

The condition of the samples analyzed was acceptable upon receipt per laboratory protocol unless otherwise noted on this report. All internal quality control requirements associated with the batch were met, unless otherwise noted. Results represent the analysis of samples submitted by the client. Sample location, description, area, volume, etc., was provided by the client. This report cannot be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government. This report shall not be reproduced except in full, without the written consent of the Environmental Hazards Service, L.L.C. California Certification #2319 NY ELAP #11714.

Legend g = gram ppm = parts per million mg/L = milligrams per liter

BURNS McDONNELL

Request for Analysis and Chain of Custody Record

Company: Burns & McDonnell	Laboratory: EHS	Project No. & Task: 125460
9400 Ward Pkwy, Kansas City, MO 64114	7469 White Pine Road	Client/Location: KCMO/Todd Creek WTP
Phone: (816) 333-9400	Richmond, VA 23237	PO: 125460
Contact: Mathew Crawford Email: mdcrawford@burnsmcd.com	Phone: 800-347-4010	Sample Dates: 2/21/23

Sample ID	Description	Sample Matrix*	Analyte	Sampling/ Analytical Method	Notes
P1	Tan Paint	Bulk	Lead	Flame AA	Run TCLP if possible
P2	Cream Paint	Bulk	Lead	Flame AA	Run TCLP if possible
P3	Pink Paint	Bulk	Lead	Flame AA	Run TCLP if possible
P4	Blue green Paint	Bulk	Lead	Flame AA	Run TCLP if possible
P5	Gray/green/black Paint	Bulk	Lead	Flame AA	Run TCLP if possible
P6	Black Paint	Bulk	Lead	Flame AA	Run TCLP if possible
P7	Gray on reddish brown Paint	Bulk	Lead	Flame AA	Run TCLP if possible
P9	Gray Paint	Bulk	Lead	Flame AA	Run TCLP if possible
P10	White Paint	Bulk	Lead	Flame AA	Run TCLP if possible
P11	Light blue Paint	Bulk	Lead	Flame AA	Run TCLP if possible
					P8 WAS NOT COLLECTED

Special Instuctions: Standard Turnaround Time	Sampler (Print and Sign): Matt Crawford	
	Relinquished By (Signature): Date/Time: 2/22/23 1330	
	Relinquished By (Signature): Date/Time: 2/23/23	
	Sample Condition:	Lab Comments:

23-02-04073

Due Date:
03/02/2023
(Thursday)

EL MM-L

3 Pb TCLP

Environmental Hazards Services, L.L.C.
7469 Whitepine Rd
Richmond, VA 23237
Telephone: 800.347.4010

Lead Paint Chip Analysis Report

Report Number: 23-02-04071

Client: Burns & McDonnell Engineering
9400 Ward Pkwy.
Kansas City, MO 64114

Received Date: 02/23/2023
Analyzed Date: 03/01/2023
Reported Date: 03/02/2023

Project/Test Address: 125460; KCMO/Todd Creek TWP
Collection Date: 02/21/2023

Client Number: 26-3514

Laboratory Results

Fax Number: 816-822-3494

Lab Sample Number	Client Sample Number	Collection Location	Pb (ug/g) ppm	% Pb by Wt.	Narrative ID
23-02-04071-001	P1	TAN PAINT	170	0.017	
23-02-04071-002	P2	CREAM PAINT	1400	0.14	
23-02-04071-003	P3	PINK PAINT	700	0.070	
23-02-04071-004	P4	BLUE GREEN PAINT	54	0.0054	L04
23-02-04071-005	P7	GRAY ON REDDISH BROWN PAINT	880	0.088	L04
23-02-04071-006	P9	GRAY PAINT	<35	<0.0035	L04
23-02-04071-007	P11	LIGHT BLUE PAINT	350	0.035	

Environmental Hazards Services, L.L.C

Client Number: 26-3514 Report Number: 23-02-04071

Project/Test Address: 125460; KCMO/Todd Creek TWP

Lab Sample Number	Client Sample Number	Collection Location	Pb (ug/g) ppm	% Pb by Wt.	Narrative ID

Sample Narratives:

L04: Sample contains substantial amounts of substrate which may affect the calculated results with units of ppm and % by weight.

Preparation Method: ASTM E-1979-17

Analysis Method: EPA SW846 7000B

Reviewed By Authorized Signatory:

Howard Varner
General Manager

The Reporting Limit (RL) for samples prepared by ASTM E-1979-17 is 10.0 ug Total Pb. The RL for samples prepared by EPA SW846 3050B is 25.0 ug Total Pb. Paint chip area and results are calculated based on area measurements determined by the client. All internal quality control requirements associated with this batch were met, unless otherwise noted.

The condition of the samples analyzed was acceptable upon receipt per laboratory protocol unless otherwise noted on this report. Results represent the analysis of samples submitted by the client. Sample location, description, area, etc., was provided by the client. Results reported above in mg/cm3 are calculated based on area supplied by client. This report shall not be reproduced except in full, without the written consent of Environmental Hazards Services, L.L.C.

ELLAP Accredtitation through AIHA LAP, LLC (100420), NY ELAP #11714.

LEGEND	Pb= lead	ug = microgram	ppm = parts per million
	ug/g = micrograms per gram	Wt. = weight	

BURNS McDONNELL

Request for Analysis and Chain of Custody Record

Company: Burns & McDonnell	Laboratory: EHS	Project No. & Task: 125460
9400 Ward Pkwy, Kansas City, MO 64114	7469 White Pine Road	Client/Location: KCMO/Todd Creek WTP
Phone: (816) 333-9400	Richmond, VA 23237	PO: 125460
Contact: Mathew Crawford Email: mdcrawford@burnsmcd.com	Phone: 800-347-4010	Sample Dates: 2/21/23

Sample ID	Description	Sample Matrix*	Analyte	Sampling/ Analytical Method	Notes
P1	Tan Paint	Bulk	Lead	Flame AA	Run TCLP if possible
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P3	Pink Paint	Bulk	Lead	Flame AA	Run TCLP if possible
P4	Blue green Paint	Bulk	Lead	Flame AA	Run TCLP if possible
P5	Gray/green/black Paint	Bulk	Lead	Flame AA	Run TCLP if possible
P6	Black Paint	Bulk	Lead	Flame AA	Run TCLP if possible
P7	Gray on reddish brown Paint	Bulk	Lead	Flame AA	Run TCLP if possible
P9	Gray Paint	Bulk	Lead	Flame AA	Run TCLP if possible
P10	White Paint	Bulk	Lead	Flame AA	Run TCLP if possible
P11	Light blue Paint	Bulk	Lead	Flame AA	Run TCLP if possible
					P8 WAS NOT COLLECTED

Special Instuctions: Standard Turnaround Time	Sampler (Print and Sign): Matt Crawford	
	Relinquished By (Signature): Date/Time: 2/22/23 1330	
	Relinquished By (Signature): Date/Time: 2/23/23	
	Sample Condition:	Lab Comments:

23-02-04071

Due Date:
03/02/2023
(Thursday)
EL MM-L
ACW

BURNS McDONNELL

CREATE AMAZING.

Burns & McDonnell World Headquarters
9400 Ward Parkway
Kansas City, MO 64114
O 816-333-9400
F 816-333-3690
www.burnsmcd.com

APPENDIX D

Report of Subsurface Exploration & Geotechnical Engineering Evaluation (To be provided upon request to Project Manager: Shawn Cross – shawn.cross@kcmo.org or Conner Hanlon – conner.hanlon@kcmo.org)

APPENDIX E

SKM electrical One Line Models
(To be provided upon request to Project Manager: Shawn Cross – shawn.cross@kcmo.org or Conner Hanlon – conner.hanlon@kcmo.org)

APPENDIX F

F.1- Cut Fill Summary
F.2 - TC Existing Grade 3D Base .DWG File
F.3 – TC Finished Grade 3D Base .DWG File
(To be provided upon request to Project Manager: Shawn Cross – shawn.cross@kcmo.org or Conner Hanlon – conner.hanlon@kcmo.org)

APPENDIX G

125460 TC Site Coordination .nwd File
(To be provided upon request to Project Manager: Shawn Cross – shawn.cross@kcmo.org or Conner Hanlon – conner.hanlon@kcmo.org)

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

INSTRUCTIONS TO BIDDERS

Project Number: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrade (DBE)

1. Sealed Bids for the ***Todd Creek WWTP Expansion & Major Upgrade*** project will be received by the General Services Department at 4800 E 63rd Street, Kansas City, Missouri 64130 **until 2:00 P.M., February 3rd, 2026,** at which time bidding will be closed.

   a. All Bids will be opened and read aloud. The Bid Envelope must contain all required submissions to be included with the Bid. No Bid may be withdrawn for a period of ninety (90) days after the Bid is opened. Bid security shall likewise continue for the same ninety (90) days unless earlier released by the City. The successful Bidder shall comply with all Bidding and contract requirements. Bids, once opened and read, may not be withdrawn without forfeiture of the Bid security.

   b. All Bids shall be addressed to *the Senior Officer off Procurement Services Marzella N. Buckner*, shall state on the outside of the sealed Bid envelope "Bid Enclosed", title and Project number, and shall be deposited in the locked Bid box. All Bids must comply with the Bidding Requirements of Kansas City, Missouri (CITY).

2. Consideration of Bids

   a. The City will determine the lowest, responsive and responsible Bid. The City may reject any or all bids. If the City rejects all Bids, the City may: (1) resolicit Bids following the City's normal solicitation procedure; or (2) solicit Bids only from those Bidders that submitted a Bid pursuant to the original solicitation; or (3) use an expedited Bid submission schedule with or without readvertising or issuing any other public notice when the City determines that the delay from the normal City solicitation procedure would not be in the City's best interests.

   b. Alternates. If this solicitation includes Bid Alternates, the City, in its sole discretion, may include any, all or none of the Alternates in determining the lowest, responsive and responsible Bid. In determining lowest, responsive and responsible Bid, the City may include the Alternates in any combination and in any order or priority or choose none of the Alternates. The City may make this determination at any time after Bid Closing and prior to Contract award. The City will act in the best interest of the City in determining whether to include any, all or none of the Alternates and the combination and priority of any Alternates selected. If additional funding becomes available after Contract award, City may add any or all of the Alternates to the Contract by change order.

3. Evidence of Competency to Perform. Each bidder shall furnish with the bid satisfactory evidence of Bidder's competency to perform the proposed work. Such evidence of competency shall consist of the following:

   a. Completed Form 00410.01 Experience Reference Summary for three projects of similar scope performed within the past 5 years including the name, address and telephone number of the contact person having knowledge of the project and the dollar value of the project.

   b. Statement that, during the three (3) years immediately preceding the date of the Bid, Bidder has received no written notices of violations of any federal or state prevailing wage statute in which prevailing wage penalties were assessed against the Bidder or Bidder has been found in such but has made restitution to affected workmen and complied with any statutory penalty; and a

statement that Bidder is current on payment of Federal and State income tax withholdings and unemployment insurance payments

c. Statement that Bidder participates in a training program that facilitates entry into the construction industry and which may include an on-the-job or in-house training program. By submitting its Bid, Bidder is agreeing to timely submit during the 48 hours after Bid opening an affidavit of describing such program and Bidder's participation.

d. Identify the following Key Personnel proposed for the Project. (**NOTE:** Key Personnel must be committed to the Project for its duration and may not be removed or substituted without the City's prior written consent.)

   (1) GC Project Manager

   (2) On-Site Field Superintendent

   (3) QC/QA Manager

   (4) Safety Officer

e. For each of the Key Personnel, provide the following background information.

   (1) Years of employment with current employer

   (2) City of residence

   (3) Identify any other projects this person will be involved with concurrently with the Project, and state the time commitment for the Project and each other project

   (4) Discuss professional registrations, education, certifications, and credentials held by this person that are applicable to the Project

f. Discuss generally the tasks involved in the Project.

g. Illustrate clearly and concisely Bidder's understanding of the technical elements that must be addressed for successful completion of the Project.

h. Submit a bid schedule with anticipated milestones for the Project using Microsoft Project 2007 or later format.

i. Describe key issues that might affect the Project schedule and how Bidder proposes to address them.

j. Summary of the Project Safety Plan for the Project.

   (1) Describe how Bidder proposes to address any unique safety issues for the Project

   (2) Describe your safety record and environmental compliance record along with your Firm's OSHA reportable accident rates on recent comparable size projects

   (3) Statement of Bidder's Experience Modification Ratio (EMR)

k. Discuss Bidder's understanding of the traffic control required for the Project, if applicable, and how traffic control will impact the Project schedule. Discuss any major traffic control issues that need to be addressed and Bidder's proposed solutions.

l. Identify any other special issues or problems that are likely to be encountered. Outline the manner in which Bidder suggests resolving them.

m. Outline key community relations issues and how they might be resolved.

n. Describe any difficulties Bidder anticipates encountering in serving the City, in light of the City's status as a municipality and public entity. Explain how Bidder plans to manage them.

o. Summary of Bidder's Quality Assurance/Quality Control Plan for this project

p. Statement regarding all work performed two (2) years immediately preceding the date of the Bid, that contains either (a) a contract by contract listing of any written notices of violations of any

federal, state or local DBE/MBE/WBE Program and any damages assessed; or (b) a statement that there have been no such written notices of violations or such penalties assessed; and a statement that Program requirements have been met.

q. Statement that the Bidder has not been rescinded or debarred from any bidding, contractual, procurement, or other such programs by federal, state or local entities.

r. Statement that Bidder is current on payment of Federal and State income tax withholdings and unemployment insurance payments

s. Statement of Bidder's litigation and/or arbitration history over the past five (5) years including final ruling.

t. Statement of Bidder's bond history over the past five (5) years including any incidences of failure to perform.

u. MBE / WBE past project performance and compliance with participation goals in comparable size commercial projects

v. Other.

4. Waiver of Bid Requirements The City Manager or his delegate at any time may waive any requirements imposed by this solicitation or by any City regulation when failure to grant the waiver will result in an increased cost to the City and the requirement waived would be waived for all Bidders for this solicitation and it is in the best interest of the City to grant the waiver. The City Council at any time may waive any requirements imposed in this solicitation by the City's Code of Ordinances when it finds failure to grant the waiver will result in an increased cost to the City and the waived requirement would be waived for all Bidders for this solicitation and it is in the best interest of the City to grant the waiver. The City reserves the right to waive any irregularities and/or formalities as deemed appropriate.

5. Late Bids Bids and modifications of Bids received after the exact hour and date specified for receipt will not be considered unless: (1) the Bid is sent via the U.S. Postal Service, common carrier or contract carrier, by a delivery method that guarantees the Bid will be delivered to the City prior to the submission deadline; or (2) if the Bid is submitted by mail, common carrier or contract carrier it is determined by the City that the late receipt was due solely to an error by the U.S Postal Service, common carrier or contract carrier; or (3) the Bid is timely delivered to the City but is at a different City location than that specified in this IFB; or (4) the City extends the time after the deadline for a force majeure event that could potentially affect any or all Bidders meeting the deadline.

6. Interpretations and Addenda All questions about the meaning or intent of the Bidding Documents may be directed to the Project Manager listed at the end of these Instructions to Bidders. Interpretations or clarifications considered necessary by the Project Manager in response to such questions will be issued by Addenda to all parties recorded as having received the Bidding Documents. Questions received less than ten (10) days prior to the date for opening of Bids may not be answered. Only answers issued by formal written Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect. Addenda may also be issued to modify the Bidding Documents as deemed advisable by the City.

7. Bid Security Requirements All Bids submitted must be accompanied by a Bid deposit in the amount of five percent (5%) of the base Bid which shall be in the form of a Bid Bond (on the form provided in these Bidding Documents), Cashier's Check, Letter of Credit, Certificate of Deposit or other instrument approved in advance by the City. Prior to submittal of the Bid the City Treasurer must approve both the financial institution and text of a Letter of Credit. A Cashier's Check or a Certificate of Deposit shall be payable to the City Treasurer.

8. Forfeiture of Security If a Bidder fails or refuses to execute the Contract when requested by the City, any Bid security given to the City shall immediately become due and payable and forfeited to the City as liquidated damages.

9. Mistake in Bid Security By submitting a Bid, Bidder agrees to correct any mistakes on a Bid security submission when requested by the City. When such a mistake occurs and a Bidder fails or refuses to

correct the mistake or execute the Contract when requested by the City, any Bid security shall be forfeited to the City and the Bidder shall also be subject to debarment and damages.

10. Bids that Exceed the Engineer's Estimate The City may offer the apparent lowest, responsive and responsible Bidders the option of performing the Work for the Engineer's estimate for the Project with no changes to the Bid requirements or scope of the Project if the Bid is not more than five percent higher than the Engineer's estimate.

11. Post Bid Required Submissions The successful Bidder will be required to submit the following documents with the signed copies of the Bid Form/Contract or within the timeframes specified in the Notice of Intent to Contract letter. Copies of the City's forms that the successful Bidder will be required to sign are bound into this Project Manual for information:

a. Properly signed, dated, and sealed Performance and Maintenance Bond and Payment Bond;

b. Properly completed certificates of insurance;

c. Copies of licenses required by the City to do the Work;

d. A copy of CONTRACTOR's current Certificate of Good Standing or Fictitious Name Registration from the Missouri Secretary of State, or other acceptable proof; and

12. Indemnification – City of Kansas City. The contract documents contains a requirement that Contractor shall indemnify, defend and hold harmless the City and any of its agencies, officials, officers, or employees from and against all claims, damages, liability, losses, costs, and expenses, including reasonable attorneys' fees, arising out of or resulting from any acts or omissions in connection with the contract, caused in whole or in part by Contractor, its employees, agents, or Subcontractors, or caused by others for whom Contractor is liable, including negligent acts or omissions of the City, its agencies, officials, officers, or employees. The contract requires Contractor to obtain specified limits of insurance to insure the indemnity obligation. Contractor has the opportunity to recover the cost of the required insurance in the Contract Price by including the cost of that insurance in the Bid amount.

13. City's Buy American and Missouri Preference Policies It is the policy of the City that any manufactured goods or commodities used or supplied in the performance of any City contract or any subcontract thereto shall be manufactured or produced in the United States whenever possible. When Bids offer quality, price, conformity with specifications, term of delivery and other conditions imposed in the specifications that are equal, the City shall select the Bid that uses manufactured goods or commodities that are manufactured or produced in the United States. The City shall give preference to all commodities manufactured, produced, or grown within the State of Missouri and to all firms, corporations, or individuals doing business as Missouri firms, corporations or individuals, when quality is equal or better and delivered price is the same or less. It is the bidder's responsibility to claim these preferences.

14. Affirmative Action It is the policy of the City that any person or entity entering into a contract with the City, will employ applicants and treat employees equally without regard to their race, color, sex, religion, national origin or ancestry, disability, sexual orientation, gender identity or age. Bidder will be required to comply with the City's Affirmative Action ordinance if Bidder is awarded a contract from the City totaling more than $300,000.00. If you have any questions regarding the City's Affirmative Action requirements, please contact CREO KC at (816) 513-1836 or visit the City's website at www.kcmo.gov.

15. Tax Clearance Bidder will be required to furnish to CITY sufficient proof from City's Commissioner of Revenue, verifying that Bidder is in compliance with the license and tax ordinances administered by City's Revenue Division as a precondition to CITY making its first payment under any CONTRACT over $160,000.00. Bidder will also be required to obtain proof of City tax compliance from all of its Subcontractors prior to the Subcontractors performing any Work.

16. Substitutions or "Or-Equal" Items The procedure for submission of substitutions or "or-equal" items is set forth in the General Conditions and Supplementary Conditions.

17. Prevailing Wage Requirements The successful Bidder shall pay the prevailing hourly rate of wages as determined by the Missouri Annual Wage Order and/or Federal Wage Determination set forth in the Project Manual. In case of a conflict between Missouri and Federal wage rates, the higher rate shall apply.

Successful Bidder shall be required to use City's Internet web based Prevailing Wage Reporting System provided by City and protocols included in that software during the term of this Contract. When requested by the City, Bidder shall submit user applications to City's provided Prevailing Wage Reporting System for all applicable personnel and shall require subcontractors to submit same.

18. Contract Information Management System Successful Bidder shall be required to use City's Internet web-based Contract Information Management System/Project Management Communications Tool provided by City and protocols included in that software during the term of this Contract. Bidder/Proposer shall submit user applications to City's provided Contract Information Management System for all personnel, subcontractors or suppliers as applicable.

19. Disadvantaged Business Statement The Kansas City Water Services Department is an Equal Opportunity Employer and invites the submission of bids from Disadvantaged Business Enterprises.

20. Forfeiture of Bid Bonds for Failure to Make DBE Submission: By submitting its Bid, Bidders is agreeing to following the (1) Bidder has made by Bid opening a good faith effort to meet the DBE requirements established for the Project; or Bidder will continue to make during the **48 hours** after Bid opening a good faith effort to meet the DBE requirements. Established for the Project: and a timely submitting its **00990.01** attachment form for the DBE Missouri requirements.

21. DBE Program Requirements City desires that Disadvantaged Business Enterprises (DBE) have a maximum opportunity to participate in the performance of City contracts. Program specifics are available in Section 00990 Clean Water State Revolving Funds Specification Requirements.

22. Workforce Program Requirements City desires that minorities and women have a maximum opportunity to practice their trades on city construction projects. The minimum company-wide goals are a ten percent (10%) minority workforce and two percent (2%) women workforce. The City's CREO KC Forms and CREO KC Instructions for Construction Projects are incorporated into these Bidding Documents and the Contract Documents.

Successful Bidder shall be required to use City's Internet web-based Workforce Program Reporting System provided by City and protocols included in that software during the term of this Contract. When requested by the City, Bidder shall submit user applications to City's provided Workforce Program Reporting System for all applicable personnel and shall require subcontractors to submit same.

23. Subcontractors, Suppliers and Others

a. If the Contract Documents require the identity of certain Subcontractors, Suppliers and other persons and organizations (including those who are to furnish the principal items of material and equipment) to be submitted to City, the apparent lowest, responsive and responsible Bidder, and any other Bidder so requested, shall submit to City a list of all such Subcontractors, Suppliers and other persons and organizations proposed for those portions of the Work for which such identification is required. An experience statement shall accompany such list with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier or organization if requested by City. If City has reasonable objection to any proposed Subcontractor, Supplier or other person or organization, City may request the apparent lowest, responsive and responsible Bidder to submit an acceptable substitute without an increase in Bid price.

b. By submitting its Bid, Bidder agrees that it has read and understands all the provisions of General Condition No. 6.07, Concerning Subcontractors, Suppliers and Others, and that it will comply with all those provisions including but not limited to mandatory mediation of disputes and the prohibition against paid-if-paid and paid-when-paid contract clauses. It is the City's expectation that all Subcontractors and Suppliers will be treated fairly and in good faith by the successful Bidders and that the successful Bidder will make all reasonable efforts to resolve contract disputes with a Subcontractor or Supplier in a prompt and fair manner. If the City is notified by a Subcontractor or Supplier of a contract claim with the successful Bidder, City will notify the successful Bidder and will request prompt resolution of the claim. City will provide any such Subcontractor or Supplier information regarding mandatory mediation as well as a copy of the Payment Bond. City may notify the Surety that City has taken cognizance of such claim.

c. In accordance with the Missouri Prompt Payment Act, City reserves the right to withhold payment(s) in good faith from the successful Bidder due to: i)the successful Bidder's failure to comply with any

material provision of the contract; ii)third party claims filed or reasonable evidence that a claim will be filed; iii)the successful Bidder's failure to make timely payments for labor, equipment or materials; or iv)for damage to a Subcontractor or Supplier.

d. By submitting its Bid, Bidder agrees it will not deny any Subcontractor subcontracting opportunities solely because the Subcontractor is not a signatory to collective bargaining agreements with organized labor.

e. The provisions of GC 6.07 are a material term of the Contract with the City and failure by the successful Bidder to comply with the provisions of this section will be taken into consideration by City in making the determination of lowest, responsive and responsible bidder in any subsequent City contracts.

24. Pre-Bid Conference The Water Services Department will hold a pre-Bid conference on January 15th, 2026, at 2:00 PM on Microsoft Teams and in-person at Kansas City Water Services Department. Contact the Project Manager prior to the meeting for the link to attend. Attendance at the pre-Bid conference is mandatory for all Bidders on this Project. For this Project, the City shall not contract with a Bidder who has not attended the entire pre-Bid conference for this Project.

25. On-Site Inspection The Project Site will be available for inspection by Bidders. Bidders visiting the Project Site shall be responsible for their own safety. The Project Site shall be available for inspection by appointment from 8 AM to 3 PM each day Monday through Friday (holidays excepted). Bidders may contact the following individual from the Water Services Department for an appointment.

Contact: Shawn Cross

Phone: (816) 503-0442

E-mail: shawn.cross@kcmo.org

26. Signatures Each copy of the Bid Form/Contract must be signed and properly dated by the following, as applicable:

Limited Liability Company:

□ a member of the limited liability Company authorized to sign on behalf of the company.

Partnership:

□ a partner authorized to sign on behalf of the partnership.

Sole Proprietor:

□ the proprietor.

Joint Venture:

□ the parties to the Joint Venture authorized to sign on behalf of each party to the Joint Venture, or a person authorized by each party to the Joint Venture to sign on behalf of all parties to the Joint Venture.

Corporation:

□ a corporate office authorized to sign on behalf of the corporation. Corporation's seal must be attached to the signature.

27. SRF Statement This project is being financed through the Missouri State Revolving Fund, by the Water and Wastewater Loan Revolving Fund and federal Capitalization Grants to Missouri.

28. Forward all questions in writing to the following Project Manager and Contract Administrator. Questions received less than three (3) days prior to the Bid Date may not be answered. Interpretations or clarifications considered necessary by the Project Manager in response to such questions will be issued by Addenda to all Bidders. Oral or other interpretations or clarifications shall be without legal effect, even if made at a Pre-Bid Meeting.

Shawn Cross, Project Manager
Water Services Department
4800 E. 63rd Street
Kansas City, Missouri 64130
Phone: (816) 513-0442
Fax: (816) 513-0343
E-mail: Shawn.Cross@kcmo.org

Marzella Newman-Buckner, Contract Administration
Water Services Department
4800 E. 63rd Street
Kansas City, Missouri 64130
(816) 513-0319
E-mail: Marzella.Newman-Buckner@kcmo.org

For persons with disabilities needing reasonable accommodations please contact Daniel O'Conner at 816-513-1824 or Cowan Byers at 816-513-1802. If you need to use the Relay Missouri Center call 1-800-RELAY-MO (1-800-735-2966).

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CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

ADDENDUM NUMBER 2

Project/Contract Number: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrade

ISSUE DATE: **1/20/2026**

Bidders are hereby notified that the Bidding and Contract Documents for the above project, for which Bids are to be received on **February 3rd, 2026**, are amended as follows:

The Bid date for this Project stated in Document 00130 - Invitation to Bid shall be changed to: 2:00 PM, on **February 24th, 2026.**

Information to Bidders The following is provided to Bidders for information only:

1. DBE Partnering Session In-Person Attendance List
2. DBE Partnering Session Online Attendance List
3. Pre-Bid Meeting PowerPoint Slides
4. Pre-Bid Meeting In-Person Attendance List
5. Pre-Bid Meeting Online Attendance List

Q1.	There is a note that all stormwater pipe should be RCP Cl3. Polypropylene is approved by KCMO for any application including ROW. Would polypropylene pipe be acceptable for use on this project.
A1.	**Yes, dual wall and triple wall polypropylene storm sewer pipe is acceptable per Kansas City, Missouri Water Services Department standard specification section 02630 – Stormwater Pipe and Structures.**
Q2.	• KCMO provided the quote and Set Price for the AGS System by Aqua-Aerobics. Within this quote there are Payment Terms already noted by Aqua-Aerobic, does KCMO agree to these payment terms? o 10% of total purchase price at order execution. o 30% of total purchase price at our transmittal of engineer's submittal data. o 50% of total purchase price at shipment of goods. o 5% of total purchase price at completion of Start-up and Training. o 5% of total purchase price at completion of final process checkout.
A2.	**Yes, KCMO does agree to those terms.**
Q3.	The specifications provide both Building and Heavy wage rates. Please confirm which one should be used for this project.
A3.	**Both wage rates will be required for the work on this project dependent on what is being completed.**
Q4.	The Equipment Questionnaire calls for Rammed Aggregate Piles spec 31 66 13.13 - There is no specification for this. However there is a specification for 31 66 12 Cast-In-Place Ground Improvements. Please clarify.

A4.	**The spec for Cast-In-Place Ground Improvements should be used. Rammed Aggregate Piles should not have been included in the questionnaire and will be removed with this addendum.**
Q5.	Can Hoover Forcemain be shutdown for tie-in? If not - where is the bypass supposed to pull from?
A5.	**Yes, the Hoover Heights forcemain can be shut down for a tie-in. We have updated SECTION 01140 – WORK RESTRICTIONS to include this work.**
Q6.	Is the contractor responsible for the cost of the building permit fees? The Valuation and the Plan Check Fee?
A6.	**Yes, the contractor will be responsible for the building permit fees, valuation fees, and plan check fee.**
Q7.	Who is responsible for the cost of the in-field testing? Concrete testing, earthwork, etc.
A7.	**The contractor will be responsible for the cost of in-field testing, concrete testing, earthwork and other forms of testing.**
Q8.	Spec 01210 Admin Building Furniture allowance section 1.03 B and 1.03 C both state labor, installation, testing and finishing. Can you please clarifier if the labor to install the furniture will be paid out of the allowance?
A8.	**Yes, the labor to install the furniture will be paid out of the allowance.**

Bidding Requirements

1. Delete and replace the following section(s):
    a. Delete Drawing C128 – Note 1:

       "ALL STORM SEWER PIPE SHALL BE
       TYPE III RCP."

       and replace with the following Drawing C128 – Note 1:

       "ALL STORM SEWER PIPE SHALL BE TYPE III RCP OR DUAL/TRIPLE WALL POLYPROPYLENE."

    b. Delete Drawing C129 – Note 1:

       "ALL STORM SEWER PIPE SHALL BE
       TYPE III RCP."

       and replace with the following Drawing C128 – Note 1:

       "ALL STORM SEWER PIPE SHALL BE TYPE III RCP OR DUAL/TRIPLE WALL POLYPROPYLENE."

    c. Delete Drawing C130 – Note 1:

       "ALL STORM SEWER PIPE SHALL BE
       TYPE III RCP."

       and replace with the following Drawing C128 – Note 1:

"ALL STORM SEWER PIPE SHALL BE TYPE III RCP OR DUAL/TRIPLE WALL POLYPROPYLENE."

d. Delete Drawing C131 – Note 1:

"ALL STORM SEWER PIPE SHALL BE
TYPE III RCP."

and replace with the following Drawing C128 – Note 1:

"ALL STORM SEWER PIPE SHALL BE TYPE III RCP OR DUAL/TRIPLE WALL POLYPROPYLENE."

e. Delete Drawing C132 – Note 1:

"ALL STORM SEWER PIPE SHALL BE
TYPE III RCP."

and replace with the following Drawing C128 – Note 1:

"ALL STORM SEWER PIPE SHALL BE TYPE III RCP OR DUAL/TRIPLE WALL POLYPROPYLENE."

f. Delete Drawing C133 – Note 1:

"ALL STORM SEWER PIPE SHALL BE
TYPE III RCP."

and replace with the following Drawing C128 – Note 1:

"ALL STORM SEWER PIPE SHALL BE TYPE III RCP OR DUAL/TRIPLE WALL POLYPROPYLENE."

2. Add the following section(s):
   a. Document, Section 33 33 11, Part 2 – Products, Subsection 2.09 Polypropylene Pipe – Stormwater (PP), Paragraph A:

   "Specified in KC Water Standard Specifications Section 02630 – Stormwater Pipe and Structures."

   b. Document, Section 33 33 11, Part 3 – Execution, Subsection 3.08 Polypropylene Pipe – Stormwater (PP), Paragraph A:

   "Specified in KC Water Standard Specifications Section 02630 – Stormwater Pipe and Structures."

Contracting Requirements

1. Delete the following section(s):
    a. Document, Section 00130 – Invitation to Bid, Page 1, Paragraph 1:

        "The General Services Department of Kansas City, Missouri will receive sealed Bids until 2:00 PM, on February 3, 2026 at 4800 E 63rd Street, Kansas City, Missouri 64130, for Project No. 81000927/Contract No. 1698, Todd Creek WWTP Expansion & Major Upgrades. Bids will be opened after that time at the same Location."

    b. Document, Section 00130 – Invitation to Bid, Page 1, Paragraph 2, Sentence 2:

        "City desires that Disadvantaged Business Enterprises (DBE) have an opportunity to participate in the performance of City contracts. The goals for this specific Project are stated in the Missouri State Revolving Fund Procedures for Implementation."

    c. Document, Section 00210 - Instruction to Bidders, Section 22 – Workforce Program Requirements, Paragraph 1, Sentence 2:

        "The minimum company-wide goals are a ten percent (10%) minority workforce and two percent (2%) women workforce."

2. Add the following section(s):
    a. Document, Section 00130 – Invitation to Bid, Page 1, Paragraph 1:

        "The General Services Department of Kansas City, Missouri will receive sealed Bids until 2:00 PM, on February 24, 2026 at 4800 E 63rd Street, Kansas City, Missouri 64130, for Project No. 81000927/Contract No. 1698, Todd Creek WWTP Expansion & Major Upgrades. Bids will be opened after that time at the same Location."

    b. Document, Document, Section 00130 – Invitation to Bid, Page 1, Paragraph 2, Sentence 2:

        "The goals for this specific Project are stated in the Missouri State Revolving Fund Procedures for Implementation and are (10%) MBE, (5%) WBE. See Section 00990 for further instructions."

    c. Document, Section 00210 - Instruction to Bidders, Section 22 – Workforce Program Requirements, Paragraph 1, Sentence 2:

        "The minimum company-wide goals are (12.7%) minority workforce and (6.9%) women workforce."

d. Document, Section 00990 CSSRF Drop-In Specifications, Section Standard Federal Equal Employment Opportunity Construction Contract Specifications (Executive Order 11246), Page 4, Section 2, Table Column "Goals for Minority Participation for Each Trade, Row 2:

"12.7%"

Specifications:

1. Delete and replace the following section(s):
    a. Delete Document, DIV 00, Section 00410.04 – Equipment Questionnaire, and replace with the following DIV 00, Section 00410.04 – Equipment Questionnaire
    b. Delete Document, DIV 01, Section 01140 – Work Restrictions, and replace with the following DIV 01, Section 01140 – Work Restrictions
2. Delete the following section(s):
    a. Document DIV 00, Section 00440 – CREO KC Form 5

Drawings: Re-issue the drawings listed below.

1. D116 - POTABLE WATER PROFILES - SHEET 2
2. E393 - HEADWORKS ELECTRICAL CABLE TAG SCHEDULE SHEET 3
3. Y407 - AERATION BLOWERS NO. 1, NO. 2 AND NO. 3 PROCESS & INSTRUMENTATION DIAGRAM
4. Y704 - THICKENED SLUDGE HOLDING AND LOADOUT PROCESS & INSTRUMENTATION DIAGRAM
5. Y706 - THICKENED SLUDGE TANK MIXING AIR COMPRESSORS AND RECEIVING TANK PROCESS & INSTRUMENTATION DIAGRAM

NOTE: Bidders must acknowledge receipt of this Addendum by listing the number and date, where provided, on the Bid Form - Document 00410.

DBE Partnering Session In-Person Attendance (1/13/2026 2-3PM)

Name	Company	Contact Information
Kevin White	KC Water	Kevin.White@kcmo.org
Kate Pfefferkorn	Pfefferkorn Eng. + Env.	Kate.p@p-e2.com
Dylan Mann	Genesis Environmental Solutions	dmann@genesisenviro.com
Brad Boyles	MegaKC Corporation	megabids@megakc.com
John Rolls	WITEC Electrical + Plumbing	JohnR@WITECINC.com
Zachary Benson	Garney Construction	zbenson@garney.com
Sara Buckler	Goodwin Bros Construction Co	sbuckler@goodwinbros.com
Evan Dolan	EDolan@Hgcons.com	Hg Consult Inc.
James Brizendine	Hg Consult, Inc.	jbrizendine@hgcons.com
Keith Lawson	Lippert Mech	KLawson@Lippertmechanical.com
Shawn Cross	KC Water	shawn.cross@kcmo.org
Brett Kreikemeier	Burns + Mcdonnell	bjkreikemeier@burnsmcd.com
Bryce Dickmeyer	Burns & McDonnell	bdickmeyer@burnsmcd.com
Conner Hanlon	KC Water	conner.hanlon@kcmo.org

DBE Partnering Session Online Attendance (1/13/2026 3-4PM)

Todd Creek DBE Partnering Session Online Attendance	
Name	**Email**
Hanlon, Conner	Conner.Hanlon@kcmo.org
White, Kevin	Kevin.White@kcmo.org
Brad Emory	bemory@garney.com
Michelle Land	mland@alexandermechanical.com
Fahteema Parrish	fahteema@parrishandsonsconstruction.com
Abdul	ayahaya@parrishandsonsconstruction.com
Toby Aylward	Toby.Aylward@markone.com
Brian Schultz	bschultz@garney.com
Kris	kris@shedigsit.com
Dickmeyer, Bryce (External)	bdickmeyer@burnsmcd.com
Luke Messer	lmesser@garney.com
KeShaun Childress	kchildress@parrishandsonsconstruction.com
Max's Assistant (Unverified)	
Thomas Hudgens	Thomas@redfordconstruction.com
Audrey Schultz	audrey.schultz@garney.com
Steve Harris	sharris@garney.com
Corey O'Neill (External)	coneill@megakc.com
Nick Clemons	nick.clemons@markone.com
18167628383 (Unverified)	
Austin Pfannenstiel (External)	austinp@megakc.com
Rochelle Bonty	rochelleb@rmbmech.com

Mandatory Pre-Bid Meeting Slide Deck

KCWATER

Todd Creek WWTP Expansion & Major Upgrade - Agenda

- Introductions
- Bidder Instructions
- Contract Compliance
- Project Information

Thursday January 15th, 2:00 pm

Potential Bidders

Pre-Proposal Meeting

Todd Creek WWTP Expansion & Major Upgrade – Project Team

KC Water

- ❑ Interim Chief Engineering Officer: David Poirier
- ❑ Facilities & Plants Engineering Division Head: Blake Anderson
- ❑ Facilities & Plants Engineering Section Head: Kevin White
- ❑ Project Manager: Shawn Cross
- ❑ Assistant Project Manager: Conner Hanlon
- ❑ Contract Administrator: Marzella Newman-Buckner

Todd Creek WWTP Expansion & Major Upgrade – Project Team

Project Manager: Shawn Cross
Phone Number: (816) 513-0442
E-Mail: Shawn.Cross@kcmo.org

Assistant Project Manager: Conner Hanlon
Phone Number: (816)-513-0526
E-Mail: Conner.Hanlon@kcmo.org

Contract Administrator: Marzella Newman-Buckner
Phone Number: (816) 513-0319
E-Mail: Marzella.Newman-Buckner@kcmo.org

Disadvantaged Business Enterprise Requirements (DBE)

DBE Goals: 10% MBE and 5% WBE

Work Force Goals: 12.7 MBE 6.9% WBE

MBE/WBE Compliance Inquiries:

Alvaro Ontiveros
alvaro.ontiveros@kcmo.org

Workforce Compliance Inquiries:

Valerie Johnson
Phone (816) 513-1406
Valerie.Johnson@kcmo.org

Note: All DBE forms in Attachment 1 must be included with your bid

Bidder Instructions

Sealed Bids Due Thursday, February 3rd, 2026, by 2:00 PM

Outside of each envelope/package must include:

Bidder's Name and Address

Project No. 81000927 / Contract No. 1698

Invitation For Bid – Construction Submittal for Project No. 81000927

Deliver to:

Marzella Newman-Buckner, Senior Procurement Officer

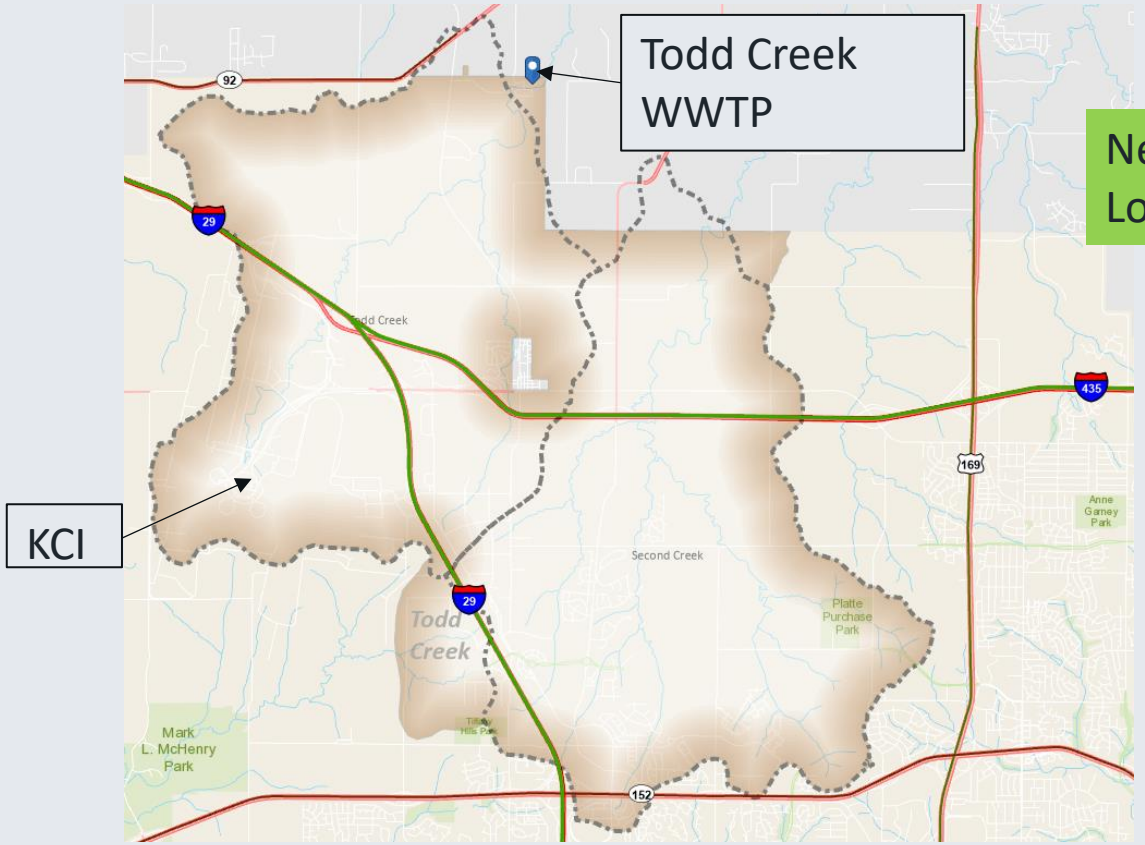
4800 E. 63rd Kansas City,

Kansas City, MO 64130

Project Information & Details

Todd Creek WWTP Expansion & Major Upgrade

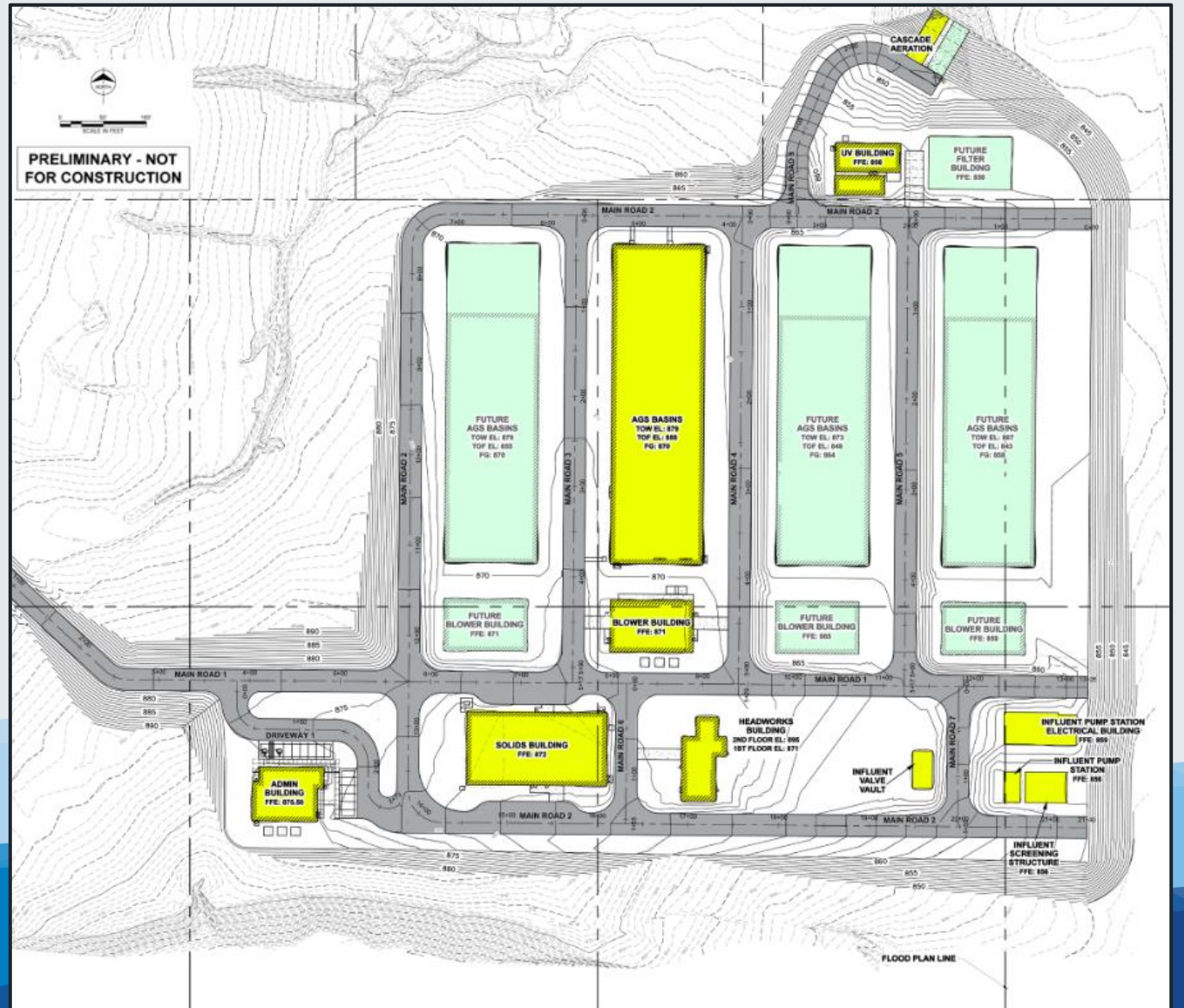
Project Location



Project Overview

- Greenfield Site
- New Treatment Technology (Aerobic Granular Sludge)
- Modular Design, Expand as Necessary
- 4.6 MGD

Plant Layout and Processes

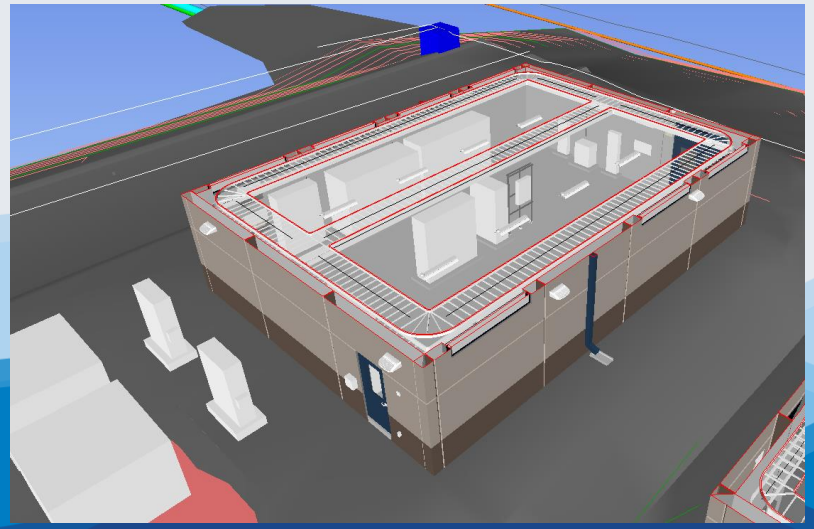


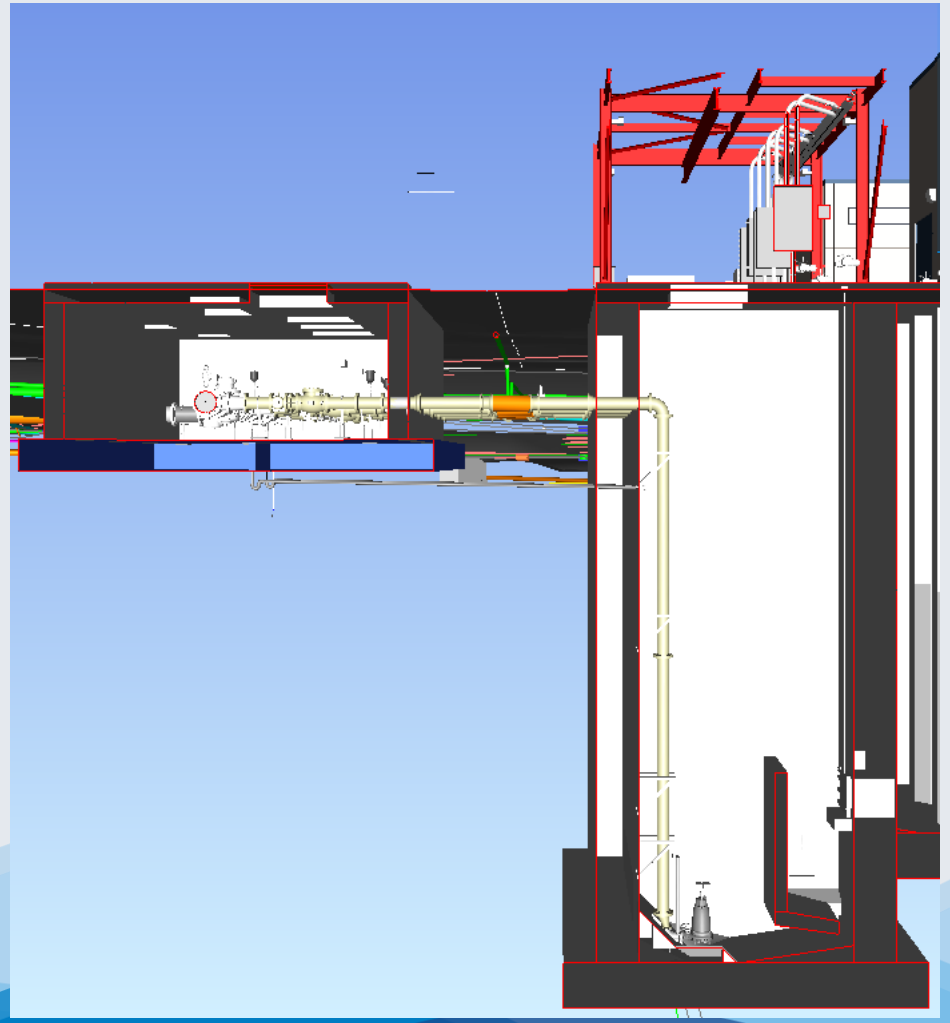
Coarse Screening

- (3) Channels
- (2) Screens
- Electrical Room
- Ozone injected in channels
- Hydrogen Peroxide Injected Upstream
- Channel Depth ~42’

Influent Pump Station & Electrical Room

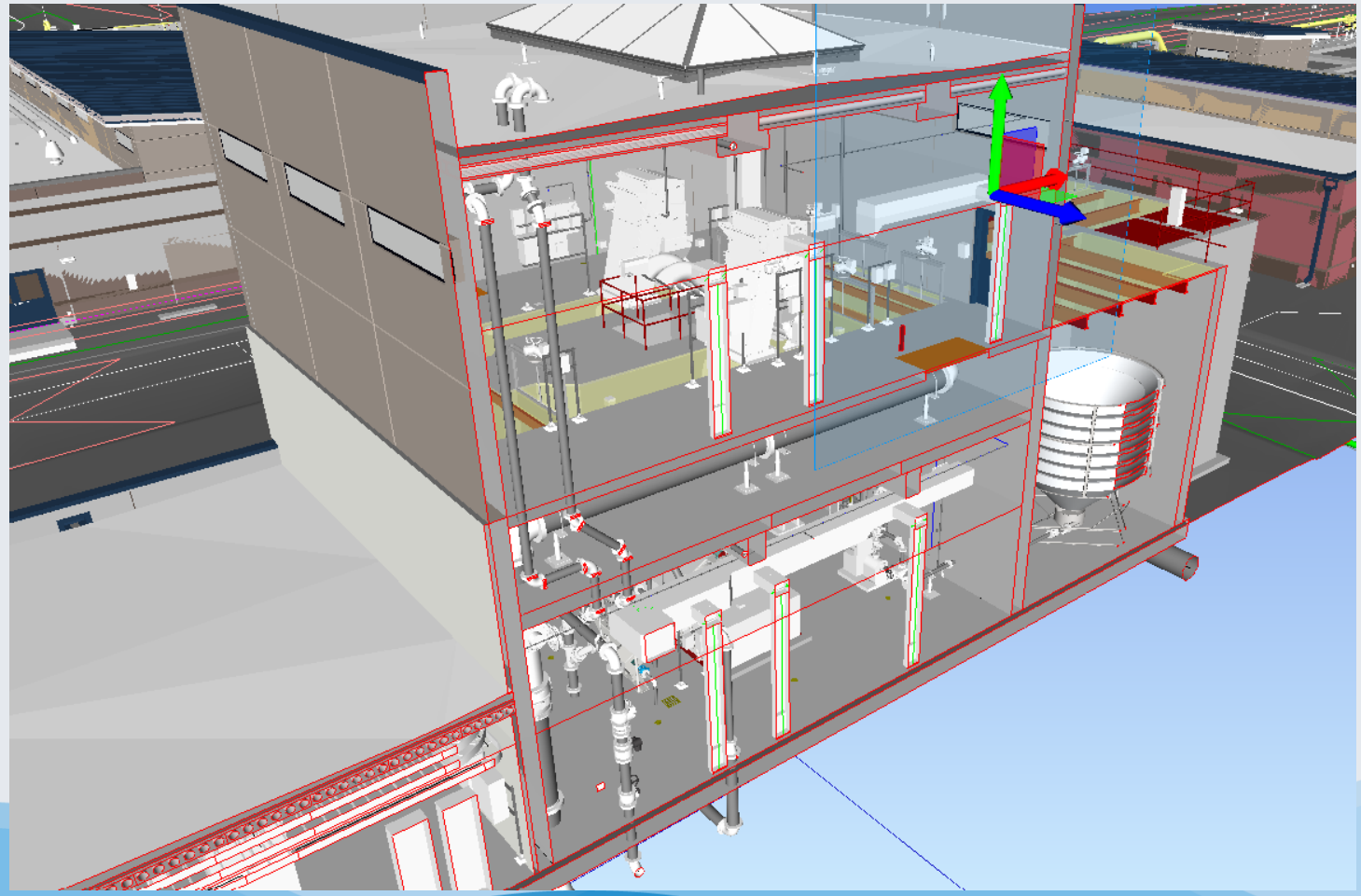
- (5) Pumps
  - (3) 150 HP
  - (2) 50 HP
- (1) Future Pump
- Electrical Building (Utility Entrance)



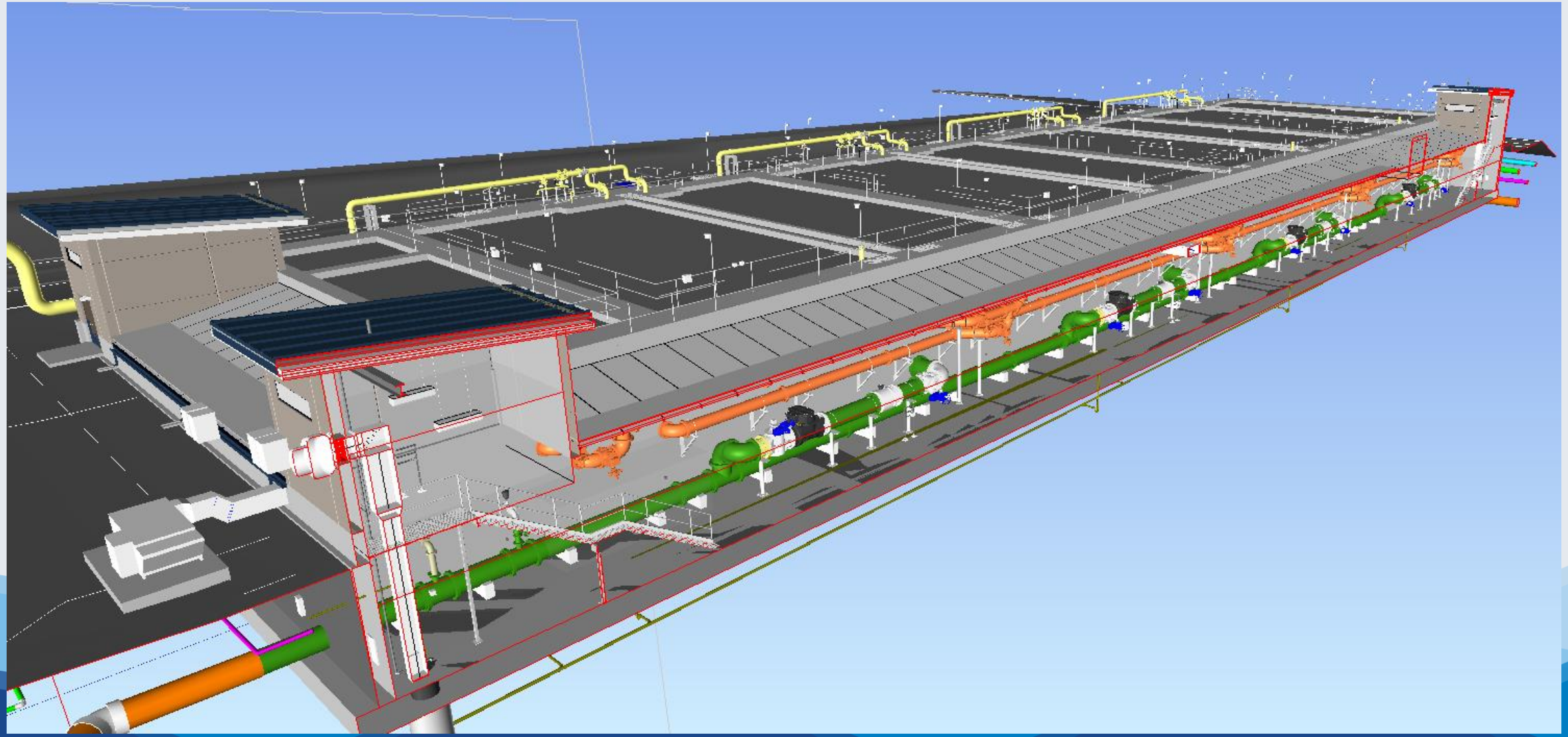


Headworks Building & Electrical Room

- (2) 6mm Screens
- (1) Headcell Grit Removal
- Separate Electrical Room
- Designed for Future Growth

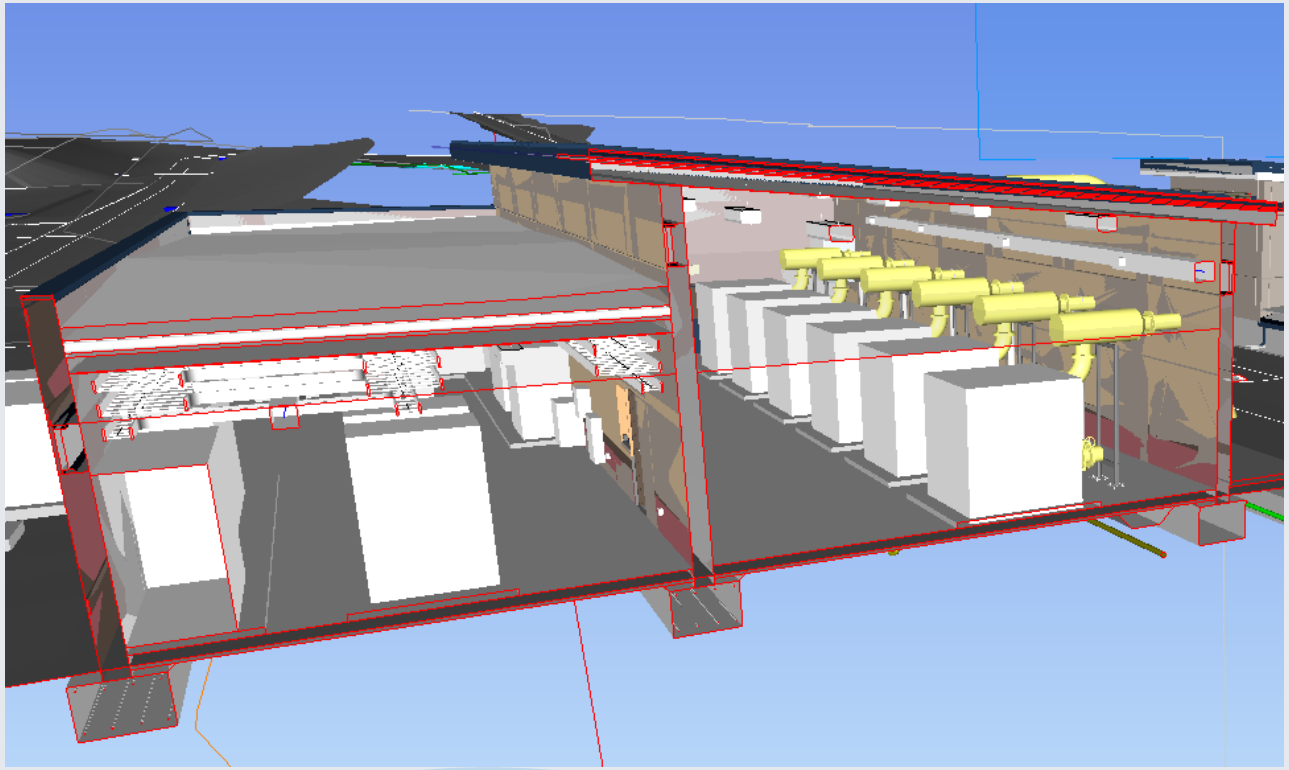


AGS Basin



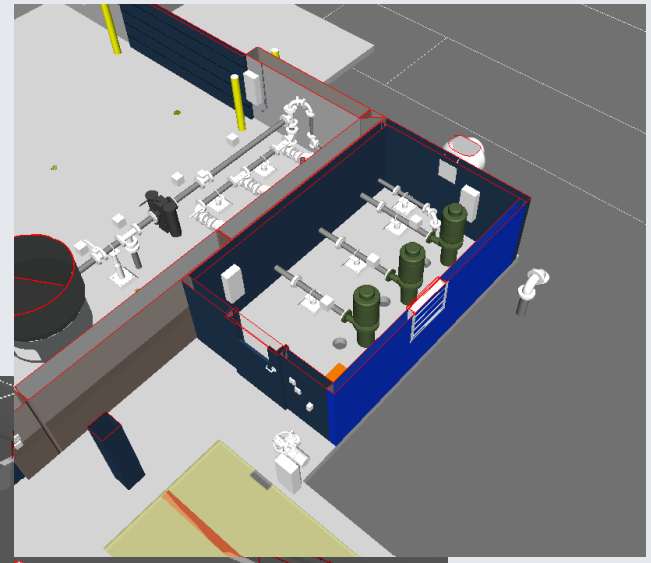
Blower Building

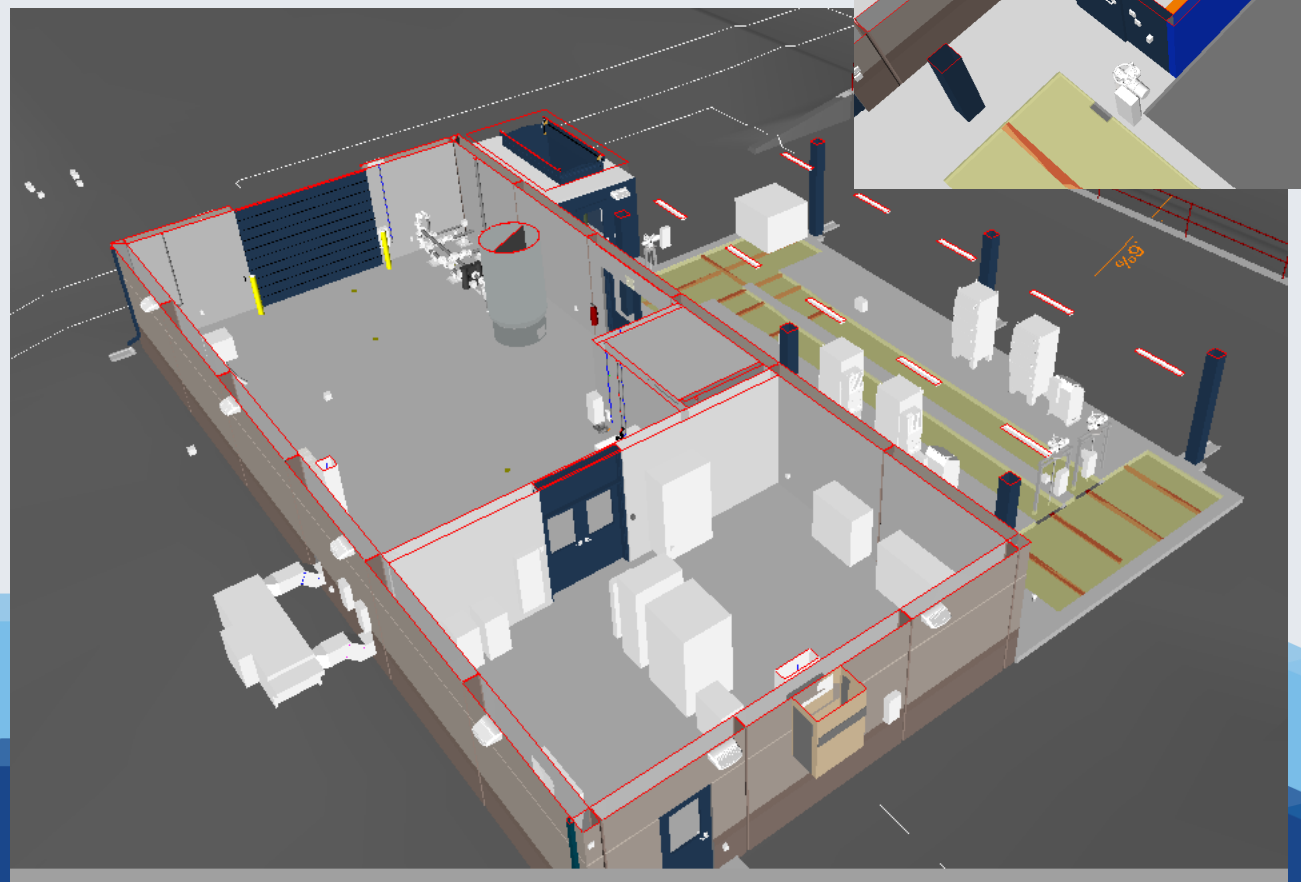
- (5) PD Blowers
  - (2) Future
- Electrical Room for Blower Building and AGS System
- Utility Entrance



Disinfection Building

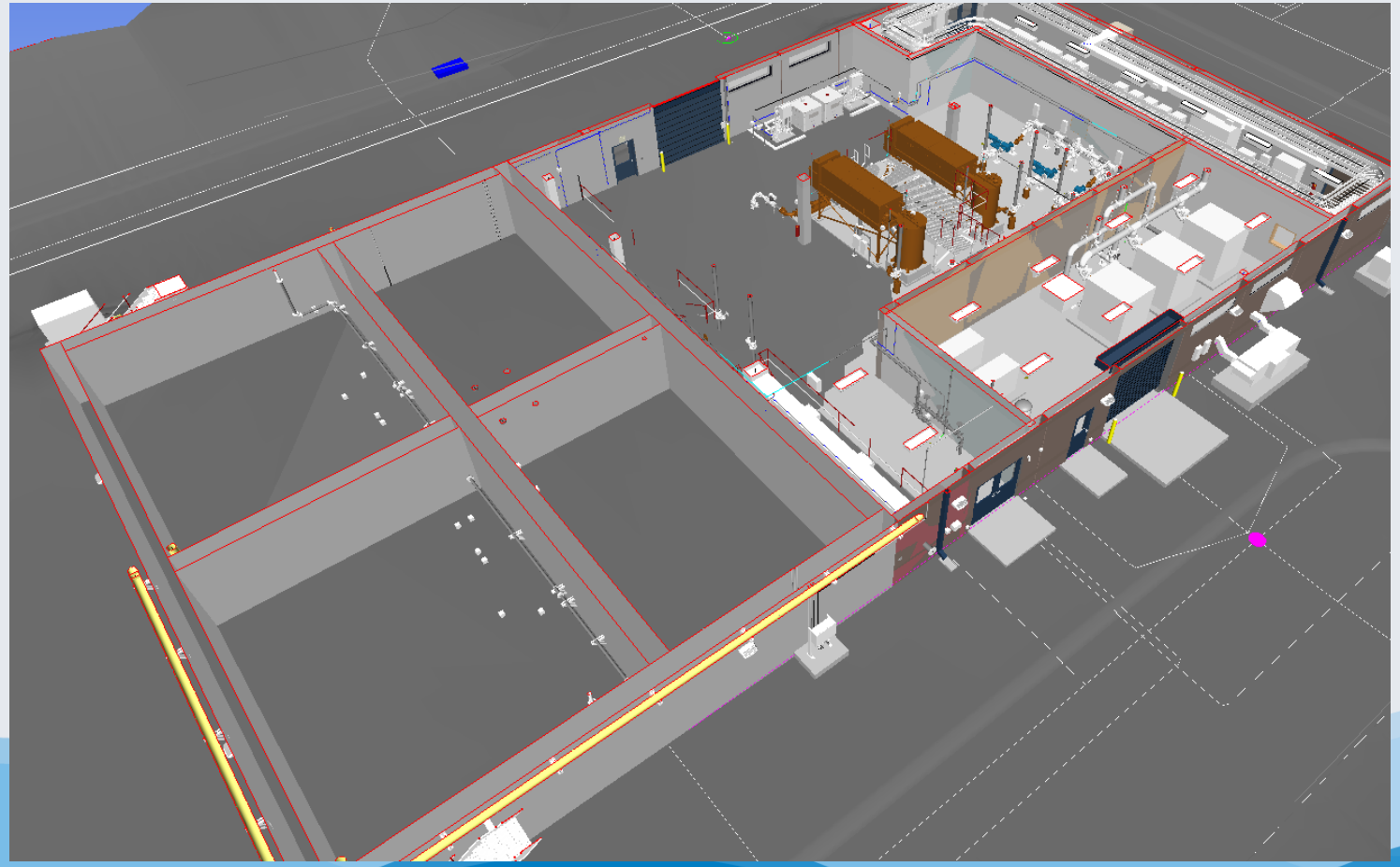
- (2) UV Channels
  - Accommodates future growth
  - Discharges to cascading aeration structure
- Electrical Room
- Storage Space
- Process Water Pump Station





Solids Handling Building

- (2) Rotary Drum Thickeners
  - (1) Future
- Electrical Room
- (3) PD Blowers
- Holding Tanks
  - Thin Sludge (Uncovered, Medium Bubble Diffusers)
  - Thick Sludge (Covered, Large Bubble Diffusers)



Admin Building

- Laboratory
- Incoming Electrical Utilities
- Electrical Room
- Office Space
- Conference Room

Old Facility Demolition

- Sludge Holding Cell Closure Plan
- Return Site to Natural Conditions

Final Reminders

Questions are due February 2nd, 2026, by 2pm

Sealed Bids are due February 3rd, 2026, by 2pm

Deliver to:

Marzella Newman-Buckner, Senior Procurement Officer
4800 E. 63rd Kansas City,
Kansas City, MO 64130

Questions?

Project Manager: Shawn Cross
Phone Number: (816) 513-0442
E-Mail: Shawn.Cross@kcmo.org

Assistant Project Manager: Conner Hanlon
Phone Number: (816)-513-0526
E-Mail: Conner.Hanlon@kcmo.org

Contract Administrator: Marzella Newman-Buckner
Phone Number: (816) 513-0319
E-Mail: Marzella.Newman-Buckner@kcmo.org

Mandatory Pre-Bid Meeting In-Person Attendance
(1/15/2026 2-3PM)

Attendance List for

Pre-Proposal Conference

Project Number: 81000927

Day/Time: 1/15/2026 Time: 2:00 P.M.

Name:	Email:	Organization:
Conner Hanlon	Conner.Hanlon@kcmo.org	KC Water
Audrey Schultz	audrey.schultz@garney.com	Garney
Brian Schultz	bschultz@garney.com	Garney
Dave Farkas	dfarkas@garney.com	Garney
John Clary	JClary@Fluidequip	Fluid
Sara Buckler	SBuckler@Goodwinbros.com	Goodwin Bros
Madelyn Buckler	Mbuckler@goodwinbros.com	Goodwin Bros
Paul Koehler	paul.koehler@otcindustrial.com	JCI/OTC
Steve Harris	sharris@garney.com	Garney
Bryce Dickmeyer	bdickmeyer@burnsmcd.com	BMcD
Craig Brewster	ckbrewster@customengr.com	CET
MAXIM RAILEANU	mraileanu@dowdlingerbuilder	Dowdlinger.
Jake Jacobson	jake@247fire.net	24/7 Fire Protection
Garrett Isenhart	GRIsenhart@winsupply.com	KC Winwater
Grant Mckinsey	Ghmckinsey@winsupply.com	Kc winwater
Toby Aylward	toby.aylward@markone.com	Mark One Electric
Dpp Reifer	gregg.Reifer@markone	markone Electric
Kevin D. Guy	KGUY@Hayneseqip.com	HECI/Haynes Equip.
Michael Bierman	michael.bierman@wachter.com	WACHTER, Inc.
DAVE NAVARO	david.navaro@wachter.com	WACHTER, Inc.
Clint Hayes	clint@megakc.com	MegaKC Inc.
Benny Avery	bavery@kissickco.com	KISSICK

David McClure	dmcclure@pps-mw.com	PPS
Justin Henry	Jhenry@etank.net	E-TANK
Rick VanKirk	RICK@LETTSVANKIRK.com	LETK, VANKIRK & ASSOC
Kevin McCleary	kmccleary@heavycontractors.com	Crossland Heavy
Todd Nason	toddnason@midamericalube.com	MACU
Kate Mansker	kate.p@p-e2.com	Pfefferkorn Eng.
Conner Brady	CBrady@SouthWestSolutions.com	South West Solutions Group
Caleb LaRue	caleb.larue@vectorcy.com	Vector
August Dunlap	adunlap@fluidequip.com	Fluid Equipment
JACKSON NZIOKI	JACKSON.NZIOKI@ALPHACE.COM	ALPHA ENERGY & ELECTRIC
AUSTIN PFANNENSTIEL	AUSTINP@megakc.com	MEGAKC
Bryce Trew	btrew@foleyeq.com	Foley Power Solutions
Corbyn Hutchings	corbyn@ecosafekc.com	EcoSafe Environmental
Shawna Sorenson	ssorenson@haynesequip.com	Haynes Equipment
Robert Wells	rwells@ruckerconstruction.com	rucker construction
Amber Roberts	amber.roberts@endress.com	Endress + Hauser
KEITH JENSEN	KEITH.JENSEN@WELLS.BUILD	WELLS PRECAST
JON PRINCE	DUALIN EQUIPMENT	jprince@impact-automations.com
KEVIN ROBERTSON	KevinR@Vazquezcc.com	Vazquez Commercial Contractors
Woody Haywood	woodyhaywood@NTSafety.com	NAT Trench Safety
Griffan Kerkmann	Griffan.kerkmann@hercrentals.com	Herc Rentals
Levi Brunton	lbrunton@scruggsco.com	Scruggs Co.
James Brizendine	jbrizendine@hgcons.com	Hg Consult, Inc.
Eric Swenson	eswenson@dodlinger.build	Dodlinger
Ryan Hola	rhola@stadiumsheetmetal.com	Stadium Sheet Metal
Justin Ricketts	JRicketts@lippertmechanical.com	Lippert Mechanical
Keith Lawson	klawson@lippertmechanical.com	Lippert Mechanical

Mandatory Pre-Bid Meeting Online Attendance (1/15/2026 2-3PM)

Todd Creek Pre-Bid Conference Online Attendance		
Name	**Email**	**Organization**
Hanlon, Conner	Conner.Hanlon@kcmo.org	KC Water
Newman-Buckner, Marzella	Marzella.Newman-Buckner@kcmo.org	KC Water
Cross, Shawn	Shawn.Cross@kcmo.org	KC Water
McCall, Chris	Chris.McCall@Lubrizol.com	Lubrizol
Russ Stark - Realm Construction, Inc.	russ@realmconstructioninc.com	Johnson Controls
Dickmeyer, Bryce	bdickmeyer@burnsmcd.com	Burns & McDonnell
Birkey, Philip	Philip.Birkey@brownandroot.com	Brown and Root Industrial Services
Dan Hansen	dhansen@rbemidwest.com	Radmacher Brothers Excavating
Scott Seitzer	scotts@kissickco.com	
Tina Fuller	tina@tcfullerconstruction.com	
Brad Emory	bemory@garney.com	Garney Construction
Zachary Oursler	zoursler@esi-cc.com	ESI Contracting, Corp.
Gabe Probst	gprobst@dondlinger.build	Dondlinger Construction
Kevin Waldron	kevin.waldron@garney.com	Garney Construction
Patrick Burns	patrick@brisonexcavating.com	Brison Excavating
13148425335 (Unverified)		
Joey Perell	jperell@garney.com	Garney Construction
Pratt Todd	Todd.Pratt@andritz.com	Andritz
Jason Barker	jason@wellner.com	
Cody Schmidt	cschmidt@garney.com	Garney Construction
Anderson, Blake	Blake.W.Anderson@kcmo.org	KC Water
David Farkas	dfarkas@garney.com	Garney Construction
Avery Purtee	apurtee@kissickco.com	
Matt Rothermel	mrothermel@kissickco.com	
Steve Stanish (Unverified)		Aqua-Aerobics Systems
Ward, Paul E (External)	peward@burnsmcd.com	Burns & McDonnell
Brad August	baugust@processcontrolsolutions.com	Durkin Equipment
Frank Bazzano	frankb@goldenharvestinc.com	Golden Harvest, Inc.
Jeffrey Marshall	jmarshall@alexandermechanical.com	Alexander Mechanical
15857276060 (Unverified)		
Kelkar, Saurabh	Saurabh.Kelkar@kcmo.org	KC Water
Gilmore, Marcus	MGilmore@McCarthy.com	
Josh Riedy	jriedy@universalblowerpac.com	Universal Blower Pac
Doug Wachsnicht	dwachsnicht@goodwinbros.com	
Brian Trigg	btrigg@p1-service.com	P1 Service, Lenexa
19137493296 (Unverified)		
Hruska, Jack	JLHruska@mccarthy.com	
Zachary Benson	zbenson@garney.com	
Landon Behrens	landonb@convergerep.com	
Derek Rephlo	derek.rephlo@jci.com	Johnson Controls
14056279522 (Unverified)		
13145745108 (Unverified)		
Tyler Lehman	Tyler.Lehman@vectorcag.com	Vector CAG
Dave Caughlin	dcaughlin@structuraltec.com	
Marc Pedrotti	marcp@repedrotti.com	R. E. Pedrotti Co.
George Kellum	George.Kellum@kusterswater.com	
18165643115 (Unverified)		
18168784980 (Unverified)		
19132950780 (Unverified)		
Michelle Land	mland@alexandermechanical.com	Alexander Mechanical
John Warren	john.warren@mersino.com	Mersino Water Solutions
18166735823 (Unverified)		
18165874039 (Unverified)		
Jon Gray	jgray@duboisengrs.com	
Fasika Kassaye	fasika@abayconstruction.com	
Keller, Jeff (External)	jkeller@burnsmcd.com	Burns & McDonnell

SECTION 00410.04 – EQUIPMENT QUESTIONNAIRE

The Bidder shall enter in the spaces provided the names of the manufacturers of equipment which Bidder proposes to furnish and shall submit this Equipment Questionnaire with its Bid. Owner will review and evaluate the information before award of the Contract.

Only one manufacturer's name shall be listed for each item of equipment. Upon award of a contract, the named equipment shall be furnished. Substitutions will be permitted only if named equipment does not meet the requirements of the Contract Documents, the manufacturer is unable to meet the delivery requirements of the construction schedule, or the manufacturer is dilatory in complying with the requirements of the Contract Documents. Substitutions shall be subject to concurrence of Owner and shall be confirmed by Change Order.

Preliminary acceptance of equipment listed by manufacturer's name shall not in any way constitute a waiver of the specifications covering such equipment; final acceptance will be based on full conformity with the Contract Documents.

Failure to furnish all information requested or entering more than one manufacturer's name for any item in this Equipment Questionnaire may be cause for rejection of the Bid.

	Equipment	Manufacturer
	Section 26 24 13 - SWITCHBOARDS	
	Section 26 24 14 - DOCKING STATION FOR PORTABLE GENERATOR	
	Section 26 24 16 - PANELBOARDS	
	Section 26 24 19 – Motor Control Centers	
	Section 26 29 23 – Variable-Frequency Motor Controllers	
	Section 26 33 53 – Static Uninterruptible Power Supply	
	Section 26 50 00 - Lighting	
	Section 33 32 22 – Submersible Pumps	
	Section 35 20 16 – Slide Gates	
	Section 43 11 38 – Positive Displacement Blowers	
	Section 43 23 57 – Progressive Cavity Pumps	
	Section 43 23 58 – Rotary Lobe Pumps	
	Section 46 21 13 – Screening Equipment	

	Section 46 33 33 – Polymer Feed	
	Section 46 66 00 – Ultraviolet Light Disinfection Equipment	
	Section 46 71 33 – Rotary Drum Thickener	

End of Section

SECTION 01140 – WORK RESTRICTIONS

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes: Requirements for sequencing and scheduling the Work affected by existing site and facility; work restrictions; and coordination between construction operations and plant operations.

1.02 SUBMITTALS

A. Baseline Schedule with OCCP tasks.
B. Operational Change Control Plan (OCCP) Form.
C. Progress Schedule with OCCP tasks.

1.03 GENERAL CONSTRAINTS ON SEQUENCE AND SCHEDULING OF WORK

A. Wastewater projects:
    1. The Todd Creek Wastewater Treatment Plant is the City's only means of treating sewage for the designated service area prior to discharging to the Missouri River. Impairing the operational capabilities of this treatment plant will result in serious environmental damage and monetary fines.
    2. Conduct Work in a manner that will not impair the operational capabilities of essential elements of the treatment process or reduce the capacity of the entire treatment plant below levels sufficient to treat the quality of raw wastewater to the water quality limitations specified in the discharge permit. 3. Conduct commissioning and process start-up activities as specified in Section 01757 - Commissioning in a manner that will not impair the operational capabilities of essential elements of the treatment process or reduce the capacity of the entire existing treatment plant below levels sufficient to treat the quality of raw wastewater to the water quality limitations specified in the discharge permit.
    3. The status of the new treatment plant shall be defined as "operational" when it is capable of treating the entire quantity of wastewater received at the Todd Creek WWTP to the water quality limits specified in the discharge permit.
B. Work sequence and constraints:
    1. Utilize description of critical events in work sequence in this Section as a guideline for scheduling and undertaking the Work.
    2. Work sequence and constraints presented do not include all items affecting completion of the Work, but are intended to describe critical events necessary to minimize disruption of the existing facilities and to ensure compliance with National Pollutant Discharge Elimination System (NPDES) permit requirements.
C. Instrumentation and controls process performance testing:
    1. After the Process Operational Period, test PCIS system as specified in Section 01757 - Commissioning.

1.04 SHUTDOWN AND CONSTRUCTION CONSTRAINTS

A. Normal working hours:
    1. Construction will take place during normal working hours as defined:
        a. 7AM to 6PM Monday through Friday.

b. Refer to 0700 General Conditions Section 6.03 for further restrictions.

B. Construction Operations and Safety Constraints
   1. In recognition of nearby property owners concerns with construction activities, the following restrictions shall be adhered to unless otherwise accepted by the Owner in writing:
      a. Vehicle access for the demolition of the existing plant shall be through NW 144th Street. Access shall not be permitted off of Todd Creek Road.
      b. Vehicle and motorized equipment on site shall include backup/reverse alarms that utilize a "white noise" system rather than the more typical "beeper" system. The system should be in compliance with OSHA requirements for this type of safety device.

C. General shutdown constraints:
   1. Execute the Work while the existing facility is in operation.
   2. Some activities may be accomplished without a shutdown.
   3. Apply to activities of construction regardless of process or work area.
   4. Activities that disrupt plant or utilities operations must comply with these shutdown constraints.
   5. Organize work to be completed in a minimum number of shutdowns.
   6. Provide thorough advanced planning, including having required equipment, materials, and labor on hand at time of shutdown.
   7. Notify the City at least 30 days in advance of any tasks that will require dewatering and cleaning to allow the City the appropriate amount of time to conduct the work.
   8. Where required to minimize treatment process interruptions while complying with specified sequencing constraints, provide temporary pumping, power, lighting, controls, instrumentation, and safety devices.
   9. Final determination of the permitting of shutdowns will be the sole judgment of the Owner.
   10. Owner maintains the ability to abort on the day of the scheduled shutdown or to hold at any hold point.

D. Hoover Heights force main shutdown constraints:
   1. The Hoover Heights force main should not be shutdown for more than 8 hours at a time.
   2. There should be no rain in the area for at least 48 hours prior to the work taking place.
   3. Notify the City at least 14 days in advance of any tasks that will require the Hoover Heights force main to be shutdown.
   4. Coordinate all work that will require a shutdown with the Owner.
   5. Final determination of the permitting of shutdowns will be the sole judgment of the Owner.
   6. Owner maintains the ability to abort on the day of the scheduled shutdown or to hold at any hold point.

E. Unit process availability work limitations:
   1. Shutdowns and tie-ins or other activities that disrupt plant operations shall not occur if the following conditions exist unless approved by the OWNER in writing, or specified in 01140.01 Process and System Shutdown Constraints Schedule:
      a. Rainfall has occurred in the 2 days preceding the shutdown.
      b. Rainfall is forecast for more than 3 of the first 14 days of the shutdown period.

F. Shutdown activities:
   1. Scheduling:
      a. Perform between the hours of 10 p.m and 4 a.m. unless otherwise specified herein or as approved by Owner.

2. Unplanned shutdowns due to emergencies are not defined in this Section.

G. Dewatering of existing process and disposal of residue:
    1. When the Owner has turned the process unit over to the Contractor for modification or temporary use, the Contractor is responsible for costs and procedures required to dewater and dispose of liquid, solids, etc. in the process unit unless the Owner has made prior arrangements.
        a. Drainage and disposal of process unit liquids, solids, etc. into another treatment process unit on the plant site may be allowed if approved in advance by the Engineer and Owner and is conducted in accordance with the Project requirements.
        b. Costs for dewatering, disposal of solids and residuals, and preparation of surfaces for the Work are Contractor's responsibility.
            (1) Includes tipping fees for the removal and disposal of the grit/debris.
        c. Dewatering of grit/debris to meet landfill requirements is the responsibility of the Contractor.
        d. Contractor shall provide adequate time in schedules for draining and cleanup of basins and channels.

H. Refer to the Process and System Shutdown Constraints Schedule in Section 01140.01 for additional requirements.

1.05 OPERATIONAL CHANGE CONTROL PLAN (OCCP)

A. Refer to Section 01140.02 - Operational Change Control Plan (OCCP) Documents for additional requirements.
B. Submit Baseline Schedule, as specified in Section 01320 – Construction Progress Documentation.
C. No consideration will be given to claims of additional time and cost associated to preparing OCCPs required by the Owner and Engineer to complete this work in a manner that facilitates proper operation of the facility and compliance with effluent discharge criteria.
D. Where required to minimize treatment process interruptions while complying with specified sequencing constraints, provide temporary pumping, power, lighting, controls, instrumentation, and safety devices.
E. OCCPs are required whenever an existing asset or a new asset that could affect treatment or conveyance are modified including but not limited to set points and operational modes.

1.06 COMPLIANCE WITH NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT

A. The existing facility is operating under the terms of a NPDES permit issued by the State of Missouri. This permit specifies the water quality limits that the plant must meet prior to discharge of effluent. A copy of the existing permit (Missouri State Operating Permit No. MO-0024961) is on file for review at the Administration Building at the Todd Creek WWTP. The facility includes a biological process that may require extended periods of acclimation after a shutdown or other impact before it can reasonably be expected to perform as intended. Contractor will include adequate acclimation time as a part of any construction activity.
B. Perform work in a manner that will not prevent the existing facility from achieving the finished water quality requirements established by regulations.
C. Bear the cost of penalties imposed on the Owner for discharge violations caused by actions of the Contractor.

1.07 REQUIREMENTS FOR OPERATION OF PLANT AND MAINTAINING CONTINUOUS OPERATION OF EXISTING FACILITIES

A. Facilities or conditions required to keep the existing plant operational include, but are not limited to, the following:
    1. Influent gravity sewer
    2. Influent screening and pumping
    3. Blowers
    4. Aeration basins and clarifiers
    5. RAS/WAS pump station
    6. UV disinfection system
    7. Existing outfall
B. Contractor shall protect existing grating with steel traffic plate or other Engineer approved means when moving equipment or supplies over grating.
C. Maximum allowable superimposed live load on any existing grating or walkway shall be 50 psf. If higher loads are proposed, provide detailed calculations demonstrating adequacy of grating or walkway system for higher loads. The calculations shall be sealed and signed by a registered professional engineer and submitted to the Engineer for review and acceptance.

1.08 OPERATION AND MAINTENANCE ACCESS

A. Provide safe, continuous access to process control equipment for plant operations personnel.

1.09 COORDINATION OF THE WORK

A. Maintain overall coordination of the Work.
B. Obtain construction schedules from subcontractors and suppliers and assume responsibility for correctness.
C. Incorporate schedules from subcontractors and suppliers into Progress Schedule to plan for and comply with sequencing constraints.

1.10 WORK BY OTHERS

A. Where proper execution of the Work depends upon work by others, inspect and promptly report discrepancies and defects.

1.11 UTILITIES

A. Provide advance notice to request and utilize services of the Missouri One Call System (www.mo1call.com or 1-800-344-7483 (DIG-RITE)) for location and marking of underground utilities operated by utility agencies other than the Owner.
B. Maintain electrical, telephone, water, gas, sanitary facilities, and other utilities within existing facilities in service. Provide temporary utilities when necessary.
C. New yard utilities were designed using existing facility drawings.
    1. Field verification of utilities locations was not performed during design.
    2. Services crossed or located nearby new yard utilities may require relocation and possible shutdowns.

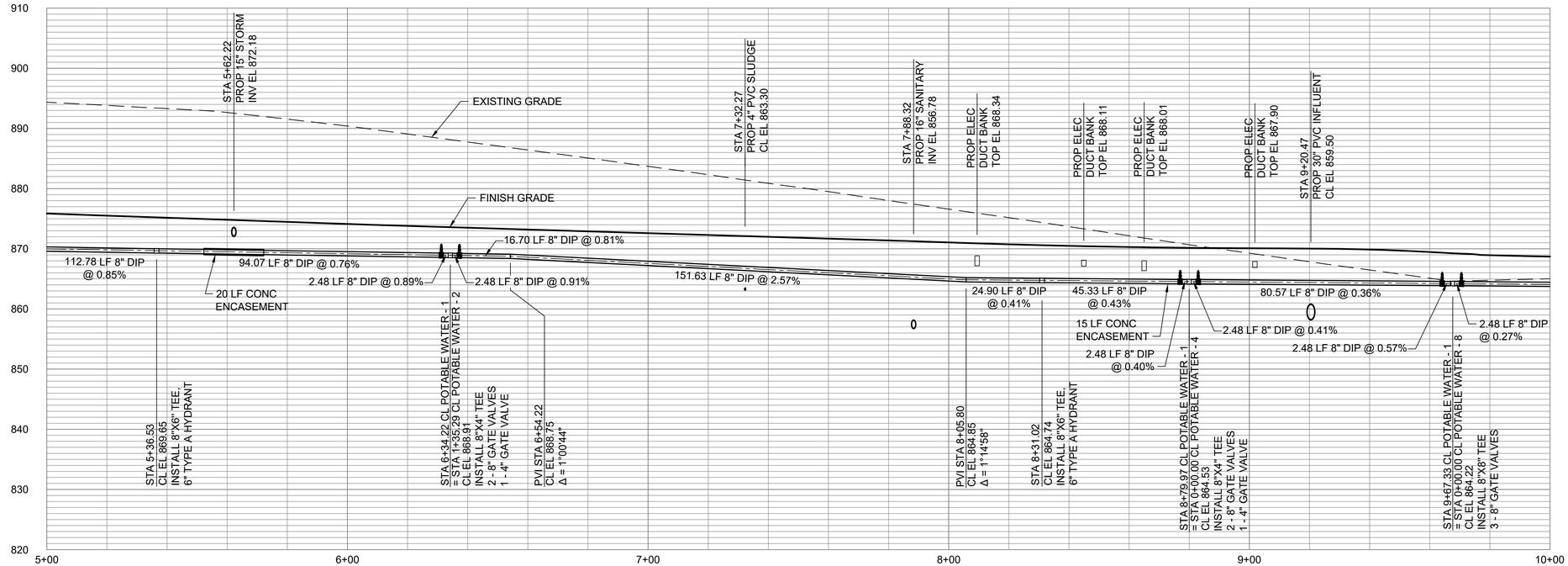
PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 PROCESS AND SYSTEM SHUTDOWN CONSTRAINTS SCHEDULE

A. Refer to the Process and System Shutdown Constraints Schedule in Section 01140.01 for constraints on process and system shutdowns.
B. Requests for variance from any part of this schedule must be approved in writing by the OWNER.
C. The planned date of shutdown as listed on the Operational Change Control Plan (OCCP) form shall be considered the start date for the shutdown and used for calculating the actual shutdown duration, unless approved in writing by the OWNER. In the event that the OWNER can shut down a system or process prior to the planned date of shutdown and the CONTRACTOR agrees to commence work at that earlier date, the date that the CONTRACTOR commences work on the associated process or system shall be considered the start date for the shutdown and for calculating the actual shutdown duration.
D. These constraints are intended to supplement the demolition, modification, tie-in, and construction activities and constraints described in Article 1.12 of this Section.

End of Section



POTABLE WATER - 1 PROFILE

HORIZONTAL 0 10' 20' 40' SCALE IN FEET

VERTICAL 0 10' 20' SCALE IN FEET

NO.	DATE	BY:	CHECKED:	DESCRIPTION
0	12/19/25	RLL	MDG	ISSUED FOR BID

REVISION BLOCK

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

STATE OF MISSOURI
RACHELLE LYNN LOWE
NUMBER PE-2010019568
PROFESSIONAL ENGINEER

RACHELLE LYNN LOWE
CIVIL
PE - 20100019568

FOR WSD USE:

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

POTABLE WATER PROFILES - SHEET 2

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
D. HOWARD	M. GALLAGHER	12/19/25			

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698				D116

PROJECT NO. 81000927 SHEET 310 OF 643

KCWATER
CUSTOM ENGINEERING MECHANICAL & ELECTRICAL ENGINEERING
DuBois Consultants CIVIL + STRUCTURAL ENGINEERING
WELLNER architects
BURNS McDONNELL
9400 WARD PARKWAY
KANSAS CITY, MO 64114
Burns & McDonnell Engineering Co, Inc
816-333-9400
LICENSEE NO. 000165

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PLOT DATE 12/18/2025 11:06:20 AM by DHOWARD
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TODD CREEK WATER/WASTEWATER TREATMENT PLANT - HEADWORKS CONDUIT AND CABLE SCHEDULE

CONDUIT							CABLE						
NO.	#SET	SIZE	TYPE	ROUTE	FROM	TO	NO.	TYPE	#	SIZE	GND	FROM	TO
C35022	1	3/4"	RAL	AG	GRSC-PLC-061	GRSC-FIT-311	I-GRSC-FIT311-01	IVV1	2-TSP	#18		GRSC-PLC-061	GRSC-FIT-311
C35023	1	3/4"	RAL	AG	GRSC-FIT-311	GRSC-FE-311	I-GRSC-FE311-01	MFR CABLE				GRSC-FIT-311	GRSC-FE-311
C35024	1	3/4"	RAL	AG	GRSC-PLC-061	PSEW-FIT-101	I-PSEW-FIT101-01	IVV1	2-TSP	#18		GRSC-PLC-061	PSEW-FIT-101
C35025	1	3/4"	RAL	AG	PSEW-FIT-101	PSEW-FE-101	I-PSEW-FE101-01	MFR CABLE				PSEW-FIT-101	PSEW-FE-101
COMMUNICATIONS CONDUITS							COMMUNICATIONS CABLES						
	1			TRAY	GRSC-MCP-100	GRSC-NER-061	T-GRSC-MCP100-01	CAT 6				GRSC-MCP-100	GRSC-NER-061
	1			TRAY	GRSC-MCP-200	GRSC-NER-061	T-GRSC-MCP200-01	CAT 6				GRSC-MCP-200	GRSC-NER-061
	1			TRAY	GRSC-MCP-300	GRSC-NER-061	T-GRSC-MCP300-01	CAT 6				GRSC-MCP-300	GRSC-NER-061
	1			TRAY	GRSCS-OIT-061	GRSCS-NER-061	T-GRSCS-OIT061-01	CAT 6				GRSCS-OIT-061	GRSCS-NER-061
	1			TRAY	GRSCS-PLC-061	GRSCS-NER-061	T-GRSCS-PLC061-01	CAT 6				GRSCS-PLC-061	GRSCS-NER-061
	1			TRAY	GRSCS-PLC-061	GRSCS-NER-061	T-GRSCS-PLC061-02	CAT 6				GRSCS-PLC-061	GRSCS-NER-061
	1			TRAY	GRSCS-SWB-001	GRSCS-NER-061	T-GRSCS-SWB021-01	CAT 6				GRSCS-SWB-021	GRSCS-NER-061
	1			TRAY	GRSCS-UPS-051	GRSCS-NER-061	T-GRSCS-UPS051-01	CAT 6				GRSCS-UPS-051	GRSCS-NER-061
C37001	1	2"	40PVC	BG	GRSC-FPP-001	ADM-FPP-001	F-GRSC-FPP001-01	FIBER	24 FIBER			GRSC-FPP-001	ADM-FPP-001
C38001	1	3/4"	RAL	AG	GRSC-CAMSEC-071	GRSC-NER-061	T-GRSC-CAMSEC071-01	CAT 6S				GRSC-CAMSEC-071	GRSC-NER-061
	1			TRAY	GRSC-ACP-071	GRSC-NER-061	T-GRSC-ACP071-01	CAT 6				GRSC-ACP-071	GRSC-NER-061
C38002	1	3/4"	RAL	AG	GRSC-ACP-071	DOOR 300A	T-GRSC-ACP071-11	SUPPLIER CABLE				GRSC-ACP-071	DOOR 300A
C38003	1	3/4"	RAL	AG	GRSC-ACP-071	DOOR 300B	T-GRSC-ACP071-12	SUPPLIER CABLE				GRSC-ACP-071	DOOR 300B
C38004	1	3/4"	RAL	AG	GRSC-ACP-071	DOOR 301A	T-GRSC-ACP071-21	SUPPLIER CABLE				GRSC-ACP-071	DOOR 301A
C38005	1	3/4"	RAL	AG	GRSC-ACP-071	DOOR 302A	T-GRSC-ACP071-22	SUPPLIER CABLE				GRSC-ACP-071	DOOR 302A
C38006	1	3/4"	RAL	AG	GRSC-ACP-071	DOOR 301B	T-GRSC-ACP071-23	SUPPLIER CABLE				GRSC-ACP-071	DOOR 301B
C38007	1	3/4"	RAL	AG	GRSC-ACP-071	DOOR 305A	T-GRSC-ACP071-31	SUPPLIER CABLE				GRSC-ACP-071	DOOR 305A

GENERAL NOTES:

1. CABLES LEAVING THE ELECTRICAL ROOM AND DESIGNATED AS ABOVE GRADE MAY BE ROUTED THROUGH CABLE TRAY BEFORE TRANSITIONING TO THE INDICATED CONDUIT TYPE.

KCWATER
CUSTOM ENGINEERING
MECHANICAL & ELECTRICAL ENGINEERING
DuBois Consultants
CIVIL + STRUCTURAL ENGINEERING
WELLNER architects
BURNS McDONNELL
9400 WARD PARKWAY
KANSAS CITY, MO 64114
Burns & McDonnell Engineering Co, Inc
816-333-9400
Licensee No. 000165

NO.	DATE	BY:	CHECKED:	DESCRIPTION
0	12/19/25	PRS	SST	ISSUED FOR BID

REVISIONS

STATE OF MISSOURI
SHAWN TAYLOR
NUMBER
PE-2015030345
12/19/2025
PROFESSIONAL ENGINEER

SHAWN TAYLOR
ELECTRICAL
PE-2015030345

FOR WSD USE:

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

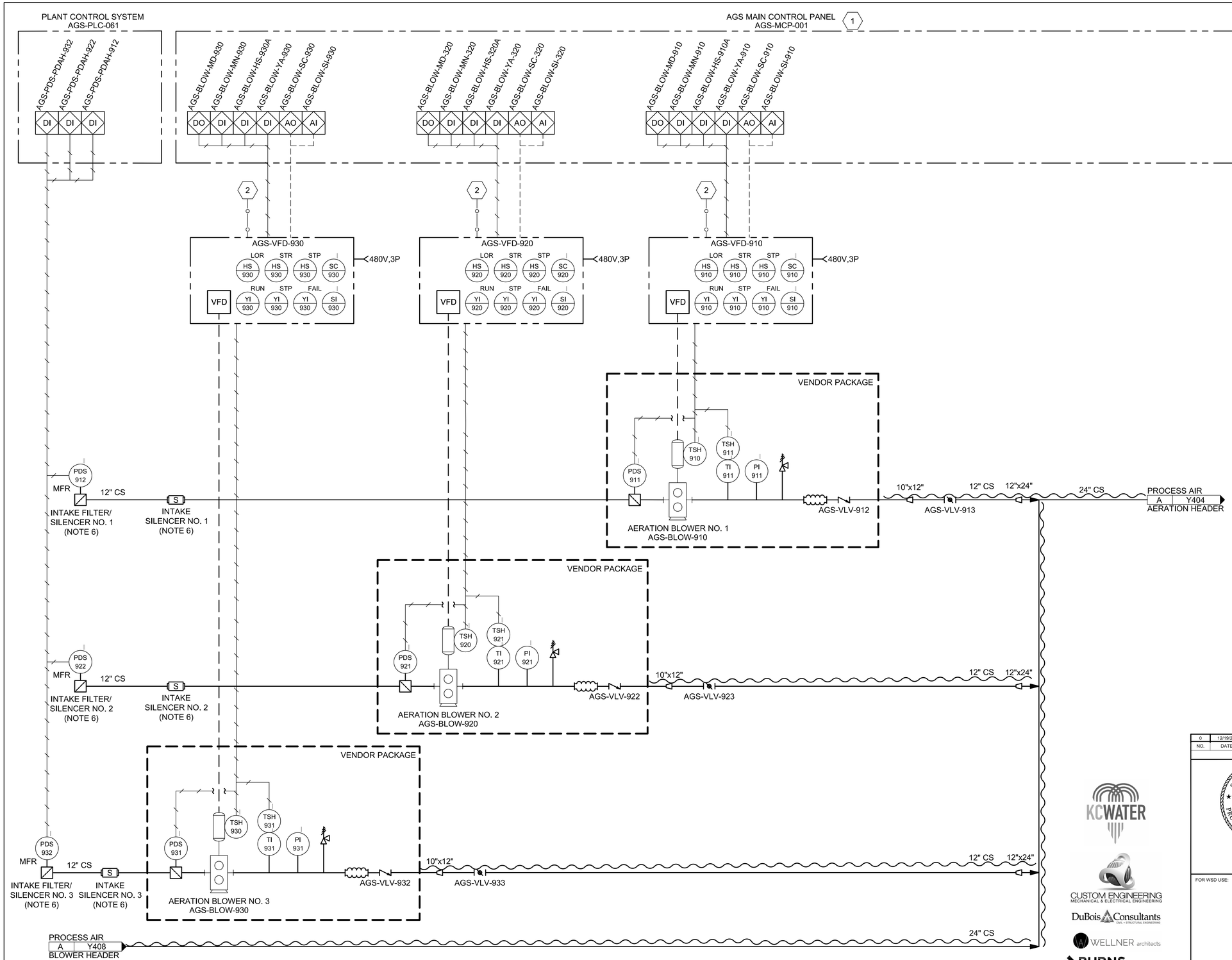
HEADWORKS ELECTRICAL CABLE TAG SCHEDULE SHEET 3

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
A.GIAMPETRUZZI	C.BEHRENDS	12/19/25	34W	53N	36

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	-

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	E393

PROJECT NO.	SHEET	OF
81000927	-	643



GENERAL NOTE:

1. AERATION BLOWER PACKAGES PROVIDED BY AGS EQUIPMENT SUPPLIER.
2. AERATION BLOWER AND AUTOMATIC AGS BASIN AIR SUPPLY VALVES CONTROLLED VIA AGS EQUIPMENT SUPPLIER-PROVIDED PROGRAMMABLE LOGIC CONTROLLER (PLC). REFER TO Y402 AND Y403 FOR AUTOMATIC AGS BASIN AIR SUPPLY VALVE LOCATIONS.
3. ALL INSTRUMENT TAGS ON THIS SHEET ARE PRECEDED BY LEVELS 5 AND 6 TAG CODES "SEC-AGS" UNLESS OTHERWISE INDICATED. ALL OTHER EQUIPMENT TAGS ARE PRECEDED BY LEVEL 5 CODE "SEC."
4. ALL FLANGED CONNECTIONS ON DISCHARGE SIDE OF BLOWER SHALL UTILIZE FLUOROELASTOMER (FKM) GASKET MATERIAL.
5. INTERIOR CARBON STEEL DISCHARGE PIPING SHALL BE INSULATED PER SECTION 22 07 19 PLUMBING PIPING INSULATION.
6. INTAKE FILTER/SILENCERS WITH PRESSURE DIFFERENTIAL TRANSMITTER, AND INTAKE SILENCERS SHALL BE PROVIDED BY AGS EQUIPMENT SUPPLIER. COMPATIBILITY SHALL BE CONFIRMED BY BLOWER MANUFACTURER. COMMON AERATION HEADER PRESSURE TRANSMITTER AGS-PIT-901 ON SHEET Y408 SHALL BE PROVIDED BY AGS EQUIPMENT SUPPLIER.

KEYED NOTE:

1. I/O POINTS ASSOCIATED WITH VENDOR-SUPPLIED SYSTEM EQUIPMENT WILL BE COMMUNICATED TO THE PLANT CONTROL SYSTEM OVER THE ETHERNET NETWORK.
2. NOT ALL I/O POINTS ARE SHOWN FOR THE ASSOCIATED VFD. REFER TO SPECIFICATIONS AND I/O LIST FOR ADDITIONAL POINTS TO BE COMMUNICATED TO THE PLANT CONTROL SYSTEM OVER THE ETHERNET NETWORK.

NO.	DATE	BY:	CHECKED:	DESCRIPTION
0	12/19/25	PEW	ALW	ISSUED FOR BID

REVISION BLOCK

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

STATE OF MISSOURI
PAUL E. WARD
NUMBER PE-2016017691
PROFESSIONAL ENGINEER

PAUL E. WARD
PROCESS
PE-2016017691

FOR WSD USE:

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

AERATION BLOWERS NO. 1, NO. 2 AND NO. 3
PROCESS & INSTRUMENTATION DIAGRAM

KCWATER

CUSTOM ENGINEERING
MECHANICAL & ELECTRICAL ENGINEERING

DuBois Consultants
CIVIL • STRUCTURAL • PLANNING

WELLNER architects

BURNS McDONNELL
9400 WARD PARKWAY
KANSAS CITY, MO 64114
Burns & McDonnell Engineering Co, Inc
816-333-9400
LICENSEE NO. 000165

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
C. JENSEN	A.WADDOUPS	9/12/25	34W	53N	36

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698				Y407

PROJECT NO. 81000927

SHEET 275 OF 643

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PLANT CONTROL SYSTEM
SPB-PLC-061

SCIN-LCP-YA-201 (DI) · SCIN-LCP-YA-101 (DI) · SCIN-LIT-LI-201 (AI) · SCIN-LIT-LI-101 (AI) · SCIN-LSH-LAH-101 (DI) · SCIN-LSH-LAH-201 (DI) · SCIN-VLV-ZI-112 (AI) · SCIN-VLV-ZC-112 (AO) · SCIN-VLV-ZSC-112 (DI) · SCIN-VLV-YA-112 (DI) · SCIN-VLV-HS-112 (DI) · SCIN-PMP-MD-110 (DO) · SCIN-PMP-ES-110 (DI) · SCIN-PMP-HS-110A (DI) · SCIN-PMP-HS-110B (DI) · SCIN-PMP-MN-110A (DI) · SCIN-PMP-TAH-110A (DI) · SCIN-PMP-TAH-110B (DI) · SCIN-PMP-PAL-110 (DI) · SCIN-PMP-PAH-110 (DI) · SCIN-PMP-YA-110 (DI) · SCIN-FIT-FI-111 (AI) · SCIN-FIT-FI-211 (AI) · SCIN-PMP-MD-210 (DO) · SCIN-PMP-ES-210 (DI) · SCIN-PMP-HS-210A (DI) · SCIN-PMP-HS-210B (DI) · SCIN-PMP-MN-210A (DI) · SCIN-PMP-TAH-210A (DI) · SCIN-PMP-TAH-210B (DI) · SCIN-PMP-PAL-210 (DI) · SCIN-PMP-PAH-210 (DI) · SCIN-PMP-YA-210 (DI)

AIR/CARRIER PIPE A Y802 — 6" PVC — ODOR CONTROL SYSTEM
2" FLEXIBLE HOSE
2" FLEXIBLE HOSE
2" FLEXIBLE HOSE
COMPRESSED AIR A Y706 — 1 1/2" SST — MIXING COMPRESSORS
THICKENED SLUDGE A Y703 — 6" DIP-E — SLUDGE THICKENING
THIN SLUDGE B Y702 — 6" DIP-E — RDT BYPASS
THICKENED SLUDGE B Y703 — 6" DIP-E — SLUDGE THICKENING
THIN SLUDGE C Y702 — 6" DIP-E — RDT BYPASS

(2) MIXING VALVE PANEL (VENDOR) — 120V — SCIN-LCP-101
(2) MIXING VALVE PANEL (VENDOR) — 120V — SCIN-LCP-201
NOZZLE MOUNTING JOINT (TYP)
1" PVC AIR (TYP)
3/8" OXIDANT TUBING (TYP)
1/4" OXIDANT TUBING (TYP)
NOZZLE NO. 1 · NOZZLE NO. 2 · NOZZLE NO. 3 · NOZZLE NO. 4 · NOZZLE NO. 5 · NOZZLE NO. 6
LIT 101 · LSH 101 · LIT 201 · LSH 201

THICKENED SLUDGE TANK NO. 1
THICKENED SLUDGE TANK NO. 2

SCIN-RVSS-110 — 480V,3P — RVSS — LOR HS 110 · STR HS 110A · STP HS 110A · SC 110 — RUN YI 110 · STP YI 110 · FAIL YI 110 · SI 110 — (1) (2)
SCIN-RVSS-210 — 480V,3P — RVSS — LOR HS 210 · STR HS 210A · STP HS 210A · SC 210 — RUN YI 210 · STP YI 210 · FAIL YI 210 · SI 210 — (3) (4)

SCIN-VLV-112 — 480V,3P — FAIL ZSC 112 · LOR YA 112 · OC HS 112 · HS 112 — ZC 112 · ZT 112 — (M)
SCIN-VLV-112 (NOTE 2) — PSL 110A · PI 110A — PSH 110B · PI 110B — 8" DIP-E — SCIN-VLV-113 (NOTE 2) (M) — 1 1/2" — FE 111 — FIT 111 — 120V — (5)
SCIN-VLV-111 (NOTE 2) — 10" DIP-E — 1 1/2" — TE 110 · TAY 110 · TSH 110 — (3) — (4)
SLUDGE LOADOUT PUMP NO. 1 SCIN-PMP-110
18" DIP — SCIN-VLV-111
SCIN-VLV-212 (NOTE 2) (4) (M) — PSL 210A · PI 210A — PSH 210B · PI 210B — 8" DIP-E — SCIN-VLV-213 (NOTE 2) (M) — 1 1/2" — FE 211 — FIT 211 — 120V — (5)
SCIN-VLV-211 (NOTE 2) — 10" DIP-E — 1 1/2" — TE 210 · TAY 210 · TSH 210 — (3) — (4)
SLUDGE LOADOUT PUMP NO. 2 SCIN-PMP-210
SOLIDS PROCESSING BUILDING

(1) ES HS 110 · SS HS 110B · RUN YI 110 · STP YI 110 — SCIN-CST-101
(2) ES HS 110 · STP HS 110C · RUN YI 110 · STP YI 110 — SCIN-CST-102
OFFSITE SLUDGE HAULING
(3) ES HS 210 · STP HS 210B · RUN YI 210 · STP YI 210 — SCIN-CST-201
(4) ES HS 210 · STP HS 210C · RUN YI 210 · STP YI 210 — SCIN-CST-202
OFFSITE SLUDGE HAULING

GENERAL NOTES:

1. ALL INSTRUMENT TAGS ON THIS SHEET ARE PRECEDED BY LEVELS 5 AND 6 TAG CODES "SOL-SCIN" UNLESS OTHERWISE INDICATED. ALL OTHER EQUIPMENT TAGS ARE PRECEDED BY LEVEL 5 CODE "SOL."
2. SCIN-VLV-111, SCIN-VLV-112, SCIN-VLV-113, SCIN-VLV-211, SCIN-VLV-212, AND SCIN-VLV-213 SHALL BE FULL-PORT STYLE PLUG VALVE.

KEYED NOTES:

1. I/O POINTS ASSOCIATED WITH VENDOR-SUPPLIED SYSTEM EQUIPMENT WILL BE COMMUNICATED OVER ETHERNET NETWORK.
2. VALVE PANELS, DOWNSTREAM DROP PIPES AND LARGE BUBBLE MIXING GRIDS PROVIDED BY EQUIPMENT VENDOR. VENDOR SUPPLY INCLUDES ONE VALVE PANEL PER TANK WITH THREE (3) POPPET VALVES, THREE (3) DROP PIPES, AND THREE (3) LARGE-BUBBLE DIFFUSER GRID ASSEMBLIES.
3. TEMPERATURE RELAY SUPPLIED BY PUMP SKID MANUFACTURER AND INSTALLED WITHIN THE VFD ENCLOSURE.
4. MOTOR OPERATOR FIELD DEVICES AND I/O FOR THE INDICATED MODULATING VALVE ARE NOT SHOWN FOR CLARITY. REFER TO VLV-112 THIS SHEET FOR TYPICAL FIELD DEVICES AND I/O. REFER TO CONTROL SCHEMATICS AND I/O LIST FOR ADDITIONAL DETAILS.
5. THE INDICATED FLOW METER DISPLAY IS LOCATED ON THE EXTERIOR OF THE SOLIDS PROCESSING BUILDING, ADJACENT TO THE ASSOCIATED CONTROL STATION.

NO.	DATE	BY:	CHECKED:	DESCRIPTION
0	12/19/25	PEW	ALW	ISSUED FOR BID

REVISION BLOCK

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

THICKENED SLUDGE HOLDING AND LOADOUT PROCESS & INSTRUMENTATION DIAGRAM

STATE OF MISSOURI · PAUL E. WARD · NUMBER PE-2016017691 · PROFESSIONAL ENGINEER

PAUL E. WARD
PROCESS
PE-2016017691

FOR WSD USE:

KCWATER

CUSTOM ENGINEERING
MECHANICAL & ELECTRICAL ENGINEERING

DuBois Consultants
CIVIL + STRUCTURAL ENGINEERING

WELLNER architects

BURNS McDONNELL
9400 WARD PARKWAY
KANSAS CITY, MO 64114
Burns & McDonnell Engineering Co, Inc
816-333-9400
LICENSEE NO. 000165

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
P. WARD	A.WADDOUPS	12/19/25	34W	53N	36

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698				Y704

PROJECT NO. 81000927 — SHEET 280 OF 643

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PLANT CONTROL SYSTEM
SPB-PLC-061

SCIN-AIRC-MN-310 | SCIN-AIRC-YA-310A | SCIN-AIRC-YA-310B
SCIN-AIRC-MN-320 | SCIN-AIRC-YA-320A | SCIN-AIRC-YA-320B
DI | DI | DI | DI | DI | DI

GENERAL NOTES:

1. ALL INSTRUMENT TAGS ON THIS SHEET ARE PRECEDED BY LEVELS 5 AND 6 TAG CODES "SOL-SCIN" UNLESS OTHERWISE INDICATED. ALL OTHER EQUIPMENT TAGS ARE PRECEDED BY LEVEL 5 CODE "SOL."
2. COMPRESSORS AND AIR RECEIVER TANK SHALL BE PROVIDED BY LARGE BUBBLE MIXING VENDOR (REF SECTION 46 42 57).

UNIT-MOUNTED CONTROL PANEL SCIN-LCP-310
480V,3P
PDS 310
3/4" SS
3/4"x1 1/2"
SCIN-VLV-311
1 1/2" SS
ATM
PI
SCIN-VLV-301
1 1/2" SS
COMPRESSED AIR
A | Y704
THICK SLUDGE TANKS
SLUDGE MIXING AIR COMPRESSOR NO. 1 SCIN-AIRC-310
VENDOR PACKAGE
AIR RECEIVER TANK SCIN-TANK-301 (VENDOR PACKAGE)
120V
FLOOR DRAIN

UNIT-MOUNTED CONTROL PANEL SCIN-LCP-320
480V,3P
PDS 320
3/4" SS
3/4"x1 1/2"
SCIN-VLV-321
SLUDGE MIXING AIR COMPRESSOR NO. 2 SCIN-AIRC-320
VENDOR PACKAGE
FLOOR DRAIN

NO.	DATE	BY:	CHECKED:	DESCRIPTION
0	12/19/25	PEW	ALW	ISSUED FOR BID

REVISION BLOCK

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

STATE OF MISSOURI · PAUL E. WARD · NUMBER PE-2016017691 · PROFESSIONAL ENGINEER

PAUL E. WARD
PROCESS
PE-2016017691

FOR WSD USE:

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

THICKENED SLUDGE TANK MIXING AIR COMPRESSORS AND RECEIVING TANK PROCESS & INSTRUMENTATION DIAGRAM

KCWATER
CUSTOM ENGINEERING MECHANICAL & ELECTRICAL ENGINEERING
DuBois Consultants CIVIL + STRUCTURAL ENGINEERING
WELLNER architects
BURNS McDONNELL
9400 WARD PARKWAY
KANSAS CITY, MO 64114
Burns & McDonnell Engineering Co, Inc
816-333-9400
LICENSEE NO. 000165

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
C. JENSEN	A.WADDOUPS	9/12/25	34W	53N	36

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698				Y706

PROJECT NO. 81000927 | SHEET 282 OF 643

Saved 12-18-2025 8:46:58 AM by PEWARD
PLOT DATE: 12/18/2025 4:16:44 PM by PEWARD
C:\USERS\PEWARD\APPDATA\LOCAL\AUTODESK\AUTOCAD PLANT 3D\COLLABORATION\CACHE\125460_TODDCREEKFP_P3D_V2021\PID DWG\125460_Y706.DWG

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

ADDENDUM NUMBER 003

Project/Contract Number: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrade

ISSUE DATE: **1/22/2026**

Bidders are hereby notified that the Bidding and Contract Documents for the above project, for which Bids are to be received on **February 24, 2026**, are amended as follows:

Information to Bidders The following is provided to Bidders for information only:

1. All tree removal shall be limited to occur between November 1 and March 31, during bat inactive season. Note 12 added to revision 1 of L000 conveying as such.
2. Energy code analysis compliance certificate updated for Administration Building. Drawing ECA-1 revision 1 conveying as such.
3. Blower Building electrical room equipment pads revised sizing. Drawing S415 revision 003 conveying as such.
4. IPS-VLV-102 callout on D202 is revised to 20 inches. Drawing D202 revision 1 conveying as such.
5. IPS-GATE-001 and IPS-GATE-101 on D206 are revised. Tags on Section A and B have been revised. Drawing D206 revision 1 conveying as such.
6. Keyed valve 14 on D303 is revised to PSEW-VLV-103. Drawing D303 revision 1 conveying as such.
7. Removed unnecessary details from D411 and D412. Drawings revised as such.
8. AGS-VLV-112 callout on D413 is revised to 4 inches. Drawing D413 revision 1 conveying as such.
9. Keyed valve names 16 and 24 on D703 are revised to STH-VLV-101 and STH-VLV-201, respectively. Keyed valve 29 has been revised to STH-VLV-232. Drawing D703 revision 1 conveying as such.
10. Valve tag WAS-VLV-307 on D707 is revised. Drawing D707 revision 1 conveying as such.
11. Added instruments to Y402 and Y403.
12. Reducers and line size revisions were added on drawing Y702. Drawing Y702 revision 1 conveying as such.
13. Added I/O points for four (4) AGS basin nitrate probes, eight (8) analytical controllers, and revised probe tags on Specification Section 40 61 96A – I/O List.
14. Added four (4) AGS basin nitrate probes, eight (8) analytical controllers, six (6) alarm horns, and seven (7) alarm strobes, and revised probe tags on Specification Section 40 70 00A – Instrument List
15. Drawing E001includes general note edits and symbol notes added.
16. Drawing E007 includes clarifications for flex cable connections to pump motors and horse powers updated. Motor detail A note added.
17. Drawing E011 includes edit to thread rod size.
18. Drawing E012 includes edited note.
19. Drawing E015 includes clarification for conduit seal detail.

20. Drawing E020 includes relocated cable tray and hanger rod details moved to E025 and E026
21. Drawings E025, E026 include added cable tray installation details
22. Drawing E043 includes added nitrate probes, analytical controllers, and associated interconnections
23. Drawing E051 includes added ventilation alarm equipment for the AGS Basins.
24. Drawing E114 includes sign labeled.
25. Drawing E116 includes clarification for roadway handhole requirements.
26. Drawing E118: Revised note for Lighting Controller Coordinates.
27. Drawing E119: Clarification for site ground cable route added. Revised notes.
28. Drawing E120: No fence grounding on this sheet so related notes deleted.
29. Drawing E131: Section A updated schedule.
30. Drawing E132: Section F1 sheet number updated.
31. Drawing E134: Sections Q and R updated schedule.
32. Drawing E135: Sections S and T updated schedule.
33. Drawings E201, E202, E204, E205, E206: Circuit changes clouded.
34. Drawings E211, E212: Additional ground ring connections to equipment clouded.
35. Drawing E221: Circuit changes and note changes clouded.
36. Drawing E222: Circuit changes and panel moves clouded.
37. Drawing E231: Revised Note.
38. Drawing E251: Relocated control panel IPS-LWCO-001
39. Drawing E291: Circuit changes clouded.
40. Drawings E301, E302, E303: Circuit changes clouded.
41. Drawings E311, E312: Additional ground ring connections to equipment clouded.
42. Drawing E321: Circuit changes and note changes clouded. Deleted three VFDs.
43. Drawing E322: Showed Water Heater and note changes clouded.
44. Drawings E331, E332: Revised symbols and note changes.
45. Drawing E351: Corrected floor plan for Headworks Building
46. Drawings E391, E401, E402, E403, E404, E405: Circuit changes clouded.
47. Drawings E411, E412, E413: Additional ground ring connections to equipment clouded.
48. Drawing E421: Revised receptacles, circuits and tag locations.
49. Drawing E422 : Added AITs to120V circuits.
50. Drawing E423: Light switches removed. Added AITs to 120V circuits. Moved circuit tags.
51. Drawing E441: Revised equipment pads in the electrical room
52. Drawing E442: Added ventilation alarm horns and strobes, nitrate probes, and analytical controllers at the AGS Basins
53. Drawing E443: Added ventilation alarm horns and strobes, nitrate probes, and analytical controllers at the AGS Basins
54. Drawing E451: Revised equipment pads in the electrical room
55. Drawing E491: Circuit changes clouded.
56. Drawing E493: Added cables for ventilation alarms, nitrate probes, and analytical controllers
57. Drawing E494: Existing cables from the previous sheet were relocated to this sheet
58. Drawings E601, E602, E603: Circuit changes clouded.
59. Drawings E611, E612: Additional ground ring connections to equipment clouded. Added notes.
60. Drawings E621, E622: Circuit changes clouded and note revisions clouded.
61. Drawing E641: Corrected the north arrow for the Parshall flume structure and revised the underground duct bank route

62. Drawings E691, E701, E702, E703, E704: Circuit changes clouded.
63. Drawings E711, E712: Additional ground ring connections to equipment clouded and notes clouded.
64. Drawings E721, E722: Circuit changes and additions, notes and tag changes clouded.
65. Drawings E791, E801, E802, E803: Circuit changes clouded.
66. Drawing E811: Revised ground ring connections to equipment clouded and notes clouded.
67. Drawing E821: VAV circuits added and clouded. Circuit changes, device relocations, tag and new notes clouded.
68. Drawing E831: Added missing Keyed Note 1.
69. Drawing E891: Circuit changes clouded.
70. Drawing M002: Air unit schedule updated to show equipment revisions.

71. Section 46 53 60 – Granular Sludge Biological Treatment System
    a. Subparagraph 2.10.C.5.a.
        i. Change item (12) to the following:

(12) Basin No. 1 Analytical Transmitter AGS-AIT-120:
(a) Transmitter/controller for monitoring the following basin probes:
i) Analytical element AGS-AE-121 for measuring pH/Temperature.
ii) Analytical element AGS-AE-122 for measuring dissolved oxygen (DO).

        ii. Insert the following item (13) after item (12):

(13) Basin No. 1 Analytical Transmitter AGS-AIT-130:
(a) Transmitter/controller for monitoring the following basin probes:
i) Analytical element AGS-AE-131 for measuring total suspended solids (TSS).
ii) Analytical element AGS-AE-132 for measuring oxidation-reduction potential (ORP).

        iii. Insert the following item (14) after item (13):

(14) Basin No. 1 Analytical Transmitter AGS-AIT-140
(a) Transmitter/controller for monitoring the following basin probes:
i) Analytical Elements AGS-AE-141 for measuring nitrates.

    b. Subparagraph 2.10.C.5.b.
        i. Change item (12) to the following:

(12) Basin No. 2 Analytical Transmitter AGS-AIT-220:
(a) Transmitter/controller for monitoring the following basin probes:
i) Analytical element AGS-AE-221 for measuring pH/Temperature.
ii) Analytical element AGS-AE-222 for measuring DO.

        ii. Insert the following item (13) after item (12):

(13) Basin No. 2 Analytical Transmitter AGS-AIT-230
(a) Transmitter/controller for monitoring the following basin probes:
i) Analytical element AGS-AE-231 for measuring TSS.

ii) Analytical element AGS-AE-232 for measuring ORP.

iii. Insert the following item (14) after item (13):

(14) Basin No. 2 Analytical Transmitter AGS-AIT-240
(a) Transmitter/controller for monitoring the following basin probes:
i) Analytical Elements AGS-AE-241 for measuring nitrates.

c. Subparagraph 2.10.C.5.c.

iv. Change item (12) to the following:

(12) Basin No. 3 Analytical Transmitter AGS-AIT-320:
(a) Transmitter/controller for monitoring the following basin probes:
i) Analytical element AGS-AE-321 for measuring pH/Temperature.
ii) Analytical element AGS-AE-322 for measuring DO.

v. Insert the following item (13) after item (12):

(13) Basin No. 3 Analytical Transmitter AGS-AIT-330
i) Analytical element AGS-AE-331 for measuring TSS.
ii) Analytical element AGS-AE-332 for measuring ORP.

vi. Insert the following item (14) after item (13):

(14) Basin No. 3 Analytical Transmitter AGS-AIT-340
(a) Transmitter/controller for monitoring the following basin probes:
i) Analytical Elements AGS-AE-341 for measuring nitrates.

d. Subparagraph 2.10.C.5.d.

vii. Change item (12) to the following:

(12) Basin No. 4 Analytical Transmitter AGS-AIT-420:
(a) Transmitter/controller for monitoring the following basin probes:
i) Analytical element AGS-AE-421 for measuring pH/Temperature.
ii) Analytical element AGS-AE-422 for measuring DO.

viii. Insert the following item (13) after item (12):

(13) Basin No. 4 Analytical Transmitter AGS-AIT-430
(a) Transmitter/controller for monitoring the following basin probes:
i) Analytical element AGS-AE-431 for measuring TSS.
ii) Analytical element AGS-AE-432 for measuring ORP.

ix. Insert the following item (14) after item (13):

(14) Basin No. 4 Analytical Transmitter AGS-AIT-440
(a) Transmitter/controller for monitoring the following basin probes:
i) Analytical Elements AGS-AE-441 for measuring nitrates.

e. Subparagraph 2.11.C.

i. Insert the following item (4) after item (3):

(4) The probe shall be suitable for installation within a Class I, Division 2 area.

f. Subparagraph 2.11.D
   i. Insert the following item (4) after item (3):

(4) The probe shall be suitable for installation within a Class I, Division 2 area.

g. Subparagraph 2.11.F
   i. Insert the following item (5) after item (4):

(5) The probe shall be suitable for installation within a Class I, Division 2 area.

h. Subparagraph 2.11.G.
   i. Item 1. shall have the following changes:
      a. In the second sentence replace the text "*nitrate"* with the text "*ammonium*".
   ii. Item 2. shall have the following changes:
      a. Replace the text "*analyzer"* with the text "*probe*".
   iii. Insert the following item 5. after item 4.:

5. The probe shall be suitable for installation within a Class I, Division 2 area.

   iv. Insert the following paragraph 2.11.H after paragraph 2.11G:

H. Nitrate Probe:
1. Function: Continuously measure, indicate, and transmit the nitrate concentration of the liquid in the AGS Basins. Each nitrate probe shall be integrated with the Equipment Supplier PLC for monitoring, data recording, and process control.
2. Prove one Nitrate Probe per basin.
3. Nitrate probe shall be Nitratax 2 mm path length, as manufactured by Hach. Probe shall utilize UV absorption technology, and shall provide reagent-free operation. Sensor shall include self-cleaning device.
4. Nitrate probe shall be provided with pole mount assembly and handrail support. Equipment Supplier shall provide complete mounting and support assembly.
5. The probe shall be suitable for installation within a Class I, Division 2 area.

i. Subparagraphs 2.11.H-M
   i. With the insertion of a new paragraph 2.11.H, the subsequent paragraphs shall be renumbered as the following:

I. Orthophosphate Analyzer:
J. Total Suspended Solids Probe:
K. Universal Controller Probe Modules:
L. Universal Controller Probe Modules – Horiba
M. Air Flow Meter:

j. Subparagraph 2.11.J
   i. Insert the following item 6. after item 5.:

6. The probe shall be suitable for installation within a Class I, Division 2 area.

k. Subparagraph 2.11.K
   ii. Item 1.a shall have the following changes:

a. Replace the text “One (1) Hach SC1000” with the text “Three (3) Hach SC4500.

iii. Delete item 1.b and replace with the following:

b. Each basin controller shall be rated for use with Class I, Division 2 rated probes. All accessories to achieve C1D2 probe rating shall be provided.

72. Section 33 12 16 – Utility Valves and Accessories
    b. Table 3: Plug Valves Provided by Contractor
        i. Tag IPS-VLV-101 size changed from 20” to 24”
        ii. Tag WAS-VLV-305A size changed from 6” to 4”
        iii. Tag WAS-VLV-305B size changed from 6” to 4”
        iv. Tag WAS-VLV-306A size changed from 6” to 4”
        v. Tag WAS-VLV-306B size changed from 6” to 4”

73. Section 40 61 96A – I/O List
    c. Updated I/O point information shown clouded.

74. Section 40 70 00A – Instrument List
    d. Updated instrument information shown clouded.

75. Section 46 71 33 – Rotary Drum Thickener Equipment
    e. Subparagraph 2.03.B
        i. Insert after Design Criteria “(for each Rotary Drum Thickener unit)”

Bidding Requirements: N/A

Contracting Requirements: N/A

Specifications:

1. Delete and replace the following section(s):
    a. Delete Section 33 12 16 - UTILITY VALVES AND ACCESSORIES and replace with the following Document, 33 12 16 - UTILITY VALVES AND ACCESSORIES
    b. Delete 40 61 96A - IO LIST and replace with the following Document, 40 61 96A - IO LIST
    c. Delete Section 40 70 00A - INSTRUMENT LIST and replace with the following Document, 40 70 00A - INSTRUMENT LIST
    d. Delete Section 46 53 60 - GRANULAR SLUDGE BIOLOGICAL TREATMENT PACKAGE and replace with the following Document, 46 53 60 - GRANULAR SLUDGE BIOLOGICAL TREATMENT PACKAGE
    e. Delete Section 46 71 33 - ROTARY DRUM THICKENER EQUIPMENT and replace with the following Document, 46 71 33 - ROTARY DRUM THICKENER EQUIPMENT

Drawings:

1. D202 – Enlarged Influent Pump Station Plan
2. D206 – Influent Pump Station Sections and Details

3. D303 – Headworks Building Section and Details Sheet 1
4. D411 – AGS Iso Diagram Sheet 1
5. D412 – AGS Iso Diagram Sheet 2
6. D413 – AGS Iso Diagram Sheet 3
7. D603 – Effluent Structure Plan and Section
8. D703 – Enlarged Sludge Thickening Plan
9. D707 – Solids Processing Building Sections and Details Sheet 2
10. E001 - ELECTRICAL LEGEND SHEET 1
11. E007 - TYPICAL ELECTRICAL DETAILS SHEET 1
12. E011 - TYPICAL ELECTRICAL DETAILS SHEET 5
13. E012 - TYPICAL ELECTRICAL DETAILS SHEET 6
14. E015 - TYPICAL ELECTRICAL DETAILS SHEET 9
15. E020 - TYPICAL RACEWAY DETAILS SHEET 1
16. E025 - TYPICAL CABLE TRAY DETAILS SHEET 1
17. E026 - TYPICAL CABLE TRAY DETAILS SHEET 2
18. E043 - CONTROL DIAGRAMS SHEET 13
19. E051 - CONTROL DIAGRAMS SHEET 21
20. E114 - SHEET 1 ELECTRICAL SITE POWER PLAN
21. E115 - SHEET 2 ELECTRICAL SITE POWER PLAN
22. E116 - SHEET 3 ELECTRICAL SITE POWER PLAN
23. E118 - SHEET 2 ELECTRICAL SITE LIGHTING PLAN
24. E119 - SHEET 1 ELECTRICAL SITE GROUNDING PLAN
25. E120 - SHEET 2 ELECTRICAL SITE GROUNDING PLAN
26. E131 - ELECTRICAL DUCT BANK SECTIONS SHEET 1
27. E132 - ELECTRICAL DUCT BANK SECTIONS SHEET 2
28. E134 - ELECTRICAL DUCT BANK SECTIONS SHEET 4
29. E135 - ELECTRICAL DUCT BANK SECTIONS SHEET 5
30. E201 - ELECTRICAL ONE-LINE DIAGRAM
31. E202 - ELECTRICAL ONE-LINE DIAGRAM
32. E204 - INFLUENT SCREENING STATION ELECTRICAL PANELBOARD SCHEDULES
33. E205 - INFLUENT SCREENING AND PUMP STATION ELECTRICAL PANELBOARD SCHEDULES SHEET 1 OF 2
34. E206 - INFLUENT SCREENING AND PUMP STATION ELECTRICAL PANELBOARD SCHEDULES SHEET 2 OF 2
35. E211 - INFLUENT SCREENING BUILDING ELECTRICAL GROUNDING PLAN
36. E212 - INFLUENT SCREENING AND PUMP STATION ELECTRICAL GROUNDING PLAN
37. E221 - INFLUENT SCREENING BUILDING ELECTRICAL POWER PLAN
38. E222 - INFLUENT PUMP STATION ELECTRICAL BUILDING ELECTRICAL POWER PLAN
39. E231 - INFLUENT SCREENING STRUCTURE ELECTRICAL LIGHTING PLAN
40. E251 - INFLUENT PUMP STATION NETWORK AND SECURITY PLAN
41. E291 - INFLUENT SCREENING AND PUMP STATION ELECTRICAL CABLE TAG SCHEDULE SHEET 1
42. E301 - ELECTRICAL ONE-LINE DIAGRAM
43. E302 - HEADWORKS ELECTRICAL PANELBOARD SCHEDULES SHEET 1
44. E303 - HEADWORKS ELECTRICAL PANELBOARD SCHEDULES SHEET 2
45. E311 - HEADWORKS ELECTRICAL GROUNDING PLAN
46. E312 - HEADWORKS ELECTRICAL GROUNDING PLAN LEVEL 2
47. E321 - HEADWORKS ELECTRICAL POWER PLAN LEVEL 1

48. E331 - HEADWORKS ELECTRICAL LIGHTING PLAN LEVEL 1
49. E332 - HEADWORKS ELECTRICAL LIGHTING PLAN LEVEL 2
50. E351 - HEADWORKS NETWORK AND SECURITY PLAN LEVEL 1
51. E391 - HEADWORKS ELECTRICAL CABLE TAG SCHEDULE SHEET 1
52. E401 - DIAGRAM SERVICE #3 SHEET 1 OF 2
53. E402 - DIAGRAM SERVICE #3 SHEET 2 OF 2
54. E403 - AGS ELECTRICAL PANELBOARD SCHEDULES SHEET 1
55. E404 - AGS ELECTRICAL PANELBOARD SCHEDULES SHEET 2
56. E405 - AGS ELECTRICAL PANELBOARD SCHEDULES SHEET 3
57. E411 - BLOWER BUILDING ELECTRICAL GROUNDING PLAN
58. E412 - AGS BASIN ELECTRICAL GROUNDING PLAN AREA A
59. E413 - AGS BASIN ELECTRICAL GROUNDING PLAN AREA B
60. E421 - BLOWER BUILDING POWER PLAN
61. E422 - AGS BASIN ELECTRICAL POWER PLAN AREA A
62. E423 - AGS BASIN ELECTRICAL POWER PLAN AREA B
63. E441 - AGS BLOWER BUILDING INSTRUMENTATION AND CONTROLS PLAN
64. E442 - AGS INSTRUMENTATION AND CONTROLS PLAN AREA A
65. E443 - AGS INSTRUMENTATION AND CONTROLS PLAN AREA B
66. E451 - AGS BLOWER BUILDING NETWORK AND SECURITY PLAN
67. E491 - AGS ELECTRICAL CABLE TAG SCHEDULE SHEET 1
68. E493 - AGS ELECTRICAL CABLE TAG SCHEDULE SHEET 3
69. E494 - AGS ELECTRICAL CABLE TAG SCHEDULE SHEET 4
70. E601 - ELECTRICAL ONE-LINE DIAGRAM
71. E602 - UV DISINFECTION ELECTRICAL PANELBOARD SCHEDULES SHEET 1
72. E603 - UV DISINFECTION ELECTRICAL PANELBOARD SCHEDULES SHEET 2
73. E611 - UV DISINFECTION ELECTRICAL GROUNDING PLAN
74. E612 - EFFLUENT STRUCTURE ELECTRICAL GROUNDING PLAN
75. E621 - UV DISINFECTION BUILDING ELECTRICAL POWER PLAN
76. E622 - EFFLUENT STRUCTURE ELECTRICAL POWER PLAN
77. E641 - UV DISINFECTION SYSTEM INSTRUMENTATION AND CONTROLS PLAN
78. E691 - UV DISINFECTION BUILDING ELECTRICAL CABLE TAG SCHEDULE SHEET 1
79. E701 - ELECTRICAL ONE-LINE DIAGRAM 1 OF 2
80. E702 - ELECTRICAL ONE-LINE DIAGRAM 2 OF 2
81. E703 - SOLIDS PROCESSING BUILDING ELECTRICAL PANELBOARD SCHEDULE SHEET 1
82. E704 - SOLIDS PROCESSING BUILDING ELECTRICAL PANELBOARD SCHEDULE SHEET 2
83. E711 - SOLIDS PROCESSING BUILDING ELECTRICAL GROUNDING PLAN 1 OF 2
84. E712 - SOLIDS PROCESSING BUILDING ELECTRICAL GROUNDING PLAN 2 OF 2
85. E721 - SOLIDS PROCESSING BUILDING ELECTRICAL POWER PLAN 1 OF 2
86. E722 - SOLIDS PROCESSING BUILDING ELECTRICAL POWER PLAN 2 OF 2
87. E791 - SOLIDS PROCESSING ELECTRICAL CABLE TAG SCHEDULE SHEET 1
88. E801 - ADMIN ELECTRICAL ONE-LINE DIAGRAM SERVICE #2
89. E802 - ADMIN BUILDING ELECTRICAL PANELBOARD SCHEDULES SHEET 1
90. E803 - ADMIN BUILDING ELECTRICAL PANELBOARD SCHEDULES SHEET 2
91. E811 - ADMIN BUILDING ELECTRICAL GROUNDING PLAN
92. E821 - ADMIN BUILDING ELECTRICAL POWER PLAN
93. E831 - ADMIN BUILDING ELECTRICAL LIGHTING PLAN
94. E891 - ADMIN BUILDING ELECTRICAL CABLE TAG SCHEDULE
95. ECA-1 Energy Code Analysis

96. L000 – Landscape General Notes
97. M002 – Mechanical Schedules
98. S415 – Blower Building Floor Plan
99. Y402 - AGS Basins No 1 and 2 PID
100. Y403 – AGS Basins No 1 and 2 PID
101. Y702 – Thin WAS Tanks and Sludge Pumps PID

NOTE: Bidders must acknowledge receipt of this Addendum by listing the number and date, where provided, on the Bid Form - Document 00410.

SECTION 33 12 16 - UTILITY VALVES AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes all valves and accessories.

B. Related Work Specified Elsewhere:

1. Section 09 90 00 - Protective Coatings.
2. Section 33 31 50 - Pipe Installation.

1.02 REFERENCES:

A. Applicable Standards:

1. American National Standards Institute (ANSI):
   a. B16.1 - Cast-Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.
2. ASTM International (ASTM):
   a. A126 - Gray Iron Castings for Valves, Flanges and Pipe Fittings.
   b. A276 - Stainless and Heat Resisting Steel Bars and Shapes.
   c. A536 - Ductile Iron Castings.
   d. A564 - Hot-Rolled and Cold-Finished Age-Hardening Stainless and Heat Resisting Steel Bars and Shapes.
3. American Water Works Association (AWWA):
   a. C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   b. C207 - Steel Pipe Flanges for Waterworks Service - Sizes 4 Inch Through 144 Inch.
   c. C500 - Metal-Seated Gate Valves for Water Supply Service.
   d. C502 - Dry-Barrel Fire Hydrants.
   e. C504 - Rubber-Seated Butterfly Valves.
   f. C507 - Ball Valves, 6 Inch Through 48 Inch.
   g. C508 - Swing-Check Valves for Waterworks Service, 2 Inch through 24 Inch NPS.
   h. C509 - Resilient-Seated Gate Valves for Water Supply Service.
   i. C512 - Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service.
   j. C540 - Power-Actuating Devices for Valves and Sluice Gates.
   k. C550 - Protective Epoxy Interior Coatings for Valves and Hydrants.
   l. C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
   m. C606 - Grooved and Shouldered Joints.
4. National Fire Protection Association (NFPA):
   a. 1963 - Screw Threads and Gaskets, Fire Hose Connections.

1.03 SUBMITTALS:

A. Submit as specified in Division 1.

B. Include, but not limited to, the following:

1. Catalog data or illustrations showing principal dimensions, parts, and materials.
2. Spare parts list referenced to illustration of parts.
3. Assembly and disassembly or repair instructions.
4. Dimensions of the clearance required for butterfly valve discs.

C. Certificates and Affidavits: Furnish prior to shipment. Include the following:

1. Test certificates.
2. Affidavit of compliance with applicable AWWA Standard.

1.04 QUALITY ASSURANCE:

A. Manufacturers shall be experienced in the design and manufacture of specific valves and accessories.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Deliver, store, and handle equipment and materials as specified in Division 1.

1.06 RESPONSIBILITY:

A. Actuators, their controls, and accessories shall be the responsibility of the valve manufacturer for sizing, assembly, certification, field testing, and any adjustments necessary to operate the valve as specified.

PART 2 - PRODUCTS

2.01 BUTTERFLY VALVES:

A. Acceptable Manufacturers for process related valves (See Table 1 and Table 2 below for process butterfly valves):
   1. DeZURIK/Sartell - Model BAW
   2. Henry Pratt Company
   3. Val-matic

B. Acceptable Manufacturers for utility related valves (See Civil Drawings for utilities valves):
   1. SPX/DeZurik – Style BOS.
   2. Tyco-Keystone – Figure AR2.

C. Design:
   1. Conform to AWWA C504, AWWA C540, and as specified.
   2. Suitable for type of installation specified.
   3. Conform to criteria indicated in Design Data and Valve Schedule.
   4. All valve end flanges shall conform to the following:
      a. ANSI B16.1, Class 125 for cast-iron body, Class 25A through Class 150B valves.
      b. AWWA C207, Class D with ANSI B16.1 Class 125 drilling for steel body, Class 25A through Class 150B valves.
      c. ANSI B16.1, Class 250 for ductile-iron body, Class 250 valves.
      d. AWWA C207, Class E for steel body, Class 250 valves.
   5. Mechanical or push-on type rubber-gasket joint ends shall conform to AWWA C111.
   6. Valves with a stop or lug cast integrally or mechanically secured to the body for the purpose of limiting disc travel will not be acceptable.

D. Design Data: Refer to Drawings for Valve Schedule.

E. Materials and Construction:
   1. Body shall be of cast iron for Class 25A through Class 150B valves and ductile iron for Class 250 valves or fabricated steel, as indicated in the Valve Schedule.
   2. Shafts shall be ASTM A276 Type 304 or 316 stainless steel for Class 25A through Class 150B valves and ASTM 564 Type 630 stainless steel for Class 250 valves. Design velocity for Class 250 valves shall be 16 fps.
   3. Disc shall be cast or ductile iron for Class 25A through Class 150B valves and ductile iron for Class 250 valves or steel for fabricated steel valves.
   4. Seats shall be synthetic rubber and be body mounted. Provide field replaceable and adjustable seat accessible from down-pressure side of valve for sizes 30-inch and larger. Mating seat surface shall be stainless steel or Monel. Sprayed or plated mating surfaces are not acceptable.

5. Shaft seals shall be designed for use of standard self-adjusting split-V-type packing or standard O-ring seals. Pull-down packing is not acceptable.

F. Actuators:
   1. Manual Actuators:
      a. All valves shall open counterclockwise.
      b. Provide indicators to show position of disc except on buried actuators. Provide handwheels with raised cast arrow and word OPEN on rim oriented to specified opening direction.
      c. Actuators shall be oil or grease-lubricated, totally-enclosed compound lever, traveling nut type to provide characterized closure. Actuator shall be self-locking at all variable opening positions.
      d. Travel limiting stop nuts or collars installed in the actuating mechanisms shall be field adjustable and shall be locked in position by means of a removable roll pin, cotter pin, or other positive locking device. Clamps or setscrews are not acceptable.
      e. Actuators and handwheels shall be located in positions indicated or as otherwise determined when manufacturer's drawings are submitted.
      f. Furnish actuators with AWWA operating nuts for all buried installations unless otherwise scheduled.
      g. Exposed buried actuator case, supports, and connection to the valve shall be cast iron.
      h. Exposed, buried service actuator shafting, bolts, and fastening hardware shall be stainless steel.
      i. Hand chains shall be cadmium plated or stainless steel.
   2. Motor Actuators:
      a. Provide electric motor actuators as specified in sub-section 2.12 ELECTRIC MOTOR ACTUATORS herein.

G. Valve Controls:
   1. Operate valve actuator to perform control function required.
      a. Open or close valve.
      b. Modulating.
   2. Include all pilot valves, needle valves, strainers, interconnecting piping, fittings, positioners, solenoid valves, limit switches, and other accessories essential to valve function factory-assembled on valve body or actuator.
      a. Small control valves shall be bronze or brass; and piping shall be copper.
      b. Provide solenoid valves, limit switches, positioners, and other accessories as required for proper operation.
   3. Equip actuators with heavy-duty, screw type terminal strip assemblies, designed to accept ring-tongue terminals for minimum size number 14 AWG wire.

H. Testing: Furnish certified copies of results of performance, leakage, and hydrostatic tests performed in compliance with Section 5, AWWA C504.

I. Shop Painting: Paint exterior surface of valves in compliance with AWWA C504 for installation as noted. Apply interior coating conforming to AWWA C550 to exposed ferrous metal surfaces. Provide affidavit or certificate of compliance per AWWA C550.

J. Valve Schedule:

Table 1: Butterfly Valves Provided by Contractor

Tag	Size (in)	Max P (psig)	Max T (deg F)	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
AGS-VLV-104	14"	20	300	Air	Flg x Flg	Chainwheel	Vert	CS Vert	O/C	Y402	AGS West Wall Exterior Above Grade ~6.5 ft grade to valve CL
AGS-VLV-106	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y402	AGS West Walkway Exterior Above Grade
AGS-VLV-107	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y402	AGS West Walkway Exterior Above Grade
AGS-VLV-112	4"	20	300	Air	Flg x Flg	Handwheel / Lever	Horiz	CS Vert	O/C	Y402	AGS West Walkway Exterior Above Grade
AGS-VLV-204	14"	20	300	Air	Flg x Flg	Chainwheel	Vert	CS Vert	O/C	Y402	AGS West Wall Exterior Above Grade ~6.5 ft grade to valve CL
AGS-VLV-206	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y402	AGS West Walkway Exterior Above Grade
AGS-VLV-207	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y402	AGS West Walkway Exterior Above Grade
AGS-VLV-212	4"	20	300	Air	Flg x Flg	Handwheel	Horiz	CS Horiz	O/C	Y402	AGS West Walkway Exterior Above Grade
AGS-VLV-304	14"	20	300	Air	Flg x Flg	Chainwheel	Vert	CS Vert	O/C	Y403	AGS West Wall Exterior Above Grade ~6.5 ft grade to valve CL
AGS-VLV-306	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y403	AGS West Walkway Exterior Above Grade
AGS-VLV-307	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y403	AGS West Walkway Exterior Above Grade
AGS-VLV-312	4"	20	300	Air	Flg x Flg	Handwheel	Horiz	CS Horiz	O/C	Y403	AGS West Walkway Exterior Above Grade

Tag	Size (in)	Max P (psig)	Max T (deg F)	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
AGS-VLV-404	14"	20	300	Air	Flg x Flg	Chainwheel	Vert	CS Vert	O/C	Y403	AGS West Wall Exterior Above Grade ~6.5 ft grade to valve CL
AGS-VLV-406	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y403	AGS West Walkway Exterior Above Grade
AGS-VLV-407	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y403	AGS West Walkway Exterior Above Grade
AGS-VLV-412	4"	20	300	Air	Flg x Flg	Handwheel	Horiz	CS Horiz	O/C	Y403	AGS West Walkway Exterior Above Grade
AGS-VLV-913	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y407	Blower BuildingInterior Above Grade
AGS-VLV-923	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y407	Blower Building Interior Above Grade
AGS-VLV-933	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y407	Blower Building Interior Above Grade
AGS-VLV-943	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y408	Blower Building Interior Above Grade
AGS-VLV-953	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y408	Blower Building Interior Above Grade
UV-VLV-001	36"	10	100	Effluent WW	MJ x MJ	Buried Nut w/ Extension	Horiz	DIP Horiz	O/C	Y601	Yard @ UV Structure Buried
UV-VLV-002	36"	10	100	Effluent WW	MJ x MJ	Buried Nut w/ Extension	Horiz	DIP Horiz	O/C	Y601	Yard @ UV Structure Buried
UV-VLV-003	36"	10	100	Effluent WW	MJ x MJ	Buried Nut w/ Extension	Horiz	DIP Horiz	O/C	Y601	Yard @ UV Structure Buried
PW-VLV-112	4"	190	100	Effluent WW	Flg x Flg	Handwheel	Vert	DIP Horiz	O/C	Y601	UV Building Interior Above Grade
PW-VLV-122	4"	190	100	Effluent WW	Flg x Flg	Handwheel	Vert	DIP Horiz	O/C	Y601	UV Building Interior Above Grade
PW-VLV-132	4"	190	100	Effluent WW	Flg x Flg	Handwheel	Vert	DIP Horiz	O/C	Y601	UV Building Interior Above Grade

Tag	Size (in)	Max P (psig)	Max T (deg F)	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
PW-VLV-101	4"	190	100	Effluent WW	Flg x Flg	Handwheel	Vert	DIP Horiz	O/C	Y601	UV Building Interior Above Grade
PW-VLV-102	4"	190	100	Effluent WW	Flg x Flg	Handwheel	Horiz	DIP Vert	O/C	Y601	UV Building Interior Above Grade
WAS-VLV-411	10"	-5 to 0	105	Air	Flg x Flg	Chainwheel	Vert	CS Horiz	O/C	Y705	Solids Processing Bldg Interior Above Grade ~5.85 ft FF to valve CL
WAS-VLV-421	10"	-5 to 0	105	Air	Flg x Flg	Chainwheel	Vert	CS Horiz	O/C	Y705	Solids Processing Bldg Interior Above Grade ~5.85 ft FF to valve CL
WAS-VLV-431	10"	-5 to 0	105	Air	Flg x Flg	Chainwheel	Vert	CS Horiz	O/C	Y705	Solids Processing Bldg Interior Above Grade ~5.85 ft FF to valve CL
WAS-VLV-413	8"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y705	Solids Processing Bldg Interior Above Grade
WAS-VLV-423	8"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y705	Solids Processing Bldg Interior Above Grade
WAS-VLV-433	8"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y705	Solids Processing BldgInterior Above Grade
WAS-VLV-401	10"	20	300	Air	Flg x Flg	Handwheel	Horiz	CS Vert	O/C	Y705	Solids Processing Bldg Interior Above Grade
WAS-VLV-402	10"	20	300	Air	Flg x Flg	Handwheel	Horiz	CS Vert	O/C	Y705	Solids Processing Bldg Interior Above Grade

Table 2: Butterfly Valves provided by Granular Sludge Biological Treatment System Supplier (Section 46 54 60)

Tag	Size (in)	Max P (psig)	Max T (deg F)	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
AGS-VLV-105	10"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Horiz	CS Horiz	Air	Y402	AGS West Walkway Exterior Above Grade
AGS-VLV-108	4"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Vert	CS Horiz	Air	Y402	AGS West Walkway Exterior Above Grade
AGS-VLV-109	4"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Vert	CS Horiz	Air	Y402	AGS West Walkway Exterior Above Grade
AGS-VLV-205	10"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Horiz	CS Horiz	Air	Y402	AGS West Walkway Exterior Above Grade
AGS-VLV-208	4"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Vert	CS Horiz	Air	Y402	AGS West Walkway Exterior Above Grade
AGS-VLV-209	4"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Vert	CS Horiz	Air	Y403	AGS West Walkway Exterior Above Grade
AGS-VLV-305	10"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Horiz	CS Horiz	Air	Y403	AGS West Walkway Exterior Above Grade
AGS-VLV-308	4"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Vert	CS Horiz	Air	Y403	AGS West Walkway Exterior Above Grade
AGS-VLV-309	4"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Vert	CS Horiz	Air	Y403	AGS West Walkway Exterior Above Grade
AGS-VLV-405	10"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Horiz	CS Horiz	Air	Y403	AGS West Walkway Exterior Above Grade

Tag	Size (in)	Max P (psig)	Max T (deg F)	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
AGS-VLV-408	4"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Vert	CS Horiz	Air	Y403	AGS West Walkway Exterior Above Grade
AGS-VLV-409	4"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Vert	CS Horiz	Air	Y403	AGS West Walkway Exterior Above Grade

2.02 ECCENTRIC PLUG VALVES:

A. Acceptable Manufacturers:
   1. DeZurik
   2. Nordstrom
   3. Walworth
   4. Henry Pratt Company

B. Design:
   1. Quarter-turn nonlubricated eccentric type with resilient faced plug. Valves with vane type seat rings are not acceptable. Shutoff up to scheduled rating with pressure in reverse direction where scheduled.
   2. Conform to criteria indicated in Valve Schedule table.
   3. Flanged valve ends shall be faced and drilled to conform to ANSI B16.1, Class 125 for thickness and drilling.
   4. Mechanical or push-on type rubber-gasketed joint ends shall conform to AWWA C111.
   5. Port areas for valves through 500 mm 20-inch shall be at least 80% of full pipe area. Port areas of 24-inch and larger valves shall be at least 70% of full pipe area.
      a. Valves specified as “Full Port”: Bodies shall be Cast Iron ASTM A126 Class B. Ports shall be rectangular and 100% Port Area. The valve port area shall meet or exceed standard pipe area per ASME/ANSI B36.10M.
   6. Plugs shall be eccentric type with no backing ring or frame.
   7. Valve body cavity shall be smooth without protrusions or baffles.
   8. Design velocity for valves shall be 12 fps.

C. Materials and Construction:
   1. Bodies shall be of ASTM A126, Class B cast iron.
   2. Valve plug shall be ASTM A126, Class B cast iron or ASTM A536 ductile iron. Resilient plug facing or replaceable style body seats shall be synthetic rubber, neoprene, or Buna N compound suitable for use with water and wastewater applications.
   3. Seat rings shall be threaded or welded of corrosion-resistant 18-8 stainless steel, nickel, or Monel conforming to AWWA C504. Sprayed or plated mating seat surfaces are not acceptable.
   4. Bearings shall be replaceable. Sleeve type and thrust bearings in the upper and lower journals shall be corrosion-resistant stainless steel or bronze.
   5. Shaft seals shall be multiple O-ring, self-adjusting U-cup or chevron type packing conforming to AWWA C504. Pull-down packing is not acceptable.
   6. Shaft seals shall be field adjustable or replaceable without valve disassembly.
   7. All exposed fastening hardware shall be zinc plated or stainless steel. Provide stainless steel for buried service.

D. Actuators:
   1. Manual Actuators:
      a. All valves shall open counterclockwise.
      b. Provide indicators to show position of plug except on buried actuators.
      c. Nut operators shall be AWWA 2-inch size for operation by valve key, wrench head lever, or a chain lever. Furnish one lever for each valve.
      d. Hand chains shall be cadmium plated or stainless steel.
      e. Worm gear actuators shall be totally enclosed, grease sealed, gear type furnished with AWWA nut, crank, handwheel, or chainwheel. All buried valves shall be provided with worm gear actuators, AWWA nut, and enclosed cover plate. All

valves with reverse pressure capacity requirement shall be provided with worm gear actuators. Worm gear actuators shall be self-locking at all variable opening positions and sized to meet the torque ratings of AWWA C504. The shaft in a worm gear actuator shall have a nonmetallic or bronze sleeve type bearing. Submit manufacturer's parts and materials drawings.

f. Handwheels shall be located in positions indicated or as otherwise determined when manufacturer's drawings are submitted.

2. Motor Actuators:
   a. Provide electric motor actuators as specified in sub-section 2.12 ELECTRIC MOTOR ACTUATORS herein.

E. Valve Controls:
1. Operate valve actuator to perform control function required.
   a. Open or close valve.
   b. Modulating.
2. Include all pilot valves, needle valves, strainers, interconnecting piping, fittings, positioners, solenoid valves, limit switches, and other accessories essential to valve function factory-assembled on valve body or operator.
   a. Small control valves shall be bronze or brass; piping shall be copper.
   b. Provide solenoid valves, limit switches, positioners, and other accessories as required for proper operation.
3. Equip actuators with heavy-duty, screw type terminal strip assemblies, designed to accept ring tongue terminals for minimum size number 14 AWG wire.

F. Testing: Furnish certified copies of results of tests prior to shipment. All valves shall be subjected to an AWWA C504 procedure cycle life and pressure leak test at 150 psi and a body hydrostatic test at 300 psi. Valves shall be capable of providing drip-tight shutoff up to the full leak test rating. Certify reverse pressure capacity.

G. Shop Painting: Apply interior coating conforming to AWWA C550 to exposed ferrous metal surfaces. Provide affidavit or certificate of compliance per AWWA C550.

H. Valve Schedule:

Table 3: Plug Valves Provided by Contractor

Tag	Size (in)	Max P (psig)	Max T (deg F)	Full Port?	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
IPS-VLV-101	24”	120	100	No	Influent Wastewater	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y202	IPS Valve Vault Interior Below Grade
IPS-VLV-102	20”	120	100	No	Influent Wastewater	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y202	IPS Valve Vault Interior Below Grade
IPS-VLV-103	20”	120	100	No	Influent Wastewater	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y202	IPS Valve Vault Interior Below Grade
IPS-VLV-112	14"	120	100	No	Influent Wastewater	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y202	IPS Valve Vault Interior Below Grade
IPS-VLV-122	12"	120	100	No	Influent Wastewater	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y202	IPS Valve Vault Interior Below Grade
IPS-VLV-132	14"	120	100	No	Influent Wastewater	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y202	IPS Valve Vault Interior Below Grade
IPS-VLV-142	12"	120	100	No	Influent Wastewater	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y202	IPS Valve Vault Interior Below Grade
IPS-VLV-152	14"	120	100	No	Influent Wastewater	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y202	IPS Valve Vault Interior Below Grade
GRSC-VLV-001	20"	120	100	No	Influent Wastewater	MJ x MJ	Buried Nut w/ Extension	Horiz	DIP Horiz	O/C	Y301	Yard Exterior of Headworks Buried ~5.9 ft CL of valve to grade
GRSC-VLV-002	20"	120	100	No	Influent Wastewater	FLG x FLG	Chainwheel	Horiz	DIP Vert	O/C	Y301	Headworks First Floor Interior Above Grade ~10 ft FF to CL of valve
GRSC-VLV-003	20"	120	100	**YES**	Influent Wastewater	FLG x FLG	Chainwheel	Horiz	DIP Vert	O/C	Y301	Headworks First Floor Interior Above Grade ~10 ft FF to CL of valve

Tag	Size (in)	Max P (psig)	Max T (deg F)	Full Port?	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
GRSC-VLV-004	20"	120	100	No	Influent Wastewater	FLG x FLG	Chainwheel	Horiz	DIP Vert	O/C	Y301	Headworks First Floor Interior Above Grade ~14.7 ft FF to CL of valve
GRSC-VLV-005	20"	120	100	No	Influent Wastewater	FLG x FLG	Chainwheel	Horiz	DIP Vert	O/C	Y301	Headworks First Floor Interior Above Grade ~14.7 ft FF to CL of valve
GRSC-VLV-103	6"	10	100	No	Influent Wastewater	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y301	Headworks First Floor Interior Above Grade ~13.5 ft FF to CL of valve
GRSC-VLV-203	6"	10	100	No	Influent Wastewater	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y301	Headworks First Floor Interior Above Grade ~13.5 ft FF to CL of valve
PSEW-VLV-101	8”	60	100	No	Plant Sewer Return	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y301	Headworks First Floor Interior Above Grade ~2 ft FF to CL of valve
PSEW-VLV-102	8”	60	100	No	Plant Sewer Return	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y301	Headworks First Floor Interior Above Grade ~5 ft FF to CL of valve
PSEW-VLV-103	8”	60	100	No	Plant Sewer Return	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y301	Headworks First Floor Interior Above Grade ~8 ft FF to CL of valve
PSEW-VLV-104	8”	60	100	No	Plant Sewer Return	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y301	Headworks First Floor Interior Above Grade ~12 ft FF to CL of valve
GRSC-VLV-311	4"	15	100	**YES**	Grit Slurry	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y302	Headworks First Floor Interior Above Grade
GRSC-VLV-313	3"	15	100	No	Grit Slurry	FLG x FLG	Handwheel	Horiz	DIP Vert	O/C	Y302	Headworks First Floor Interior Above Grade

Tag	Size (in)	Max P (psig)	Max T (deg F)	Full Port?	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
GRSC-VLV-315	4"	15	100	**YES**	Grit Slurry	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y302	Headworks First Floor Interior Above Grade ~9 ft FF to CL of valve
GRSC-VLV-316	4"	15	100	**YES**	Grit Slurry	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y302	Headworks First Floor Interior Above Grade ~9 ft FF to CL of valve
GRSC-VLV-317	4"	15	100	**YES**	Grit Slurry	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y302	Headworks First Floor Interior Above Grade ~9 ft FF to CL of valve
AGS-VLV-601	8"	10	100	No	Supernatant	FLG x FLG	Handwheel	Vert	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-602	8"	10	100	No	Supernatant	FLG x FLG	Handwheel	Vert	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-603	8"	30	100	No	Supernatant	FLG x FLG	Chainwheel	Vert	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade ~6.3 ft FF to CL of valve
AGS-VLV-611	8"	10	100	No	Supernatant	FLG x FLG	Handwheel	Vert	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-621	8"	10	100	No	Supernatant	FLG x FLG	Handwheel	Vert	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-631	8"	10	100	No	Supernatant	FLG x FLG	Handwheel	Vert	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-613	8"	30	100	No	Supernatant	FLG x FLG	Chainwheel	Vert	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade ~6.3 ft FF to CL of valve
AGS-VLV-623	8"	30	100	No	Supernatant	FLG x FLG	Chainwheel	Vert	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade ~6.3 ft FF to CL of valve

Tag	Size (in)	Max P (psig)	Max T (deg F)	Full Port?	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
AGS-VLV-633	8"	30	100	No	Supernatant	FLG x FLG	Chainwheel	Vert	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade ~6.3 ft FF to CL of valve
AGS-VLV-701	4"	10	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-702	4"	10	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-703	4"	30	100	No	Sludge	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y405	AGS Pump RoomInterior Above Grade~4.5 ft FF to CL of valve
AGS-VLV-711	4"	10	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-721	4"	10	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-731	4"	10	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-713	4"	30	100	No	Sludge	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade ~4.5 ft FF to CL of valve
AGS-VLV-723	4"	30	100	No	Sludge	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade ~4.5 ft FF to CL of valve
AGS-VLV-733	4"	30	100	No	Sludge	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade ~4.5 ft FF to CL of valve
AGS-VLV-811	6"	10	100	No	Supernatant	FLG x FLG	Handwheel	Vert	DIP Horiz	O/C	Y406	AGS Pump Room Interior Above Grade
AGS-VLV-821	6"	10	100	No	Supernatant	FLG x FLG	Handwheel	Vert	DIP Horiz	O/C	Y406	AGS Pump Room Interior Above Grade

Tag	Size (in)	Max P (psig)	Max T (deg F)	Full Port?	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
AGS-VLV-813	6"	30	100	No	Supernatant	FLG x FLG	Chainwheel	Vert	DIP Horiz	O/C	Y406	AGS Pump Room Interior Above Grade ~5.9 ft FF to CL of valve
AGS-VLV-823	6"	30	100	No	Supernatant	FLG x FLG	Chainwheel	Vert	DIP Horiz	O/C	Y406	AGS Pump Room Interior Above Grade ~5.9 ft FF to CL of valve
AGS-VLV-001	6"	30	100	No	Supernatant	FLG x FLG	Chainwheel	Vert	DIP Vert	O/C	Y401	AGS Utility Corridor Interior Above Grade ~5.6 ft FF to CL of valve
WAS-VLV-101	4"	30	100	No	Sludge	FLG x FLG	Extended w/ Handwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Below Grade ~2 ft CL of valve to walkway above
WAS-VLV-201	4"	30	100	No	Sludge	FLG x FLG	Extended w/ Handwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Below Grade ~2 ft CL of valve to walkway above
WAS-VLV-301	8"	10	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Vert	O/C	Y702	Solids Processing Building Interior Above Grade
WAS-VLV-302	8"	10	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Vert	O/C	Y702	Solids Processing BuildingInterior Above Grade
WAS-VLV-303	8"	10	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade
WAS-VLV-304	8"	10	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade
WAS-VLV-311	6"	10	100	No	Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade
WAS-VLV-321	6"	10	100	No	Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade
WAS-VLV-331	6"	10	100	No	Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade

Tag	Size (in)	Max P (psig)	Max T (deg F)	Full Port?	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
WAS-VLV-313	6"	10	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade
WAS-VLV-323	6"	50	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade
WAS-VLV-333	6"	50	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade
WAS-VLV-305	6"	50	100	No	Sludge	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade ~12 ft FF to CL of valve
WAS-VLV-305A	4”	50	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade ~3 ft FF to CL of valve
WAS-VLV-305B	4”	50	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade ~3 ft FF to CL of valve
WAS-VLV-306	6"	50	100	No	Sludge	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade ~12 ft FF to CL of valve
WAS-VLV-306A	4"	50	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade ~3 ft FF to CL of valve
WAS-VLV-306B	4"	50	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade ~3 ft FF to CL of valve
WAS-VLV-307	6"	50	100	No	Sludge	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade ~13 ft FF to CL of valve

Tag	Size (in)	Max P (psig)	Max T (deg F)	Full Port?	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
WAS-VLV-308	6"	50	100	No	Sludge	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade ~13 ft FF to CL of valve
STH-VLV-101	6"	50	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Vert	O/C	Y702	Solids Processing Building Interior Above Grade
STH-VLV-201	6"	50	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Vert	O/C	Y702	Solids Processing Building Interior Above Grade
SCIN-VLV-101	6"	50	100	No	Sludge	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade ~13 ft FF to CL of valve
SCIN-VLV-201	6"	50	100	No	Sludge	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing BuildingInterior Above Grade~13 ft FF to CL of valve
STH-VLV-132	4"	90	100	**YES**	Thickened Sludge	FLG x FLG	Handwheel	Horiz	DIP Vert	O/C	Y703	Solids Processing Building Interior Above Grade
STH-VLV-232	4"	90	100	**YES**	Thickened Sludge	FLG x FLG	Handwheel	Horiz	DIP Vert	O/C	Y703	Solids Processing Building Interior Above Grade
SCIN-VLV-102	6"	90	100	No	Thickened Sludge	FLG x FLG	Handwheel	Horiz	DIP Vert	O/C	Y703	Solids Processing Building Interior Above Grade
SCIN-VLV-202	6"	90	100	No	Thickened Sludge	FLG x FLG	Handwheel	Horiz	DIP Vert	O/C	Y703	Solids Processing Building Interior Above Grade
SCIN-VLV-001	18"	15	100	No	Thickened Sludge	FLG x FLG	Extended w/ Handwheel	Horiz	DIP Horiz	O/C	Y704	Solids Processing Building Interior Below Grade ~2.1 ft CL of valve to walkway above
SCIN-VLV-111	10"	10	100	No	Thickened Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y704	Solids Processing Building Interior Below Grade
SCIN-VLV-211	10"	10	100	No	Thickened Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y704	Solids Processing Building Interior Below Grade

Tag	Size (in)	Max P (psig)	Max T (deg F)	Full Port?	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
SCIN-VLV-112	8"	60	100	No	Thickened Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Vert	Modulating	Y704	Solids Processing Building Interior Below Grade
SCIN-VLV-212	8"	60	100	No	Thickened Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Vert	Modulating	Y704	Solids Processing Building Interior Below Grade
SCIN-VLV-113	8"	60	100	No	Thickened Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	Modulating	Y704	Solids Processing Building Interior Below Grade
SCIN-VLV-213	8"	60	100	No	Thickened Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	Modulating	Y704	Solids Processing Building Interior Below Grade
PSEW-VLV-112	8"	120	100	No	Return Wastewater	FLG x FLG	Handwheel	Horiz	DIP Vert	O/C	Y801	Headworks First Floor Interior Above Grade
PSEW-VLV-122	8"	120	100	No	Return Wastewater	FLG x FLG	Handwheel	Horiz	DIP Vert	O/C	Y801	Headworks First Floor Interior Above Grade

Table 4: Plug Valves provided by Granular Sludge Biological Treatment System Supplier (Section 46 54 60)

Tag	Size (in)	Max P (psig)	Max T (deg F)	Full Port?	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
AGS-VLV-101	30"	20	100	No	Influent Wastewater	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y401	AGS Utility Corridor Interior Above Grade
AGS-VLV-103	30"	20	100	No	Influent Wastewater	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y401	AGS Utility Corridor Interior Above Grade
AGS-VLV-201	30"	20	100	No	Influent Wastewater	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y401	AGS Utility Corridor Interior Above Grade
AGS-VLV-203	30"	20	100	No	Influent Wastewater	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y401	AGS Utility Corridor Interior Above Grade
AGS-VLV-301	30"	20	100	No	Influent Wastewater	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y401	AGS Utility Corridor Interior Above Grade
AGS-VLV-303	30"	20	100	No	Influent Wastewater	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y401	AGS Utility Corridor Interior Above Grade
AGS-VLV-401	30"	20	100	No	Influent Wastewater	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y401	AGS Utility Corridor Interior Above Grade
AGS-VLV-403	30"	20	100	No	Influent Wastewater	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y401	AGS Utility Corridor Interior Above Grade
AGS-VLV-110	20"	10	100	No	Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	Modulating	Y402	AGS Utility Corridor Interior Above Grade
AGS-VLV-111	20"	10	100	No	Supernatant	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	Modulating	Y402	AGS Utility Corridor Interior Above Grade

Tag	Size (in)	Max P (psig)	Max T (deg F)	Full Port?	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
AGS-VLV-210	20"	10	100	No	Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	Modulating	Y402	AGS Utility Corridor Interior Above Grade
AGS-VLV-211	20"	10	100	No	Supernatant	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	Modulating	Y402	AGS Utility Corridor Interior Above Grade
AGS-VLV-310	20"	10	100	No	Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	Modulating	Y403	AGS Utility Corridor Interior Above Grade
AGS-VLV-311	20"	10	100	No	Supernatant	FLG x FLG	Motor Actuator	Horiz	DIPHoriz	Modulating	Y403	AGS Utility CorridorInterior Above Grade
AGS-VLV-410	20"	10	100	No	Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	Modulating	Y403	AGS Utility Corridor Interior Above Grade
AGS-VLV-411	20"	10	100	No	Supernatant	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	Modulating	Y403	AGS Utility Corridor Interior Above Grade
AGS-VLV-511	20"	10	100	No	Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y405	AGS Utility Corridor Interior Above Grade
AGS-VLV-521	20"	10	100	No	Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y405	AGS Utility Corridor Interior Above Grade

2.03 STANDARD SWING CHECK VALVES:

A. Acceptable Manufacturers less than 4-inches in diameter:
   1. Crane Valve Company - Model: Number 36
   2. Lunkenheimer Company - Model: Figure 554Y

B. Acceptable Manufacturers 4-inches and greater in diameter:
   1. Kennedy Valve Company – Model: 159
   2. M&H – Model 159
   3. Mueller Company – Model A-2600
   4. Apco Willamette Valve and Primer Corporation – Model 250

C. Design:
   1. Conform to AWWA C508 and as specified.
   2. Iron body, bronze mounted, full opening.
   3. Extended stainless steel hinge pin with outside lever and weight.
   4. Design velocity shall be 12 fps.

D. Materials and Construction:
   1. Body and cover shall be cast iron. Flanges shall be ANSI B16.1, Class 125.
   2. Valve disc shall be bronze faced cast iron.
   3. Rubber faced discs or disc rings shall be Buna N for liquid applications and Viton for compressed air applications.
   4. Suitable for listed operating pressure.

E. Valve Schedule:

Table 5: Check Valves Provided by Contractor

Tag	Size (in)	Max P (psig)	Max T (deg F)	Media	Valve Ends	System Pipe	PID	Installation
IPS-VLV-111	14"	120	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y202	IPS Valve Vault Interior Below Grade
IPS-VLV-121	12"	120	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y202	IPS Valve Vault Interior Below Grade
IPS-VLV-131	14"	120	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y202	IPS Valve Vault Interior Below Grade
IPS-VLV-141	12"	120	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y202	IPS Valve Vault Interior Below Grade
IPS-VLV-151	14"	120	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y202	IPS Valve Vault Interior Below Grade
AGS-VLV-102	30"	20	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y401	AGS Pump Room Interior Above Grade
AGS-VLV-202	30"	20	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y401	AGS Pump Room Interior Above Grade
AGS-VLV-302	30"	20	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y401	AGS Pump Room Interior Above Grade
AGS-VLV-402	30"	20	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y401	AGS Pump Room Interior Above Grade
AGS-VLV-612	8"	30	100	Supernatant	FLG x FLG	DIP Horiz	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-622	8"	30	100	Supernatant	FLG x FLG	DIP Horiz	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-632	8"	30	100	Supernatant	FLG x FLG	DIP Horiz	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-712	4"	30	100	Sludge	FLG x FLG	DIP Horiz	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-722	4"	30	100	Sludge	FLG x FLG	DIP Horiz	Y405	AGS Pump Room Interior Above Grade

Tag	Size (in)	Max P (psig)	Max T (deg F)	Media	Valve Ends	System Pipe	PID	Installation
AGS-VLV-732	4"	30	100	Sludge	FLG x FLG	DIP Horiz	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-812	6"	30	100	Supernatant	FLG x FLG	DIP Horiz	Y406	AGS Pump Room Interior Above Grade
AGS-VLV-822	6"	30	100	Supernatant	FLG x FLG	DIP Horiz	Y406	AGS Pump Room Interior Above Grade
PW-VLV-111	4"	30	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y601	UV Disinfection Bldg Interior Above Grade
PW-VLV-121	4"	30	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y601	UV Disinfection Bldg Interior Above Grade
PW-VLV-131	4"	30	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y601	UV Disinfection Bldg Interior Above Grade
WAS-VLV-312	6"	50	100	Sludge	FLG x FLG	DIP Horiz	Y702	Solids Processing Interior Above Grade
WAS-VLV-322	6"	50	100	Sludge	FLG x FLG	DIP Horiz	Y702	Solids Processing Interior Above Grade
WAS-VLV-332	6"	50	100	Sludge	FLG x FLG	DIP Horiz	Y702	Solids Processing Interior Above Grade
STH-VLV-131	4"	30	100	Thickened Sludge	FLG x FLG	DIP Horiz	Y703	Solids Processing Interior Above Grade
STH-VLV-231	4"	30	100	Thickened Sludge	FLG x FLG	DIP Horiz	Y703	Solids Processing Interior Above Grade
PSEW-VLV-111	8"	120	100	Returned Wastewater	FLG x FLG	DIP Vert	Y801	Headworks Building Interior Above Grade
PSEW-VLV-121	8"	120	100	Returned Wastewater	FLG x FLG	DIP Vert	Y801	Solids Processing Interior Above Grade

2.04 BALL VALVES:

A. Acceptable Manufacturers for Ball Valves less than 6-inches in diameter:
   1. Conbraco Industries, Inc. – Apollo Valves.
   2. Metso Automation/Jamesbury.
   3. NIBCO, Inc.
   4. Flow-Tek, Inc.

B. Operational Requirements:
   1. Suitable for isolation service.
   2. Operation of the valve will be continuous.
   3. Operational pressures will be as follows:
      a. Normal system range 0 to 200 psi.

C. Design: Conform to AWWA C507, AWWA C540 and as specified.
   1. Valves shall consist of essentially three main parts:
      a. Body with full unrestricted circular inlet and outlet with diameter equal to rated size of valve.
      b. A moveable plug having a full, unobstructed circular waterway opening equal to valve body opening.
      c. A totally-enclosed operating mechanism mounted on and attached to valve body.
   2. Seats shall consist of flexible metal on the ball or resilient rubber on the body and rigid stainless steel seats opposite and located on both ends of valve.
   3. Shaft seals shall be self-adjusting split-V-type or rubber O-ring type designed for replacement under line pressure.
   4. Valve body shall have flanged ends. Flanges shall be ANSI B16.1, Class 125.

D. Materials and Construction:
   1. Valve body and plug shall match or be compatible with pipe material.
   2. Valve shall be furnished complete with operating mechanism and accessories suitable for accomplishing specified operations.

E. Valve Operating Mechanism:
   1. Valve shall be equipped with a traveling cross-head type operator and shall operate plug by means of a cross-head linked to a rotator lever.
   2. Rotator lever shall impart rotary motion to plug shaft.
   3. Provide an indicator to show position of plug with respect to body opening.

F. Actuators:
   1. Manual Actuators:
      a. Valve shall open counterclockwise.
      b. Provide non-rising stem mechanism self-locking in all positions.

G. Testing: Furnish certified copies of results of tests performed in compliance with Section 13, AWWA C507.

H. Valve Schedule: Refer to Drawings for Valve Schedule.

I. Shop Painting: Apply interior epoxy coating conforming to AWWA C550 and NSF to exposed ferrous metal surfaces. Provide affidavit or certificate of compliance per AWWA C550 and NSF.

J. Valve Schedule:

VALVE TAG	SIZE (IN)	OPERATING PRESSURE (PSI)	LOCATION	INSTALLATION	VALVE ENDS	ACTUATOR			MEDIA	SYSTEM PIPE
						Mechanism	Shaft Position	Function		
STH-VLV-102	3	75	Solids Handling Building	Above Grade	FLG X FLG	Handwheel/ Lever	Horizontal	Open/Close	Process Water	Copper
STH-VLV-202	3	75	Solids Handling Building	Above Grade	FLG X FLG	Handwheel/ Lever	Horizontal	Open/Close	Process Water	Copper
POL-VLV-103	1	65	Solids Handling Building	Above Grade	FLG X FLG	Handwheel/ Lever	Vertical	Open/Close	Polymer	DIP
POL-VLV-203	1	65	Solids Handling Building	Above Grade	FLG X FLG	Handwheel/ Lever	Vertical	Open/Close	Polymer	DIP
SCIN-VLV-301	1 1/2	200	Solids Handling Building Blower Room	Above Grade	FLG X FLG	Lever	Horizontal	Open/Close	Compressed Air	CS
SCIN-VLV-311	1 1/2	200	Solids Handling Building Blower Room	Above Grade	FLG X FLG	Lever	Horizontal	Open/Close	Compressed Air	CS
SCIN-VLV-321	1 1/2	200	Solids Handling Building Blower Room	Above Grade	FLG X FLG	Lever	Horizontal	Open/Close	Compressed Air	CS
POL-VLV-101	1/2	2.2	Solids Handling Building	Above Grade	Threaded	Lever	Horizontal	Open/Close	Polymer	Poly

2.05 PINCH VALVES:

A. Acceptable Manufacturers:
   1. Onyx Valve Company.
   2. Red Valve Company.
   3. RF Valves.

B. Design:
   1. Valves shall be full cast metal body mechanical pinch type with integral flanges on body and flexible sleeve.
   2. All internal metal parts are to be isolated from the process fluid by the flexible rubber sleeve.

C. Materials and Construction:
   1. Valve body shall be ductile iron, stem and pinch bar shall be stainless steel, and sleeve shall be rubber.
   2. Suitable for 150 psi operating pressure.
   3. Valve body shall have flanged ends. Flanges shall be ANSI B16.1, Class 125.

D. Valve Operating Mechanism:
   1. The steel mechanism shall be double acting with pinching of the sleeve trim occurring equally from two sides.
   2. Rotating the handle counterclockwise shall lower a pinch bar above the sleeve, while raising a pinch bar below the sleeve, pinching the sleeve closed at the center of the valve.

E. Actuators:
   1. Manual Actuators:
      a. Valve shall open counterclockwise.
      b. Provide non-rising stem mechanism.
   2. Motor Actuators:
      a. Provide electric motor actuators as specified in sub-section 2.12 ELECTRIC MOTOR ACTUATORS herein.

F. Testing: Furnish certified copies of results of tests prior to shipment.

G. Valve List:

Parameter	**GRSC-VLV-312**	**GRSC-VLV-314**
Size, (in)	4”	4”
Max P (psig)	15	15
Max T (deg F)	100	100
Full Port?	Yes	Yes
Media	Grit Slurry	Grit Slurry
Valve Ends	FLG x FLG	FLG x FLG
Actuator Type	Handwheel	Motor Actuator
Actuator Shaft Position	Horizontal	Horizontal
System Pipe	DIP Vertical	DIP Vertical
Service	Open/Close	Open/Close
PID	Y302	Y302
Installation	Headworks Building Interior Above Grade	Headworks Building Interior Above Grade

2.06 PRESSURE REDUCING VALVES:

A. Provided as indicated on Contract Drawings.

B. Acceptable Manufacturers less than 3-inches in diameter:
   1. Watts Automatic Control Valve Company – Model 500 Series LF223
   2. Wilkins – Model 500 Series
   3. Engineer-approved equal.

C. Acceptable Manufacturers 3-inches and larger in diameter:
   1. Watts Automatic Control Valve Company – Model ACV Series 115
   2. Cla-Val Company – Model 90-01
   3. Engineer-approved equal.

D. Design:
   1. Valves shall be of flanged globe body type.
   2. Inlet flange shall be ANSI B16.1, Class 125. Outlet flange shall be ANSI B16.1, Class 125.
   3. Suitable for operation as follows:
      a. Maximum flow rate condition: 215 GPM.
      b. Normal system inlet pressure: 75 psi to 135 psi.
      c. Regulate downstream pressure at Headworks: 85 psi.
      d. Regulate downstream pressure at Solids Handling Building: 85 psi.
   4. Such that internal main valve assembly can be dismantled without removing valve body from pipeline.

E. Materials and Construction:
   1. Body shall be cast iron, ductile iron, or stainless steel.
   2. Trim shall be bronze or stainless steel.
   3. Seats shall be leather or other resilient material and shall be replaceable.

F. Operational Requirements:
   1. Suitable for pressure-reducing service.
   2. Operation of the valve will be frequent.
   3. Cushioned to permit operation without causing shock or water hammer.
   4. Operate without continuous waste of water.
   5. Provide tight closure when shut and full pipeline opening when open.
   6. The valve shall maintain accurate control of the downstream pressure regardless of fluctuation in flow or upstream pressure.
   7. Adjustable for speed of open and close operation and control pressure.

G. Valve Controls:
   1. Control Function:
      a. Pressure regulation - maintain preadjusted downstream pressure for varying rates of flow and upstream pressure.
      b. Open and close according to downstream pressure transmitter indication.
   2. Include all pilot valves, needle valves, strainers, interconnecting piping, fittings, cylinders, positioners, solenoid valves, limit switches, and other accessories essential to valve function factory assembled on valve body.
      a. Pilot shall be self-cleaning and self-flushing by locating the outlet in the bottom of the pilot ninety degrees to the inlet
      b. Small control valves shall be bronze or brass; pilot tubing shall be stainless steel braided with Teflon lining. Copper/brass fittings and pilot.

2.07 PRESSURE SAFETY VALVES:

A. Provided as indicated on Contract Drawings.

B. Acceptable Manufacturers:
   1. Watts Automatic Control Valve Company – Model ACV Series 116
   2. Cla-Val Company - Model 50-01
   3. Engineer-approved equal.

C. Design:
   1. Valves shall be of flanged globe body pattern.
   2. Inlet and outlet flanges shall be 6-inch ASME B16.1 Class 125.
   1. Valves shall be external pilot actuated with spring to adjust pressure setting.
   2. Provide indicator rod to show position of opening of the piston or diaphragm.
   3. Suitable for operation as follows:
      a. Pump shutoff head 360-460 feet (155-200 psi).
      b. Normal system operating pressure 75 psi to 150 psi.
      c. Open at 160 psi.
   4. Such that internal main valve assembly can be dismantled without removing valve body from pipeline.
   5. Provide shutoff cocks and Y-strainers on control tubing.
   6. Valve shall have a protective fusion bonded epoxy coating internally and externally. The coating shall conform to AWWA C116.

B. Materials and Construction:
   1. Body shall be cast iron, ductile iron, or stainless steel.
   2. Trim shall be bronze or stainless steel.
   3. Seats shall be EPDM rubber and shall be replaceable.

D. Operational Requirements:
   1. Suitable for pressure-reducing service.
   2. Operation of the valve will be intermittent.
   3. Cushioned to permit operation without causing shock or water hammer.
   4. Operate without continuous waste of water.
   5. Provide tight closure when shut and full pipeline opening when open.
   6. Adjustable for speed of open and close operation and control pressure.

E. Valve Controls:
   1. Control Function:
      a. Open when line pressure exceeds preset value.
   2. Include all pilot valves, needle valves, strainers, interconnecting piping, fittings, cylinders, positioners, solenoid valves, limit switches, and other accessories essential to valve function factory assembled on valve body.
      a. Small control valves shall be bronze or brass; piping shall be copper.
      b. Provide orifice plate assembly for flow control function.

2.08 TELESCOPING VALVES:

A. Telescoping Valves shall be specified herein and have the characteristics and dimensions as shown in the drawings

B. Acceptable Manufactures
   1. Watermann Valves
   2. Whipps, Inc
   3. Troy Valve

C. Design

1. The valve shall utilize a low friction seal to mount to engage the slip tube and mount to the flange of the receiving pipe.
2. All welds shall be performed by welders with AWS certification.
3. Finish: Mill finish on stainless steel. Welds shall be sandblasted to remove weld burn and scale.

D. Slip Tube and Bail
1. The slip tube shall be constructed of Schedule 10 minimum thickness stainless steel pipe. The the overflow end slip tube shall be fitted with a V-notch weir and shall be Schedule 10 stainless steel.
2. The bail shall be constructed of stainless steel and shall be bolted to the stem and welded to the slip tube. The bail style shall be comptible for v-notch weir slipe tube.
3. The maximum travel distance of the slip tube shall be 48 inches. The maximum depth of slip tube shall extend more than 12 inches past the center line of the receiving flange into the recieving pipe at a travel distance of 0 inches.
4. Slip tubes shall be equipped with a grease fitting to allow the operator to apply grease to the slip tube from the operator level.

E. Seal Flange
1. The telescoping valve shall be provided with a self-adjusting seal system to restrict leakage between the slip tube and the receiving pipe.
2. If a neoprene seal and separate companion flange is provided, the neoprene seal shall have a minimum thickness of 1/4-inch and the companion flange shall be stainless steel and shall have a minimum thickness of 3/8-inch.
3. The slipe tube gasket shall be replaceable without the rmeoval of the slip tube assmbly from the reciver pipe, or actuator.
4. The companion flange shall be provided with a bolt pattern suitable for attachment to the flange on the receiving pipe.

F. Stem
1. A threaded operating stem shall be utilized to connect the operating mechanism to the bail which in turn is attached to the slip tube. The threaded portion of the rising stem valves shall engage the operating nut in the manual operator and shall provide autmoatic self-locking, infinite valve positioning.
2. The threaded portion of the stem shall have a minimum outside diameter of 1-1/2 inches. Stem extension pipes are not acceptable.
3. The stem shall be constructed of solid stainless steel bar for the entire length, the metal having a tensile strength of not less than 75,000 psi.
4. Maximum L/R ratio for the unsupported part of the stem shall not exceed 200.
5. In compression, the stem shall be designed for a critical buckling load caused by a 40 lb effort on the handwheel with a safety factor of 2, using the Euler column formula.
6. The stem shall be designed to withstand the tension load caused by the application of a 40 lb effort on the handwheel without exceeding 1/5 of the ultimate tensile strength of the stem material.
7. The threaded portion of the stem shall have machine rolled double lead threads of the full Acme type with a 16 microinch finish or better. Stub threads are not acceptable.
8. Stems shall be provided with adjustable stop collars to prevent over travel.

G. Stem Guides
1. Stem guide shall be provided when necessary to ensure that the maximum L/R ratio for the unsupported part of the stem is 200 or less.
2. Stem guide brackets shall be fabricated of stainless steel and shall be outfitted with UHMW or bronze bushings.

3. Adjustable in two directions.

H. Anchor Bolts
1. Anchor bolts shall be provided by the valve manufacturer for mounting the pedestal and appurtenances.
2. Quantity and location shall be determined by the valve manufacturer.

I. Materials of Construction
1. Slip tube and bail shall be stainless steel, Type 304L
2. Stem shall be stainless steel, Type 304L
3. Anchor Studs, Fasteners and Nuts shall be stainless steel, Type 316
4. Seal shall be Urethane, Neoprene or Buna-N
5. Lift Nuts shall be stainless stainless steel, Type 304.
6. Pedestals and wall bracks shall be stainless steel, Type 304L
7. Operator Housing shall be cast aluminum
8. Stem cover shall be a clear plastic Butyrate
9. Companion flange shall be cast iron

J. Valve Operator
1. Valves shall be operated by a manual handwheel. The operator shall be mounted on a pedestal
2. The valve manufacturer shall select the proper gear ratio to ensure that the valve can be operated with no more than a 40 lb effort.
3. An arrow with the word "OPEN" shall be permanently attached or cast onto the operator to indicate the direction or rotation to open the valve
4. Handwheel operators shall be fully enclosed and shall have a cast aluminum housing.
5. The handwheel shall be removable. Pedestals shall be constructed of stainless steel. Aluminum pedestals are not acceptable.
6. The pedestal height shall be such that the handwheel is located approximately 36-in above the top of the tank walls.
7. Operators shall be equipped with fracture-resistant clear butyrate.
   a. The top of the stem cover shall be closed.
   b. The bottom end of the stem cover shall be mounted in a housing or adapter for easy field mounting.
   c. Stem covers shall be complete with a mylar strip type position indicator, calibrated in ¼ inch increments to illustrate valve position. The mylar strip, provided by the manufacturer, will be affixed by the CONTRACTOR after installation to provide a true and accurate indication of the tube elevation by comparing it to the top of the rising stem.
8. Valve Schedule:

Parameter	**WAS-VLV-001**	**WAS-VLV-002**
Size, (in)	6”	6”
Max T (deg F)	100	100
Media	Thin Sludge Decant	Thin Sludge Decant
Actuator Type	Manual, Handwheel	Manual, Handwheel
System Pipe	DIP Vertical	DIP Vertical
Service	Open/Close	Open/Close
PID	Y401	Y401
Installation	Exterior-Exposed	Exterior-Exposed

2.09 TAPPING SADDLES:

A. Provide tapping saddles for services as indicated on the Contract Drawings.
B. Acceptable Manufacturers:
   1. A.Y. McDonald 73805
   2. Ford S90-xxx-NL
   3. Mueller
      a. H-13000 Series
      b. H-13400 Series
      c. S-13000 Series
   4. Engineer approved equal.

2.10 CORPORATION STOPS:

A. Provide corporation stops for service reactivations as indicated on the Contract Drawings.
B. Acceptable Manufacturers:
   1. A.Y. McDonald 74701
   2. Cambridge Brass 302NL Series
   3. Ford FB-600-x-NL
   4. Mueller B25000N
   5. Engineer approved equal.

2.11 SAMPLE/DRAIN TAPS:

A. Provide sample/drain taps on all suction and discharge pump connections and on all common pump headers after last pump connection to main header.
B. Connecting fittings and pipe shall of the same material as the receiving pipe and rated for 150 psi service.
C. Sample/drain taps shall be 1 inch and connected through corporation stops.
D. Isolation valves shall be provided with all sample/drain taps and shall be Crane bronze ball valves or Engineer-approved equal.

2.12 ELECTRIC MOTOR ACTUATORS:

A. Provide factory-mounted electric motor actuators conforming to AWWA C540 for open-close and modulating service to operate on 480V, 3 phase, 60-hertz, ac supply. Motor and control compartment enclosure shall be totally enclosed rated NEMA 4X.
C. For valves installed in Class 1, Division 1 or Class 1, Division 2 areas, motor and control compartment enclosures shall be explosionproof and listed for the classification of the area. Refer to Contract Drawings' Hazardous Area Classification Site Plan for requirements.
D. Motor shall be AC induction type, TEFC, rated 460V.
E. Duration for actuator to move from fully-open to fully-closed position, or reverse as indicated:
   1. Approximately 30 Seconds for eccentric plug valves.
   2. Approximately 5 seconds per diameter inch, but not less than 20 seconds for air service butterfly valves.
F. Equipped with a direct position readout at the valve by means of a mechanical dial-position indicator showing percent of valve opening.
G. Provide with manual handwheel operator and lockable de-clutch mechanism. Handwheel shall not rotate when electrically driven.
H. Provide the following integral accessories:
   1. Integral reversing motor starter.

2. Separate non-fused disconnects. Disconnects shall be operable from outside the enclosure and shall be integral to the assembly. Disconnect enclosure rating shall conform to the valve enclosure rating.
3. Local/Off/Remote (LOR) selector switch with auxiliary remote status contact.
4. Open/Close pushbuttons to operate actuator when LOR is in "Local".
5. Hard-wired I/O points as indicated on the Contract Drawings' Control Diagrams and Section 40 61 96A - I/O List. Discrete outputs shall be provided by dry contacts, rated minimum 2A at 120Vac.
6. Butterfly valves:
   a. Internal 480V to 24VDC power supply (PS).
      (1) PS shall be sized to operate starter, local indicating lights, internal heating systems, and provide sufficient volt-amperes to field power two digital inputs and two digital outputs to PLC.
7. Eccentric plug valves:
   a. Internal 480V to 120VAC control power transformer (CPT).
      (1) CPT shall be sized to operate starter, local indicating lights, internal heating systems, and provide sufficient volt-amperes to field power two digital inputs and two digital outputs to PLC.
8. Modulating Valves:
   a. Shall accept a 4-20mA input signal for position control.
   b. Shall provide an isolated 4-20mA isolated output signal (with integral power supply) for position indication.
9. Open/Close Valves:
   a. Provide with two indicating lights in limit switch compartment cover.
      (1) One red light indicating valve is fully open.
      (2) One green light indicating valve is fully closed.
      (3) Both lights shall be on while valve is in travel
   b. Provide 4 train mechanically driven limit switches and overtorque switches.
   c. Switches shall be gear driven from the actuator gear train, electronic switches with battery pack shall not be allowed.
10. Internal heater to prevent condensation.

I. Products of the following manufacturers shall be acceptable:
   a. Auma Actuators, Inc.
   b. Limitorque Corporation.
   C. Rotork Controls, Incorporated.

2.13 COMBINATION AIR VALVES:

A. Acceptable Manufacturers:
   1. Multiplex Manufacturing Co. Model: Crispin SA Series.
   2. Valve and Primer Corp., DeZurik/APCO Model: Series 401.

B. Design: Conform to AWWA C512 and as specified.
   1. Valve shall be heavy-duty combination air release, water style.
   2. Body and cover shall be cast or ductile iron.
   3. Float shall be stainless steel.
   4. All internal parts shall be stainless steel.

C. Operation:
   1. Release air when filling line.
   2. Admit air when emptying line.
   3. Release accumulated air while pipeline is full and operating under pressure.

D. Connection:
   1. Connect air valves 2 inches and smaller to pipeline through corporation stops.
   2. Connecting fittings and pipe shall be bronze, brass, or copper rated for 250 psi service.
   3. Isolation valves shall be provided for all air valves and shall be bronze gate valves for sizes 3 inches and smaller unless otherwise noted.
      a. Acceptable Manufacturers:
         (1) Crane Model: Figure 431.
         (2) Jenkins Model: Figure 47.
         (3) Lunkenheimer Co. Model: Figure 2151.
   4. Couplings or unions indicated between pipeline and air valve piping shall be insulated style.

2.14 FIRE HYDRANTS:

A. Acceptable Manufacturers:
   1. American Flow Control.
   2. Mueller Company, model Centurion.
   3. Engineer Approved Equal

B. Design:
   1. Conform to AWWA C502 and as specified.
   2. Provide compression type main valve designed to open against pressure. Valve facings shall be of nontoxic materials suitable for potable water service.
   3. Provide internal main valve seat opening of not less than 5 inches diameter.
   4. Design to open counterclockwise.
   5. Provide dry-type bonnet with lubricant reservoir protected by O- or Quad-ring seals.
   6. Provide mechanical joint bell on shoe.
   7. Furnish for minimum bury depth of 3.5 feet. Include extensions as required for blow-offs.
   8. Furnish with two 2-1/2-inch hose nozzles and one 4-1/2-inch pumper nozzle with NFPA 1963 standard threads. Nozzle caps shall be chained to hydrant.
   9. Provide traffic break-off joint located above and near ground surface designed to minimize accident repairs.

C. Shop Painting:
   1. Shop paint exterior of hydrants red.
   2. Interior Coating:
      a. Conform to AWWA C550.
      b. Apply to exposed interior ferrous metal surfaces.

2.15 CORPORATION STOPS:

A. Provide corporation stops as specified to isolate air valves or as manual air release or inlet valves.

B. Mueller Company Style H-10003, H-10013, or H-10045 or Engineer-approved equal as applicable.

2.16 CURB STOPS:

A. Provide curb stops for service isolation.

B. Acceptable Manufacturers:
   1. A.Y. McDonald 74701.
   2. Cambridge Brass 302NL Series.
   3. Ford FB-600-x-NL.

4. Mueller B25000N.

2.17 VALVE BOXES:

A. Acceptable Manufacturers:
   1. Clay and Bailey Manufacturing Company.
   2. Dresser Industries, Inc.
   3. Mueller Company.
   4. Neenah Foundry Company.
   5. Tyler Company.
   6. Engineer Approved Equal
B. Provide for all buried valves.
C. Design:
   1. Boxes shall consist of a cast-iron cover, lid, and base castings with 6-inch cast-iron pipe shaft.
   2. Provide extension stem to bring operating nut within 2 feet of valve box top.
   3. Drop cover shall be marked for the appropriate system (i.e., "WATER", “SEWER”).

2.18 CURB STOP SERVICE BOXES:

A. Provide curb stops and service boxes for all curb stops installed.
B. Acceptable Manufacturers:
   1. Tyler Union, Star Pipe, Castings – SB94ES, SB95ES.

2.19 VALVE IDENTIFICATION TAGS:

A. Exposed interior or exterior valves: Provide heavy duty, permanent plastic ID tags with valve number printed on tag using indelible ink and contrasting colors. Minimum tag size shall be 2"x3" and minimum letter height shall be 1". Tag shall be easily removable and shall be mounted so as not to interfere with normal valve operations. Valve ID shall be as identified in the valve schedule.
B. Vault or Pit Installed Valves: Provide a cast bronze floor plate to be anchored into the top concrete slab of pit or valve adjacent to the floor box or floor stand. Plate shall be minimum of 4"x3"x 3/16". Valve number shall be engraved in plate with minimum letter height of 1 1/2". Plate shall be anchored into concrete using threaded lugs with split stud anchor or other suitable anchoring device. Valve number shall be as identified in the valve schedule.

2.20 VALVE ACCESSORIES:

A. Post Indicator:

2.21 SHOP PAINTING:

A. Prepare surfaces and paint or coat all valves, fire hydrants, floor stands, valve boxes, corporation stops, and all related accessories standard of the manufacturer unless otherwise specified herein.
B. Paint and coatings shall be suitable for the service intended.
C. Submit type of paint or coating proposed with drawings and data for Engineer approval prior to fabrication.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Comply with provisions of AWWA C600 and as specified.

B. Thoroughly clean and remove all shipping materials prior to setting. Operate all valves from fully opened to totally closed.
C. Install eccentric plug valves in reverse position, flow and pressure against the plug face when closed, in lines with solids or stringy materials. When installed horizontally with shaft in the horizontal, the plug shall rotate open to the top recess of the valve body.
D. Install double-door wafer check valves with hinge pin in the vertical position for horizontal flow applications.
E. Install single-door wafer swing check valves with hinge pin in the horizontal position for horizontal flow applications.
F. Equip with anchorage where indicated.
G. Set fire hydrants with lowest nozzle 18 inches above finished grade. Check and fill stem bonnet lubricant reservoir.

3.02 FIELD TESTING:

A. Perform on piping and valves as specified in Section 33 31 50 - Pipe Installation and for the following:
    1. Gate valves.
    2. Butterfly valves.
    3. Check valves.
    4. Eccentric plug valves.
    5. Ball valves.
    6. Air and air/vacuum valves.
    7. Fire hydrants.

END OF SECTION 33 12 16

TODD CREEK
WWTP
I/O LIST

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
PRE-IPS-GATE-ZD-001	PRE-IPS-PLC-061	PRE-IPS-GATE-001	SCREEN EFFLUENT CHANNEL SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-GATE-ZB-001	PRE-IPS-PLC-061	PRE-IPS-GATE-001	SCREEN EFFLUENT CHANNEL SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-GATE-HS-001	PRE-IPS-PLC-061	PRE-IPS-GATE-001	SCREEN EFFLUENT CHANNEL SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-YA-001	PRE-IPS-PLC-061	PRE-IPS-GATE-001	SCREEN EFFLUENT CHANNEL SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-ZSC-001	PRE-IPS-PLC-061	PRE-IPS-GATE-001	SCREEN EFFLUENT CHANNEL SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-ZI-001	PRE-IPS-PLC-061	PRE-IPS-GATE-001	SCREEN EFFLUENT CHANNEL SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y201	
PRE-IPS-GATE-ZD-002	PRE-IPS-PLC-061	PRE-IPS-GATE-002	SCREEN EFFLUENT CHANNEL SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-GATE-ZB-002	PRE-IPS-PLC-061	PRE-IPS-GATE-002	SCREEN EFFLUENT CHANNEL SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-GATE-HS-002	PRE-IPS-PLC-061	PRE-IPS-GATE-002	SCREEN EFFLUENT CHANNEL SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-YA-002	PRE-IPS-PLC-061	PRE-IPS-GATE-002	SCREEN EFFLUENT CHANNEL SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-ZSC-002	PRE-IPS-PLC-061	PRE-IPS-GATE-002	SCREEN EFFLUENT CHANNEL SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-ZI-002	PRE-IPS-PLC-061	PRE-IPS-GATE-002	SCREEN EFFLUENT CHANNEL SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y201	
PRE-IPS-GATE-ZD-101	PRE-IPS-PLC-061	PRE-IPS-GATE-101	IPS WET WELL SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	2
PRE-IPS-GATE-ZB-101	PRE-IPS-PLC-061	PRE-IPS-GATE-101	IPS WET WELL SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	2
PRE-IPS-GATE-HS-101	PRE-IPS-PLC-061	PRE-IPS-GATE-101	IPS WET WELL SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	2
PRE-IPS-GATE-YA-101	PRE-IPS-PLC-061	PRE-IPS-GATE-101	IPS WET WELL SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	2
PRE-IPS-GATE-ZSC-101	PRE-IPS-PLC-061	PRE-IPS-GATE-101	IPS WET WELL SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	2
PRE-IPS-GATE-ZI-101	PRE-IPS-PLC-061	PRE-IPS-GATE-101	IPS WET WELL SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y201	2
PRE-IPS-LIT-LI-101	PRE-IPS-PLC-061	PRE-IPS-LIT-101	IPS WET WELL	LEVEL	AI	4-20mA	0-45	FEET	2-WIRE	SYSTEM	Y202	2, 8
PRE-IPS-LSLL-LALL-101	PRE-IPS-PLC-061	PRE-IPS-LSLL-101	IPS WET WELL	LEVEL LOW-LOW	DI	N.O. CONTACT	790.25	FEET(MSL)	N/A	SYSTEM	Y202	2, 8
PRE-IPS-LSL-LAL-101	PRE-IPS-PLC-061	PRE-IPS-LSL-101	IPS WET WELL	LEVEL LOW	DI	N.O. CONTACT	790.75	FEET(MSL)	N/A	SYSTEM	Y202	2, 8
PRE-IPS-LSH-LAH-101	PRE-IPS-PLC-061	PRE-IPS-LSH-101	IPS WET WELL	LEVEL HIGH	DI	N.O. CONTACT	796.28	FEET(MSL)	N/A	SYSTEM	Y202	2, 8
PRE-IPS-LSHH-LAHH-101	PRE-IPS-PLC-061	PRE-IPS-LSHH-101	IPS WET WELL	LEVEL HIGH-HIGH	DI	N.O. CONTACT	798.75	FEET(MSL)	N/A	SYSTEM	Y202	2, 8
PRE-IPS-LWCO-HS-101	PRE-IPS-PLC-061	PRE-IPS-LWCO-101	LWCO NO. 1 IN BYPASS	IN-BYPASS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-LWCO-YA-101	PRE-IPS-PLC-061	PRE-IPS-LWCO-101	LWCO NO. 1 CUTOUT	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-LIT-LI-102	PRE-IPS-PLC-061	PRE-IPS-LIT-102	IPS WET WELL	LEVEL	AI	4-20mA	0-45	FEET	2-WIRE	SYSTEM	Y202	2, 8
PRE-IPS-LSLL-LALL-102	PRE-IPS-PLC-061	PRE-IPS-LSLL-102	IPS WET WELL	LEVEL LOW-LOW	DI	N.O. CONTACT	790.25	FEET(MSL)	N/A	SYSTEM	Y202	2, 8
PRE-IPS-LSL-LAL-102	PRE-IPS-PLC-061	PRE-IPS-LSL-102	IPS WET WELL	LEVEL LOW	DI	N.O. CONTACT	790.75	FEET(MSL)	N/A	SYSTEM	Y202	2, 8
PRE-IPS-LSH-LAH-102	PRE-IPS-PLC-061	PRE-IPS-LSH-102	IPS WET WELL	LEVEL HIGH	DI	N.O. CONTACT	796.28	FEET(MSL)	N/A	SYSTEM	Y202	2, 8
PRE-IPS-LSHH-LAHH-102	PRE-IPS-PLC-061	PRE-IPS-LSHH-102	IPS WET WELL	LEVEL HIGH-HIGH	DI	N.O. CONTACT	798.75	FEET(MSL)	N/A	SYSTEM	Y202	2, 8
PRE-IPS-LWCO-HS-102	PRE-IPS-PLC-061	PRE-IPS-LWCO-101	LWCO NO. 2 IN BYPASS	IN-BYPASS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-LWCO-YA-102	PRE-IPS-PLC-061	PRE-IPS-LWCO-101	LWCO NO. 2 CUTOUT	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
PRE-IPS-PMP-HS-110A	PRE-IPS-PLC-061	PRE-IPS-PMP-110	INFLUENT SUBMERSIBLE PUMP	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-HS-110B	PRE-IPS-PLC-061	PRE-IPS-PMP-110	INFLUENT SUBMERSIBLE PUMP	IN-LOCAL	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-HS-110C	PRE-IPS-PLC-061	PRE-IPS-PMP-110	INFLUENT SUBMERSIBLE PUMP	IN-VFD	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-HS-110D	PRE-IPS-PLC-061	PRE-IPS-PMP-110	INFLUENT SUBMERSIBLE PUMP	IN-BYPASS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-MN-110A	PRE-IPS-PLC-061	PRE-IPS-PMP-110	INFLUENT SUBMERSIBLE PUMP	VFD RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-MN-110B	PRE-IPS-PLC-061	PRE-IPS-PMP-110	INFLUENT SUBMERSIBLE PUMP	BYPASS RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-TAH-110	PRE-IPS-PLC-061	PRE-IPS-PMP-110	INFLUENT SUBMERSIBLE PUMP TEMP HIGH	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y202	
PRE-IPS-PMP-MAH-110	PRE-IPS-PLC-061	PRE-IPS-PMP-110	INFLUENT SUBMERSIBLE PUMP SEAL LEAK	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y202	
PRE-IPS-PMP-YA-110A	PRE-IPS-PLC-061	PRE-IPS-PMP-110	INFLUENT SUBMERSIBLE PUMP	VFD FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-YA-110B	PRE-IPS-PLC-061	PRE-IPS-PMP-110	INFLUENT SUBMERSIBLE PUMP	OVERLOAD	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-MD-110	PRE-IPS-PLC-061	PRE-IPS-PMP-110	INFLUENT SUBMERSIBLE PUMP	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y202	
PRE-IPS-PMP-II-110	PRE-IPS-PLC-061	PRE-IPS-PMP-110	INFLUENT SUBMERSIBLE PUMP	CURRENT	AI	COMM	N/A	N/A	N/A	N/A	Y202	
PRE-IPS-PMP-SI-110	PRE-IPS-PLC-061	PRE-IPS-PMP-110	INFLUENT SUBMERSIBLE PUMP	SPEED	AI	4-20mA	0 - 100	%	2-WIRE	FIELD	Y202	
PRE-IPS-PMP-SC-110	PRE-IPS-PLC-061	PRE-IPS-PMP-110	INFLUENT SUBMERSIBLE PUMP	SPEED CONTROL	AO	4-20mA	0 - 100	%	2-WIRE	SYSTEM	Y202	
PRE-IPS-PMP-HS-120A	PRE-IPS-PLC-061	PRE-IPS-PMP-120	INFLUENT SUBMERSIBLE PUMP	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-HS-120B	PRE-IPS-PLC-061	PRE-IPS-PMP-120	INFLUENT SUBMERSIBLE PUMP	IN-LOCAL	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-HS-120C	PRE-IPS-PLC-061	PRE-IPS-PMP-120	INFLUENT SUBMERSIBLE PUMP	IN-VFD	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-HS-120D	PRE-IPS-PLC-061	PRE-IPS-PMP-120	INFLUENT SUBMERSIBLE PUMP	IN-BYPASS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-MN-120A	PRE-IPS-PLC-061	PRE-IPS-PMP-120	INFLUENT SUBMERSIBLE PUMP	VFD RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-MN-120B	PRE-IPS-PLC-061	PRE-IPS-PMP-120	INFLUENT SUBMERSIBLE PUMP	BYPASS RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-TAH-120	PRE-IPS-PLC-061	PRE-IPS-PMP-120	INFLUENT SUBMERSIBLE PUMP TEMP HIGH	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y202	
PRE-IPS-PMP-MAH-120	PRE-IPS-PLC-061	PRE-IPS-PMP-120	INFLUENT SUBMERSIBLE PUMP SEAL LEAK	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y202	
PRE-IPS-PMP-YA-120A	PRE-IPS-PLC-061	PRE-IPS-PMP-120	INFLUENT SUBMERSIBLE PUMP	VFD FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-YA-120B	PRE-IPS-PLC-061	PRE-IPS-PMP-120	INFLUENT SUBMERSIBLE PUMP	OVERLOAD	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-MD-120	PRE-IPS-PLC-061	PRE-IPS-PMP-120	INFLUENT SUBMERSIBLE PUMP	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y202	
PRE-IPS-PMP-II-120	PRE-IPS-PLC-061	PRE-IPS-PMP-120	INFLUENT SUBMERSIBLE PUMP	CURRENT	AI	COMM	N/A	N/A	N/A	N/A	Y202	
PRE-IPS-PMP-SI-120	PRE-IPS-PLC-061	PRE-IPS-PMP-120	INFLUENT SUBMERSIBLE PUMP	SPEED	AI	4-20mA	0 - 100	%	2-WIRE	FIELD	Y202	
PRE-IPS-PMP-SC-120	PRE-IPS-PLC-061	PRE-IPS-PMP-120	INFLUENT SUBMERSIBLE PUMP	SPEED CONTROL	AO	4-20mA	0 - 100	%	2-WIRE	SYSTEM	Y202	
PRE-IPS-PMP-HS-130A	PRE-IPS-PLC-061	PRE-IPS-PMP-130	INFLUENT SUBMERSIBLE PUMP	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-HS-130B	PRE-IPS-PLC-061	PRE-IPS-PMP-130	INFLUENT SUBMERSIBLE PUMP	IN-LOCAL	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-HS-130C	PRE-IPS-PLC-061	PRE-IPS-PMP-130	INFLUENT SUBMERSIBLE PUMP	IN-VFD	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-HS-130D	PRE-IPS-PLC-061	PRE-IPS-PMP-130	INFLUENT SUBMERSIBLE PUMP	IN-BYPASS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-MN-130A	PRE-IPS-PLC-061	PRE-IPS-PMP-130	INFLUENT SUBMERSIBLE PUMP	VFD RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-MN-130B	PRE-IPS-PLC-061	PRE-IPS-PMP-130	INFLUENT SUBMERSIBLE PUMP	BYPASS RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-TAH-130	PRE-IPS-PLC-061	PRE-IPS-PMP-130	INFLUENT SUBMERSIBLE PUMP TEMP HIGH	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y202	
PRE-IPS-PMP-MAH-130	PRE-IPS-PLC-061	PRE-IPS-PMP-130	INFLUENT SUBMERSIBLE PUMP SEAL LEAK	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y202	
PRE-IPS-PMP-YA-130A	PRE-IPS-PLC-061	PRE-IPS-PMP-130	INFLUENT SUBMERSIBLE PUMP	VFD FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-YA-130B	PRE-IPS-PLC-061	PRE-IPS-PMP-130	INFLUENT SUBMERSIBLE PUMP	OVERLOAD	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-MD-130	PRE-IPS-PLC-061	PRE-IPS-PMP-130	INFLUENT SUBMERSIBLE PUMP	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y202	
PRE-IPS-PMP-II-130	PRE-IPS-PLC-061	PRE-IPS-PMP-130	INFLUENT SUBMERSIBLE PUMP	CURRENT	AI	COMM	N/A	N/A	N/A	N/A	Y202	
PRE-IPS-PMP-SI-130	PRE-IPS-PLC-061	PRE-IPS-PMP-130	INFLUENT SUBMERSIBLE PUMP	SPEED	AI	4-20mA	0 - 100	%	2-WIRE	FIELD	Y202	
PRE-IPS-PMP-SC-130	PRE-IPS-PLC-061	PRE-IPS-PMP-130	INFLUENT SUBMERSIBLE PUMP	SPEED CONTROL	AO	4-20mA	0 - 100	%	2-WIRE	SYSTEM	Y202	

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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
PRE-IPS-PMP-HS-140A	PRE-IPS-PLC-061	PRE-IPS-PMP-140	INFLUENT SUBMERSIBLE PUMP	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-HS-140B	PRE-IPS-PLC-061	PRE-IPS-PMP-140	INFLUENT SUBMERSIBLE PUMP	IN-LOCAL	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-HS-140C	PRE-IPS-PLC-061	PRE-IPS-PMP-140	INFLUENT SUBMERSIBLE PUMP	IN-VFD	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-HS-140D	PRE-IPS-PLC-061	PRE-IPS-PMP-140	INFLUENT SUBMERSIBLE PUMP	IN-BYPASS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-MN-140A	PRE-IPS-PLC-061	PRE-IPS-PMP-140	INFLUENT SUBMERSIBLE PUMP	VFD RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-MN-140B	PRE-IPS-PLC-061	PRE-IPS-PMP-140	INFLUENT SUBMERSIBLE PUMP	BYPASS RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-TAH-140	PRE-IPS-PLC-061	PRE-IPS-PMP-140	INFLUENT SUBMERSIBLE PUMP TEMP HIGH	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y202	
PRE-IPS-PMP-MAH-140	PRE-IPS-PLC-061	PRE-IPS-PMP-140	INFLUENT SUBMERSIBLE PUMP SEAL LEAK	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y202	
PRE-IPS-PMP-YA-140A	PRE-IPS-PLC-061	PRE-IPS-PMP-140	INFLUENT SUBMERSIBLE PUMP	VFD FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-YA-140B	PRE-IPS-PLC-061	PRE-IPS-PMP-140	INFLUENT SUBMERSIBLE PUMP	OVERLOAD	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-MD-140	PRE-IPS-PLC-061	PRE-IPS-PMP-140	INFLUENT SUBMERSIBLE PUMP	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y202	
PRE-IPS-PMP-II-140	PRE-IPS-PLC-061	PRE-IPS-PMP-140	INFLUENT SUBMERSIBLE PUMP	CURRENT	AI	COMM	N/A	N/A	N/A	N/A	Y202	
PRE-IPS-PMP-SI-140	PRE-IPS-PLC-061	PRE-IPS-PMP-140	INFLUENT SUBMERSIBLE PUMP	SPEED	AI	4-20mA	0 - 100	%	2-WIRE	FIELD	Y202	
PRE-IPS-PMP-SC-140	PRE-IPS-PLC-061	PRE-IPS-PMP-140	INFLUENT SUBMERSIBLE PUMP	SPEED CONTROL	AO	4-20mA	0 - 100	%	2-WIRE	SYSTEM	Y202	
PRE-IPS-PMP-HS-150A	PRE-IPS-PLC-061	PRE-IPS-PMP-150	INFLUENT SUBMERSIBLE PUMP	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-HS-150B	PRE-IPS-PLC-061	PRE-IPS-PMP-150	INFLUENT SUBMERSIBLE PUMP	IN-LOCAL	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-HS-150C	PRE-IPS-PLC-061	PRE-IPS-PMP-150	INFLUENT SUBMERSIBLE PUMP	IN-VFD	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-HS-150D	PRE-IPS-PLC-061	PRE-IPS-PMP-150	INFLUENT SUBMERSIBLE PUMP	IN-BYPASS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-MN-150A	PRE-IPS-PLC-061	PRE-IPS-PMP-150	INFLUENT SUBMERSIBLE PUMP	VFD RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-MN-150B	PRE-IPS-PLC-061	PRE-IPS-PMP-150	INFLUENT SUBMERSIBLE PUMP	BYPASS RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-TAH-150	PRE-IPS-PLC-061	PRE-IPS-PMP-150	INFLUENT SUBMERSIBLE PUMP TEMP HIGH	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y202	
PRE-IPS-PMP-MAH-150	PRE-IPS-PLC-061	PRE-IPS-PMP-150	INFLUENT SUBMERSIBLE PUMP SEAL LEAK	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y202	
PRE-IPS-PMP-YA-150A	PRE-IPS-PLC-061	PRE-IPS-PMP-150	INFLUENT SUBMERSIBLE PUMP	VFD FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-YA-150B	PRE-IPS-PLC-061	PRE-IPS-PMP-150	INFLUENT SUBMERSIBLE PUMP	OVERLOAD	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-MD-150	PRE-IPS-PLC-061	PRE-IPS-PMP-150	INFLUENT SUBMERSIBLE PUMP	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y202	
PRE-IPS-PMP-II-150	PRE-IPS-PLC-061	PRE-IPS-PMP-150	INFLUENT SUBMERSIBLE PUMP	CURRENT	AI	COMM	N/A	N/A	N/A	N/A	Y202	
PRE-IPS-PMP-SI-150	PRE-IPS-PLC-061	PRE-IPS-PMP-150	INFLUENT SUBMERSIBLE PUMP	SPEED	AI	4-20mA	0 - 100	%	2-WIRE	FIELD	Y202	
PRE-IPS-PMP-SC-150	PRE-IPS-PLC-061	PRE-IPS-PMP-150	INFLUENT SUBMERSIBLE PUMP	SPEED CONTROL	AO	4-20mA	0 - 100	%	2-WIRE	SYSTEM	Y202	
PRE-IPS-PIT-PI-110	PRE-IPS-PLC-061	PRE-IPS-PIT-110	INFLUENT SUBMERSIBLE PUMP	PRESSURE	AI	4-20mA	0-150	PSI	2-WIRE	SYSTEM	Y202	2, 8
PRE-IPS-PIT-PI-120	PRE-IPS-PLC-061	PRE-IPS-PIT-120	INFLUENT SUBMERSIBLE PUMP	PRESSURE	AI	4-20mA	0-150	PSI	2-WIRE	SYSTEM	Y202	2, 8
PRE-IPS-PIT-PI-130	PRE-IPS-PLC-061	PRE-IPS-PIT-130	INFLUENT SUBMERSIBLE PUMP	PRESSURE	AI	4-20mA	0-150	PSI	2-WIRE	SYSTEM	Y202	2, 8
PRE-IPS-PIT-PI-140	PRE-IPS-PLC-061	PRE-IPS-PIT-140	INFLUENT SUBMERSIBLE PUMP	PRESSURE	AI	4-20mA	0-150	PSI	2-WIRE	SYSTEM	Y202	2, 8
PRE-IPS-PIT-PI-150	PRE-IPS-PLC-061	PRE-IPS-PIT-150	INFLUENT SUBMERSIBLE PUMP	PRESSURE	AI	4-20mA	0-150	PSI	2-WIRE	SYSTEM	Y202	2, 8

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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
PRE-IPS-SWB_52U1-HS-001	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 CIRCUIT BREAKER 52-U1	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A		6
PRE-IPS-SWB_52U1-YA-001A	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 CIRCUIT BREAKER 52-U1 TRIP	ALARM	DI	COMM	N/A	N/A	N/A	N/A		6
PRE-IPS-SWB_52U1-YA-001B	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 CIRCUIT BREAKER 52-U1 OPEN/CLOSE	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A		6
PRE-IPS-SWB_52U1-YN-001	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 SOURCE AVAILABLE	STATUS	DI	COMM	N/A	N/A	N/A	N/A		6
PRE-IPS-SWB_52U1-ZSC-001	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 CIRCUIT BREAKER 52-U1	CLOSED	DI	COMM	N/A	N/A	N/A	N/A		6
PRE-IPS-SWB_52U1-ZSO-001	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 CIRCUIT BREAKER 52-U1	OPEN	DI	COMM	N/A	N/A	N/A	N/A		6
PRE-IPS-SWB_52U1-EI-001AN	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 A-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
PRE-IPS-SWB_52U1-EI-001BN	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 B-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
PRE-IPS-SWB_52U1-EI-001CN	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 C-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
PRE-IPS-SWB_52U1-EI-001AB	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 A-B PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
PRE-IPS-SWB_52U1-EI-001BC	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 B-C PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
PRE-IPS-SWB_52U1-EI-001CA	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 C-A PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
PRE-IPS-SWB_52U1-II-001A	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 A LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
PRE-IPS-SWB_52U1-II-001B	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 B LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
PRE-IPS-SWB_52U1-II-001C	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 C LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
PRE-IPS-SWB_52U1-JI-001A	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 AVERAGE APPARENT	POWER	AI	COMM		KVA	N/A	N/A		4, 6
PRE-IPS-SWB_52U1-JI-001R	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 AVERAGE REAL	POWER	AI	COMM		KW	N/A	N/A		4, 6
PRE-IPS-SWB_52U1-JQ-001	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 TOTAL	ENERGY	AI	COMM		KWh	N/A	N/A		4, 6
PRE-IPS-SWB_52U1-JN-001	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 AVERAGE	POWER FACTOR	AI	COMM		PF	N/A	N/A		4, 6
PRE-IPS-SWB_52U1-SI-001	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1	FREQUENCY	AI	COMM		HERTZ	N/A	N/A		4, 6
PRE-IPS-SWB_52U2-HS-001	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 CIRCUIT BREAKER 52-U2	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A		6
PRE-IPS-SWB_52U2-YA-001A	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 CIRCUIT BREAKER 52-U2 TRIP	ALARM	DI	COMM	N/A	N/A	N/A	N/A		6
PRE-IPS-SWB_52U2-YA-001B	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 CIRCUIT BREAKER 52-U2 OPEN/CLOSE	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A		6
PRE-IPS-SWB_52U2-YN-001	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 SOURCE AVAILABLE	STATUS	DI	COMM	N/A	N/A	N/A	N/A		6
PRE-IPS-SWB_52U2-ZSC-001	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 CIRCUIT BREAKER 52-U2	CLOSED	DI	COMM	N/A	N/A	N/A	N/A		6
PRE-IPS-SWB_52U2-ZSO-001	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 CIRCUIT BREAKER 52-U2	OPEN	DI	COMM	N/A	N/A	N/A	N/A		6
PRE-IPS-SWB_52U2-EI-001AN	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 A-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
PRE-IPS-SWB_52U2-EI-001BN	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 B-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
PRE-IPS-SWB_52U2-EI-001CN	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 C-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
PRE-IPS-SWB_52U2-EI-001AB	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 A-B PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
PRE-IPS-SWB_52U2-EI-001BC	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 B-C PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
PRE-IPS-SWB_52U2-EI-001CA	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 C-A PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
PRE-IPS-SWB_52U2-II-001A	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 A LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
PRE-IPS-SWB_52U2-II-001B	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 B LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
PRE-IPS-SWB_52U2-II-001C	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 C LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
PRE-IPS-SWB_52U2-JI-001A	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 AVERAGE APPARENT	POWER	AI	COMM		KVA	N/A	N/A		4, 6
PRE-IPS-SWB_52U2-JI-001R	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 AVERAGE REAL	POWER	AI	COMM		KW	N/A	N/A		4, 6
PRE-IPS-SWB_52U2-JQ-001	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 TOTAL	ENERGY	AI	COMM		KWh	N/A	N/A		4, 6
PRE-IPS-SWB_52U2-JN-001	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 AVERAGE	POWER FACTOR	AI	COMM		PF	N/A	N/A		4, 6
PRE-IPS-SWB_52U2-SI-001	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2	FREQUENCY	AI	COMM		HERTZ	N/A	N/A		4, 6

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
PRE-IPS-CTRL-TAH-001	PRE-IPS-PLC-061	PRE-IPS-CTRL-001	IPS ELECTRICAL ROOM	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-IPS-CTRL-YA-001A	PRE-IPS-PLC-061	PRE-IPS-CTRL-001	DIRTY FILTER	WARNING	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-IPS-CTRL-YA-001B	PRE-IPS-PLC-061	PRE-IPS-CTRL-001	HVAC CONTROL SYSTEM	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-IPS-UPS-JA-051	PRE-IPS-PLC-061	PRE-IPS-UPS-051	UPS SYSTEM REPLACE BATTERY	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-UPS-JAL-051	PRE-IPS-PLC-061	PRE-IPS-UPS-051	UPS SYSTEM LOW BATTERY	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-UPS-YA-051A	PRE-IPS-PLC-061	PRE-IPS-UPS-051	UPS SYSTEM	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-UPS-YN-051	PRE-IPS-PLC-061	PRE-IPS-UPS-051	UPS SYSTEM ON BATTERY	STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-UPS-ZS-051	PRE-IPS-PLC-061	PRE-IPS-UPS-051	UPS SYSTEM BYPASS	STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-NSW-YA-061A	PRE-IPS-PLC-061	PRE-IPS-NSW-061	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-NSW-YA-061B	PRE-IPS-PLC-061	PRE-IPS-NSW-061	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-NSW-YA-061C	PRE-IPS-PLC-061	PRE-IPS-NSW-061	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-NSW-TI-061	PRE-IPS-PLC-061	PRE-IPS-NSW-061	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		4, 9
PRE-IPS-NSW-YA-071A	PRE-IPS-PLC-061	PRE-IPS-NSW-071	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-NSW-YA-071B	PRE-IPS-PLC-061	PRE-IPS-NSW-071	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-NSW-YA-071C	PRE-IPS-PLC-061	PRE-IPS-NSW-071	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-NSW-TI-071	PRE-IPS-PLC-061	PRE-IPS-NSW-071	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		4, 9

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
PRE-IPS-AIT-YA-001A	PRE-IPS-PLC-062	PRE-IPS-AIT-001	COARSE SCREENING COMBUSTIBLE GAS	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-AIT-YA-001B	PRE-IPS-PLC-062	PRE-IPS-AIT-001	COARSE SCREENING AREA GAS CONTROL PANEL	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-AE-AI-001	PRE-IPS-PLC-062	PRE-IPS-AE-001	COARSE SCREENING COMBUSTIBLE GAS	LEVEL	AI	4-20mA	0-100%	LEL	3-WIRE	FIELD	Y201	
PRE-IPS-AE-AI-003	PRE-IPS-PLC-062	PRE-IPS-AE-003	COARSE SCREENING H2S GAS	LEVEL	AI	4-20mA	0-2000	PPM	3-WIRE	FIELD	Y201	
PRE-IPS-AIT-YA-002A	PRE-IPS-PLC-062	PRE-IPS-AIT-002	COARSE SCREENING OZONE GAS	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-AIT-YA-002B	PRE-IPS-PLC-062	PRE-IPS-AIT-002	COARSE SCREENING OZONE GAS CONTROL PANEL	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-AE-AI-002	PRE-IPS-PLC-062	PRE-IPS-AE-002	COARSE SCREENING LEVEL 2 OZONE GAS	LEVEL	AI	4-20mA	0-100%	O3	3-WIRE	FIELD	Y201	
PRE-IPS-LSH-LAH-001	PRE-IPS-PLC-062	PRE-IPS-LSH-001	COARSE SCREENING INFLUENT CHANNEL	LEVEL HIGH	DI	N.O. CONTACT		FEET(MSL)	N/A	SYSTEM	Y201	8
PRE-IPS-GATE-ZD-011	PRE-IPS-PLC-062	PRE-IPS-GATE-011	SCREEN CHANNEL SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-GATE-ZB-011	PRE-IPS-PLC-062	PRE-IPS-GATE-011	SCREEN CHANNEL SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-GATE-HS-011	PRE-IPS-PLC-062	PRE-IPS-GATE-011	SCREEN CHANNEL SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-YA-011	PRE-IPS-PLC-062	PRE-IPS-GATE-011	SCREEN CHANNEL SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-ZSC-011	PRE-IPS-PLC-062	PRE-IPS-GATE-011	SCREEN CHANNEL SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-ZI-011	PRE-IPS-PLC-062	PRE-IPS-GATE-011	SCREEN CHANNEL SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y201	
PRE-IPS-GATE-ZD-012	PRE-IPS-PLC-062	PRE-IPS-GATE-012	SCREEN CHANNEL SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-GATE-ZB-012	PRE-IPS-PLC-062	PRE-IPS-GATE-012	SCREEN CHANNEL SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-GATE-HS-012	PRE-IPS-PLC-062	PRE-IPS-GATE-012	SCREEN CHANNEL SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-YA-012	PRE-IPS-PLC-062	PRE-IPS-GATE-012	SCREEN CHANNEL SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-ZSC-012	PRE-IPS-PLC-062	PRE-IPS-GATE-012	SCREEN CHANNEL SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-ZI-012	PRE-IPS-PLC-062	PRE-IPS-GATE-012	SCREEN CHANNEL SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y201	
PRE-IPS-GATE-ZD-021	PRE-IPS-PLC-062	PRE-IPS-GATE-021	SCREEN CHANNEL SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-GATE-ZB-021	PRE-IPS-PLC-062	PRE-IPS-GATE-021	SCREEN CHANNEL SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-GATE-HS-021	PRE-IPS-PLC-062	PRE-IPS-GATE-021	SCREEN CHANNEL SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-YA-021	PRE-IPS-PLC-062	PRE-IPS-GATE-021	SCREEN CHANNEL SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-ZSC-021	PRE-IPS-PLC-062	PRE-IPS-GATE-021	SCREEN CHANNEL SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-ZI-021	PRE-IPS-PLC-062	PRE-IPS-GATE-021	SCREEN CHANNEL SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y201	
PRE-IPS-GATE-ZD-022	PRE-IPS-PLC-062	PRE-IPS-GATE-022	SCREEN CHANNEL SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-GATE-ZB-022	PRE-IPS-PLC-062	PRE-IPS-GATE-022	SCREEN CHANNEL SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-GATE-HS-022	PRE-IPS-PLC-062	PRE-IPS-GATE-022	SCREEN CHANNEL SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-YA-022	PRE-IPS-PLC-062	PRE-IPS-GATE-022	SCREEN CHANNEL SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-ZSC-022	PRE-IPS-PLC-062	PRE-IPS-GATE-022	SCREEN CHANNEL SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-ZI-022	PRE-IPS-PLC-062	PRE-IPS-GATE-022	SCREEN CHANNEL SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y201	
PRE-IPS-GATE-ZD-031	PRE-IPS-PLC-062	PRE-IPS-GATE-031	SCREEN CHANNEL SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-GATE-ZB-031	PRE-IPS-PLC-062	PRE-IPS-GATE-031	SCREEN CHANNEL SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-GATE-HS-031	PRE-IPS-PLC-062	PRE-IPS-GATE-031	SCREEN CHANNEL SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-YA-031	PRE-IPS-PLC-062	PRE-IPS-GATE-031	SCREEN CHANNEL SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-ZSC-031	PRE-IPS-PLC-062	PRE-IPS-GATE-031	SCREEN CHANNEL SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
PRE-IPS-GATE-ZI-031	PRE-IPS-PLC-062	PRE-IPS-GATE-031	SCREEN CHANNEL SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y201	
PRE-IPS-GATE-ZD-032	PRE-IPS-PLC-062	PRE-IPS-GATE-032	SCREEN CHANNEL SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-GATE-ZB-032	PRE-IPS-PLC-062	PRE-IPS-GATE-032	SCREEN CHANNEL SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-GATE-HS-032	PRE-IPS-PLC-062	PRE-IPS-GATE-032	SCREEN CHANNEL SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-YA-032	PRE-IPS-PLC-062	PRE-IPS-GATE-032	SCREEN CHANNEL SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-ZSC-032	PRE-IPS-PLC-062	PRE-IPS-GATE-032	SCREEN CHANNEL SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-ZI-032	PRE-IPS-PLC-062	PRE-IPS-GATE-032	SCREEN CHANNEL SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y201	
PRE-IPS-MCP-YS-010	PRE-IPS-PLC-062	PRE-IPS-MCP-010	CHANNEL NO.1 SCREEN SYSTEM INHIBIT	ENABLE/DISABLE	DO	COMM	N/A	N/A	N/A	N/A	Y201	7
PRE-IPS-LSH-LAH-010	PRE-IPS-PLC-062	PRE-IPS-LSH-010	CHANNEL NO.1	LEVEL HIGH	DI	COMM		FEET(MSL)	N/A	N/A	Y201	6
PRE-IPS-SCR-HSS-010	PRE-IPS-PLC-062	PRE-IPS-SCR-010	CHANNEL NO.1 SCREEN	EMERGENCY STOP	DI	COMM	N/A	N/A	N/A	N/A	Y201	6
PRE-IPS-SCR-HS-010A	PRE-IPS-PLC-062	PRE-IPS-SCR-010	CHANNEL NO.1 SCREEN	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y201	6
PRE-IPS-SCR-HS-010B	PRE-IPS-PLC-062	PRE-IPS-SCR-010	CHANNEL NO.1 SCREEN	IN-HAND	DI	COMM	N/A	N/A	N/A	N/A	Y201	6
PRE-IPS-SCR-MN-010A	PRE-IPS-PLC-062	PRE-IPS-SCR-010	CHANNEL NO.1 SCREEN	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y201	6
PRE-IPS-SCR-YA-010	PRE-IPS-PLC-062	PRE-IPS-SCR-010	CHANNEL NO.1 SCREEN	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y201	6
PRE-IPS-SCR-TAH-010	PRE-IPS-PLC-062	PRE-IPS-SCR-010	CHANNEL NO.1 SCREEN	TEMPERATURE-HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y201	6
PRE-IPS-LE-LI-010A	PRE-IPS-PLC-062	PRE-IPS-LIT-010	CHANNEL NO.1 SCREEN UPSTREAM LEVEL	LEVEL	AI	COMM		INCHES	N/A	N/A	Y201	4,6
PRE-IPS-LE-LI-010B	PRE-IPS-PLC-062	PRE-IPS-LIT-010	CHANNEL NO.1 SCREEN DOWNSTREAM LEVEL	LEVEL	AI	COMM		INCHES	N/A	N/A	Y201	4,6
PRE-IPS-LDT-LI-010	PRE-IPS-PLC-062	PRE-IPS-MCP-010	CHANNEL NO.1 SCREEN DIFFERENTIAL LEVEL	LEVEL	AI	COMM		INCHES	N/A	N/A	Y201	4,6
PRE-IPS-MCP-YS-020	PRE-IPS-PLC-062	PRE-IPS-MCP-020	CHANNEL NO.2 SCREEN SYSTEM INHIBIT	ENABLE/DISABLE	DO	COMM	N/A	N/A	N/A	N/A	Y201	7
PRE-IPS-LSH-LAH-020	PRE-IPS-PLC-062	PRE-IPS-LSH-020	CHANNEL NO.2	LEVEL HIGH	DI	COMM		FEET(MSL)	N/A	N/A	Y201	6
PRE-IPS-SCR-HSS-020	PRE-IPS-PLC-062	PRE-IPS-SCR-020	CHANNEL NO.2 SCREEN	EMERGENCY STOP	DI	COMM	N/A	N/A	N/A	N/A	Y201	6
PRE-IPS-SCR-HS-020A	PRE-IPS-PLC-062	PRE-IPS-SCR-020	CHANNEL NO.2 SCREEN	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y201	6
PRE-IPS-SCR-HS-020B	PRE-IPS-PLC-062	PRE-IPS-SCR-020	CHANNEL NO.2 SCREEN	IN-HAND	DI	COMM	N/A	N/A	N/A	N/A	Y201	6
PRE-IPS-SCR-MN-020A	PRE-IPS-PLC-062	PRE-IPS-SCR-020	CHANNEL NO.2 SCREEN	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y201	6
PRE-IPS-SCR-YA-020	PRE-IPS-PLC-062	PRE-IPS-SCR-020	CHANNEL NO.2 SCREEN	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y201	6
PRE-IPS-SCR-TAH-020	PRE-IPS-PLC-062	PRE-IPS-SCR-020	CHANNEL NO.2 SCREEN	TEMPERATURE-HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y201	6
PRE-IPS-LE-LI-020A	PRE-IPS-PLC-062	PRE-IPS-LIT-020	CHANNEL NO.2 SCREEN UPSTREAM LEVEL	LEVEL	AI	COMM		INCHES	N/A	N/A	Y201	4,6
PRE-IPS-LE-LI-020B	PRE-IPS-PLC-062	PRE-IPS-LIT-020	CHANNEL NO.2 SCREEN DOWNSTREAM LEVEL	LEVEL	AI	COMM		INCHES	N/A	N/A	Y201	4,6
PRE-IPS-LDT-LI-020	PRE-IPS-PLC-062	PRE-IPS-MCP-020	CHANNEL NO.2 SCREEN DIFFERENTIAL LEVEL	LEVEL	AI	COMM		INCHES	N/A	N/A	Y201	4,6
PRE-ODR-MCP-PI-200A	PRE-IPS-PLC-062	PRE-ODR-MCP-200	ODOR CONTROL ENCLOSURE - OZONE	PRESSURE	AI	COMM		PSI	N/A	N/A	Y203	2, 4, 6
PRE-ODR-MCP-PI-200B	PRE-IPS-PLC-062	PRE-ODR-MCP-200	ODOR CONTROL ENCLOSURE - WATER	PRESSURE	AI	COMM		PSI	N/A	N/A	Y203	2, 4, 6
PRE-ODR-MCP-PI-200C	PRE-IPS-PLC-062	PRE-ODR-MCP-200	ODOR CONTROL ENCLOSURE - AIR	PRESSURE	AI	COMM		PSI	N/A	N/A	Y203	2, 4, 6
PRE-ODR-MCP-FAL-200	PRE-IPS-PLC-062	PRE-ODR-MCP-200	ODOR CONTROL ENCLOSURE - OZONE	FLOW LOW	DI	COMM	N/A	N/A	N/A	N/A	Y203	2, 4, 6
PRE-ODR-MCP-TAH-200	PRE-IPS-PLC-062	PRE-ODR-MCP-200	ODOR CONTROL ENCLOSURE	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y203	2, 4, 6
PRE-ODR-MCP-MN-200	PRE-IPS-PLC-062	PRE-ODR-MCP-200	ODOR CONTROL ENCLOSURE	ENABLE/DISABLE	DO	COMM	N/A	N/A	N/A	N/A	Y203	2
PRE-ODR-MCP-YA-200	PRE-IPS-PLC-062	PRE-ODR-MCP-200	ODOR CONTROL ENCLOSURE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y203	2

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
PRE-H2O2-LIT-LI-101	PRE-IPS-PLC-062	H2O2-LIT-101	HYDROGEN PEROXIDE BULK TANK	LEVEL	AI	COMM		INCHES	N/A	N/A	Y204	4, 6
PRE-H2O2-LS-LAH-101	PRE-IPS-PLC-062	H2O2-LS-101	HYDROGEN PEROXIDE BULK TANK LEAK DETECTION	LEVEL HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y204	6
PRE-H2O2-MCP-HS-100	PRE-IPS-PLC-062	H2O2-MCP-100	H2O2 SYSTEM REMOTE MODE STATUS	STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y204	6
PRE-H2O2-MCP-YA-100	PRE-IPS-PLC-062	H2O2-MCP-100	H2O2 SYSTEM COMMON FAULT	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y204	6
PRE-H2O2-FIT-FI-101	PRE-IPS-PLC-062	H2O2-MCP-100	H2O2 CHEMICAL FLOW RATE	FLOW	AI	4-20mA	0-10	GPM	N/A	SYSTEM	Y204	6
PRE-H2O2-MCP-MN-100A	PRE-IPS-PLC-062	H2O2-MCP-100	H2O2 SYSTEM REMOTE RUN COMMAND	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y204	7
PRE-H2O2-MCP-MN-100B	PRE-IPS-PLC-062	H2O2-MCP-100	H2O2 AUTO (FLOW-PACING) MODE SELECT	ENABLE/DISABLE	DO	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y204	7
PRE-H2O2-MCP-SC-100	PRE-IPS-PLC-062	H2O2-MCP-100	H2O2 PUMP SPEED	SPEED CONTROL	AO	4-20mA	0-100%	%	2-WIRE	FIELD	Y204	7
PRE-H2O2-MCP-SI-100	PRE-IPS-PLC-062	H2O2-PMP-120	H2O2 PUMP SPEED	SPEED INDICATION	AI	4-20mA	0-100%	%	2-WIRE	FIELD	Y204	6
PRE-H2O2-MCP-FC-100	PRE-IPS-PLC-062	H2O2-MCP-100	INFLUENT FLOW	FLOW	AO	4-20mA	0-5000	GPM	2-WIRE	FIELD	Y204	7
PRE-H2O2-MCP-XC-100	PRE-IPS-PLC-062	H2O2-MCP-100	HYDROGEN PEROXIDE CHEMICAL CONCENTRATION	DOSE	AO	4-20mA	0-100	PPM	N/A	FIELD	Y204	7
PRE-H2O2-PMP-MN-110	PRE-IPS-PLC-062	H2O2-PMP-110	HYDROGEN PEROXIDE FEED PUMP NO. 1	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y204	6
PRE-H2O2-PMP-YA-110	PRE-IPS-PLC-062	H2O2-PMP-110	HYDROGEN PEROXIDE FEED PUMP NO. 1	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y204	6
PRE-H2O2-PMP-MN-120	PRE-IPS-PLC-062	H2O2-PMP-120	HYDROGEN PEROXIDE FEED PUMP NO. 2	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y204	6
PRE-H2O2-PMP-YA-120	PRE-IPS-PLC-062	H2O2-PMP-120	HYDROGEN PEROXIDE FEED PUMP NO. 2	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y204	6
PRE-H2O2-LS-LAH-102	PRE-IPS-PLC-062	H2O2-LS-102	HYDROGEN PEROXIDE FEED SKID LEAK DETECTION	LEVEL HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y204	6
PRE-H2O2-PIT-PI-101	PRE-IPS-PLC-062	H2O2-PIT-101	HYDROGEN PEROXIDE PUMP DISCHARGE	PRESSURE	AI	4-20mA		PSI	2-WIRE	FIELD	Y204	4, 6
PRE-IPS-CTRL-TAH-002	PRE-IPS-PLC-062	PRE-IPS-CTRL-002	COARSE SCREENING ELECTRICAL ROOM	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-IPS-CTRL-YA-002A	PRE-IPS-PLC-062	PRE-IPS-CTRL-002	DIRTY FILTER	WARNING	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-IPS-CTRL-YA-002B	PRE-IPS-PLC-062	PRE-IPS-CTRL-002	HVAC CONTROL SYSTEM	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-IPS-CTRL-YA-002C	PRE-IPS-PLC-062	PRE-IPS-CTRL-002	VENTILATION FAILURE	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-IPS-CTRL-YA-002D	PRE-IPS-PLC-062	PRE-IPS-CTRL-002	SMOKE ALARM	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-IPS-UPS-JA-052	PRE-IPS-PLC-062	PRE-IPS-UPS-052	UPS SYSTEM REPLACE BATTERY	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-UPS-JAL-052	PRE-IPS-PLC-062	PRE-IPS-UPS-052	UPS SYSTEM LOW BATTERY	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-UPS-YA-052A	PRE-IPS-PLC-062	PRE-IPS-UPS-052	UPS SYSTEM	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-UPS-YN-052	PRE-IPS-PLC-062	PRE-IPS-UPS-052	UPS SYSTEM ON BATTERY	STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-UPS-ZS-052	PRE-IPS-PLC-062	PRE-IPS-UPS-052	UPS SYSTEM BYPASS	STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-NSW-YA-062A	PRE-IPS-PLC-062	PRE-IPS-NSW-062	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-NSW-YA-062B	PRE-IPS-PLC-062	PRE-IPS-NSW-062	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-NSW-YA-062C	PRE-IPS-PLC-062	PRE-IPS-NSW-062	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-NSW-TI-062	PRE-IPS-PLC-062	PRE-IPS-NSW-062	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		3, 9
PRE-IPS-NSW-YA-072A	PRE-IPS-PLC-062	PRE-IPS-NSW-072	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-NSW-YA-072B	PRE-IPS-PLC-062	PRE-IPS-NSW-072	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-NSW-YA-072C	PRE-IPS-PLC-062	PRE-IPS-NSW-072	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-NSW-TI-072	PRE-IPS-PLC-062	PRE-IPS-NSW-072	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		3, 9

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
PRE-GRSC-AIT-YA-001A	PRE-GRSC-PLC-061	PRE-GRSC-AIT-001	HEADWORKS COMBUSTIBLE GAS	ALARM	DI	N.O. CONTACT	10%	LEL	N/A	SYSTEM	Y301	
PRE-GRSC-AIT-YA-001B	PRE-GRSC-PLC-061	PRE-GRSC-AIT-001	HEADWORKS AREA GAS CONTROL PANEL	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-AE-AI-001	PRE-GRSC-PLC-061	PRE-GRSC-AE-001	HEADWORKS LEVEL 1 COMBUSTIBLE GAS	LEVEL	AI	4-20mA	0-100%	LEL	3-WIRE	FIELD	Y301	
PRE-GRSC-AE-AI-002	PRE-GRSC-PLC-061	PRE-GRSC-AE-002	HEADWORKS LEVEL 2 COMBUSTIBLE GAS	LEVEL	AI	4-20mA	0-100%	LEL	3-WIRE	FIELD	Y302	
PRE-GRSC-FIT-FA-001	PRE-GRSC-PLC-061	PRE-GRSC-FIT-001	INFLUENT PUMP STATION	REVERSE FLOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	8,10
PRE-GRSC-FIT-FI-001	PRE-GRSC-PLC-061	PRE-GRSC-FIT-001	INFLUENT PUMP STATION	FLOW	AI	4-20mA	0 - 15,000	GPM	4-WIRE	FIELD	Y301	8
PRE-GRSC-PIT-PI-001	PRE-GRSC-PLC-061	PRE-GRSC-PIT-001	HEADWORKS PROCESS WATER	PRESSURE	AI	4-20mA	0 - 200	PSI	2-WIRE	SYSTEM	Y601	8
PRE-GRSC-PSL-PAL-001	PRE-GRSC-PLC-061	PRE-GRSC-PSL-001	HEADWORKS PROCESS WATER	PRESSURE LOW	DI	N.O. CONTACT	40	PSIG	N/A	SYSTEM	Y302	8
PRE-GRSC-GATE-ZD-101	PRE-GRSC-PLC-061	PRE-GRSC-GATE-101	SCREEN CHANNEL SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	
PRE-GRSC-GATE-ZB-101	PRE-GRSC-PLC-061	PRE-GRSC-GATE-101	SCREEN CHANNEL SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	
PRE-GRSC-GATE-HS-101	PRE-GRSC-PLC-061	PRE-GRSC-GATE-101	SCREEN CHANNEL SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-YA-101	PRE-GRSC-PLC-061	PRE-GRSC-GATE-101	SCREEN CHANNEL SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-ZSC-101	PRE-GRSC-PLC-061	PRE-GRSC-GATE-101	SCREEN CHANNEL SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-ZI-101	PRE-GRSC-PLC-061	PRE-GRSC-GATE-101	SCREEN CHANNEL SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y301	
PRE-GRSC-GATE-ZD-102	PRE-GRSC-PLC-061	PRE-GRSC-GATE-102	SCREEN CHANNEL SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	
PRE-GRSC-GATE-ZB-102	PRE-GRSC-PLC-061	PRE-GRSC-GATE-102	SCREEN CHANNEL SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	
PRE-GRSC-GATE-HS-102	PRE-GRSC-PLC-061	PRE-GRSC-GATE-102	SCREEN CHANNEL SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-YA-102	PRE-GRSC-PLC-061	PRE-GRSC-GATE-102	SCREEN CHANNEL SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-ZSC-102	PRE-GRSC-PLC-061	PRE-GRSC-GATE-102	SCREEN CHANNEL SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-ZI-102	PRE-GRSC-PLC-061	PRE-GRSC-GATE-102	SCREEN CHANNEL SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y301	
PRE-GRSC-GATE-ZD-201	PRE-GRSC-PLC-061	PRE-GRSC-GATE-201	SCREEN CHANNEL SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	
PRE-GRSC-GATE-ZB-201	PRE-GRSC-PLC-061	PRE-GRSC-GATE-201	SCREEN CHANNEL SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	
PRE-GRSC-GATE-HS-201	PRE-GRSC-PLC-061	PRE-GRSC-GATE-201	SCREEN CHANNEL SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-YA-201	PRE-GRSC-PLC-061	PRE-GRSC-GATE-201	SCREEN CHANNEL SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-ZSC-201	PRE-GRSC-PLC-061	PRE-GRSC-GATE-201	SCREEN CHANNEL SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-ZI-201	PRE-GRSC-PLC-061	PRE-GRSC-GATE-201	SCREEN CHANNEL SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y301	
PRE-GRSC-GATE-ZD-202	PRE-GRSC-PLC-061	PRE-GRSC-GATE-202	SCREEN CHANNEL SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	
PRE-GRSC-GATE-ZB-202	PRE-GRSC-PLC-061	PRE-GRSC-GATE-202	SCREEN CHANNEL SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	
PRE-GRSC-GATE-HS-202	PRE-GRSC-PLC-061	PRE-GRSC-GATE-202	SCREEN CHANNEL SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-YA-202	PRE-GRSC-PLC-061	PRE-GRSC-GATE-202	SCREEN CHANNEL SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-ZSC-202	PRE-GRSC-PLC-061	PRE-GRSC-GATE-202	SCREEN CHANNEL SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-ZI-202	PRE-GRSC-PLC-061	PRE-GRSC-GATE-202	SCREEN CHANNEL SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y301	

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
PRE-GRSC-GATE-ZD-301	PRE-GRSC-PLC-061	PRE-GRSC-GATE-301	GRIT EFFLUENT SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	
PRE-GRSC-GATE-ZB-301	PRE-GRSC-PLC-061	PRE-GRSC-GATE-301	GRIT EFFLUENT SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	
PRE-GRSC-GATE-HS-301	PRE-GRSC-PLC-061	PRE-GRSC-GATE-301	GRIT EFFLUENT SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-YA-301	PRE-GRSC-PLC-061	PRE-GRSC-GATE-301	GRIT EFFLUENT SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-ZSC-301	PRE-GRSC-PLC-061	PRE-GRSC-GATE-301	GRIT EFFLUENT SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-ZI-301	PRE-GRSC-PLC-061	PRE-GRSC-GATE-301	GRIT EFFLUENT SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y301	
PRE-GRSC-GATE-ZD-302	PRE-GRSC-PLC-061	PRE-GRSC-GATE-302	GRIT REMOVAL SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	
PRE-GRSC-GATE-ZB-302	PRE-GRSC-PLC-061	PRE-GRSC-GATE-302	GRIT REMOVAL SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	
PRE-GRSC-GATE-HS-302	PRE-GRSC-PLC-061	PRE-GRSC-GATE-302	GRIT REMOVAL SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-YA-302	PRE-GRSC-PLC-061	PRE-GRSC-GATE-302	GRIT REMOVAL SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-ZSC-302	PRE-GRSC-PLC-061	PRE-GRSC-GATE-302	GRIT REMOVAL SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-ZI-302	PRE-GRSC-PLC-061	PRE-GRSC-GATE-302	GRIT REMOVAL SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y301	
PRE-GRSC-GATE-ZD-303	PRE-GRSC-PLC-061	PRE-GRSC-GATE-303	FUTURE GRIT SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	
PRE-GRSC-GATE-ZB-303	PRE-GRSC-PLC-061	PRE-GRSC-GATE-303	FUTURE GRIT SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	
PRE-GRSC-GATE-HS-303	PRE-GRSC-PLC-061	PRE-GRSC-GATE-303	FUTURE GRIT SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-YA-303	PRE-GRSC-PLC-061	PRE-GRSC-GATE-303	FUTURE GRIT SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-ZSC-303	PRE-GRSC-PLC-061	PRE-GRSC-GATE-303	FUTURE GRIT SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-ZI-303	PRE-GRSC-PLC-061	PRE-GRSC-GATE-303	FUTURE GRIT SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y301	
PRE-GRSC-GATE-ZD-304	PRE-GRSC-PLC-061	PRE-GRSC-GATE-304	DEGRITTED INFLUENT TO AGS SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	2
PRE-GRSC-GATE-ZB-304	PRE-GRSC-PLC-061	PRE-GRSC-GATE-304	DEGRITTED INFLUENT TO AGS SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	2
PRE-GRSC-GATE-HS-304	PRE-GRSC-PLC-061	PRE-GRSC-GATE-304	DEGRITTED INFLUENT TO AGS SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	2
PRE-GRSC-GATE-YA-304	PRE-GRSC-PLC-061	PRE-GRSC-GATE-304	DEGRITTED INFLUENT TO AGS SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	2
PRE-GRSC-GATE-ZSC-304	PRE-GRSC-PLC-061	PRE-GRSC-GATE-304	DEGRITTED INFLUENT TO AGS SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	2
PRE-GRSC-GATE-ZI-304	PRE-GRSC-PLC-061	PRE-GRSC-GATE-304	DEGRITTED INFLUENT TO AGS SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y301	2
PRE-GRSC-MCP-YS-100	PRE-GRSC-PLC-061	PRE-GRSC-MCP-100	CHANNEL NO.1 SCREEN SYSTEM INHIBIT	ENABLE/DISABLE	DO	COMM	N/A	N/A	N/A	N/A	Y301	7
PRE-GRSC-LSH-LAH-100	PRE-GRSC-PLC-061	PRE-GRSC-LSH-100	CHANNEL NO.1	LEVEL HIGH	DI	COMM		FEET(MSL)	N/A	N/A	Y301	6
PRE-GRSC-SCR-HSS-110	PRE-GRSC-PLC-061	PRE-GRSC-SCR-100	CHANNEL NO.1 SCREEN	EMERGENCY STOP	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-SCR-HS-110A	PRE-GRSC-PLC-061	PRE-GRSC-SCR-110	CHANNEL NO.1 SCREEN	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-SCR-HS-110B	PRE-GRSC-PLC-061	PRE-GRSC-SCR-110	CHANNEL NO.1 SCREEN	IN-HAND	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-SCR-MN-110A	PRE-GRSC-PLC-061	PRE-GRSC-SCR-110	CHANNEL NO.1 SCREEN	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-SCR-MN-110B	PRE-GRSC-PLC-061	PRE-GRSC-SCR-110	CHANNEL NO.1 SCREEN	RUN-HIGH SPEED	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-SCR-YA-110	PRE-GRSC-PLC-061	PRE-GRSC-SCR-110	CHANNEL NO.1 SCREEN	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-SCR-TAH-110	PRE-GRSC-PLC-061	PRE-GRSC-SCR-110	CHANNEL NO.1 SCREEN	TEMPERATURE-HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-SCR-MD-110	PRE-GRSC-PLC-061	PRE-GRSC-SCR-110	CHANNEL NO.1 SCREEN	START/STOP	DO	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-SCR-II-110	PRE-GRSC-PLC-061	PRE-GRSC-SCR-110	CHANNEL NO.1 SCREEN	CURRENT	AI	COMM		AMPS	N/A	N/A	Y301	6
PRE-GRSC-LE-LI-100A	PRE-GRSC-PLC-061	PRE-GRSC-LIT-100	CHANNEL NO.1 SCREEN UPSTREAM LEVEL	LEVEL	AI	COMM		INCHES	N/A	N/A	Y301	4,6
PRE-GRSC-LE-LI-100B	PRE-GRSC-PLC-061	PRE-GRSC-LIT-100	CHANNEL NO.1 SCREEN DOWNSTREAM LEVEL	LEVEL	AI	COMM		INCHES	N/A	N/A	Y301	4,6
PRE-GRSC-LDT-LI-100	PRE-GRSC-PLC-061	PRE-GRSC-MCP-100	CHANNEL NO.1 SCREEN DIFFERENTIAL LEVEL	LEVEL	AI	COMM		INCHES	N/A	N/A	Y301	4,6

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
PRE-GRSC-BR-HS-115A	PRE-GRSC-PLC-061	PRE-GRSC-BR-115	CHANNEL NO.1 BRUSH DRIVE	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-BR-HS-115B	PRE-GRSC-PLC-061	PRE-GRSC-BR-115	CHANNEL NO.1 BRUSH DRIVE	IN-HAND	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-BR-MN-115A	PRE-GRSC-PLC-061	PRE-GRSC-BR-115	CHANNEL NO.1 BRUSH DRIVE	RUN-FORWARD	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-BR-MN-115B	PRE-GRSC-PLC-061	PRE-GRSC-BR-115	CHANNEL NO.1 BRUSH DRIVE	RUN-REVERSE	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-BR-YA-115	PRE-GRSC-PLC-061	PRE-GRSC-BR-115	CHANNEL NO.1 BRUSH DRIVE	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-BR-TAH-115	PRE-GRSC-PLC-061	PRE-GRSC-BR-115	CHANNEL NO.1 BRUSH DRIVE	TEMPERATURE-HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-BR-II-115	PRE-GRSC-PLC-061	PRE-GRSC-BR-115	CHANNEL NO.1 BRUSH DRIVE	CURRENT	AI	COMM		AMPS	N/A	N/A	Y301	6
PRE-GRSC-WC-HS-120A	PRE-GRSC-PLC-061	PRE-GRSC-WC-120	CHANNEL NO.1 WASHER/COMPACTOR	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-WC-HS-120B	PRE-GRSC-PLC-061	PRE-GRSC-WC-120	CHANNEL NO.1 WASHER/COMPACTOR	IN-HAND	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-WC-MN-120A	PRE-GRSC-PLC-061	PRE-GRSC-WC-120	CHANNEL NO.1 WASHER/COMPACTOR	RUN-FORWARD	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-WC-MN-120B	PRE-GRSC-PLC-061	PRE-GRSC-WC-120	CHANNEL NO.1 WASHER/COMPACTOR	RUN-REVERSE	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-WC-YA-120	PRE-GRSC-PLC-061	PRE-GRSC-WC-120	CHANNEL NO.1 WASHER/COMPACTOR	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-WC-TAH-120	PRE-GRSC-PLC-061	PRE-GRSC-WC-120	CHANNEL NO.1 WASHER/COMPACTOR	TEMPERATURE-HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y301	6

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
PRE-GRSC-VLV-ZD-125	PRE-GRSC-PLC-061	PRE-GRSC-VLV-125	CHANNEL NO.1 HEATED PROCESS WATER	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	
PRE-GRSC-MCP-YS-200	PRE-GRSC-PLC-061	PRE-GRSC-MCP-200	CHANNEL NO.2 SCREEN SYSTEM INHIBIT	ENABLE/DISABLE	DO	COMM	N/A	N/A	N/A	N/A	Y301	7
PRE-GRSC-LSH-LAH-200	PRE-GRSC-PLC-061	PRE-GRSC-LSH-200	CHANNEL NO.2	LEVEL HIGH	DI	COMM		FEET(MSL)	N/A	N/A	Y301	6
PRE-GRSC-SCR-HSS-210	PRE-GRSC-PLC-061	PRE-GRSC-SCR-210	CHANNEL NO.2 SCREEN	EMERGENCY STOP	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-SCR-HS-210A	PRE-GRSC-PLC-061	PRE-GRSC-SCR-210	CHANNEL NO.2 SCREEN	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-SCR-HS-210B	PRE-GRSC-PLC-061	PRE-GRSC-SCR-210	CHANNEL NO.2 SCREEN	IN-HAND	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-SCR-MN-210A	PRE-GRSC-PLC-061	PRE-GRSC-SCR-210	CHANNEL NO.2 SCREEN	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-SCR-MN-210B	PRE-GRSC-PLC-061	PRE-GRSC-SCR-210	CHANNEL NO.2 SCREEN	RUN-HIGH SPEED	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-SCR-YA-210	PRE-GRSC-PLC-061	PRE-GRSC-SCR-210	CHANNEL NO.2 SCREEN	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-SCR-TAH-210	PRE-GRSC-PLC-061	PRE-GRSC-SCR-210	CHANNEL NO.2 SCREEN	TEMPERATURE-HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-SCR-MD-210	PRE-GRSC-PLC-061	PRE-GRSC-SCR-210	CHANNEL NO.2 SCREEN	START/STOP	DO	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-SCR-II-210	PRE-GRSC-PLC-061	PRE-GRSC-SCR-210	CHANNEL NO.2 SCREEN	CURRENT	AI	COMM		AMPS	N/A	N/A	Y301	6
PRE-GRSC-LE-LI-200A	PRE-GRSC-PLC-061	PRE-GRSC-LIT-200	CHANNEL NO.2 SCREEN UPSTREAM LEVEL	LEVEL	AI	COMM		INCHES	N/A	N/A	Y301	4,6
PRE-GRSC-LE-LI-200B	PRE-GRSC-PLC-061	PRE-GRSC-LIT-200	CHANNEL NO.2 SCREEN DOWNSTREAM LEVEL	LEVEL	AI	COMM		INCHES	N/A	N/A	Y301	4,6
PRE-GRSC-LDT-LI-200	PRE-GRSC-PLC-061	PRE-GRSC-MCP-200	CHANNEL NO.2 SCREEN DIFFERENTIAL LEVEL	LEVEL	AI	COMM		INCHES	N/A	N/A	Y301	4,6
PRE-GRSC-BR-HS-215A	PRE-GRSC-PLC-061	PRE-GRSC-BR-215	CHANNEL NO.2 BRUSH DRIVE	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-BR-HS-215B	PRE-GRSC-PLC-061	PRE-GRSC-BR-215	CHANNEL NO.2 BRUSH DRIVE	IN-HAND	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-BR-MN-215A	PRE-GRSC-PLC-061	PRE-GRSC-BR-215	CHANNEL NO.2 BRUSH DRIVE	RUN-FORWARD	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-BR-MN-215B	PRE-GRSC-PLC-061	PRE-GRSC-BR-215	CHANNEL NO.2 BRUSH DRIVE	RUN-REVERSE	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-BR-YA-215	PRE-GRSC-PLC-061	PRE-GRSC-BR-215	CHANNEL NO.2 BRUSH DRIVE	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-BR-TAH-215	PRE-GRSC-PLC-061	PRE-GRSC-BR-215	CHANNEL NO.2 BRUSH DRIVE	TEMPERATURE-HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-BR-II-215	PRE-GRSC-PLC-061	PRE-GRSC-BR-215	CHANNEL NO.2 BRUSH DRIVE	CURRENT	AI	COMM		AMPS	N/A	N/A	Y301	6
PRE-GRSC-WC-HS-220A	PRE-GRSC-PLC-061	PRE-GRSC-WC-220	CHANNEL NO.2 WASHER/COMPACTOR	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-WC-HS-220B	PRE-GRSC-PLC-061	PRE-GRSC-WC-220	CHANNEL NO.2 WASHER/COMPACTOR	IN-HAND	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-WC-MN-220A	PRE-GRSC-PLC-061	PRE-GRSC-WC-220	CHANNEL NO.2 WASHER/COMPACTOR	RUN-FORWARD	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-WC-MN-220B	PRE-GRSC-PLC-061	PRE-GRSC-WC-220	CHANNEL NO.2 WASHER/COMPACTOR	RUN-REVERSE	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-WC-YA-220	PRE-GRSC-PLC-061	PRE-GRSC-WC-220	CHANNEL NO.2 WASHER/COMPACTOR	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-WC-TAH-220	PRE-GRSC-PLC-061	PRE-GRSC-WC-220	CHANNEL NO.2 WASHER/COMPACTOR	TEMPERATURE-HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-VLV-ZD-225	PRE-GRSC-PLC-061	PRE-GRSC-VLV-225	CHANNEL NO.2 HEATED PROCESS WATER	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	
PRE-GRSC-LSH-LAH-301	PRE-GRSC-PLC-061	PRE-GRSC-LSH-301	GRIT SYSTEM EFFLUENT	LEVEL HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y302	2,8
PRE-GRSC-FIT-FA-311	PRE-GRSC-PLC-061	PRE-GRSC-FIT-311	GRIT REMOVAL	REVERSE FLOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y302	8,10
PRE-GRSC-FIT-FI-311	PRE-GRSC-PLC-061	PRE-GRSC-FIT-311	GRIT REMOVAL	FLOW	AI	4-20mA	0-500	GPM	4-WIRE	FIELD	Y302	8
PRE-GRSC-PSH-PAH-312	PRE-GRSC-PLC-061	PRE-GRSC-PSH-312	GRIT REMOVAL	PRESSURE HIGH	DI	N.O. CONTACT	5	PSIG	N/A	SYSTEM	Y302	8

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
PRE-GRSC-MCP-HSS-300	PRE-GRSC-PLC-061	PRE-GRSC-MCP-300	GRIT SYSTEM	EMERGENCY STOP	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-MCP-HS-300A	PRE-GRSC-PLC-061	PRE-GRSC-MCP-300	GRIT SYSTEM IN WET MODE	STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-MCP-HS-300B	PRE-GRSC-PLC-061	PRE-GRSC-MCP-300	AUTO DRAIN	ON/OFF	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-MCP-HS-300C	PRE-GRSC-PLC-061	PRE-GRSC-MCP-300	RINSE WATER	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-MCP-HS-300D	PRE-GRSC-PLC-061	PRE-GRSC-MCP-300	GRIT WASHER/CYCLONE	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-MCP-FYH-300	PRE-GRSC-PLC-061	PRE-GRSC-MCP-300	WET WEATHER MODE	ENABLE/DISABLE	DO	COMM	N/A	N/A	N/A	N/A	Y302	7
PRE-GRSC-P-MX-310	PRE-GRSC-PLC-061	PRE-GRSC-MCP-300	GRIT SYSTEM INHIBIT	ENABLE/DISABLE	DO	COMM	N/A	N/A	N/A	N/A	Y302	7
PRE-GRSC-VLV-YA-314	PRE-GRSC-PLC-061	PRE-GRSC-VLV-314	GRIT REMOVAL PINCH VALVE	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-VLV-ZSO-314	PRE-GRSC-PLC-061	PRE-GRSC-VLV-314	GRIT REMOVAL PINCH VALVE	OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-VLV-ZSC-314	PRE-GRSC-PLC-061	PRE-GRSC-VLV-314	GRIT REMOVAL PINCH VALVE	CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-PMP-HS-310	PRE-GRSC-PLC-061	PRE-GRSC-PMP-310	GRIT PUMP	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-PMP-MN-310	PRE-GRSC-PLC-061	PRE-GRSC-PMP-310	GRIT PUMP	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-PMP-TAH-310	PRE-GRSC-PLC-061	PRE-GRSC-PMP-310	GRIT PUMP TEMPERATURE HIGH	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-PMP-YA-310	PRE-GRSC-PLC-061	PRE-GRSC-PMP-310	GRIT PUMP	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-CONV-HS-330	PRE-GRSC-PLC-061	PRE-GRSC-CONV-330	GRIT CONVEYOR	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-CONV-MN-330	PRE-GRSC-PLC-061	PRE-GRSC-CONV-330	GRIT CONVEYOR	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-CONV-TAH-330	PRE-GRSC-PLC-061	PRE-GRSC-CONV-330	GRIT CONVEYOR TEMPERATURE HIGH	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-CONV-ZAH-330	PRE-GRSC-PLC-061	PRE-GRSC-CONV-330	GRIT CONVEYOR PROXIMITY SWITCH	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-CONV-YA-330	PRE-GRSC-PLC-061	PRE-GRSC-CONV-330	GRIT CONVEYOR	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-CONV-YI-330	PRE-GRSC-PLC-061	PRE-GRSC-CONV-330	GRIT INTERMITTENT/CONTINUOUS MODE	STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-CONV-SC-330	PRE-GRSC-PLC-061	PRE-GRSC-CONV-330	GRIT CONVEYOR	SPEED CONTROL	AO	COMM	0 - 100	%	N/A	N/A	Y302	7
SEC-PSEW-FIT-FA-101	PRE-GRSC-PLC-061	SEC-PSEW-FIT-101	PLANT SEWER HEADER	REVERSE FLOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	8,10
SEC-PSEW-FIT-FI-101	PRE-GRSC-PLC-061	SEC-PSEW-FIT-101	PLANT SEWER HEADER	FLOW	AI	4-20mA	0-1000	GPM	4-WIRE	FIELD	Y301	8

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
PRE-GRSC-SWB-EI-021AN	PRE-GRSC-PLC-061	PRE-GRSC-SWB-021	SWITCHBOARD A-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4
PRE-GRSC-SWB-EI-021BN	PRE-GRSC-PLC-061	PRE-GRSC-SWB-021	SWITCHBOARD B-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4
PRE-GRSC-SWB-EI-021CN	PRE-GRSC-PLC-061	PRE-GRSC-SWB-021	SWITCHBOARD C-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4
PRE-GRSC-SWB-EI-021AB	PRE-GRSC-PLC-061	PRE-GRSC-SWB-021	SWITCHBOARD A-B PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4
PRE-GRSC-SWB-EI-021BC	PRE-GRSC-PLC-061	PRE-GRSC-SWB-021	SWITCHBOARD B-C PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4
PRE-GRSC-SWB-EI-021CA	PRE-GRSC-PLC-061	PRE-GRSC-SWB-021	SWITCHBOARD C-A PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4
PRE-GRSC-SWB-II-021A	PRE-GRSC-PLC-061	PRE-GRSC-SWB-021	SWITCHBOARD A LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4
PRE-GRSC-SWB-II-021B	PRE-GRSC-PLC-061	PRE-GRSC-SWB-021	SWITCHBOARD B LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4
PRE-GRSC-SWB-II-021C	PRE-GRSC-PLC-061	PRE-GRSC-SWB-021	SWITCHBOARD C LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4
PRE-GRSC-SWB-JI-021A	PRE-GRSC-PLC-061	PRE-GRSC-SWB-021	SWITCHBOARD AVERAGE APPARENT	POWER	AI	COMM		KVA	N/A	N/A		4
PRE-GRSC-SWB-JI-021R	PRE-GRSC-PLC-061	PRE-GRSC-SWB-021	SWITCHBOARD AVERAGE REAL	POWER	AI	COMM		KW	N/A	N/A		4
PRE-GRSC-SWB-JQ-021	PRE-GRSC-PLC-061	PRE-GRSC-SWB-021	SWITCHBOARD TOTAL	ENERGY	AI	COMM		KWh	N/A	N/A		4
PRE-GRSC-SWB-JN-021	PRE-GRSC-PLC-061	PRE-GRSC-SWB-021	SWITCHBOARD AVERAGE	POWER FACTOR	AI	COMM		PF	N/A	N/A		4
PRE-GRSC-SWB-SI-021	PRE-GRSC-PLC-061	PRE-GRSC-SWB-021	SWITCHBOARD	FREQUENCY	AI	COMM		HERTZ	N/A	N/A		4
PRE-GRSC-CTRL-TAH-001	PRE-GRSC-PLC-061	PRE-GRSC-CTRL-001	HEADWORKS ELECTRICAL ROOM	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-GRSC-CTRL-YA-001A	PRE-GRSC-PLC-061	PRE-GRSC-CTRL-001	DIRTY FILTER	WARNING	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-GRSC-CTRL-YA-001B	PRE-GRSC-PLC-061	PRE-GRSC-CTRL-001	HVAC CONTROL SYSTEM	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-GRSC-CTRL-YA-001C	PRE-GRSC-PLC-061	PRE-GRSC-CTRL-001	VENTILATION FAILURE	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-GRSC-CTRL-YA-001D	PRE-GRSC-PLC-061	PRE-GRSC-CTRL-001	SMOKE ALARM	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-GRSC-UPS-JA-051	PRE-GRSC-PLC-061	PRE-GRSC-UPS-051	UPS SYSTEM REPLACE BATTERY	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-GRSC-UPS-JAL-051	PRE-GRSC-PLC-061	PRE-GRSC-UPS-051	UPS SYSTEM LOW BATTERY	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-GRSC-UPS-YA-051A	PRE-GRSC-PLC-061	PRE-GRSC-UPS-051	UPS SYSTEM	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-GRSC-UPS-YN-051	PRE-GRSC-PLC-061	PRE-GRSC-UPS-051	UPS SYSTEM ON BATTERY	STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-GRSC-UPS-ZS-051	PRE-GRSC-PLC-061	PRE-GRSC-UPS-051	UPS SYSTEM BYPASS	STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-GRSC-NSW-YA-061A	PRE-GRSC-PLC-061	PRE-GRSC-NSW-061	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-GRSC-NSW-YA-061B	PRE-GRSC-PLC-061	PRE-GRSC-NSW-061	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-GRSC-NSW-YA-061C	PRE-GRSC-PLC-061	PRE-GRSC-NSW-061	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-GRSC-NSW-TI-061	PRE-GRSC-PLC-061	PRE-GRSC-NSW-061	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		3, 9
PRE-GRSC-NSW-YA-071A	PRE-GRSC-PLC-061	PRE-GRSC-NSW-071	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-GRSC-NSW-YA-071B	PRE-GRSC-PLC-061	PRE-GRSC-NSW-071	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-GRSC-NSW-YA-071C	PRE-GRSC-PLC-061	PRE-GRSC-NSW-071	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-GRSC-NSW-TI-071	PRE-GRSC-PLC-061	PRE-GRSC-NSW-071	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		3, 9

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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-VLV-ZSO-101	SEC-AGS-MCP-001	SEC-AGS-VLV-101	AGS BASIN NO. 1 INFLUENT VALVE A	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-ZSO-101	SEC-AGS-MCP-001	SEC-AGS-VLV-101	AGS BASIN NO. 1 INFLUENT VALVE A	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-HS-101	SEC-AGS-MCP-001	SEC-AGS-VLV-101	AGS BASIN NO. 1 INFLUENT VALVE A	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-ZD-101	SEC-AGS-MCP-001	SEC-AGS-VLV-101	AGS BASIN NO. 1 INFLUENT VALVE A	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y401	
SEC-AGS-VLV-ZSO-103	SEC-AGS-MCP-001	SEC-AGS-VLV-103	AGS BASIN NO. 1 INFLUENT VALVE B	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-ZSO-103	SEC-AGS-MCP-001	SEC-AGS-VLV-103	AGS BASIN NO. 1 INFLUENT VALVE B	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-HS-103	SEC-AGS-MCP-001	SEC-AGS-VLV-103	AGS BASIN NO. 1 INFLUENT VALVE B	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-ZD-103	SEC-AGS-MCP-001	SEC-AGS-VLV-103	AGS BASIN NO. 1 INFLUENT VALVE B	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y401	
SEC-AGS-VLV-HS-105	SEC-AGS-MCP-001	SEC-AGS-VLV-105	AGS BASIN NO. 1 AIR VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZSC-105	SEC-AGS-MCP-001	SEC-AGS-VLV-105	AGS BASIN NO. 1 AIR VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZI-105	SEC-AGS-MCP-001	SEC-AGS-VLV-105	AGS BASIN NO. 1 AIR VALVE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZC-105	SEC-AGS-MCP-001	SEC-AGS-VLV-105	AGS BASIN NO. 1 AIR VALVE	POSITION CONTROL	AO	4-20mA	0-100	%	2-WIRE	FIELD	Y402	2, 6
SEC-AGS-VLV-ZSO-108	SEC-AGS-MCP-001	SEC-AGS-VLV-108	AGS BASIN NO. 1 AIR VALVE	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZSO-108	SEC-AGS-MCP-001	SEC-AGS-VLV-108	AGS BASIN NO. 1 AIR VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-HS-108	SEC-AGS-MCP-001	SEC-AGS-VLV-108	AGS BASIN NO. 1 AIR VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZD-108	SEC-AGS-MCP-001	SEC-AGS-VLV-108	AGS BASIN NO. 1 AIR VALVE	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y402	
SEC-AGS-VLV-ZSO-109	SEC-AGS-MCP-001	SEC-AGS-VLV-109	AGS BASIN NO. 1 SLUDGE AIR VALVE	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZSO-109	SEC-AGS-MCP-001	SEC-AGS-VLV-109	AGS BASIN NO. 1 SLUDGE AIR VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-HS-109	SEC-AGS-MCP-001	SEC-AGS-VLV-109	AGS BASIN NO. 1 SLUDGE AIR VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZD-109	SEC-AGS-MCP-001	SEC-AGS-VLV-109	AGS BASIN NO. 1 INFLUENT VALVE B	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y401	
SEC-AGS-VLV-HS-110	SEC-AGS-MCP-001	SEC-AGS-VLV-110	AGS BASIN NO. 1 SLUDGE VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZSC-110	SEC-AGS-MCP-001	SEC-AGS-VLV-110	AGS BASIN NO. 1 SLUDGE VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZI-110	SEC-AGS-MCP-001	SEC-AGS-VLV-110	AGS BASIN NO. 1 SLUDGE VALVE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZC-110	SEC-AGS-MCP-001	SEC-AGS-VLV-110	AGS BASIN NO. 1 SLUDGE VALVE	POSITION CONTROL	AO	4-20mA	0-100	%	2-WIRE	FIELD	Y402	2, 6
SEC-AGS-VLV-HS-111	SEC-AGS-MCP-001	SEC-AGS-VLV-111	AGS BASIN NO. 1 WLC VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZSC-111	SEC-AGS-MCP-001	SEC-AGS-VLV-111	AGS BASIN NO. 1 WLC VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZI-111	SEC-AGS-MCP-001	SEC-AGS-VLV-111	AGS BASIN NO. 1 WLC VALVE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZC-111	SEC-AGS-MCP-001	SEC-AGS-VLV-111	AGS BASIN NO. 1 WLC VALVE	POSITION CONTROL	AO	4-20mA	0-100	%	2-WIRE	FIELD	Y402	2, 6

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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-FIT-FA-101	SEC-AGS-MCP-001	SEC-AGS-FIT-101	AGS BASIN NO. 1 INFLUENT	REVERSE FLOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	6, 10
SEC-AGS-FIT-FI-101	SEC-AGS-MCP-001	SEC-AGS-FIT-101	AGS BASIN NO. 1 INFLUENT	FLOW	AI	4-20mA	0 - 15,000	GPM	4-WIRE	FIELD	Y401	2, 6
SEC-AGS-FIT-FI-102	SEC-AGS-MCP-001	SEC-AGS-FIT-102	AGS BASIN NO. 1 PROCESS AIR	FLOW	AI	4-20mA	0 - 15,000	SCFM	4-WIRE	FIELD	Y402	2, 6
SEC-AGS-PIT-PI-101	SEC-AGS-MCP-001	SEC-AGS-PIT-101	AGS BASIN NO. 1 SLUDGE PRESSURE TRANSMITTER	PRESSURE	AI	4-20mA	TBD	PSI	2-WIRE	SYSTEM	Y402	2, 6
SEC-AGS-LT-LI-101	SEC-AGS-MCP-001	SEC-AGS-LT-101	AGS BASIN NO. 1 LEVEL TRANSMITTER	LEVEL	AI	4-20mA	0 - 25	FEET	2-WIRE	SYSTEM	Y402	2, 6, 8
SEC-AGS-LSH-LAH-101	SEC-AGS-MCP-001	SEC-AGS-LSH-101	AGS BASIN NO. 1 LEVEL SWITCH	LEVEL HIGH	DI	N.O. CONTACT	TBD	FEET	N/A	N/A	Y402	2, 6, 8
SEC-AGS-AE-AI-111	SEC-AGS-MCP-001	SEC-AGS-AIT-110	AGS BASIN NO. 1 NH4 TRANSDUCER	NH4	AI	4-20mA	0 - 100	mg/L	4-WIRE	FIELD	Y402	2, 6
SEC-AGS-AE-TI-121	SEC-AGS-MCP-001	SEC-AGS-AIT-120	AGS BASIN NO. 1 TEMPERATURE	TEMPERATURE	AI	4-20mA	TBD	°F	4-WIRE	FIELD	Y402	2, 6
SEC-AGS-AE-AI-121	SEC-AGS-MCP-001	SEC-AGS-AIT-120	AGS BASIN NO. 1 pH TRANSDUCER	pH	AI	4-20mA	0 - 14	SU	4-WIRE	FIELD	Y402	2, 6
SEC-AGS-AE-AI-122	SEC-AGS-MCP-001	SEC-AGS-AIT-120	AGS BASIN NO. 1 D.O. TRANSDUCER	DISSOLVED OXYGEN	AI	4-20mA	0 - 10.0	mg/L	4-WIRE	FIELD	Y402	2, 6
SEC-AGS-AE-AI-131	**SEC-AGS-MCP-001**	**SEC-AGS-AIT-130**	**AGS BASIN NO. 1 TSS TRANSDUCER**	**TSS**	**AI**	**4-20mA**	**0 - 50,000**	**mg/L**	**4-WIRE**	**FIELD**	**Y402**	**2, 6**
SEC-AGS-AE-AI-132	**SEC-AGS-MCP-001**	**SEC-AGS-AIT-130**	**AGS BASIN NO. 1 ORP TRANSDUCER**	**ORP**	**AI**	**4-20mA**	**-1,500 - 1,500**	**mV**	**4-WIRE**	**FIELD**	**Y402**	**2, 6**
SEC-AGS-AE-AI-141	**SEC-AGS-MCP-001**	**SEC-AGS-AIT-140**	**AGS BASIN NO. 1 NITRATE TRANSDUCER**	**NITRATE**	**AI**	**4-20mA**	**0.5-20**	**mg/L**	**4-WIRE**	**FIELD**	**Y402**	**2, 6**
SEC-AGS-VLV-ZSO-201	SEC-AGS-MCP-001	SEC-AGS-VLV-201	AGS BASIN NO. 2 INFLUENT VALVE A	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-ZSO-201	SEC-AGS-MCP-001	SEC-AGS-VLV-201	AGS BASIN NO. 2 INFLUENT VALVE A	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-HS-201	SEC-AGS-MCP-001	SEC-AGS-VLV-201	AGS BASIN NO. 2 INFLUENT VALVE A	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-ZD-201	SEC-AGS-MCP-001	SEC-AGS-VLV-201	AGS BASIN NO. 2 INFLUENT VALVE A	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y401	
SEC-AGS-VLV-ZSO-203	SEC-AGS-MCP-001	SEC-AGS-VLV-203	AGS BASIN NO. 2 INFLUENT VALVE B	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-ZSO-203	SEC-AGS-MCP-001	SEC-AGS-VLV-203	AGS BASIN NO. 2 INFLUENT VALVE B	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-HS-203	SEC-AGS-MCP-001	SEC-AGS-VLV-203	AGS BASIN NO. 2 INFLUENT VALVE B	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-ZD-203	SEC-AGS-MCP-001	SEC-AGS-VLV-203	AGS BASIN NO. 2 INFLUENT VALVE B	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y401	
SEC-AGS-VLV-HS-205	SEC-AGS-MCP-001	SEC-AGS-VLV-205	AGS BASIN NO. 2 AIR VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZSC-205	SEC-AGS-MCP-001	SEC-AGS-VLV-205	AGS BASIN NO. 2 AIR VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZI-205	SEC-AGS-MCP-001	SEC-AGS-VLV-205	AGS BASIN NO. 2 AIR VALVE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZC-205	SEC-AGS-MCP-001	SEC-AGS-VLV-205	AGS BASIN NO. 2 AIR VALVE	POSITION CONTROL	AO	4-20mA	0-100	%	2-WIRE	FIELD	Y402	2, 6
SEC-AGS-VLV-ZSO-208	SEC-AGS-MCP-001	SEC-AGS-VLV-208	AGS BASIN NO. 2 AIR VALVE	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZSO-208	SEC-AGS-MCP-001	SEC-AGS-VLV-208	AGS BASIN NO. 2 AIR VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-HS-208	SEC-AGS-MCP-001	SEC-AGS-VLV-208	AGS BASIN NO. 2 AIR VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZD-208	SEC-AGS-MCP-001	SEC-AGS-VLV-208	AGS BASIN NO. 2 AIR VALVE	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y402	
SEC-AGS-VLV-ZSO-209	SEC-AGS-MCP-001	SEC-AGS-VLV-209	AGS BASIN NO. 2 SLUDGE AIR VALVE	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZSO-209	SEC-AGS-MCP-001	SEC-AGS-VLV-209	AGS BASIN NO. 2 SLUDGE AIR VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-HS-209	SEC-AGS-MCP-001	SEC-AGS-VLV-209	AGS BASIN NO. 2 SLUDGE AIR VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZD-209	SEC-AGS-MCP-001	SEC-AGS-VLV-209	AGS BASIN NO. 2 INFLUENT VALVE B	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y401	
SEC-AGS-VLV-HS-210	SEC-AGS-MCP-001	SEC-AGS-VLV-210	AGS BASIN NO. 2 SLUDGE VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZSC-210	SEC-AGS-MCP-001	SEC-AGS-VLV-210	AGS BASIN NO. 2 SLUDGE VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZI-210	SEC-AGS-MCP-001	SEC-AGS-VLV-210	AGS BASIN NO. 2 SLUDGE VALVE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZC-210	SEC-AGS-MCP-001	SEC-AGS-VLV-210	AGS BASIN NO. 2 SLUDGE VALVE	POSITION CONTROL	AO	4-20mA	0-100	%	2-WIRE	FIELD	Y402	2, 6

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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-VLV-HS-211	SEC-AGS-MCP-001	SEC-AGS-VLV-211	AGS BASIN NO. 2 WLC VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZSC-211	SEC-AGS-MCP-001	SEC-AGS-VLV-211	AGS BASIN NO. 2 WLC VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZI-211	SEC-AGS-MCP-001	SEC-AGS-VLV-211	AGS BASIN NO. 2 WLC VALVE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZC-211	SEC-AGS-MCP-001	SEC-AGS-VLV-211	AGS BASIN NO. 2 WLC VALVE	POSITION CONTROL	AO	4-20mA	0-100	%	2-WIRE	FIELD	Y402	2, 6
SEC-AGS-FIT-FA-201	SEC-AGS-MCP-001	SEC-AGS-FIT-201	AGS BASIN NO. 2 INFLUENT	REVERSE FLOW	DI	N.O. CONTACT		N/A	N/A	SYSTEM	Y401	6, 10
SEC-AGS-FIT-FI-201	SEC-AGS-MCP-001	SEC-AGS-FIT-201	AGS BASIN NO. 2 INFLUENT	FLOW	AI	4-20mA	0 - 15,000	GPM	4-WIRE	FIELD	Y401	2, 6
SEC-AGS-FIT-FI-202	SEC-AGS-MCP-001	SEC-AGS-FIT-202	AGS BASIN NO. 2 PROCESS AIR	FLOW	AI	4-20mA	0 - 15,000	SCFM	4-WIRE	FIELD	Y402	2, 6
SEC-AGS-PIT-PI-201	SEC-AGS-MCP-001	SEC-AGS-PIT-201	AGS BASIN NO. 2 SLUDGE PRESSURE TRANSMITTER	PRESSURE	AI	4-20mA	TBD	PSI	2-WIRE	SYSTEM	Y402	2, 6
SEC-AGS-LT-LI-201	SEC-AGS-MCP-001	SEC-AGS-LT-201	AGS BASIN NO. 2 LEVEL TRANSMITTER	LEVEL	AI	4-20mA	0 - 25	FEET	2-WIRE	SYSTEM	Y402	2, 6, 8
SEC-AGS-LSH-LAH-201	SEC-AGS-MCP-001	SEC-AGS-LSH-201	AGS BASIN NO. 2 LEVEL SWITCH	LEVEL HIGH	DI	N.O. CONTACT	TBD	FEET	N/A	N/A	Y402	2, 6, 8
SEC-AGS-AE-AI-211	SEC-AGS-MCP-001	SEC-AGS-AIT-210	AGS BASIN NO. 2 NH4 TRANSDUCER	NH4	AI	4-20mA	0 - 100	mg/L	4-WIRE	FIELD	Y402	2, 6
SEC-AGS-AE-TI-221	SEC-AGS-MCP-001	SEC-AGS-AIT-220	AGS BASIN NO. 2 TEMPERATURE	TEMPERATURE	AI	4-20mA	TBD	°F	4-WIRE	FIELD	Y402	2, 6
SEC-AGS-AE-AI-221	SEC-AGS-MCP-001	SEC-AGS-AIT-220	AGS BASIN NO. 2 pH TRANSDUCER	pH	AI	4-20mA	0 - 14	SU	4-WIRE	FIELD	Y402	2, 6
SEC-AGS-AE-AI-222	SEC-AGS-MCP-001	SEC-AGS-AIT-220	AGS BASIN NO. 2 D.O. TRANSDUCER	DISSOLVED OXYGEN	AI	4-20mA	0 - 10.0	mg/L	4-WIRE	FIELD	Y402	2, 6
SEC-AGS-AE-AI-223	SEC-AGS-MCP-001	SEC-AGS-AIT-220	AGS BASIN NO. 2 TSS TRANSDUCER	TSS	AI	4-20mA	0 - 50,000	mg/L	4-WIRE	FIELD	Y402	2, 6
SEC-AGS-AE-AI-224	SEC-AGS-MCP-001	SEC-AGS-AIT-220	AGS BASIN NO. 2 ORP TRANSDUCER	ORP	AI	4-20mA	-1,500 - 1,500	mV	4-WIRE	FIELD	Y402	2, 6
SEC-AGS-AE-AI-231	**SEC-AGS-MCP-001**	**SEC-AGS-AIT-230**	**AGS BASIN NO. 2 TSS TRANSDUCER**	**TSS**	**AI**	**4-20mA**	**0 - 50,000**	**mg/L**	**4-WIRE**	**FIELD**	**Y402**	**2, 6**
SEC-AGS-AE-AI-232	**SEC-AGS-MCP-001**	**SEC-AGS-AIT-230**	**AGS BASIN NO. 2 ORP TRANSDUCER**	**ORP**	**AI**	**4-20mA**	**-1,500 - 1,500**	**mV**	**4-WIRE**	**FIELD**	**Y402**	**2, 6**
SEC-AGS-AE-AI-241	**SEC-AGS-MCP-001**	**SEC-AGS-AIT-240**	**AGS BASIN NO. 2 NITRATE TRANSDUCER**	**NITRATE**	**AI**	**4-20mA**	**0.5-20**	**mg/L**	**4-WIRE**	**FIELD**	**Y402**	**2, 6**
SEC-AGS-VLV-ZSO-301	SEC-AGS-MCP-001	SEC-AGS-VLV-301	AGS BASIN NO. 3 INFLUENT VALVE A	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-ZSO-301	SEC-AGS-MCP-001	SEC-AGS-VLV-301	AGS BASIN NO. 3 INFLUENT VALVE A	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-HS-301	SEC-AGS-MCP-001	SEC-AGS-VLV-301	AGS BASIN NO. 3 INFLUENT VALVE A	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-ZD-301	SEC-AGS-MCP-001	SEC-AGS-VLV-301	AGS BASIN NO. 3 INFLUENT VALVE A	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y401	
SEC-AGS-VLV-ZSO-303	SEC-AGS-MCP-001	SEC-AGS-VLV-303	AGS BASIN NO. 3 INFLUENT VALVE B	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-ZSO-303	SEC-AGS-MCP-001	SEC-AGS-VLV-303	AGS BASIN NO. 3 INFLUENT VALVE B	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-HS-303	SEC-AGS-MCP-001	SEC-AGS-VLV-303	AGS BASIN NO. 3 INFLUENT VALVE B	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-ZD-303	SEC-AGS-MCP-001	SEC-AGS-VLV-303	AGS BASIN NO. 3 INFLUENT VALVE B	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y401	
SEC-AGS-VLV-HS-305	SEC-AGS-MCP-001	SEC-AGS-VLV-305	AGS BASIN NO. 3 AIR VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZSC-305	SEC-AGS-MCP-001	SEC-AGS-VLV-305	AGS BASIN NO. 3 AIR VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZI-305	SEC-AGS-MCP-001	SEC-AGS-VLV-305	AGS BASIN NO. 3 AIR VALVE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZC-305	SEC-AGS-MCP-001	SEC-AGS-VLV-305	AGS BASIN NO. 3 AIR VALVE	POSITION CONTROL	AO	4-20mA	0-100	%	2-WIRE	FIELD	Y403	2, 6
SEC-AGS-VLV-ZSO-308	SEC-AGS-MCP-001	SEC-AGS-VLV-308	AGS BASIN NO. 3 AIR VALVE	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZSO-308	SEC-AGS-MCP-001	SEC-AGS-VLV-308	AGS BASIN NO. 3 AIR VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-HS-308	SEC-AGS-MCP-001	SEC-AGS-VLV-308	AGS BASIN NO. 3 AIR VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZD-308	SEC-AGS-MCP-001	SEC-AGS-VLV-308	AGS BASIN NO. 3 AIR VALVE	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y403	

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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-VLV-ZSO-309	SEC-AGS-MCP-001	SEC-AGS-VLV-309	AGS BASIN NO. 3 SLUDGE AIR VALVE	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZSO-309	SEC-AGS-MCP-001	SEC-AGS-VLV-309	AGS BASIN NO. 3 SLUDGE AIR VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-HS-309	SEC-AGS-MCP-001	SEC-AGS-VLV-309	AGS BASIN NO. 3 SLUDGE AIR VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZD-309	SEC-AGS-MCP-001	SEC-AGS-VLV-309	AGS BASIN NO. 3 INFLUENT VALVE B	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y403	
SEC-AGS-VLV-HS-310	SEC-AGS-MCP-001	SEC-AGS-VLV-310	AGS BASIN NO. 3 SLUDGE VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZSC-310	SEC-AGS-MCP-001	SEC-AGS-VLV-310	AGS BASIN NO. 3 SLUDGE VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZI-310	SEC-AGS-MCP-001	SEC-AGS-VLV-310	AGS BASIN NO. 3 SLUDGE VALVE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZC-310	SEC-AGS-MCP-001	SEC-AGS-VLV-310	AGS BASIN NO. 3 SLUDGE VALVE	POSITION CONTROL	AO	4-20mA	0-100	%	2-WIRE	FIELD	Y403	2, 6
SEC-AGS-VLV-HS-311	SEC-AGS-MCP-001	SEC-AGS-VLV-311	AGS BASIN NO. 3 WLC VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZSC-311	SEC-AGS-MCP-001	SEC-AGS-VLV-311	AGS BASIN NO. 3 WLC VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZI-311	SEC-AGS-MCP-001	SEC-AGS-VLV-311	AGS BASIN NO. 3 WLC VALVE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZC-311	SEC-AGS-MCP-001	SEC-AGS-VLV-311	AGS BASIN NO. 3 WLC VALVE	POSITION CONTROL	AO	4-20mA	0-100	%	2-WIRE	FIELD	Y403	2, 6
SEC-AGS-FIT-FA-301	SEC-AGS-MCP-001	SEC-AGS-FIT-301	AGS BASIN NO. 3 INFLUENT	REVERSE FLOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	6, 10
SEC-AGS-FIT-FI-301	SEC-AGS-MCP-001	SEC-AGS-FIT-301	AGS BASIN NO. 3 INFLUENT	FLOW	AI	4-20mA	0 - 15,000	GPM	4-WIRE	FIELD	Y401	2, 6
SEC-AGS-FIT-FI-302	SEC-AGS-MCP-001	SEC-AGS-FIT-302	AGS BASIN NO. 3 PROCESS AIR	FLOW	AI	4-20mA	0 - 15,000	SCFM	4-WIRE	FIELD	Y403	2, 6
SEC-AGS-PIT-PI-301	SEC-AGS-MCP-001	SEC-AGS-PIT-301	AGS BASIN NO. 3 SLUDGE PRESSURE TRANSMITTER	PRESSURE	AI	4-20mA	TBD	PSI	2-WIRE	SYSTEM	Y403	2, 6
SEC-AGS-LT-LI-301	SEC-AGS-MCP-001	SEC-AGS-LT-301	AGS BASIN NO. 3 LEVEL TRANSMITTER	LEVEL	AI	4-20mA	0 - 25	FEET	2-WIRE	SYSTEM	Y403	2, 6, 8
SEC-AGS-LSH-LAH-301	SEC-AGS-MCP-001	SEC-AGS-LSH-301	AGS BASIN NO. 3 LEVEL SWITCH	LEVEL HIGH	DI	N.O. CONTACT	TBD	FEET	N/A	N/A	Y403	2, 6, 8
SEC-AGS-AE-AI-311	SEC-AGS-MCP-001	SEC-AGS-AIT-310	AGS BASIN NO. 3 NH4 TRANSDUCER	NH4	AI	4-20mA	0 - 100	mg/L	4-WIRE	FIELD	Y403	2, 6
SEC-AGS-AE-TI-321	SEC-AGS-MCP-001	SEC-AGS-AIT-320	AGS BASIN NO. 3 TEMPERATURE	TEMPERATURE	AI	4-20mA	TBD	°F	4-WIRE	FIELD	Y403	2, 6
SEC-AGS-AE-AI-321	SEC-AGS-MCP-001	SEC-AGS-AIT-320	AGS BASIN NO. 3 pH TRANSDUCER	pH	AI	4-20mA	0 - 14	SU	4-WIRE	FIELD	Y403	2, 6
SEC-AGS-AE-AI-322	SEC-AGS-MCP-001	SEC-AGS-AIT-320	AGS BASIN NO. 3 D.O. TRANSDUCER	DISSOLVED OXYGEN	AI	4-20mA	0 - 10.0	mg/L	4-WIRE	FIELD	Y403	2, 6
SEC-AGS-AE-AI-323	SEC-AGS-MCP-001	SEC-AGS-AIT-320	AGS BASIN NO. 3 TSS TRANSDUCER	TSS	AI	4-20mA	0 - 50,000	mg/L	4-WIRE	FIELD	Y403	2, 6
SEC-AGS-AE-AI-324	SEC-AGS-MCP-001	SEC-AGS-AIT-320	AGS BASIN NO. 3 ORP TRANSDUCER	ORP	AI	4-20mA	-1,500 - 1,500	mV	4-WIRE	FIELD	Y403	2, 6
SEC-AGS-AE-AI-331	**SEC-AGS-MCP-001**	**SEC-AGS-AIT-330**	**AGS BASIN NO. 3 TSS TRANSDUCER**	**TSS**	**AI**	**4-20mA**	**0 - 50,000**	**mg/L**	**4-WIRE**	**FIELD**	**Y403**	**2, 6**
SEC-AGS-AE-AI-332	**SEC-AGS-MCP-001**	**SEC-AGS-AIT-330**	**AGS BASIN NO. 3 ORP TRANSDUCER**	**ORP**	**AI**	**4-20mA**	**-1,500 - 1,500**	**mV**	**4-WIRE**	**FIELD**	**Y403**	**2, 6**
SEC-AGS-AE-AI-341	**SEC-AGS-MCP-001**	**SEC-AGS-AIT-340**	**AGS BASIN NO. 3 NITRATE TRANSDUCER**	**NITRATE**	**AI**	**4-20mA**	**0.5-20**	**mg/L**	**4-WIRE**	**FIELD**	**Y403**	**2, 6**
SEC-AGS-VLV-ZSO-401	SEC-AGS-MCP-001	SEC-AGS-VLV-401	AGS BASIN NO. 4 INFLUENT VALVE A	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-ZSO-401	SEC-AGS-MCP-001	SEC-AGS-VLV-401	AGS BASIN NO. 4 INFLUENT VALVE A	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-HS-401	SEC-AGS-MCP-001	SEC-AGS-VLV-401	AGS BASIN NO. 4 INFLUENT VALVE A	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-ZD-401	SEC-AGS-MCP-001	SEC-AGS-VLV-401	AGS BASIN NO. 4 INFLUENT VALVE A	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y401	
SEC-AGS-VLV-ZSO-403	SEC-AGS-MCP-001	SEC-AGS-VLV-403	AGS BASIN NO. 4 INFLUENT VALVE B	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-ZSO-403	SEC-AGS-MCP-001	SEC-AGS-VLV-403	AGS BASIN NO. 4 INFLUENT VALVE B	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-HS-403	SEC-AGS-MCP-001	SEC-AGS-VLV-403	AGS BASIN NO. 4 INFLUENT VALVE B	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-ZD-403	SEC-AGS-MCP-001	SEC-AGS-VLV-403	AGS BASIN NO. 4 INFLUENT VALVE B	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y401	

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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-VLV-HS-405	SEC-AGS-MCP-001	SEC-AGS-VLV-405	AGS BASIN NO. 4 AIR VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZSC-405	SEC-AGS-MCP-001	SEC-AGS-VLV-405	AGS BASIN NO. 4 AIR VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZI-405	SEC-AGS-MCP-001	SEC-AGS-VLV-405	AGS BASIN NO. 4 AIR VALVE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZC-405	SEC-AGS-MCP-001	SEC-AGS-VLV-405	AGS BASIN NO. 4 AIR VALVE	POSITION CONTROL	AO	4-20mA	0-100	%	2-WIRE	FIELD	Y403	2, 6
SEC-AGS-VLV-ZSO-408	SEC-AGS-MCP-001	SEC-AGS-VLV-408	AGS BASIN NO. 4 AIR VALVE	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZSO-408	SEC-AGS-MCP-001	SEC-AGS-VLV-408	AGS BASIN NO. 4 AIR VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-HS-408	SEC-AGS-MCP-001	SEC-AGS-VLV-408	AGS BASIN NO. 4 AIR VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZD-408	SEC-AGS-MCP-001	SEC-AGS-VLV-408	AGS BASIN NO. 4 AIR VALVE	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y403	
SEC-AGS-VLV-ZSO-409	SEC-AGS-MCP-001	SEC-AGS-VLV-409	AGS BASIN NO. 4 SLUDGE AIR VALVE	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZSO-409	SEC-AGS-MCP-001	SEC-AGS-VLV-409	AGS BASIN NO. 4 SLUDGE AIR VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-HS-409	SEC-AGS-MCP-001	SEC-AGS-VLV-409	AGS BASIN NO. 4 SLUDGE AIR VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZD-409	SEC-AGS-MCP-001	SEC-AGS-VLV-409	AGS BASIN NO. 4 INFLUENT VALVE B	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y403	
SEC-AGS-VLV-HS-410	SEC-AGS-MCP-001	SEC-AGS-VLV-410	AGS BASIN NO. 4 SLUDGE VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZSC-410	SEC-AGS-MCP-001	SEC-AGS-VLV-410	AGS BASIN NO. 4 SLUDGE VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZI-410	SEC-AGS-MCP-001	SEC-AGS-VLV-410	AGS BASIN NO. 4 SLUDGE VALVE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZC-410	SEC-AGS-MCP-001	SEC-AGS-VLV-410	AGS BASIN NO. 4 SLUDGE VALVE	POSITION CONTROL	AO	4-20mA	0-100	%	2-WIRE	FIELD	Y403	2, 6
SEC-AGS-VLV-HS-411	SEC-AGS-MCP-001	SEC-AGS-VLV-411	AGS BASIN NO. 4 WLC VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZSC-411	SEC-AGS-MCP-001	SEC-AGS-VLV-411	AGS BASIN NO. 4 WLC VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZI-411	SEC-AGS-MCP-001	SEC-AGS-VLV-411	AGS BASIN NO. 4 WLC VALVE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZC-411	SEC-AGS-MCP-001	SEC-AGS-VLV-411	AGS BASIN NO. 4 WLC VALVE	POSITION CONTROL	AO	4-20mA	0-100	%	2-WIRE	FIELD	Y403	2, 6
SEC-AGS-FIT-FA-401	SEC-AGS-MCP-001	SEC-AGS-FIT-401	AGS BASIN NO. 4 INFLUENT	REVERSE FLOW	DI	N.O. CONTACT		N/A	N/A	SYSTEM	Y401	6, 10
SEC-AGS-FIT-FI-401	SEC-AGS-MCP-001	SEC-AGS-FIT-401	AGS BASIN NO. 4 INFLUENT	FLOW	AI	4-20mA	0 - 15,000	GPM	4-WIRE	FIELD	Y401	2, 6
SEC-AGS-FIT-FI-402	SEC-AGS-MCP-001	SEC-AGS-FIT-402	AGS BASIN NO. 4 PROCESS AIR	FLOW	AI	4-20mA	0 - 15,000	SCFM	4-WIRE	FIELD	Y403	2, 6
SEC-AGS-PIT-PI-401	SEC-AGS-MCP-001	SEC-AGS-PIT-401	AGS BASIN NO. 4 SLUDGE PRESSURE TRANSMITTER	PRESSURE	AI	4-20mA	TBD	PSI	2-WIRE	SYSTEM	Y403	2, 6
SEC-AGS-LT-LI-401	SEC-AGS-MCP-001	SEC-AGS-LT-401	AGS BASIN NO. 4 LEVEL TRANSMITTER	LEVEL	AI	4-20mA	0 - 25	FEET	2-WIRE	SYSTEM	Y403	2, 6, 8
SEC-AGS-LSH-LAH-401	SEC-AGS-MCP-001	SEC-AGS-LSH-401	AGS BASIN NO. 4 LEVEL SWITCH	LEVEL HIGH	DI	N.O. CONTACT	TBD	FEET	N/A	N/A	Y403	2, 6, 8
SEC-AGS-AE-AI-411	SEC-AGS-MCP-001	SEC-AGS-AIT-410	AGS BASIN NO. 4 NH4 TRANSDUCER	NH4	AI	4-20mA	0 - 100	mg/L	4-WIRE	FIELD	Y403	2, 6
SEC-AGS-AE-TI-421	SEC-AGS-MCP-001	SEC-AGS-AIT-420	AGS BASIN NO. 4 TEMPERATURE	TEMPERATURE	AI	4-20mA	TBD	°F	4-WIRE	FIELD	Y403	2, 6
SEC-AGS-AE-AI-421	SEC-AGS-MCP-001	SEC-AGS-AIT-420	AGS BASIN NO. 4 pH TRANSDUCER	pH	AI	4-20mA	0 - 14	SU	4-WIRE	FIELD	Y403	2, 6
SEC-AGS-AE-AI-422	SEC-AGS-MCP-001	SEC-AGS-AIT-420	AGS BASIN NO. 4 D.O. TRANSDUCER	DISSOLVED OXYGEN	AI	4-20mA	0 - 10.0	mg/L	4-WIRE	FIELD	Y403	2, 6
SEC-AGS-AE-AI-423	SEC-AGS-MCP-001	SEC-AGS-AIT-420	AGS BASIN NO. 4 TSS TRANSDUCER	TSS	AI	4-20mA	0 - 50,000	mg/L	4-WIRE	FIELD	Y403	2, 6
SEC-AGS-AE-AI-424	SEC-AGS-MCP-001	SEC-AGS-AIT-420	AGS BASIN NO. 4 ORP TRANSDUCER	ORP	AI	4-20mA	-1,500 - 1,500	mV	4-WIRE	FIELD	Y403	2, 6
SEC-AGS-AE-AI-431	**SEC-AGS-MCP-001**	**SEC-AGS-AIT-430**	**AGS BASIN NO. 4 TSS TRANSDUCER**	**TSS**	**AI**	**4-20mA**	**0 - 50,000**	**mg/L**	**4-WIRE**	**FIELD**	**Y403**	**2, 6**
SEC-AGS-AE-AI-432	**SEC-AGS-MCP-001**	**SEC-AGS-AIT-430**	**AGS BASIN NO. 4 ORP TRANSDUCER**	**ORP**	**AI**	**4-20mA**	**-1,500 - 1,500**	**mV**	**4-WIRE**	**FIELD**	**Y403**	**2, 6**
SEC-AGS-AE-AI-441	**SEC-AGS-MCP-001**	**SEC-AGS-AIT-440**	**AGS BASIN NO. 4 NITRATE TRANSDUCER**	**NITRATE**	**AI**	**4-20mA**	**0.5-20**	**mg/L**	**4-WIRE**	**FIELD**	**Y403**	**2, 6**

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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-FIT-FA-601	SEC-AGS-MCP-001	SEC-AGS-FIT-601	SUPERNATANT INFLUENT HEADER	REVERSE FLOW	DI	N.O. CONTACT		N/A	N/A	SYSTEM	Y405	6, 10
SEC-AGS-FIT-FI-601	SEC-AGS-MCP-001	SEC-AGS-FIT-601	SUPERNATANT INFLUENT HEADER	FLOW	AI	4-20mA	0 - 1,200	GPM	4-WIRE	FIELD	Y405	2, 6
SEC-AGS-AIT-AI-701	SEC-AGS-MCP-001	SEC-AGS-AIT-701	SLUDGE PUMPING	TSS	AI	4-20mA	0 - 50,000	mg/L	4-WIRE	FIELD	Y405	2, 6
SEC-AGS-FIT-FA-701	SEC-AGS-MCP-001	SEC-AGS-FIT-701	SLUDGE PUMPING	REVERSE FLOW	DI	N.O. CONTACT		N/A	N/A	SYSTEM	Y405	6, 10
SEC-AGS-FIT-FI-701	SEC-AGS-MCP-001	SEC-AGS-FIT-701	SLUDGE PUMPING	FLOW	AI	4-20mA	0 - 500	GPM	4-WIRE	FIELD	Y405	2, 6
SEC-AGS-LT-LI-510	SEC-AGS-MCP-001	SEC-AGS-LT-510	SLUDGE BUFFER TANK NO. 1	LEVEL	AI	4-20mA	0 - 25	FEET	2-WIRE	SYSTEM	Y405	2, 6, 8
SEC-AGS-LSH-LAH-510	SEC-AGS-MCP-001	SEC-AGS-LSH-510	SLUDGE BUFFER TANK NO. 1	LEVEL HIGH	DI	N.O. CONTACT	TBD	FEET	N/A	SYSTEM	Y405	2, 6, 8
SEC-AGS-LSL-LAL-510	SEC-AGS-MCP-001	SEC-AGS-LSL-510	SLUDGE BUFFER TANK NO. 1	LEVEL LOW	DI	N.O. CONTACT	TBD	FEET	N/A	SYSTEM	Y405	2, 6, 8
SEC-AGS-LSLL-LALL-510	SEC-AGS-MCP-001	SEC-AGS-LSLL-510	SLUDGE BUFFER TANK NO. 1	LEVEL LOW-LOW	DI	N.O. CONTACT	TBD	FEET	N/A	SYSTEM	Y405	2, 6, 8
SEC-AGS-VLV-ZSO-511	SEC-AGS-MCP-001	SEC-AGS-VLV-511	SLUDGE BUFFER TANK NO. 1 INFLUENT VALVE	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	2, 6
SEC-AGS-VLV-ZSO-511	SEC-AGS-MCP-001	SEC-AGS-VLV-511	SLUDGE BUFFER TANK NO. 1 INFLUENT VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	2, 6
SEC-AGS-VLV-HS-511	SEC-AGS-MCP-001	SEC-AGS-VLV-511	SLUDGE BUFFER TANK NO. 1 INFLUENT VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	2, 6
SEC-AGS-VLV-ZD-511	SEC-AGS-MCP-001	SEC-AGS-VLV-511	SLUDGE BUFFER TANK NO. 1 INFLUENT VALVE	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y405	6
SEC-AGS-LT-LI-520	SEC-AGS-MCP-001	SEC-AGS-LT-520	SLUDGE BUFFER TANK NO. 2	LEVEL	AI	4-20mA	0 - 25	FEET	2-WIRE	SYSTEM	Y405	2, 6, 8
SEC-AGS-LSH-LAH-520	SEC-AGS-MCP-001	SEC-AGS-LSH-520	SLUDGE BUFFER TANK NO. 2	LEVEL HIGH	DI	N.O. CONTACT	TBD	FEET	N/A	SYSTEM	Y405	2, 6, 8
SEC-AGS-LSL-LAL-520	SEC-AGS-MCP-001	SEC-AGS-LSL-520	SLUDGE BUFFER TANK NO. 2	LEVEL LOW	DI	N.O. CONTACT	TBD	FEET	N/A	SYSTEM	Y405	2, 6, 8
SEC-AGS-LSLL-LALL-520	SEC-AGS-MCP-001	SEC-AGS-LSLL-520	SLUDGE BUFFER TANK NO. 2	LEVEL LOW-LOW	DI	N.O. CONTACT	TBD	FEET	N/A	SYSTEM	Y405	2, 6, 8
SEC-AGS-VLV-ZSO-521	SEC-AGS-MCP-001	SEC-AGS-VLV-521	SLUDGE BUFFER TANK NO. 2 INFLUENT VALVE	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	2, 6
SEC-AGS-VLV-ZSO-521	SEC-AGS-MCP-001	SEC-AGS-VLV-521	SLUDGE BUFFER TANK NO. 2 INFLUENT VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	2, 6
SEC-AGS-VLV-HS-521	SEC-AGS-MCP-001	SEC-AGS-VLV-521	SLUDGE BUFFER TANK NO. 2 INFLUENT VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	2, 6
SEC-AGS-VLV-ZD-521	SEC-AGS-MCP-001	SEC-AGS-VLV-521	SLUDGE BUFFER TANK NO. 2 INFLUENT VALVE	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y405	6
SEC-AGS-PMP-MD-610	SEC-AGS-MCP-001	SEC-AGS-PMP-610	SUPERNATANT PUMP NO. 1	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y405	6
SEC-AGS-PMP-HS-610A	SEC-AGS-MCP-001	SEC-AGS-PMP-610	SUPERNATANT PUMP NO. 1	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-MN-610	SEC-AGS-MCP-001	SEC-AGS-PMP-610	SUPERNATANT PUMP NO. 1	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-YA-610	SEC-AGS-MCP-001	SEC-AGS-PMP-610	SUPERNATANT PUMP NO. 1	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-SC-610	SEC-AGS-MCP-001	SEC-AGS-PMP-610	SUPERNATANT PUMP NO. 1	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y405	6
SEC-AGS-PMP-SI-610	SEC-AGS-MCP-001	SEC-AGS-PMP-610	SUPERNATANT PUMP NO. 1	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y405	6
SEC-AGS-PMP-MD-620	SEC-AGS-MCP-001	SEC-AGS-PMP-620	SUPERNATANT PUMP NO. 2	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y405	6
SEC-AGS-PMP-HS-620A	SEC-AGS-MCP-001	SEC-AGS-PMP-620	SUPERNATANT PUMP NO. 2	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-MN-620	SEC-AGS-MCP-001	SEC-AGS-PMP-620	SUPERNATANT PUMP NO. 2	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-YA-620	SEC-AGS-MCP-001	SEC-AGS-PMP-620	SUPERNATANT PUMP NO. 2	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-SC-620	SEC-AGS-MCP-001	SEC-AGS-PMP-620	SUPERNATANT PUMP NO. 2	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y405	6
SEC-AGS-PMP-SI-620	SEC-AGS-MCP-001	SEC-AGS-PMP-620	SUPERNATANT PUMP NO. 2	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y405	6

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-PMP-MD-630	SEC-AGS-MCP-001	SEC-AGS-PMP-630	SUPERNATANT PUMP NO. 3	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y405	6
SEC-AGS-PMP-HS-630A	SEC-AGS-MCP-001	SEC-AGS-PMP-630	SUPERNATANT PUMP NO. 3	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-MN-630	SEC-AGS-MCP-001	SEC-AGS-PMP-630	SUPERNATANT PUMP NO. 3	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-YA-630	SEC-AGS-MCP-001	SEC-AGS-PMP-630	SUPERNATANT PUMP NO. 3	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-SC-630	SEC-AGS-MCP-001	SEC-AGS-PMP-630	SUPERNATANT PUMP NO. 3	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y405	6
SEC-AGS-PMP-SI-630	SEC-AGS-MCP-001	SEC-AGS-PMP-630	SUPERNATANT PUMP NO. 3	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y405	6
SEC-AGS-PMP-MD-710	SEC-AGS-MCP-001	SEC-AGS-PMP-710	SLUDGE PUMP NO. 1	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y405	6
SEC-AGS-PMP-HS-710A	SEC-AGS-MCP-001	SEC-AGS-PMP-710	SLUDGE PUMP NO. 1	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-MN-710	SEC-AGS-MCP-001	SEC-AGS-PMP-710	SLUDGE PUMP NO. 1	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-YA-710	SEC-AGS-MCP-001	SEC-AGS-PMP-710	SLUDGE PUMP NO. 1	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-SC-710	SEC-AGS-MCP-001	SEC-AGS-PMP-710	SLUDGE PUMP NO. 1	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y405	6
SEC-AGS-PMP-SI-710	SEC-AGS-MCP-001	SEC-AGS-PMP-710	SLUDGE PUMP NO. 1	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y405	6
SEC-AGS-PMP-MD-720	SEC-AGS-MCP-001	SEC-AGS-PMP-720	SLUDGE PUMP NO. 2	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y405	6
SEC-AGS-PMP-HS-720A	SEC-AGS-MCP-001	SEC-AGS-PMP-720	SLUDGE PUMP NO. 2	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-MN-720	SEC-AGS-MCP-001	SEC-AGS-PMP-720	SLUDGE PUMP NO. 2	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-YA-720	SEC-AGS-MCP-001	SEC-AGS-PMP-720	SLUDGE PUMP NO. 2	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-SC-720	SEC-AGS-MCP-001	SEC-AGS-PMP-720	SLUDGE PUMP NO. 2	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y405	6
SEC-AGS-PMP-SI-720	SEC-AGS-MCP-001	SEC-AGS-PMP-720	SLUDGE PUMP NO. 2	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y405	6
SEC-AGS-PMP-MD-730	SEC-AGS-MCP-001	SEC-AGS-PMP-730	SLUDGE PUMP NO. 3	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y405	6
SEC-AGS-PMP-HS-730A	SEC-AGS-MCP-001	SEC-AGS-PMP-730	SLUDGE PUMP NO. 3	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-MN-730	SEC-AGS-MCP-001	SEC-AGS-PMP-730	SLUDGE PUMP NO. 3	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-YA-730	SEC-AGS-MCP-001	SEC-AGS-PMP-730	SLUDGE PUMP NO. 3	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-SC-730	SEC-AGS-MCP-001	SEC-AGS-PMP-730	SLUDGE PUMP NO. 3	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y405	6
SEC-AGS-PMP-SI-730	SEC-AGS-MCP-001	SEC-AGS-PMP-730	SLUDGE PUMP NO. 3	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y405	6
SEC-AGS-LSH-LAH-801	SEC-AGS-MCP-001	SEC-AGS-LSH-801	WLC TANK	LEVEL HIGH	DI	N.O. CONTACT	TBD	FEET(MSL)	2-WIRE	SYSTEM	Y406	2, 6, 8
SEC-AGS-LSLL-LALL-801	SEC-AGS-MCP-001	SEC-AGS-LSLL-801	WLC TANK	LEVEL LOW-LOW	DI	N.O. CONTACT	TBD	FEET(MSL)	2-WIRE	SYSTEM	Y406	6
SEC-AGS-LSL-LAL-801	SEC-AGS-MCP-001	SEC-AGS-LSL-801	WLC TANK	LEVEL LOW	DI	N.O. CONTACT	TBD	FEET(MSL)	2-WIRE	SYSTEM	Y406	6
SEC-AGS-LSHH-LAHH-801	SEC-AGS-MCP-001	SEC-AGS-LSHH-801	WLC TANK	LEVEL HIGH-HIGH	DI	N.O. CONTACT	TBD	FEET(MSL)	2-WIRE	SYSTEM	Y406	2, 6, 8
SEC-AGS-LT-LI-801	SEC-AGS-MCP-001	SEC-AGS-LT-801	WLC TANK	LEVEL	AI	4-20mA	0 - 25	FEET	2-WIRE	SYSTEM	Y406	2, 6, 8
SEC-AGS-FIT-FA-801	SEC-AGS-MCP-001	SEC-AGS-FIT-801	WLC RETURN	REVERSE FLOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y406	6, 10
SEC-AGS-FIT-FI-801	SEC-AGS-MCP-001	SEC-AGS-FIT-801	WLC RETURN	FLOW	AI	4-20mA	0 - 5,000	GPM	4-WIRE	FIELD	Y406	2, 6
SEC-AGS-PMP-MD-810	SEC-AGS-MCP-001	SEC-AGS-PMP-810	WLC PUMP NO. 1	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y406	6
SEC-AGS-PMP-HS-810A	SEC-AGS-MCP-001	SEC-AGS-PMP-810	WLC PUMP NO. 1	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y406	6
SEC-AGS-PMP-MN-810	SEC-AGS-MCP-001	SEC-AGS-PMP-810	WLC PUMP NO. 1	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y406	6
SEC-AGS-PMP-YA-810	SEC-AGS-MCP-001	SEC-AGS-PMP-810	WLC PUMP NO. 1	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y406	6
SEC-AGS-PMP-SC-810	SEC-AGS-MCP-001	SEC-AGS-PMP-810	WLC PUMP NO. 1	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y406	6
SEC-AGS-PMP-SI-810	SEC-AGS-MCP-001	SEC-AGS-PMP-810	WLC PUMP NO. 1	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y406	6

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-PMP-MD-820	SEC-AGS-MCP-001	SEC-AGS-PMP-820	WLC PUMP NO. 2	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y406	6
SEC-AGS-PMP-HS-820A	SEC-AGS-MCP-001	SEC-AGS-PMP-820	WLC PUMP NO. 2	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y406	6
SEC-AGS-PMP-MN-820	SEC-AGS-MCP-001	SEC-AGS-PMP-820	WLC PUMP NO. 2	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y406	6
SEC-AGS-PMP-YA-820	SEC-AGS-MCP-001	SEC-AGS-PMP-820	WLC PUMP NO. 2	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y406	6
SEC-AGS-PMP-SC-820	SEC-AGS-MCP-001	SEC-AGS-PMP-820	WLC PUMP NO. 2	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y406	6
SEC-AGS-PMP-SI-820	SEC-AGS-MCP-001	SEC-AGS-PMP-820	WLC PUMP NO. 2	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y406	6
SEC-AGS-PIT-PI-901	SEC-AGS-MCP-001	SEC-AGS-PIT-901	AERATION HEADER	PRESSURE	DI	4-20mA	TBD	PSI	N/A	N/A	Y408	2, 6
SEC-AGS-BLOW-MD-910	SEC-AGS-MCP-001	SEC-AGS-BLOW-910	AERATION BLOWER NO. 1	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y407	6
SEC-AGS-BLOW-MN-910	SEC-AGS-MCP-001	SEC-AGS-BLOW-910	AERATION BLOWER NO. 1	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	6
SEC-AGS-BLOW-HS-910A	SEC-AGS-MCP-001	SEC-AGS-BLOW-910	AERATION BLOWER NO. 1	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	6
SEC-AGS-BLOW-YA-910	SEC-AGS-MCP-001	SEC-AGS-BLOW-910	AERATION BLOWER NO. 1	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	6
SEC-AGS-BLOW-SC-910	SEC-AGS-MCP-001	SEC-AGS-BLOW-910	AERATION BLOWER NO. 1	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y407	6
SEC-AGS-BLOW-SI-910	SEC-AGS-MCP-001	SEC-AGS-BLOW-910	AERATION BLOWER NO. 1	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y407	6
SEC-AGS-BLOW-MD-920	SEC-AGS-MCP-001	SEC-AGS-BLOW-920	AERATION BLOWER NO. 2	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y407	6
SEC-AGS-BLOW-MN-920	SEC-AGS-MCP-001	SEC-AGS-BLOW-920	AERATION BLOWER NO. 2	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	6
SEC-AGS-BLOW-HS-920A	SEC-AGS-MCP-001	SEC-AGS-BLOW-920	AERATION BLOWER NO. 2	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	6
SEC-AGS-BLOW-YA-920	SEC-AGS-MCP-001	SEC-AGS-BLOW-920	AERATION BLOWER NO. 2	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	6
SEC-AGS-BLOW-SC-920	SEC-AGS-MCP-001	SEC-AGS-BLOW-920	AERATION BLOWER NO. 2	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y407	6
SEC-AGS-BLOW-SI-920	SEC-AGS-MCP-001	SEC-AGS-BLOW-920	AERATION BLOWER NO. 2	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y407	6
SEC-AGS-BLOW-MD-930	SEC-AGS-MCP-001	SEC-AGS-BLOW-930	AERATION BLOWER NO. 3	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y407	6
SEC-AGS-BLOW-MN-930	SEC-AGS-MCP-001	SEC-AGS-BLOW-930	AERATION BLOWER NO. 3	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	6
SEC-AGS-BLOW-HS-930A	SEC-AGS-MCP-001	SEC-AGS-BLOW-930	AERATION BLOWER NO. 3	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	6
SEC-AGS-BLOW-YA-930	SEC-AGS-MCP-001	SEC-AGS-BLOW-930	AERATION BLOWER NO. 3	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	6
SEC-AGS-BLOW-SC-930	SEC-AGS-MCP-001	SEC-AGS-BLOW-930	AERATION BLOWER NO. 3	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y407	6
SEC-AGS-BLOW-SI-930	SEC-AGS-MCP-001	SEC-AGS-BLOW-930	AERATION BLOWER NO. 3	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y407	6
SEC-AGS-BLOW-MD-940	SEC-AGS-MCP-001	SEC-AGS-BLOW-940	AERATION BLOWER NO. 4	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y408	6
SEC-AGS-BLOW-MN-940	SEC-AGS-MCP-001	SEC-AGS-BLOW-940	AERATION BLOWER NO. 4	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y408	6
SEC-AGS-BLOW-HS-940A	SEC-AGS-MCP-001	SEC-AGS-BLOW-940	AERATION BLOWER NO. 4	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y408	6
SEC-AGS-BLOW-YA-940	SEC-AGS-MCP-001	SEC-AGS-BLOW-940	AERATION BLOWER NO. 4	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y408	6
SEC-AGS-BLOW-SC-940	SEC-AGS-MCP-001	SEC-AGS-BLOW-940	AERATION BLOWER NO. 4	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y408	6
SEC-AGS-BLOW-SI-940	SEC-AGS-MCP-001	SEC-AGS-BLOW-940	AERATION BLOWER NO. 4	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y408	6
SEC-AGS-BLOW-MD-950	SEC-AGS-MCP-001	SEC-AGS-BLOW-950	AERATION BLOWER NO. 5	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y408	6
SEC-AGS-BLOW-MN-950	SEC-AGS-MCP-001	SEC-AGS-BLOW-950	AERATION BLOWER NO. 5	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y408	6
SEC-AGS-BLOW-HS-950A	SEC-AGS-MCP-001	SEC-AGS-BLOW-950	AERATION BLOWER NO. 5	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y408	6
SEC-AGS-BLOW-YA-950	SEC-AGS-MCP-001	SEC-AGS-BLOW-950	AERATION BLOWER NO. 5	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y408	6
SEC-AGS-BLOW-SC-950	SEC-AGS-MCP-001	SEC-AGS-BLOW-950	AERATION BLOWER NO. 5	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y408	6
SEC-AGS-BLOW-SI-950	SEC-AGS-MCP-001	SEC-AGS-BLOW-950	AERATION BLOWER NO. 5	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y408	6
DIS-UV-AIT-AI-021	SEC-AGS-MCP-001	DIS-UV-AIT-020	TOTAL PHOSPHATE	PHOSPHOROUS	AI	COMM	TBD	mg/L PO_4-P	4-WIRE	FIELD	Y601	7

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-AIT-AI-001	SEC-AGS-MCP-061	SEC-AGS-AIT-001	AGS INFLUENT	TSS	AI	4-20mA	0 - 50,000	mg/L	4-WIRE	FIELD	Y401	2
SEC-AGS-VLV-ZSO-101	SEC-AGS-PLC-061	SEC-AGS-VLV-101	AGS BASIN NO. 1 INFLUENT VALVE A	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-ZSO-101	SEC-AGS-PLC-061	SEC-AGS-VLV-101	AGS BASIN NO. 1 INFLUENT VALVE A	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-HS-101	SEC-AGS-PLC-061	SEC-AGS-VLV-101	AGS BASIN NO. 1 INFLUENT VALVE A	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-ZSO-103	SEC-AGS-PLC-061	SEC-AGS-VLV-103	AGS BASIN NO. 1 INFLUENT VALVE B	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-ZSO-103	SEC-AGS-PLC-061	SEC-AGS-VLV-103	AGS BASIN NO. 1 INFLUENT VALVE B	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-HS-103	SEC-AGS-PLC-061	SEC-AGS-VLV-103	AGS BASIN NO. 1 INFLUENT VALVE B	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-HS-105	SEC-AGS-PLC-061	SEC-AGS-VLV-105	AGS BASIN NO. 1 AIR VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZSC-105	SEC-AGS-PLC-061	SEC-AGS-VLV-105	AGS BASIN NO. 1 AIR VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZI-105	SEC-AGS-PLC-061	SEC-AGS-VLV-105	AGS BASIN NO. 1 AIR VALVE	POSITION	AI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZSO-108	SEC-AGS-MCP-001	SEC-AGS-VLV-108	AGS BASIN NO. 1 AIR VALVE	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZSO-108	SEC-AGS-MCP-001	SEC-AGS-VLV-108	AGS BASIN NO. 1 AIR VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-HS-108	SEC-AGS-MCP-001	SEC-AGS-VLV-108	AGS BASIN NO. 1 AIR VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZSO-109	SEC-AGS-PLC-061	SEC-AGS-VLV-109	AGS BASIN NO. 1 SLUDGE AIR VALVE	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZSO-109	SEC-AGS-PLC-061	SEC-AGS-VLV-109	AGS BASIN NO. 1 SLUDGE AIR VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-HS-109	SEC-AGS-PLC-061	SEC-AGS-VLV-109	AGS BASIN NO. 1 SLUDGE AIR VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-HS-110	SEC-AGS-PLC-061	SEC-AGS-VLV-110	AGS BASIN NO. 1 SLUDGE VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZSC-110	SEC-AGS-PLC-061	SEC-AGS-VLV-110	AGS BASIN NO. 1 SLUDGE VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZI-110	SEC-AGS-PLC-061	SEC-AGS-VLV-110	AGS BASIN NO. 1 SLUDGE VALVE	POSITION	AI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-HS-111	SEC-AGS-PLC-061	SEC-AGS-VLV-111	AGS BASIN NO. 1 WLC VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZSC-111	SEC-AGS-PLC-061	SEC-AGS-VLV-111	AGS BASIN NO. 1 WLC VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZI-111	SEC-AGS-PLC-061	SEC-AGS-VLV-111	AGS BASIN NO. 1 WLC VALVE	POSITION	AI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-FIT-FA-101	SEC-AGS-PLC-061	SEC-AGS-FIT-101	AGS BASIN NO. 1 INFLUENT	REVERSE FLOW	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-FIT-FI-101	SEC-AGS-PLC-061	SEC-AGS-FIT-101	AGS BASIN NO. 1 INFLUENT	FLOW	AI	COMM	0 - 15,000	GPM	N/A	N/A	Y401	6
SEC-AGS-FIT-FI-102	SEC-AGS-PLC-061	SEC-AGS-FIT-102	AGS BASIN NO. 1 PROCESS AIR	FLOW	AI	COMM	0 - 15,000	SCFM	N/A	N/A	Y402	6
SEC-AGS-PIT-PI-101	SEC-AGS-PLC-061	SEC-AGS-PIT-101	AGS BASIN NO. 1 SLUDGE PRESSURE TRANSMITTER	PRESSURE	AI	COMM	TBD	PSI	N/A	N/A	Y402	6
SEC-AGS-LT-LI-101	SEC-AGS-PLC-061	SEC-AGS-LT-101	AGS BASIN NO. 1 LEVEL TRANSMITTER	LEVEL	AI	COMM	0 - 25	FEET	N/A	N/A	Y402	6
SEC-AGS-LSH-LAH-101	SEC-AGS-PLC-061	SEC-AGS-LSH-101	AGS BASIN NO. 1 LEVEL SWITCH	LEVEL HIGH	DI	COMM	TBD	FEET	N/A	N/A	Y402	6
SEC-AGS-AE-AI-111	SEC-AGS-PLC-061	SEC-AGS-AIT-110	AGS BASIN NO. 1 NH4 TRANSDUCER	NH4	AI	COMM	0 - 100	mg/L	N/A	N/A	Y402	6
SEC-AGS-AE-TI-121	SEC-AGS-PLC-061	SEC-AGS-AIT-120	AGS BASIN NO. 1 TEMPERATURE	TEMPERATURE	AI	COMM	TBD	°F	N/A	N/A	Y402	6
SEC-AGS-AE-AI-121	SEC-AGS-PLC-061	SEC-AGS-AIT-120	AGS BASIN NO. 1 pH TRANSDUCER	pH	AI	COMM	0 - 14	SU	N/A	N/A	Y402	6
SEC-AGS-AE-AI-122	SEC-AGS-PLC-061	SEC-AGS-AIT-120	AGS BASIN NO. 1 D.O. TRANSDUCER	DISSOLVED OXYGEN	AI	COMM	0 - 10.0	mg/L	N/A	N/A	Y402	6
SEC-AGS-AE-AI-131	**SEC-AGS-PLC-061**	**SEC-AGS-AIT-130**	**AGS BASIN NO. 1 TSS TRANSDUCER**	**TSS**	**AI**	**COMM**	**0 - 50,000**	**mg/L**	**N/A**	**N/A**	**Y402**	**6**
SEC-AGS-AE-AI-132	**SEC-AGS-PLC-061**	**SEC-AGS-AIT-130**	**AGS BASIN NO. 1 ORP TRANSDUCER**	**ORP**	**AI**	**COMM**	**-1,500 - 1,500**	**mV**	**N/A**	**N/A**	**Y402**	**6**
SEC-AGS-AE-AI-141	**SEC-AGS-PLC-061**	**SEC-AGS-AIT-140**	**AGS BASIN NO. 1 NITRATE TRANSDUCER**	**NITRATE**	**AI**	**COMM**	**0.5-20**	**mg/L**	**N/A**	**N/A**	**Y402**	**6**

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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-VLV-ZSO-201	SEC-AGS-PLC-061	SEC-AGS-VLV-201	AGS BASIN NO. 2 INFLUENT VALVE A	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-ZSO-201	SEC-AGS-PLC-061	SEC-AGS-VLV-201	AGS BASIN NO. 2 INFLUENT VALVE A	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-HS-201	SEC-AGS-PLC-061	SEC-AGS-VLV-201	AGS BASIN NO. 2 INFLUENT VALVE A	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-ZSO-203	SEC-AGS-PLC-061	SEC-AGS-VLV-203	AGS BASIN NO. 2 INFLUENT VALVE B	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-ZSO-203	SEC-AGS-PLC-061	SEC-AGS-VLV-203	AGS BASIN NO. 2 INFLUENT VALVE B	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-HS-203	SEC-AGS-PLC-061	SEC-AGS-VLV-203	AGS BASIN NO. 2 INFLUENT VALVE B	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-HS-205	SEC-AGS-PLC-061	SEC-AGS-VLV-205	AGS BASIN NO. 2 AIR VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZSC-205	SEC-AGS-PLC-061	SEC-AGS-VLV-205	AGS BASIN NO. 2 AIR VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZI-205	SEC-AGS-PLC-061	SEC-AGS-VLV-205	AGS BASIN NO. 2 AIR VALVE	POSITION	AI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZSO-208	SEC-AGS-MCP-001	SEC-AGS-VLV-208	AGS BASIN NO. 2 AIR VALVE	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZSO-208	SEC-AGS-MCP-001	SEC-AGS-VLV-208	AGS BASIN NO. 2 AIR VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-HS-208	SEC-AGS-MCP-001	SEC-AGS-VLV-208	AGS BASIN NO. 2 AIR VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZSO-209	SEC-AGS-PLC-061	SEC-AGS-VLV-209	AGS BASIN NO. 2 SLUDGE AIR VALVE	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZSO-209	SEC-AGS-PLC-061	SEC-AGS-VLV-209	AGS BASIN NO. 2 SLUDGE AIR VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-HS-209	SEC-AGS-PLC-061	SEC-AGS-VLV-209	AGS BASIN NO. 2 SLUDGE AIR VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-HS-210	SEC-AGS-PLC-061	SEC-AGS-VLV-210	AGS BASIN NO. 2 SLUDGE VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZSC-210	SEC-AGS-PLC-061	SEC-AGS-VLV-210	AGS BASIN NO. 2 SLUDGE VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZI-210	SEC-AGS-PLC-061	SEC-AGS-VLV-210	AGS BASIN NO. 2 SLUDGE VALVE	POSITION	AI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-HS-211	SEC-AGS-PLC-061	SEC-AGS-VLV-211	AGS BASIN NO. 2 WLC VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZSC-211	SEC-AGS-PLC-061	SEC-AGS-VLV-211	AGS BASIN NO. 2 WLC VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZI-211	SEC-AGS-PLC-061	SEC-AGS-VLV-211	AGS BASIN NO. 2 WLC VALVE	POSITION	AI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-FIT-FA-201	SEC-AGS-PLC-061	SEC-AGS-FIT-201	AGS BASIN NO. 2 INFLUENT	REVERSE FLOW	DI	COMM		N/A	N/A	N/A	Y401	6
SEC-AGS-FIT-FI-201	SEC-AGS-PLC-061	SEC-AGS-FIT-201	AGS BASIN NO. 2 INFLUENT	FLOW	AI	COMM	0 - 15,000	GPM	N/A	N/A	Y401	6
SEC-AGS-FIT-FI-202	SEC-AGS-PLC-061	SEC-AGS-FIT-202	AGS BASIN NO. 2 PROCESS AIR	FLOW	AI	COMM	0 - 15,000	SCFM	N/A	N/A	Y402	6
SEC-AGS-PIT-PI-201	SEC-AGS-PLC-061	SEC-AGS-PIT-201	AGS BASIN NO. 2 SLUDGE PRESSURE TRANSMITTER	PRESSURE	AI	COMM	TBD	PSI	N/A	N/A	Y402	6
SEC-AGS-LT-LI-201	SEC-AGS-PLC-061	SEC-AGS-LT-201	AGS BASIN NO. 2 LEVEL TRANSMITTER	LEVEL	AI	COMM	0 - 25	FEET	N/A	N/A	Y402	6
SEC-AGS-LSH-LAH-201	SEC-AGS-PLC-061	SEC-AGS-LSH-201	AGS BASIN NO. 2 LEVEL SWITCH	LEVEL HIGH	DI	COMM	TBD	FEET	N/A	N/A	Y402	6
SEC-AGS-AE-AI-211	SEC-AGS-PLC-061	SEC-AGS-AIT-210	AGS BASIN NO. 2 NH4 TRANSDUCER	NH4	AI	COMM	0 - 100	mg/L	N/A	N/A	Y402	6
SEC-AGS-AE-TI-221	SEC-AGS-PLC-061	SEC-AGS-AIT-220	AGS BASIN NO. 2 TEMPERATURE	TEMPERATURE	AI	COMM	TBD	°F	N/A	N/A	Y402	6
SEC-AGS-AE-AI-221	SEC-AGS-PLC-061	SEC-AGS-AIT-220	AGS BASIN NO. 2 pH TRANSDUCER	pH	AI	COMM	0 - 14	SU	N/A	N/A	Y402	6
SEC-AGS-AE-AI-222	SEC-AGS-PLC-061	SEC-AGS-AIT-220	AGS BASIN NO. 2 D.O. TRANSDUCER	DISSOLVED OXYGEN	AI	COMM	0 - 10.0	mg/L	N/A	N/A	Y402	6
SEC-AGS-AE-AI-231	**SEC-AGS-PLC-061**	**SEC-AGS-AIT-230**	**AGS BASIN NO. 2 TSS TRANSDUCER**	**TSS**	**AI**	**COMM**	**0 - 50,000**	**mg/L**	**N/A**	**N/A**	**Y402**	**6**
SEC-AGS-AE-AI-232	**SEC-AGS-PLC-061**	**SEC-AGS-AIT-230**	**AGS BASIN NO. 2 ORP TRANSDUCER**	**ORP**	**AI**	**COMM**	**-1,500 - 1,500**	**mV**	**N/A**	**N/A**	**Y402**	**6**
SEC-AGS-AE-AI-241	**SEC-AGS-PLC-061**	**SEC-AGS-AIT-240**	**AGS BASIN NO. 2 NITRATE TRANSDUCER**	**NITRATE**	**AI**	**COMM**	**0.5-20**	**mg/L**	**N/A**	**N/A**	**Y402**	**6**

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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-VLV-ZSO-301	SEC-AGS-PLC-061	SEC-AGS-VLV-301	AGS BASIN NO. 3 INFLUENT VALVE A	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-ZSO-301	SEC-AGS-PLC-061	SEC-AGS-VLV-301	AGS BASIN NO. 3 INFLUENT VALVE A	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-HS-301	SEC-AGS-PLC-061	SEC-AGS-VLV-301	AGS BASIN NO. 3 INFLUENT VALVE A	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-ZSO-303	SEC-AGS-PLC-061	SEC-AGS-VLV-303	AGS BASIN NO. 3 INFLUENT VALVE B	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-ZSO-303	SEC-AGS-PLC-061	SEC-AGS-VLV-303	AGS BASIN NO. 3 INFLUENT VALVE B	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-HS-303	SEC-AGS-PLC-061	SEC-AGS-VLV-303	AGS BASIN NO. 3 INFLUENT VALVE B	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-HS-305	SEC-AGS-PLC-061	SEC-AGS-VLV-305	AGS BASIN NO. 3 AIR VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZSC-305	SEC-AGS-PLC-061	SEC-AGS-VLV-305	AGS BASIN NO. 3 AIR VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZI-305	SEC-AGS-PLC-061	SEC-AGS-VLV-305	AGS BASIN NO. 3 AIR VALVE	POSITION	AI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZSO-308	SEC-AGS-MCP-001	SEC-AGS-VLV-308	AGS BASIN NO. 3 AIR VALVE	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZSO-308	SEC-AGS-MCP-001	SEC-AGS-VLV-308	AGS BASIN NO. 3 AIR VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-HS-308	SEC-AGS-MCP-001	SEC-AGS-VLV-308	AGS BASIN NO. 3 AIR VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZSO-309	SEC-AGS-PLC-061	SEC-AGS-VLV-309	AGS BASIN NO. 3 SLUDGE AIR VALVE	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZSO-309	SEC-AGS-PLC-061	SEC-AGS-VLV-309	AGS BASIN NO. 3 SLUDGE AIR VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-HS-309	SEC-AGS-PLC-061	SEC-AGS-VLV-309	AGS BASIN NO. 3 SLUDGE AIR VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-HS-310	SEC-AGS-PLC-061	SEC-AGS-VLV-310	AGS BASIN NO. 3 SLUDGE VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZSC-310	SEC-AGS-PLC-061	SEC-AGS-VLV-310	AGS BASIN NO. 3 SLUDGE VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZI-310	SEC-AGS-PLC-061	SEC-AGS-VLV-310	AGS BASIN NO. 3 SLUDGE VALVE	POSITION	AI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-HS-311	SEC-AGS-PLC-061	SEC-AGS-VLV-311	AGS BASIN NO. 3 WLC VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZSC-311	SEC-AGS-PLC-061	SEC-AGS-VLV-311	AGS BASIN NO. 3 WLC VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZI-311	SEC-AGS-PLC-061	SEC-AGS-VLV-311	AGS BASIN NO. 3 WLC VALVE	POSITION	AI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-FIT-FA-301	SEC-AGS-PLC-061	SEC-AGS-FIT-301	AGS BASIN NO. 3 INFLUENT	REVERSE FLOW	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-FIT-FI-301	SEC-AGS-PLC-061	SEC-AGS-FIT-301	AGS BASIN NO. 3 INFLUENT	FLOW	AI	COMM	0 - 15,000	GPM	N/A	N/A	Y401	6
SEC-AGS-FIT-FI-302	SEC-AGS-PLC-061	SEC-AGS-FIT-302	AGS BASIN NO. 3 PROCESS AIR	FLOW	AI	COMM	0 - 15,000	SCFM	N/A	N/A	Y403	6
SEC-AGS-PIT-PI-301	SEC-AGS-PLC-061	SEC-AGS-PIT-301	AGS BASIN NO. 3 SLUDGE PRESSURE TRANSMITTER	PRESSURE	AI	COMM	TBD	PSI	N/A	N/A	Y403	6
SEC-AGS-LT-LI-301	SEC-AGS-PLC-061	SEC-AGS-LT-301	AGS BASIN NO. 3 LEVEL TRANSMITTER	LEVEL	AI	COMM	0 - 25	FEET	N/A	N/A	Y403	6
SEC-AGS-LSH-LAH-301	SEC-AGS-PLC-061	SEC-AGS-LSH-301	AGS BASIN NO. 3 LEVEL SWITCH	LEVEL HIGH	DI	COMM	TBD	FEET	N/A	N/A	Y403	6
SEC-AGS-AE-AI-311	SEC-AGS-PLC-061	SEC-AGS-AIT-310	AGS BASIN NO. 3 NH4 TRANSDUCER	NH4	AI	COMM	0 - 100	mg/L	N/A	N/A	Y403	6
SEC-AGS-AE-TI-321	SEC-AGS-PLC-061	SEC-AGS-AIT-320	AGS BASIN NO. 3 TEMPERATURE	TEMPERATURE	AI	COMM	TBD	°F	N/A	N/A	Y403	6
SEC-AGS-AE-AI-321	SEC-AGS-PLC-061	SEC-AGS-AIT-320	AGS BASIN NO. 3 pH TRANSDUCER	pH	AI	COMM	0 - 14	SU	N/A	N/A	Y403	6
SEC-AGS-AE-AI-322	SEC-AGS-PLC-061	SEC-AGS-AIT-320	AGS BASIN NO. 3 D.O. TRANSDUCER	DISSOLVED OXYGEN	AI	COMM	0 - 10.0	mg/L	N/A	N/A	Y403	6
SEC-AGS-AE-AI-331	**SEC-AGS-PLC-061**	**SEC-AGS-AIT-330**	**AGS BASIN NO. 3 TSS TRANSDUCER**	**TSS**	**AI**	**COMM**	**0 - 50,000**	**mg/L**	**N/A**	**N/A**	**Y403**	**6**
SEC-AGS-AE-AI-332	**SEC-AGS-PLC-061**	**SEC-AGS-AIT-330**	**AGS BASIN NO. 3 ORP TRANSDUCER**	**ORP**	**AI**	**COMM**	**-1,500 - 1,500**	**mV**	**N/A**	**N/A**	**Y403**	**6**
SEC-AGS-AE-AI-341	**SEC-AGS-PLC-061**	**SEC-AGS-AIT-340**	**AGS BASIN NO. 3 NITRATE TRANSDUCER**	**NITRATE**	**AI**	**COMM**	**0.5-20**	**mg/L**	**N/A**	**N/A**	**Y403**	**6**

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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-VLV-ZSO-401	SEC-AGS-PLC-061	SEC-AGS-VLV-401	AGS BASIN NO. 4 INFLUENT VALVE A	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-ZSO-401	SEC-AGS-PLC-061	SEC-AGS-VLV-401	AGS BASIN NO. 4 INFLUENT VALVE A	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-HS-401	SEC-AGS-PLC-061	SEC-AGS-VLV-401	AGS BASIN NO. 4 INFLUENT VALVE A	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-ZSO-403	SEC-AGS-PLC-061	SEC-AGS-VLV-403	AGS BASIN NO. 4 INFLUENT VALVE B	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-ZSO-403	SEC-AGS-PLC-061	SEC-AGS-VLV-403	AGS BASIN NO. 4 INFLUENT VALVE B	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-HS-403	SEC-AGS-PLC-061	SEC-AGS-VLV-403	AGS BASIN NO. 4 INFLUENT VALVE B	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-HS-405	SEC-AGS-PLC-061	SEC-AGS-VLV-405	AGS BASIN NO. 4 AIR VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZSC-405	SEC-AGS-PLC-061	SEC-AGS-VLV-405	AGS BASIN NO. 4 AIR VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZI-405	SEC-AGS-PLC-061	SEC-AGS-VLV-405	AGS BASIN NO. 4 AIR VALVE	POSITION	AI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZSO-408	SEC-AGS-MCP-001	SEC-AGS-VLV-408	AGS BASIN NO. 4 AIR VALVE	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZSO-408	SEC-AGS-MCP-001	SEC-AGS-VLV-408	AGS BASIN NO. 4 AIR VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-HS-408	SEC-AGS-MCP-001	SEC-AGS-VLV-408	AGS BASIN NO. 4 AIR VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZSO-409	SEC-AGS-PLC-061	SEC-AGS-VLV-409	AGS BASIN NO. 4 SLUDGE AIR VALVE	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZSO-409	SEC-AGS-PLC-061	SEC-AGS-VLV-409	AGS BASIN NO. 4 SLUDGE AIR VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-HS-409	SEC-AGS-PLC-061	SEC-AGS-VLV-409	AGS BASIN NO. 4 SLUDGE AIR VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-HS-410	SEC-AGS-PLC-061	SEC-AGS-VLV-410	AGS BASIN NO. 4 SLUDGE VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZSC-410	SEC-AGS-PLC-061	SEC-AGS-VLV-410	AGS BASIN NO. 4 SLUDGE VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZI-410	SEC-AGS-PLC-061	SEC-AGS-VLV-410	AGS BASIN NO. 4 SLUDGE VALVE	POSITION	AI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-HS-411	SEC-AGS-PLC-061	SEC-AGS-VLV-411	AGS BASIN NO. 4 WLC VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZSC-411	SEC-AGS-PLC-061	SEC-AGS-VLV-411	AGS BASIN NO. 4 WLC VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZI-411	SEC-AGS-PLC-061	SEC-AGS-VLV-411	AGS BASIN NO. 4 WLC VALVE	POSITION	AI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-FIT-FA-401	SEC-AGS-PLC-061	SEC-AGS-FIT-401	AGS BASIN NO. 4 INFLUENT	REVERSE FLOW	DI	COMM		N/A	N/A	N/A	Y401	6
SEC-AGS-FIT-FI-401	SEC-AGS-PLC-061	SEC-AGS-FIT-401	AGS BASIN NO. 4 INFLUENT	FLOW	AI	COMM	0 - 15,000	GPM	N/A	N/A	Y401	6
SEC-AGS-FIT-FI-402	SEC-AGS-PLC-061	SEC-AGS-FIT-402	AGS BASIN NO. 4 PROCESS AIR	FLOW	AI	COMM	0 - 15,000	SCFM	N/A	N/A	Y403	6
SEC-AGS-PIT-PI-401	SEC-AGS-PLC-061	SEC-AGS-PIT-401	AGS BASIN NO. 4 SLUDGE PRESSURE TRANSMITTER	PRESSURE	AI	COMM	TBD	PSI	N/A	N/A	Y403	6
SEC-AGS-LT-LI-401	SEC-AGS-PLC-061	SEC-AGS-LT-401	AGS BASIN NO. 4 LEVEL TRANSMITTER	LEVEL	AI	COMM	0 - 25	FEET	N/A	N/A	Y403	6
SEC-AGS-LSH-LAH-401	SEC-AGS-PLC-061	SEC-AGS-LSH-401	AGS BASIN NO. 4 LEVEL SWITCH	LEVEL HIGH	DI	COMM	TBD	FEET	N/A	N/A	Y403	6
SEC-AGS-AE-AI-411	SEC-AGS-PLC-061	SEC-AGS-AIT-410	AGS BASIN NO. 4 NH4 TRANSDUCER	NH4	AI	COMM	0 - 100	mg/L	N/A	N/A	Y403	6
SEC-AGS-AE-TI-421	SEC-AGS-PLC-061	SEC-AGS-AIT-420	AGS BASIN NO. 4 TEMPERATURE	TEMPERATURE	AI	COMM	TBD	°F	N/A	N/A	Y403	6
SEC-AGS-AE-AI-421	SEC-AGS-PLC-061	SEC-AGS-AIT-420	AGS BASIN NO. 4 pH TRANSDUCER	pH	AI	COMM	0 - 14	SU	N/A	N/A	Y403	6
SEC-AGS-AE-AI-422	SEC-AGS-PLC-061	SEC-AGS-AIT-420	AGS BASIN NO. 4 D.O. TRANSDUCER	DISSOLVED OXYGEN	AI	COMM	0 - 10.0	mg/L	N/A	N/A	Y403	6
SEC-AGS-AE-AI-431	**SEC-AGS-PLC-061**	**SEC-AGS-AIT-430**	**AGS BASIN NO. 4 TSS TRANSDUCER**	**TSS**	**AI**	**COMM**	**0 - 50,000**	**mg/L**	**N/A**	**N/A**	**Y403**	**6**
SEC-AGS-AE-AI-432	**SEC-AGS-PLC-061**	**SEC-AGS-AIT-430**	**AGS BASIN NO. 4 ORP TRANSDUCER**	**ORP**	**AI**	**COMM**	**-1,500 - 1,500**	**mV**	**N/A**	**N/A**	**Y403**	**6**
SEC-AGS-AE-AI-441	**SEC-AGS-PLC-061**	**SEC-AGS-AIT-440**	**AGS BASIN NO. 4 NITRATE TRANSDUCER**	**NITRATE**	**AI**	**COMM**	**0.5-20**	**mg/L**	**N/A**	**N/A**	**Y403**	**6**

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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-FIT-FA-601	SEC-AGS-PLC-061	SEC-AGS-FIT-601	SUPERNATANT INFLUENT HEADER	REVERSE FLOW	DI	COMM		N/A	N/A	N/A	Y405	6
SEC-AGS-FIT-FI-601	SEC-AGS-PLC-061	SEC-AGS-FIT-601	SUPERNATANT INFLUENT HEADER	FLOW	AI	COMM	0 - 1,200	GPM	N/A	N/A	Y405	6
SEC-AGS-AIT-AI-701	SEC-AGS-PLC-061	SEC-AGS-AIT-701	SLUDGE PUMPING	TSS	AI	COMM	0 - 50,000	mg/L	N/A	N/A	Y405	6
SEC-AGS-FIT-FA-701	SEC-AGS-PLC-061	SEC-AGS-FIT-701	SLUDGE PUMPING	REVERSE FLOW	DI	COMM		N/A	N/A	N/A	Y405	6
SEC-AGS-FIT-FI-701	SEC-AGS-PLC-061	SEC-AGS-FIT-701	SLUDGE PUMPING	FLOW	AI	COMM	0 - 500	GPM	N/A	N/A	Y405	6
SEC-AGS-LT-LI-510	SEC-AGS-PLC-061	SEC-AGS-LT-510	SLUDGE BUFFER TANK NO. 1	LEVEL	AI	COMM	0 - 25	FEET	N/A	N/A	Y405	6
SEC-AGS-LSH-LAH-510	SEC-AGS-PLC-061	SEC-AGS-LSH-510	SLUDGE BUFFER TANK NO. 1	LEVEL HIGH	DI	COMM	TBD	FEET	N/A	N/A	Y405	6
SEC-AGS-LSL-LAL-510	SEC-AGS-PLC-061	SEC-AGS-LSL-510	SLUDGE BUFFER TANK NO. 1	LEVEL LOW	DI	COMM	TBD	FEET	N/A	N/A	Y405	6
SEC-AGS-LSLL-LALL-510	SEC-AGS-PLC-061	SEC-AGS-LSLL-510	SLUDGE BUFFER TANK NO. 1	LEVEL LOW-LOW	DI	COMM	TBD	FEET	N/A	N/A	Y405	6
SEC-AGS-VLV-ZSO-511	SEC-AGS-PLC-061	SEC-AGS-VLV-511	SLUDGE BUFFER TANK NO. 1 INFLUENT VALVE	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y405	6
SEC-AGS-VLV-ZSO-511	SEC-AGS-PLC-061	SEC-AGS-VLV-511	SLUDGE BUFFER TANK NO. 1 INFLUENT VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y405	6
SEC-AGS-VLV-HS-511	SEC-AGS-PLC-061	SEC-AGS-VLV-511	SLUDGE BUFFER TANK NO. 1 INFLUENT VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y405	6
SEC-AGS-LT-LI-520	SEC-AGS-PLC-061	SEC-AGS-LT-520	SLUDGE BUFFER TANK NO. 2	LEVEL	AI	COMM	0 - 25	FEET	N/A	N/A	Y405	6
SEC-AGS-LSH-LAH-520	SEC-AGS-PLC-061	SEC-AGS-LSH-520	SLUDGE BUFFER TANK NO. 2	LEVEL HIGH	DI	COMM	TBD	FEET	N/A	N/A	Y405	6
SEC-AGS-LSL-LAL-520	SEC-AGS-PLC-061	SEC-AGS-LSL-520	SLUDGE BUFFER TANK NO. 2	LEVEL LOW	DI	COMM	TBD	FEET	N/A	N/A	Y405	6
SEC-AGS-LSLL-LALL-520	SEC-AGS-PLC-061	SEC-AGS-LSLL-520	SLUDGE BUFFER TANK NO. 2	LEVEL LOW-LOW	DI	COMM	TBD	FEET	N/A	N/A	Y405	6
SEC-AGS-VLV-ZSO-521	SEC-AGS-PLC-061	SEC-AGS-VLV-521	SLUDGE BUFFER TANK NO. 2 INFLUENT VALVE	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y405	6
SEC-AGS-VLV-ZSO-521	SEC-AGS-PLC-061	SEC-AGS-VLV-521	SLUDGE BUFFER TANK NO. 2 INFLUENT VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y405	6
SEC-AGS-VLV-HS-521	SEC-AGS-PLC-061	SEC-AGS-VLV-521	SLUDGE BUFFER TANK NO. 2 INFLUENT VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y405	6
SEC-AGS-PMP-HS-610A	SEC-AGS-PLC-061	SEC-AGS-PMP-610	SUPERNATANT PUMP NO. 1	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-HS-610B	SEC-AGS-PLC-061	SEC-AGS-PMP-610	SUPERNATANT PUMP NO. 1	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-MN-610	SEC-AGS-PLC-061	SEC-AGS-PMP-610	SUPERNATANT PUMP NO. 1	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-TAH-610	SEC-AGS-PLC-061	SEC-AGS-PMP-610	SUPERNATANT PUMP NO. 1	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-YA-610	SEC-AGS-PLC-061	SEC-AGS-PMP-610	SUPERNATANT PUMP NO. 1	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-SI-610	SEC-AGS-PLC-061	SEC-AGS-PMP-610	SUPERNATANT PUMP NO. 1	SPEED	AI	COMM	0-100	%	N/A	N/A	Y405	
SEC-AGS-PMP-II-610	SEC-AGS-PLC-061	SEC-AGS-PMP-610	SUPERNATANT PUMP NO. 1	CURRENT	AI	COMM		AMPS	N/A	N/A	Y405	4
SEC-AGS-PMP-HS-620A	SEC-AGS-PLC-061	SEC-AGS-PMP-620	SUPERNATANT PUMP NO. 2	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-HS-620B	SEC-AGS-PLC-061	SEC-AGS-PMP-620	SUPERNATANT PUMP NO. 2	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-MN-620	SEC-AGS-PLC-061	SEC-AGS-PMP-620	SUPERNATANT PUMP NO. 2	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-TAH-620	SEC-AGS-PLC-061	SEC-AGS-PMP-620	SUPERNATANT PUMP NO. 2	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-YA-620	SEC-AGS-PLC-061	SEC-AGS-PMP-620	SUPERNATANT PUMP NO. 2	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-SI-620	SEC-AGS-PLC-061	SEC-AGS-PMP-620	SUPERNATANT PUMP NO. 2	SPEED	AI	COMM	0-100	%	N/A	N/A	Y405	
SEC-AGS-PMP-II-620	SEC-AGS-PLC-061	SEC-AGS-PMP-620	SUPERNATANT PUMP NO. 2	CURRENT	AI	COMM		AMPS	N/A	N/A	Y405	4

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-PMP-HS-630A	SEC-AGS-PLC-061	SEC-AGS-PMP-630	SUPERNATANT PUMP NO. 3	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-HS-630B	SEC-AGS-PLC-061	SEC-AGS-PMP-630	SUPERNATANT PUMP NO. 3	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-MN-630	SEC-AGS-PLC-061	SEC-AGS-PMP-630	SUPERNATANT PUMP NO. 3	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-TAH-630	SEC-AGS-PLC-061	SEC-AGS-PMP-630	SUPERNATANT PUMP NO. 3	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-YA-630	SEC-AGS-PLC-061	SEC-AGS-PMP-630	SUPERNATANT PUMP NO. 3	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-SI-630	SEC-AGS-PLC-061	SEC-AGS-PMP-630	SUPERNATANT PUMP NO. 3	SPEED	AI	COMM	0-100	%	N/A	N/A	Y405	
SEC-AGS-PMP-II-630	SEC-AGS-PLC-061	SEC-AGS-PMP-630	SUPERNATANT PUMP NO. 3	CURRENT	AI	COMM		AMPS	N/A	N/A	Y405	4
SEC-AGS-PMP-HS-710A	SEC-AGS-PLC-061	SEC-AGS-PMP-710	SLUDGE PUMP NO. 1	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-HS-710B	SEC-AGS-PLC-061	SEC-AGS-PMP-710	SLUDGE PUMP NO. 1	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-MN-710	SEC-AGS-PLC-061	SEC-AGS-PMP-710	SLUDGE PUMP NO. 1	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-TAH-710	SEC-AGS-PLC-061	SEC-AGS-PMP-710	SLUDGE PUMP NO. 1	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-YA-710	SEC-AGS-PLC-061	SEC-AGS-PMP-710	SLUDGE PUMP NO. 1	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-SI-710	SEC-AGS-PLC-061	SEC-AGS-PMP-710	SLUDGE PUMP NO. 1	SPEED	AI	COMM	0-100	%	N/A	N/A	Y405	
SEC-AGS-PMP-II-710	SEC-AGS-PLC-061	SEC-AGS-PMP-710	SLUDGE PUMP NO. 1	CURRENT	AI	COMM		AMPS	N/A	N/A	Y405	4
SEC-AGS-PMP-HS-720A	SEC-AGS-PLC-061	SEC-AGS-PMP-720	SLUDGE PUMP NO. 2	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-HS-720B	SEC-AGS-PLC-061	SEC-AGS-PMP-720	SLUDGE PUMP NO. 2	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-MN-720	SEC-AGS-PLC-061	SEC-AGS-PMP-720	SLUDGE PUMP NO. 2	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-TAH-720	SEC-AGS-PLC-061	SEC-AGS-PMP-720	SLUDGE PUMP NO. 2	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-YA-720	SEC-AGS-PLC-061	SEC-AGS-PMP-720	SLUDGE PUMP NO. 2	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-SI-720	SEC-AGS-PLC-061	SEC-AGS-PMP-720	SLUDGE PUMP NO. 2	SPEED	AI	COMM	0-100	%	N/A	N/A	Y405	
SEC-AGS-PMP-II-720	SEC-AGS-PLC-061	SEC-AGS-PMP-720	SLUDGE PUMP NO. 2	CURRENT	AI	COMM		AMPS	N/A	N/A	Y405	4
SEC-AGS-PMP-HS-730A	SEC-AGS-PLC-061	SEC-AGS-PMP-730	SLUDGE PUMP NO. 3	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-HS-730B	SEC-AGS-PLC-061	SEC-AGS-PMP-730	SLUDGE PUMP NO. 3	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-MN-730	SEC-AGS-PLC-061	SEC-AGS-PMP-730	SLUDGE PUMP NO. 3	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-TAH-730	SEC-AGS-PLC-061	SEC-AGS-PMP-730	SLUDGE PUMP NO. 3	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-YA-730	SEC-AGS-PLC-061	SEC-AGS-PMP-730	SLUDGE PUMP NO. 3	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-SI-730	SEC-AGS-PLC-061	SEC-AGS-PMP-730	SLUDGE PUMP NO. 3	SPEED	AI	COMM	0-100	%	N/A	N/A	Y405	
SEC-AGS-PMP-II-730	SEC-AGS-PLC-061	SEC-AGS-PMP-730	SLUDGE PUMP NO. 3	CURRENT	AI	COMM		AMPS	N/A	N/A	Y405	4
SEC-AGS-LSH-LAH-801	SEC-AGS-PLC-061	SEC-AGS-LSH-801	WLC TANK	LEVEL HIGH	DI	COMM		FEET(MSL)	N/A	N/A	Y406	6
SEC-AGS-LSLL-LALL-801	SEC-AGS-PLC-061	SEC-AGS-LSLL-801	WLC TANK	LEVEL LOW-LOW	DI	COMM		FEET(MSL)	N/A	N/A	Y406	6
SEC-AGS-LSL-LAL-801	SEC-AGS-PLC-061	SEC-AGS-LSL-801	WLC TANK	LEVEL LOW	DI	COMM		FEET(MSL)	N/A	N/A	Y406	6
SEC-AGS-LSHH-LAHH-801	SEC-AGS-PLC-061	SEC-AGS-LSHH-801	WLC TANK	LEVEL HIGH-HIGH	DI	COMM		FEET(MSL)	N/A	N/A	Y406	6
SEC-AGS-LT-LI-801	SEC-AGS-PLC-061	SEC-AGS-LT-801	WLC TANK	LEVEL	AI	COMM		FEET	N/A	N/A	Y406	6
SEC-AGS-LWCO-HS-801	SEC-AGS-PLC-061	SEC-AGS-LWCO-801	LWCO IN BYPASS	IN-BYPASS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y406	
SEC-AGS-LWCO-YA-801	SEC-AGS-PLC-061	SEC-AGS-LWCO-801	LWCO CUTOUT	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y406	
SEC-AGS-FIT-FA-801	SEC-AGS-PLC-061	SEC-AGS-FIT-801	WLC RETURN	REVERSE FLOW	DI	COMM		N/A	N/A	N/A	Y406	6
SEC-AGS-FIT-FI-801	SEC-AGS-PLC-061	SEC-AGS-FIT-801	WLC RETURN	FLOW	AI	COMM		GPM	N/A	N/A	Y406	6

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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-PMP-HS-810A	SEC-AGS-PLC-061	SEC-AGS-PMP-810	WLC PUMP NO. 1	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y406	
SEC-AGS-PMP-HS-810B	SEC-AGS-PLC-061	SEC-AGS-PMP-810	WLC PUMP NO. 1	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y406	
SEC-AGS-PMP-MN-810	SEC-AGS-PLC-061	SEC-AGS-PMP-810	WLC PUMP NO. 1	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y406	
SEC-AGS-PMP-TAH-810	SEC-AGS-PLC-061	SEC-AGS-PMP-810	WLC PUMP NO. 1	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y406	
SEC-AGS-PMP-YA-810	SEC-AGS-PLC-061	SEC-AGS-PMP-810	WLC PUMP NO. 1	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y406	
SEC-AGS-PMP-SI-810	SEC-AGS-PLC-061	SEC-AGS-PMP-810	WLC PUMP NO. 1	SPEED	AI	COMM	0-100	%	N/A	N/A	Y406	
SEC-AGS-PMP-II-810	SEC-AGS-PLC-061	SEC-AGS-PMP-810	WLC PUMP NO. 1	CURRENT	AI	COMM		AMPS	N/A	N/A	Y406	4
SEC-AGS-PMP-HS-820A	SEC-AGS-PLC-061	SEC-AGS-PMP-820	WLC PUMP NO. 2	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y406	
SEC-AGS-PMP-HS-820B	SEC-AGS-PLC-061	SEC-AGS-PMP-820	WLC PUMP NO. 2	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y406	
SEC-AGS-PMP-MN-820	SEC-AGS-PLC-061	SEC-AGS-PMP-820	WLC PUMP NO. 2	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y406	
SEC-AGS-PMP-TAH-820	SEC-AGS-PLC-061	SEC-AGS-PMP-820	WLC PUMP NO. 2	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y406	
SEC-AGS-PMP-YA-820	SEC-AGS-PLC-061	SEC-AGS-PMP-820	WLC PUMP NO. 2	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y406	
SEC-AGS-PMP-SI-820	SEC-AGS-PLC-061	SEC-AGS-PMP-820	WLC PUMP NO. 2	SPEED	AI	COMM	0-100	%	N/A	N/A	Y406	
SEC-AGS-PMP-II-820	SEC-AGS-PLC-061	SEC-AGS-PMP-820	WLC PUMP NO. 2	CURRENT	AI	COMM		AMPS	N/A	N/A	Y406	4
SEC-AGS-PIT-PI-901	SEC-AGS-PLC-061	SEC-AGS-PIT-901	AERATION HEADER	PRESSURE	DI	COMM			N/A	N/A	Y408	6
SEC-AGS-PDS-PDAH-912	SEC-AGS-PLC-061	SEC-AGS-PDS-912	INLET FILTER NO. 1	DIFFERENTIAL PRESSURE	DI	N.O. CONTACT	N/A	N/A	2-WIRE	SYSTEM	Y407	
SEC-AGS-PDS-PDAH-922	SEC-AGS-PLC-061	SEC-AGS-PDS-922	INLET FILTER NO. 2	DIFFERENTIAL PRESSURE	DI	N.O. CONTACT	N/A	N/A	2-WIRE	SYSTEM	Y407	
SEC-AGS-PDS-PDAH-932	SEC-AGS-PLC-061	SEC-AGS-PDS-932	INLET FILTER NO. 3	DIFFERENTIAL PRESSURE	DI	N.O. CONTACT	N/A	N/A	2-WIRE	SYSTEM	Y407	
SEC-AGS-PDS-PDAH-942	SEC-AGS-PLC-061	SEC-AGS-PDS-942	INLET FILTER NO. 4	DIFFERENTIAL PRESSURE	DI	N.O. CONTACT	N/A	N/A	2-WIRE	SYSTEM	Y408	
SEC-AGS-PDS-PDAH-952	SEC-AGS-PLC-061	SEC-AGS-PDS-952	INLET FILTER NO. 5	DIFFERENTIAL PRESSURE	DI	N.O. CONTACT	N/A	N/A	2-WIRE	SYSTEM	Y408	
SEC-AGS-BLOW-MN-910	SEC-AGS-PLC-061	SEC-AGS-BLOW-910	AERATION BLOWER NO. 1	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y407	
SEC-AGS-BLOW-HS-910A	SEC-AGS-PLC-061	SEC-AGS-BLOW-910	AERATION BLOWER NO. 1	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y407	
SEC-AGS-BLOW-HS-910B	SEC-AGS-PLC-061	SEC-AGS-BLOW-910	AERATION BLOWER NO. 1	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y407	
SEC-AGS-BLOW-TAH-910	SEC-AGS-PLC-061	SEC-AGS-BLOW-910	AERATION BLOWER NO. 1	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	
SEC-AGS-BLOW-PDAH-911	SEC-AGS-PLC-061	SEC-AGS-BLOW-910	AERATION BLOWER NO. 1	DIFFERENTIAL PRESSURE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	
SEC-AGS-BLOW-TAH-911	SEC-AGS-PLC-061	SEC-AGS-BLOW-910	AERATION BLOWER NO. 1	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	
SEC-AGS-BLOW-YA-910	SEC-AGS-PLC-061	SEC-AGS-BLOW-910	AERATION BLOWER NO. 1	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y407	
SEC-AGS-BLOW-SI-910	SEC-AGS-PLC-061	SEC-AGS-BLOW-910	AERATION BLOWER NO. 1	SPEED	AI	COMM	0-100	%	2-WIRE	N/A	Y407	
SEC-AGS-BLOW-II-910	SEC-AGS-PLC-061	SEC-AGS-BLOW-910	AERATION BLOWER NO. 1	CURRENT	AI	COMM		AMPS	N/A	N/A	Y407	4
SEC-AGS-BLOW-MN-920	SEC-AGS-PLC-061	SEC-AGS-BLOW-920	AERATION BLOWER NO. 2	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y407	
SEC-AGS-BLOW-HS-920A	SEC-AGS-PLC-061	SEC-AGS-BLOW-920	AERATION BLOWER NO. 2	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y407	
SEC-AGS-BLOW-HS-920B	SEC-AGS-PLC-061	SEC-AGS-BLOW-920	AERATION BLOWER NO. 2	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y407	
SEC-AGS-BLOW-TAH-920	SEC-AGS-PLC-061	SEC-AGS-BLOW-920	AERATION BLOWER NO. 2	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	
SEC-AGS-BLOW-PDAH-921	SEC-AGS-PLC-061	SEC-AGS-BLOW-920	AERATION BLOWER NO. 2	DIFFERENTIAL PRESSURE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	
SEC-AGS-BLOW-TAH-921	SEC-AGS-PLC-061	SEC-AGS-BLOW-920	AERATION BLOWER NO. 2	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	
SEC-AGS-BLOW-YA-920	SEC-AGS-PLC-061	SEC-AGS-BLOW-920	AERATION BLOWER NO. 2	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y407	
SEC-AGS-BLOW-SI-920	SEC-AGS-PLC-061	SEC-AGS-BLOW-920	AERATION BLOWER NO. 2	SPEED	AI	COMM	0-100	%	2-WIRE	N/A	Y407	
SEC-AGS-BLOW-II-920	SEC-AGS-PLC-061	SEC-AGS-BLOW-920	AERATION BLOWER NO. 2	CURRENT	AI	COMM		AMPS	N/A	N/A	Y407	4

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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-BLOW-MN-930	SEC-AGS-PLC-061	SEC-AGS-BLOW-930	AERATION BLOWER NO. 3	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y407	
SEC-AGS-BLOW-HS-930A	SEC-AGS-PLC-061	SEC-AGS-BLOW-930	AERATION BLOWER NO. 3	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y407	
SEC-AGS-BLOW-HS-930B	SEC-AGS-PLC-061	SEC-AGS-BLOW-930	AERATION BLOWER NO. 3	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y407	
SEC-AGS-BLOW-TAH-930	SEC-AGS-PLC-061	SEC-AGS-BLOW-930	AERATION BLOWER NO. 3	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	
SEC-AGS-BLOW-PDAH-931	SEC-AGS-PLC-061	SEC-AGS-BLOW-930	AERATION BLOWER NO. 3	DIFFERENTIAL PRESSURE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	
SEC-AGS-BLOW-TAH-931	SEC-AGS-PLC-061	SEC-AGS-BLOW-930	AERATION BLOWER NO. 3	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	
SEC-AGS-BLOW-YA-930	SEC-AGS-PLC-061	SEC-AGS-BLOW-930	AERATION BLOWER NO. 3	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y407	
SEC-AGS-BLOW-SI-930	SEC-AGS-PLC-061	SEC-AGS-BLOW-930	AERATION BLOWER NO. 3	SPEED	AI	COMM	0-100	%	2-WIRE	N/A	Y407	
SEC-AGS-BLOW-II-930	SEC-AGS-PLC-061	SEC-AGS-BLOW-930	AERATION BLOWER NO. 3	CURRENT	AI	COMM		AMPS	N/A	N/A	Y407	4
SEC-AGS-BLOW-MN-940	SEC-AGS-PLC-061	SEC-AGS-BLOW-940	AERATION BLOWER NO. 4	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y408	
SEC-AGS-BLOW-HS-940A	SEC-AGS-PLC-061	SEC-AGS-BLOW-940	AERATION BLOWER NO. 4	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y408	
SEC-AGS-BLOW-HS-940B	SEC-AGS-PLC-061	SEC-AGS-BLOW-940	AERATION BLOWER NO. 4	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y408	
SEC-AGS-BLOW-TAH-940	SEC-AGS-PLC-061	SEC-AGS-BLOW-940	AERATION BLOWER NO. 4	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y408	
SEC-AGS-BLOW-PDAH-941	SEC-AGS-PLC-061	SEC-AGS-BLOW-940	AERATION BLOWER NO. 4	DIFFERENTIAL PRESSURE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y408	
SEC-AGS-BLOW-TAH-941	SEC-AGS-PLC-061	SEC-AGS-BLOW-940	AERATION BLOWER NO. 4	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y408	
SEC-AGS-BLOW-YA-940	SEC-AGS-PLC-061	SEC-AGS-BLOW-940	AERATION BLOWER NO. 4	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y408	
SEC-AGS-BLOW-SI-940	SEC-AGS-PLC-061	SEC-AGS-BLOW-940	AERATION BLOWER NO. 4	SPEED	AI	COMM	0-100	%	2-WIRE	N/A	Y408	
SEC-AGS-BLOW-II-940	SEC-AGS-PLC-061	SEC-AGS-BLOW-940	AERATION BLOWER NO. 4	CURRENT	AI	COMM		AMPS	N/A	N/A	Y408	4
SEC-AGS-BLOW-MN-950	SEC-AGS-PLC-061	SEC-AGS-BLOW-950	AERATION BLOWER NO. 5	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y408	
SEC-AGS-BLOW-HS-950A	SEC-AGS-PLC-061	SEC-AGS-BLOW-950	AERATION BLOWER NO. 5	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y408	
SEC-AGS-BLOW-HS-950B	SEC-AGS-PLC-061	SEC-AGS-BLOW-950	AERATION BLOWER NO. 5	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y408	
SEC-AGS-BLOW-TAH-950	SEC-AGS-PLC-061	SEC-AGS-BLOW-950	AERATION BLOWER NO. 5	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y408	
SEC-AGS-BLOW-PDAH-951	SEC-AGS-PLC-061	SEC-AGS-BLOW-950	AERATION BLOWER NO. 5	DIFFERENTIAL PRESSURE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y408	
SEC-AGS-BLOW-TAH-951	SEC-AGS-PLC-061	SEC-AGS-BLOW-950	AERATION BLOWER NO. 5	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y408	
SEC-AGS-BLOW-YA-950	SEC-AGS-PLC-061	SEC-AGS-BLOW-950	AERATION BLOWER NO. 5	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y408	
SEC-AGS-BLOW-SI-950	SEC-AGS-PLC-061	SEC-AGS-BLOW-950	AERATION BLOWER NO. 5	SPEED	AI	COMM	0-100	%	2-WIRE	N/A	Y408	
SEC-AGS-BLOW-II-950	SEC-AGS-PLC-061	SEC-AGS-BLOW-950	AERATION BLOWER NO. 5	CURRENT	AI	COMM		AMPS	N/A	N/A	Y408	4
SEC-AGS-CTRL-TAH-001	SEC-AGS-PLC-061	SEC-AGS-CTRL-001	AGS ELECTRICAL ROOM	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
SEC-AGS-CTRL-YA-001A	SEC-AGS-PLC-061	SEC-AGS-CTRL-001	DIRTY FILTER	WARNING	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
SEC-AGS-CTRL-YA-001B	SEC-AGS-PLC-061	SEC-AGS-CTRL-001	HVAC CONTROL SYSTEM	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
SEC-AGS-CTRL-YA-001C	SEC-AGS-PLC-061	SEC-AGS-CTRL-001	VENTILATION FAILURE	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
SEC-AGS-CTRL-YA-001D	SEC-AGS-PLC-061	SEC-AGS-CTRL-001	SMOKE ALARM	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-SWB_52U1-HS-001	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 CIRCUIT BREAKER 52-U1	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A		6
SEC-AGS-SWB_52U1-YA-001A	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 CIRCUIT BREAKER 52-U1 TRIP	ALARM	DI	COMM	N/A	N/A	N/A	N/A		6
SEC-AGS-SWB_52U1-YA-001B	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 CIRCUIT BREAKER 52-U1 OPEN/CLOSE	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A		6
SEC-AGS-SWB_52U1-YN-001	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 SOURCE AVAILABLE	STATUS	DI	COMM	N/A	N/A	N/A	N/A		6
SEC-AGS-SWB_52U1-ZSC-001	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 CIRCUIT BREAKER 52-U1	CLOSED	DI	COMM	N/A	N/A	N/A	N/A		6
SEC-AGS-SWB_52U1-ZSO-001	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 CIRCUIT BREAKER 52-U1	OPEN	DI	COMM	N/A	N/A	N/A	N/A		6
SEC-AGS-SWB_52U1-EI-001AN	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 A-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SEC-AGS-SWB_52U1-EI-001BN	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 B-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SEC-AGS-SWB_52U1-EI-001CN	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 C-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SEC-AGS-SWB_52U1-EI-001AB	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 A-B PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SEC-AGS-SWB_52U1-EI-001BC	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 B-C PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SEC-AGS-SWB_52U1-EI-001CA	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 C-A PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SEC-AGS-SWB_52U1-II-001A	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 A LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
SEC-AGS-SWB_52U1-II-001B	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 B LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
SEC-AGS-SWB_52U1-II-001C	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 C LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
SEC-AGS-SWB_52U1-JI-001A	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 AVERAGE APPARENT	POWER	AI	COMM		KVA	N/A	N/A		4, 6
SEC-AGS-SWB_52U1-JI-001R	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 AVERAGE REAL	POWER	AI	COMM		KW	N/A	N/A		4, 6
SEC-AGS-SWB_52U1-JQ-001	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 TOTAL	ENERGY	AI	COMM		KWh	N/A	N/A		4, 6
SEC-AGS-SWB_52U1-JN-001	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 AVERAGE	POWER FACTOR	AI	COMM		PF	N/A	N/A		4, 6
SEC-AGS-SWB_52U1-SI-001	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1	FREQUENCY	AI	COMM		HERTZ	N/A	N/A		4, 6
SEC-AGS-SWB_52U2-HS-001	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 CIRCUIT BREAKER 52-U2	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A		6
SEC-AGS-SWB_52U2-YA-001A	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 CIRCUIT BREAKER 52-U2 TRIP	ALARM	DI	COMM	N/A	N/A	N/A	N/A		6
SEC-AGS-SWB_52U2-YA-001B	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 CIRCUIT BREAKER 52-U2 OPEN/CLOSE	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A		6
SEC-AGS-SWB_52U2-YN-001	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 SOURCE AVAILABLE	STATUS	DI	COMM	N/A	N/A	N/A	N/A		6
SEC-AGS-SWB_52U2-ZSC-001	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 CIRCUIT BREAKER 52-U2	CLOSED	DI	COMM	N/A	N/A	N/A	N/A		6
SEC-AGS-SWB_52U2-ZSO-001	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 CIRCUIT BREAKER 52-U2	OPEN	DI	COMM	N/A	N/A	N/A	N/A		6
SEC-AGS-SWB_52U2-EI-001AN	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 A-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SEC-AGS-SWB_52U2-EI-001BN	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 B-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SEC-AGS-SWB_52U2-EI-001CN	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 C-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SEC-AGS-SWB_52U2-EI-001AB	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 A-B PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SEC-AGS-SWB_52U2-EI-001BC	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 B-C PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SEC-AGS-SWB_52U2-EI-001CA	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 C-A PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SEC-AGS-SWB_52U2-II-001A	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 A LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
SEC-AGS-SWB_52U2-II-001B	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 B LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
SEC-AGS-SWB_52U2-II-001C	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 C LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
SEC-AGS-SWB_52U2-JI-001A	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 AVERAGE APPARENT	POWER	AI	COMM		KVA	N/A	N/A		4, 6
SEC-AGS-SWB_52U2-JI-001R	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 AVERAGE REAL	POWER	AI	COMM		KW	N/A	N/A		4, 6
SEC-AGS-SWB_52U2-JQ-001	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 TOTAL	ENERGY	AI	COMM		KWh	N/A	N/A		4, 6
SEC-AGS-SWB_52U2-JN-001	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 AVERAGE	POWER FACTOR	AI	COMM		PF	N/A	N/A		4, 6
SEC-AGS-SWB_52U2-SI-001	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2	FREQUENCY	AI	COMM		HERTZ	N/A	N/A		4, 6

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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-UPS-JA-051	SEC-AGS-PLC-061	SEC-AGS-UPS-051	UPS SYSTEM REPLACE BATTERY	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SEC-AGS-UPS-JAL-051	SEC-AGS-PLC-061	SEC-AGS-UPS-051	UPS SYSTEM LOW BATTERY	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SEC-AGS-UPS-YA-051A	SEC-AGS-PLC-061	SEC-AGS-UPS-051	UPS SYSTEM	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
SEC-AGS-UPS-YN-051	SEC-AGS-PLC-061	SEC-AGS-UPS-051	UPS SYSTEM ON BATTERY	STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
SEC-AGS-UPS-ZS-051	SEC-AGS-PLC-061	SEC-AGS-UPS-051	UPS SYSTEM BYPASS	STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
SEC-AGS-NSW-YA-061A	SEC-AGS-PLC-061	SEC-AGS-NSW-061	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SEC-AGS-NSW-YA-061B	SEC-AGS-PLC-061	SEC-AGS-NSW-061	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SEC-AGS-NSW-YA-061C	SEC-AGS-PLC-061	SEC-AGS-NSW-061	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SEC-AGS-NSW-TI-061	SEC-AGS-PLC-061	SEC-AGS-NSW-061	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		4, 9
SEC-AGS-NSW-YA-062A	SEC-AGS-PLC-061	SEC-AGS-NSW-062	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SEC-AGS-NSW-YA-062B	SEC-AGS-PLC-061	SEC-AGS-NSW-062	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SEC-AGS-NSW-YA-062C	SEC-AGS-PLC-061	SEC-AGS-NSW-062	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SEC-AGS-NSW-TI-062	SEC-AGS-PLC-061	SEC-AGS-NSW-062	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		4, 9
SEC-AGS-NSW-YA-071A	SEC-AGS-PLC-061	SEC-AGS-NSW-071	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SEC-AGS-NSW-YA-071B	SEC-AGS-PLC-061	SEC-AGS-NSW-071	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SEC-AGS-NSW-YA-071C	SEC-AGS-PLC-061	SEC-AGS-NSW-071	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SEC-AGS-NSW-TI-071	SEC-AGS-PLC-061	SEC-AGS-NSW-071	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		4, 9

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
DIS-UV-AIT-AI-021	DIS-UV-PLC-061	DIS-UV-AIT-020	TOTAL PHOSPHATE	LEVEL	AI	4-20mA			4-WIRE	FIELD	Y601	
DIS-UV-PMP-YA-021	DIS-UV-PLC-061	DIS-UV-PMP-021	TP SAMPLE PUMP	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
DIS-UV-MCP-AAL-001	DIS-UV-PLC-061	DIS-UV-MCP-001	LOW UV DOSE	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-MCP-AALL-001	DIS-UV-PLC-061	DIS-UV-MCP-001	LOW-LOW UV DOSE	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-MCP-QAL-001	DIS-UV-PLC-061	DIS-UV-MCP-001	NOT ENOUGH CHANNELS OPERATIONAL	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-MCP-FAL-001	DIS-UV-PLC-061	DIS-UV-MCP-001	LOW FLOW	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-MCP-FAH-001	DIS-UV-PLC-061	DIS-UV-MCP-001	HIGH FLOW	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-MCP-YAL-001	DIS-UV-PLC-061	DIS-UV-MCP-001	UV SYSTEM COMMON MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-MCP-YAM-001	DIS-UV-PLC-061	DIS-UV-MCP-001	UV SYSTEM COMMON MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-MCP-YAH-001	DIS-UV-PLC-061	DIS-UV-MCP-001	UV SYSTEM COMMON CRITICAL	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-MCP-MX-001	DIS-UV-PLC-061	DIS-UV-MCP-001	UV SYSTEM INHIBIT	ENABLE/DISABLE	DO	COMM	N/A	N/A	N/A	N/A	Y601	6, 7
DIS-UV-MCP-KI-001	DIS-UV-PLC-061	DIS-UV-MCP-001	SYSTEM RETENTION	TIME	AI	COMM		SECONDS	N/A	N/A	Y601	4, 6
DIS-UV-MCP-AI-001	DIS-UV-PLC-061	DIS-UV-MCP-001	CALCULATED SYSTEM UV	DOSE	AI	COMM		mWs/cm^2	N/A	N/A	Y601	4, 6
DIS-UV-MCP-RI-001	DIS-UV-PLC-061	DIS-UV-MCP-001	CALCULATED AVERAGE UV	INTENSITY	AI	COMM		mW/cm^2	N/A	N/A	Y601	4, 6
DIS-UV-LSL-LAL-101	DIS-UV-PLC-061	DIS-UV-LSL-101	CHANNEL 1 LOW LEVEL	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LSL-LAL-201	DIS-UV-PLC-061	DIS-UV-LSL-201	CHANNEL 2 LOW LEVEL	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-AIT-AIL-010	DIS-UV-PLC-061	DIS-UV-AIT-010	UV TRANSMITTANCE	LEVEL-LOW	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-AIT-AI-010	DIS-UV-PLC-061	DIS-UV-AIT-010	UV TRANSMITTANCE	LEVEL	AI	COMM	0-100	%	4-WIRE	FIELD	Y601	6
DIS-UV-GATE-HS-101	DIS-UV-PLC-061	DIS-UV-GATE-101	CHANNEL 1 WEIR GATE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-AIT-AI-010	DIS-UV-PLC-061	DIS-UV-AIT-010	UV TRANSMITTANCE	LEVEL	AI	COMM	0-100	%	4-WIRE	FIELD	Y601	6
DIS-UV-GATE-HS-101	DIS-UV-PLC-061	DIS-UV-GATE-101	CHANNEL 1 WEIR GATE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-GATE-ZSO-101	DIS-UV-PLC-061	DIS-UV-GATE-101	CHANNEL 1 WEIR GATE	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-GATE-ZSC-101	DIS-UV-PLC-061	DIS-UV-GATE-101	CHANNEL 1 WEIR GATE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-GATE-HS-201	DIS-UV-PLC-061	DIS-UV-GATE-201	CHANNEL 2 WEIR GATE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-GATE-ZSO-201	DIS-UV-PLC-061	DIS-UV-GATE-201	CHANNEL 2 WEIR GATE	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-GATE-ZSC-201	DIS-UV-PLC-061	DIS-UV-GATE-201	CHANNEL 2 WEIR GATE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-HCP-YA-110	DIS-UV-PLC-061	DIS-UV-HCP-110	HYDRAULIC SYSTEM CENTER	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-HCP-HS-110A	DIS-UV-PLC-061	DIS-UV-HCP-110	CHANNEL 1 BANK A WIPER	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-HCP-YN-110A	DIS-UV-PLC-061	DIS-UV-HCP-110	CHANNEL 1 BANK A WIPER	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-HCP-YA-110A	DIS-UV-PLC-061	DIS-UV-HCP-110	CHANNEL 1 BANK A WIPER	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-HCP-HS-110B	DIS-UV-PLC-061	DIS-UV-HCP-110	CHANNEL 1 BANK B WIPER	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-HCP-YN-110B	DIS-UV-PLC-061	DIS-UV-HCP-110	CHANNEL 1 BANK B WIPER	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-HCP-YA-110B	DIS-UV-PLC-061	DIS-UV-HCP-110	CHANNEL 1 BANK B WIPER	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-HCP-YA-210	DIS-UV-PLC-061	DIS-UV-HCP-210	HYDRAULIC SYSTEM CENTER	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-HCP-HS-210A	DIS-UV-PLC-061	DIS-UV-HCP-210	CHANNEL 2 BANK A WIPER	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-HCP-YN-210A	DIS-UV-PLC-061	DIS-UV-HCP-210	CHANNEL 2 BANK A WIPER	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-HCP-YA-210A	DIS-UV-PLC-061	DIS-UV-HCP-210	CHANNEL 2 BANK A WIPER	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-HCP-HS-210B	DIS-UV-PLC-061	DIS-UV-HCP-210	CHANNEL 2 BANK B WIPER	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-HCP-YN-210B	DIS-UV-PLC-061	DIS-UV-HCP-210	CHANNEL 2 BANK B WIPER	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-HCP-YA-210B	DIS-UV-PLC-061	DIS-UV-HCP-210	CHANNEL 2 BANK B WIPER	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6

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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
DIS-UV-LCP-HS-110A	DIS-UV-PLC-061	DIS-UV-LCP-110A	CHANNEL 1 BANK A	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LCP-YN-110A	DIS-UV-PLC-061	DIS-UV-LCP-110A	CHANNEL 1 BANK A	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LCP-YA-110A	DIS-UV-PLC-061	DIS-UV-LCP-110A	CHANNEL 1 BANK A	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LCP-XA-110A	DIS-UV-PLC-061	DIS-UV-LCP-110A	CHANNEL 1 BANK A COMMUNICATION	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LCP-JI-110A	DIS-UV-PLC-061	DIS-UV-LCP-110A	CHANNEL 1 BANK A	POWER	AI	COMM	0-100	%	N/A	N/A	Y601	6
DIS-UV-LCP-AI-110A	DIS-UV-PLC-061	DIS-UV-LCP-110A	CHANNEL 1 BANK A UV	INTENSITY	AI	COMM		mW/cm^2	N/A	N/A	Y601	4, 6
DIS-UV-LCP-KQ-110A	DIS-UV-PLC-061	DIS-UV-LCP-110A	CHANNEL 1 BANK A	RUN TIME	AI	COMM		HOURS	N/A	N/A	Y601	4, 6
DIS-UV-LCP-HS-110B	DIS-UV-PLC-061	DIS-UV-LCP-110B	CHANNEL 1 BANK B	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LCP-YN-110B	DIS-UV-PLC-061	DIS-UV-LCP-110B	CHANNEL 1 BANK B	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LCP-YA-110B	DIS-UV-PLC-061	DIS-UV-LCP-110B	CHANNEL 1 BANK B	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LCP-XA-110B	DIS-UV-PLC-061	DIS-UV-LCP-110B	CHANNEL 1 BANK B COMMUNICATION	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LCP-JI-110B	DIS-UV-PLC-061	DIS-UV-LCP-110B	CHANNEL 1 BANK B	POWER	AI	COMM	0-100	%	N/A	N/A	Y601	6
DIS-UV-LCP-AI-110B	DIS-UV-PLC-061	DIS-UV-LCP-110B	CHANNEL 1 BANK B UV	INTENSITY	AI	COMM		mW/cm^2	N/A	N/A	Y601	4, 6
DIS-UV-LCP-KQ-110B	DIS-UV-PLC-061	DIS-UV-LCP-110B	CHANNEL 1 BANK B	RUN TIME	AI	COMM		HOURS	N/A	N/A	Y601	4, 6
DIS-UV-LCP-HS-210A	DIS-UV-PLC-061	DIS-UV-LCP-210A	CHANNEL 2 BANK A	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LCP-YN-210A	DIS-UV-PLC-061	DIS-UV-LCP-210A	CHANNEL 2 BANK A	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LCP-YA-210A	DIS-UV-PLC-061	DIS-UV-LCP-210A	CHANNEL 2 BANK A	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LCP-XA-210A	DIS-UV-PLC-061	DIS-UV-LCP-210A	CHANNEL 2 BANK A COMMUNICATION	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LCP-JI-210A	DIS-UV-PLC-061	DIS-UV-LCP-210A	CHANNEL 2 BANK A	POWER	AI	COMM	0-100	%	N/A	N/A	Y601	6
DIS-UV-LCP-AI-210A	DIS-UV-PLC-061	DIS-UV-LCP-210A	CHANNEL 2 BANK A UV	INTENSITY	AI	COMM		mW/cm^2	N/A	N/A	Y601	4, 6
DIS-UV-LCP-KQ-210A	DIS-UV-PLC-061	DIS-UV-LCP-210A	CHANNEL 2 BANK A	RUN TIME	AI	COMM		HOURS	N/A	N/A	Y601	4, 6
DIS-UV-LCP-HS-210B	DIS-UV-PLC-061	DIS-UV-LCP-210B	CHANNEL 2 BANK B	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LCP-YN-210B	DIS-UV-PLC-061	DIS-UV-LCP-210B	CHANNEL 2 BANK B	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LCP-YA-210B	DIS-UV-PLC-061	DIS-UV-LCP-210B	CHANNEL 2 BANK B	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LCP-XA-210B	DIS-UV-PLC-061	DIS-UV-LCP-210B	CHANNEL 2 BANK B COMMUNICATION	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LCP-JI-210B	DIS-UV-PLC-061	DIS-UV-LCP-210B	CHANNEL 2 BANK B	POWER	AI	COMM	0-100	%	N/A	N/A	Y601	6
DIS-UV-LCP-AI-210B	DIS-UV-PLC-061	DIS-UV-LCP-210B	CHANNEL 2 BANK B UV	INTENSITY	AI	COMM		mW/cm^2	N/A	N/A	Y601	4, 6
DIS-UV-LCP-KQ-210B	DIS-UV-PLC-061	DIS-UV-LCP-210B	CHANNEL 2 BANK B	RUN TIME	AI	COMM		HOURS	N/A	N/A	Y601	4, 6

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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
DIS-UV-FIT-FI-301	DIS-UV-PLC-061	DIS-UV-FIT-301	PLANT EFFLUENT	FLOW	AI	4-20mA	0 - 15,000	GPM	2-WIRE	SYSTEM	Y601	2
DIS-UV-GATE-ZD-001	DIS-UV-PLC-061	DIS-UV-GATE-001	PROCESS WATER SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y601	
DIS-UV-GATE-ZB-001	DIS-UV-PLC-061	DIS-UV-GATE-001	PROCESS WATER SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y601	
DIS-UV-GATE-HS-001	DIS-UV-PLC-061	DIS-UV-GATE-001	PROCESS WATER SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y601	
DIS-UV-GATE-YA-001	DIS-UV-PLC-061	DIS-UV-GATE-001	PROCESS WATER SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y601	
DIS-UV-GATE-ZSC-001	DIS-UV-PLC-061	DIS-UV-GATE-001	PROCESS WATER SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y601	
DIS-UV-GATE-ZI-001	DIS-UV-PLC-061	DIS-UV-GATE-001	PROCESS WATER SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y601	
DIS-PW-LSH-LAH-101	DIS-UV-PLC-061	DIS-PW-LSH-101	PROCESS WATER PS WET WELL	LEVEL HIGH	DI	N.O. CONTACT	8	FEET	N/A	SYSTEM	Y601	
DIS-PW-LSL-LAL-101	DIS-UV-PLC-061	DIS-PW-LSL-101	PROCESS WATER PS WET WELL	LEVEL LOW	DI	N.O. CONTACT	2.5	FEET	N/A	SYSTEM	Y601	
DIS-PW-PIT-PI-101	DIS-UV-PLC-061	DIS-PW-PIT-101	PROCESS WATER PUMPS	PRESSURE	AI	4-20mA	0-200	PSI	2-WIRE	SYSTEM	Y601	
DIS-PW-FIT-FI-101	DIS-UV-PLC-061	DIS-PW-FIT-101	PROCESS WATER PUMPS	FLOW	AI	4-20mA	0-600	GPM	4-WIRE	FIELD	Y601	
DIS-PW-PIT-PI-103	DIS-UV-PLC-061	DIS-PW-PIT-103	PROCESS WATER TANK	PRESSURE	AI	4-20mA	0-200	PSI	2-WIRE	SYSTEM	Y601	
DIS-PW-PMP-MD-110	DIS-UV-PLC-061	DIS-PW-PMP-110	PROCESS WATER PUMP NO. 1	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y601	
DIS-PW-PMP-HS-110A	DIS-UV-PLC-061	DIS-PW-PMP-110	PROCESS WATER PUMP NO. 1	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y601	
DIS-PW-PMP-HS-110B	DIS-UV-PLC-061	DIS-PW-PMP-110	PROCESS WATER PUMP NO. 1	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y601	
DIS-PW-PMP-MN-110	DIS-UV-PLC-061	DIS-PW-PMP-110	PROCESS WATER PUMP NO. 1	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y601	
DIS-PW-PMP-TAH-110	DIS-UV-PLC-061	DIS-PW-PMP-110	PROCESS WATER PUMP NO. 1	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y601	
DIS-PW-PMP-YA-110	DIS-UV-PLC-061	DIS-PW-PMP-110	PROCESS WATER PUMP NO. 1	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y601	
DIS-PW-PMP-SC-110	DIS-UV-PLC-061	DIS-PW-PMP-110	PROCESS WATER PUMP NO. 1	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y601	
DIS-PW-PMP-SI-110	DIS-UV-PLC-061	DIS-PW-PMP-110	PROCESS WATER PUMP NO. 1	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y601	
DIS-PW-PMP-II-110	DIS-UV-PLC-061	DIS-PW-PMP-110	PROCESS WATER PUMP NO. 1	CURRENT	AI	COMM		AMPS	N/A	N/A	Y601	4
DIS-PW-PMP-MD-120	DIS-UV-PLC-061	DIS-PW-PMP-120	PROCESS WATER PUMP NO. 2	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y601	
DIS-PW-PMP-HS-120A	DIS-UV-PLC-061	DIS-PW-PMP-120	PROCESS WATER PUMP NO. 2	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y601	
DIS-PW-PMP-HS-120B	DIS-UV-PLC-061	DIS-PW-PMP-120	PROCESS WATER PUMP NO. 2	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y601	
DIS-PW-PMP-MN-120	DIS-UV-PLC-061	DIS-PW-PMP-120	PROCESS WATER PUMP NO. 2	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y601	
DIS-PW-PMP-TAH-120	DIS-UV-PLC-061	DIS-PW-PMP-120	PROCESS WATER PUMP NO. 2	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y601	
DIS-PW-PMP-YA-120	DIS-UV-PLC-061	DIS-PW-PMP-120	PROCESS WATER PUMP NO. 2	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y601	
DIS-PW-PMP-SC-120	DIS-UV-PLC-061	DIS-PW-PMP-120	PROCESS WATER PUMP NO. 2	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y601	
DIS-PW-PMP-SI-120	DIS-UV-PLC-061	DIS-PW-PMP-120	PROCESS WATER PUMP NO. 2	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y601	
DIS-PW-PMP-II-120	DIS-UV-PLC-061	DIS-PW-PMP-120	PROCESS WATER PUMP NO. 2	CURRENT	AI	COMM		AMPS	N/A	N/A	Y601	4
DIS-PW-PMP-MD-130	DIS-UV-PLC-061	DIS-PW-PMP-130	PROCESS WATER PUMP NO. 3	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y601	
DIS-PW-PMP-HS-130A	DIS-UV-PLC-061	DIS-PW-PMP-130	PROCESS WATER PUMP NO. 3	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y601	
DIS-PW-PMP-HS-130B	DIS-UV-PLC-061	DIS-PW-PMP-130	PROCESS WATER PUMP NO. 3	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y601	
DIS-PW-PMP-MN-130	DIS-UV-PLC-061	DIS-PW-PMP-130	PROCESS WATER PUMP NO. 3	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y601	
DIS-PW-PMP-TAH-130	DIS-UV-PLC-061	DIS-PW-PMP-130	PROCESS WATER PUMP NO. 3	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y601	
DIS-PW-PMP-YA-130	DIS-UV-PLC-061	DIS-PW-PMP-130	PROCESS WATER PUMP NO. 3	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y601	
DIS-PW-PMP-SC-130	DIS-UV-PLC-061	DIS-PW-PMP-130	PROCESS WATER PUMP NO. 3	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y601	
DIS-PW-PMP-SI-130	DIS-UV-PLC-061	DIS-PW-PMP-130	PROCESS WATER PUMP NO. 3	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y601	
DIS-PW-PMP-II-130	DIS-UV-PLC-061	DIS-PW-PMP-130	PROCESS WATER PUMP NO. 3	CURRENT	AI	COMM		AMPS	N/A	N/A	Y601	4

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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-PSEW-LSHH-LAHH-101	PRE-GRSC-PLC-061	SEC-PSEW-LSHH-101	PLANT SEWER PS WET WELL	LEVEL HIGH-HIGH	DI	N.O. CONTACT	901	FEET(MSL)	2-WIRE	SYSTEM	Y801	2,8
SEC-PSEW-LSH-LAH-101	PRE-GRSC-PLC-061	SEC-PSEW-LSH-101	PLANT SEWER PS WET WELL	LEVEL HIGH	DI	N.O. CONTACT	899	FEET(MSL)	2-WIRE	SYSTEM	Y801	2,8
SEC-PSEW-LSL-LAL-101	PRE-GRSC-PLC-061	SEC-PSEW-LSL-101	PLANT SEWER PS WET WELL	LEVEL LOW	DI	N.O. CONTACT	894.75	FEET(MSL)	2-WIRE	SYSTEM	Y801	2,8
SEC-PSEW-LSLL-LALL-101	PRE-GRSC-PLC-061	SEC-PSEW-LSLL-101	PLANT SEWER PS WET WELL	LEVEL LOW-LOW	DI	N.O. CONTACT	894.25	FEET(MSL)	2-WIRE	SYSTEM	Y801	2,8
SEC-PSEW-LWCO-HS-101	PRE-GRSC-PLC-061	SEC-PSEW-LWCO-101	LWCO IN BYPASS	IN-BYPASS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y801	
SEC-PSEW-LWCO-YA-101	PRE-GRSC-PLC-061	SEC-PSEW-LWCO-101	LWCO CUTOUT	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y801	
SEC-PSEW-LIT-LI-101	PRE-GRSC-PLC-061	SEC-PSEW-LIT-101	PLANT SEWER PS WET WELL	LEVEL	AI	4-20mA	0-15	FEET	2-WIRE	SYSTEM	Y801	2,8
SEC-PSEW-PMP-MD-110	PRE-GRSC-PLC-061	SEC-PSEW-PMP-110	PLANT SEWER PUMP NO. 1	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y801	
SEC-PSEW-PMP-HS-110A	PRE-GRSC-PLC-061	SEC-PSEW-PMP-110	PLANT SEWER PUMP NO. 1	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y801	
SEC-PSEW-PMP-HS-110B	PRE-GRSC-PLC-061	SEC-PSEW-PMP-110	PLANT SEWER PUMP NO. 1	IN-LOCAL	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y801	
SEC-PSEW-PMP-MN-110	PRE-GRSC-PLC-061	SEC-PSEW-PMP-110	PLANT SEWER PUMP NO. 1	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y801	
SEC-PSEW-PMP-TAH-110	PRE-GRSC-PLC-061	SEC-PSEW-PMP-110	PLANT SEWER PUMP NO. 1	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y801	
SEC-PSEW-PMP-MAH-110	PRE-GRSC-PLC-061	SEC-PSEW-PMP-110	PLANT SEWER PUMP NO. 1	LEAK	DI	COMM	N/A	N/A	N/A	N/A	Y801	
SEC-PSEW-PMP-YA-110	PRE-GRSC-PLC-061	SEC-PSEW-PMP-110	PLANT SEWER PUMP NO. 1	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y801	
SEC-PSEW-PMP-SC-110	PRE-GRSC-PLC-061	SEC-PSEW-PMP-110	PLANT SEWER PUMP NO. 1	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y801	
SEC-PSEW-PMP-SI-110	PRE-GRSC-PLC-061	SEC-PSEW-PMP-110	PLANT SEWER PUMP NO. 1	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y801	
SEC-PSEW-PMP-II-110	PRE-GRSC-PLC-061	SEC-PSEW-PMP-110	PLANT SEWER PUMP NO. 1	CURRENT	AI	COMM		AMPS	N/A	N/A	Y801	
SEC-PSEW-PMP-MD-120	PRE-GRSC-PLC-061	SEC-PSEW-PMP-120	PLANT SEWER PUMP NO. 2	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y801	
SEC-PSEW-PMP-HS-120A	PRE-GRSC-PLC-061	SEC-PSEW-PMP-120	PLANT SEWER PUMP NO. 2	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y801	
SEC-PSEW-PMP-HS-120B	PRE-GRSC-PLC-061	SEC-PSEW-PMP-120	PLANT SEWER PUMP NO. 2	IN-LOCAL	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y801	
SEC-PSEW-PMP-MN-120	PRE-GRSC-PLC-061	SEC-PSEW-PMP-120	PLANT SEWER PUMP NO. 2	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y801	
SEC-PSEW-PMP-TAH-120	PRE-GRSC-PLC-061	SEC-PSEW-PMP-120	PLANT SEWER PUMP NO. 2	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y801	
SEC-PSEW-PMP-MAH-120	PRE-GRSC-PLC-061	SEC-PSEW-PMP-120	PLANT SEWER PUMP NO. 2	LEAK	DI	COMM	N/A	N/A	N/A	N/A	Y801	
SEC-PSEW-PMP-YA-120	PRE-GRSC-PLC-061	SEC-PSEW-PMP-120	PLANT SEWER PUMP NO. 2	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y801	
SEC-PSEW-PMP-SC-120	PRE-GRSC-PLC-061	SEC-PSEW-PMP-120	PLANT SEWER PUMP NO. 2	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y801	
SEC-PSEW-PMP-SI-120	PRE-GRSC-PLC-061	SEC-PSEW-PMP-120	PLANT SEWER PUMP NO. 2	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y801	
SEC-PSEW-PMP-II-120	PRE-GRSC-PLC-061	SEC-PSEW-PMP-120	PLANT SEWER PUMP NO. 2	CURRENT	AI	COMM		AMPS	N/A	N/A	Y801	

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
DIS-UV-PNL-EI-021AN	DIS-UV-PLC-061	DIS-UV-PNL-061	PANEL PQM A-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
DIS-UV-PNL-EI-021BN	DIS-UV-PLC-061	DIS-UV-PNL-061	PANEL PQM B-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
DIS-UV-PNL-EI-021CN	DIS-UV-PLC-061	DIS-UV-PNL-061	PANEL PQM C-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
DIS-UV-PNL-EI-021AB	DIS-UV-PLC-061	DIS-UV-PNL-061	PANEL PQM A-B LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
DIS-UV-PNL-EI-021BC	DIS-UV-PLC-061	DIS-UV-PNL-061	PANEL PQM B-C LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
DIS-UV-PNL-EI-021CA	DIS-UV-PLC-061	DIS-UV-PNL-061	PANEL PQM C-A LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
DIS-UV-PNL-II-021A	DIS-UV-PLC-061	DIS-UV-PNL-061	PANEL PQM A LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
DIS-UV-PNL-II-021B	DIS-UV-PLC-061	DIS-UV-PNL-061	PANEL PQM B LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
DIS-UV-PNL-II-021C	DIS-UV-PLC-061	DIS-UV-PNL-061	PANEL PQM C LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
DIS-UV-PNL-JI-021A	DIS-UV-PLC-061	DIS-UV-PNL-061	PANEL PQM AVERAGE APPARENT	POWER	AI	COMM		KVA	N/A	N/A		4, 6
DIS-UV-PNL-JI-021R	DIS-UV-PLC-061	DIS-UV-PNL-061	PANEL PQM AVERAGE REAL	POWER	AI	COMM		KW	N/A	N/A		4, 6
DIS-UV-PNL-JQ-021	DIS-UV-PLC-061	DIS-UV-PNL-061	PANEL PQM TOTAL	ENERGY	AI	COMM		KWh	N/A	N/A		4, 6
DIS-UV-PNL-JN-021	DIS-UV-PLC-061	DIS-UV-PNL-061	PANEL PQM AVERAGE	POWER FACTOR	AI	COMM		PF	N/A	N/A		4, 6
DIS-UV-PNL-SI-021	DIS-UV-PLC-061	DIS-UV-PNL-061	PANEL PQM	FREQUENCY	AI	COMM		FREQUENCY	N/A	N/A		4, 6
DIS-UV-UPS-JA-050	DIS-UV-PLC-061	DIS-UV-UPS-050	UPS SYSTEM REPLACE BATTERY	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
DIS-UV-UPS-JAL-050	DIS-UV-PLC-061	DIS-UV-UPS-050	UPS SYSTEM LOW BATTERY	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
DIS-UV-UPS-YS-050A	DIS-UV-PLC-061	DIS-UV-UPS-050	UPS SYSTEM	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
DIS-UV-UPS-YN-050	DIS-UV-PLC-061	DIS-UV-UPS-050	UPS SYSTEM ON BATTERY	STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
DIS-UV-UPS-ZS-050	DIS-UV-PLC-061	DIS-UV-UPS-050	UPS SYSTEM BYPASS	STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
DIS-UV-NSW-YA-061A	DIS-UV-PLC-061	DIS-UV-NSW-061	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
DIS-UV-NSW-YA-061B	DIS-UV-PLC-061	DIS-UV-NSW-061	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
DIS-UV-NSW-YA-061C	DIS-UV-PLC-061	DIS-UV-NSW-061	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
DIS-UV-NSW-TI-061	DIS-UV-PLC-061	DIS-UV-NSW-061	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		4, 9
DIS-UV-NSW-YA-071A	DIS-UV-PLC-061	DIS-UV-NSW-071	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
DIS-UV-NSW-YA-071B	DIS-UV-PLC-061	DIS-UV-NSW-071	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
DIS-UV-NSW-YA-071C	DIS-UV-PLC-061	DIS-UV-NSW-071	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
DIS-UV-NSW-TI-071	DIS-UV-PLC-061	DIS-UV-NSW-071	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		4, 9

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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SOL-SPB-PIT-PI-001	SOL-SPB-PLC-061	SOL-SPB-PIT-001	SOLIDS PROCESSING PROCESS WATER	PRESSURE	AI	4-20mA	0 - 200	PSI	2-WIRE	SYSTEM	Y601	
SOL-SPB-PSL-PAL-001	SOL-SPB-PLC-061	SOL-SPB-PSL-001	SOLIDS PROCESSING PROCESS WATER	PRESSURE LOW	DI	N.O. CONTACT	40	PSIG	N/A	SYSTEM	Y302	
SOL-WAS-LSL-LAL-101	SOL-SPB-PLC-061	SOL-WAS-LSL-101	THIN SLUDGE TANK NO. 1	LEVEL LOW	DI	N.O. CONTACT	911	FEET(MSL)	N/A	SYSTEM	Y702	2, 8
SOL-WAS-LSH-LAH-101	SOL-SPB-PLC-061	SOL-WAS-LSH-101	THIN SLUDGE TANK NO. 1	LEVEL HIGH	DI	N.O. CONTACT	931	FEET(MSL)	N/A	SYSTEM	Y702	2, 8
SOL-WAS-LIT-LI-101	SOL-SPB-PLC-061	SOL-WAS-LIT-101	THIN SLUDGE TANK NO. 1	LEVEL	AI	4-20mA	0-25	FEET	2-WIRE	SYSTEM	Y702	2, 8
SOL-WAS-AIT-AI-101	SOL-SPB-PLC-061	SOL-WAS-AIT-101	THIN SLUDGE TANK NO. 1	DISSOLVED OXYGEN	AI	4-20mA	0 - 10	mg/L	2-WIRE	FIELD	Y702	2
SOL-WAS-LSL-LAL-201	SOL-SPB-PLC-061	SOL-WAS-LSL-201	THIN SLUDGE TANK NO. 2	LEVEL LOW	DI	N.O. CONTACT	911	FEET(MSL)	N/A	SYSTEM	Y702	2, 8
SOL-WAS-LSH-LAH-201	SOL-SPB-PLC-061	SOL-WAS-LSH-201	THIN SLUDGE TANK NO. 2	LEVEL HIGH	DI	N.O. CONTACT	931	FEET(MSL)	N/A	SYSTEM	Y702	2, 8
SOL-WAS-LIT-LI-201	SOL-SPB-PLC-061	SOL-WAS-LIT-201	THIN SLUDGE TANK NO. 2	LEVEL	AI	4-20mA	0-25	FEET	2-WIRE	SYSTEM	Y702	2, 8
SOL-WAS-AIT-AI-201	SOL-SPB-PLC-061	SOL-WAS-AIT-201	THIN SLUDGE TANK NO. 2	DISSOLVED OXYGEN	AI	4-20mA	0 - 10	mg/L	2-WIRE	FIELD	Y702	2
SOL-WAS-PMP-MD-310	SOL-SPB-PLC-061	SOL-WAS-PMP-310	THIN SLUDGE PUMP NO. 1	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y702	
SOL-WAS-PMP-HS-310A	SOL-SPB-PLC-061	SOL-WAS-PMP-310	THIN SLUDGE PUMP NO. 1	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-PMP-HS-310B	SOL-SPB-PLC-061	SOL-WAS-PMP-310	THIN SLUDGE PUMP NO. 1	IN-LOCAL	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-PMP-MN-310	SOL-SPB-PLC-061	SOL-WAS-PMP-310	THIN SLUDGE PUMP NO. 1	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-PMP-TAH-310A	SOL-SPB-PLC-061	SOL-WAS-PMP-310	THIN SLUDGE PUMP NO. 1 MOTOR	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y702	
SOL-WAS-PMP-TAH-310B	SOL-SPB-PLC-061	SOL-WAS-PMP-310	THIN SLUDGE PUMP NO. 1 STATOR	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y702	
SOL-WAS-PMP-YA-310	SOL-SPB-PLC-061	SOL-WAS-PMP-310	THIN SLUDGE PUMP NO. 1	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-PMP-SC-310	SOL-SPB-PLC-061	SOL-WAS-PMP-310	THIN SLUDGE PUMP NO. 1	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y702	
SOL-WAS-PMP-SI-310	SOL-SPB-PLC-061	SOL-WAS-PMP-310	THIN SLUDGE PUMP NO. 1	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y702	
SOL-WAS-PMP-II-310	SOL-SPB-PLC-061	SOL-WAS-PMP-310	THIN SLUDGE PUMP NO. 1	CURRENT	AI	COMM	N/A	AMPS	N/A	N/A	Y702	
SOL-WAS-PSL-PAL-310	SOL-SPB-PLC-061	SOL-WAS-PSL-310A	THIN SLUDGE PUMP NO. 1	PRESSURE LOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-PSH-PAH-310	SOL-SPB-PLC-061	SOL-WAS-PSH-310B	THIN SLUDGE PUMP NO. 1	PRESSURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-VLV-ZSO-311	SOL-SPB-PLC-061	SOL-WAS-VLV-311	TS PUMP NO. 1 SUCTION VALVE	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-VLV-ZSO-311	SOL-SPB-PLC-061	SOL-WAS-VLV-311	TS PUMP NO. 1 SUCTION VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-VLV-YA-311A	SOL-SPB-PLC-061	SOL-WAS-VLV-311	TS PUMP NO. 1 SUCTION VALVE FAILED TO OPEN	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-VLV-YA-311B	SOL-SPB-PLC-061	SOL-WAS-VLV-311	TS PUMP NO. 1 SUCTION VALVE FAILED TO CLOSE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SOL-WAS-PMP-MD-320	SOL-SPB-PLC-061	SOL-WAS-PMP-320	THIN SLUDGE PUMP NO. 2	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y702	
SOL-WAS-PMP-HS-320A	SOL-SPB-PLC-061	SOL-WAS-PMP-320	THIN SLUDGE PUMP NO. 2	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-PMP-HS-320B	SOL-SPB-PLC-061	SOL-WAS-PMP-320	THIN SLUDGE PUMP NO. 2	IN-LOCAL	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-PMP-MN-320	SOL-SPB-PLC-061	SOL-WAS-PMP-320	THIN SLUDGE PUMP NO. 2	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-PMP-TAH-320A	SOL-SPB-PLC-061	SOL-WAS-PMP-320	THIN SLUDGE PUMP NO. 2 MOTOR	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y702	
SOL-WAS-PMP-TAH-320B	SOL-SPB-PLC-061	SOL-WAS-PMP-320	THIN SLUDGE PUMP NO. 2 STATOR	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y702	
SOL-WAS-PMP-YA-320	SOL-SPB-PLC-061	SOL-WAS-PMP-320	THIN SLUDGE PUMP NO. 2	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-PMP-SC-320	SOL-SPB-PLC-061	SOL-WAS-PMP-320	THIN SLUDGE PUMP NO. 2	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y702	
SOL-WAS-PMP-SI-320	SOL-SPB-PLC-061	SOL-WAS-PMP-320	THIN SLUDGE PUMP NO. 2	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y702	
SOL-WAS-PMP-II-320	SOL-SPB-PLC-061	SOL-WAS-PMP-320	THIN SLUDGE PUMP NO. 2	CURRENT	AI	COMM	N/A	AMPS	N/A	N/A	Y702	
SOL-WAS-PSL-PAL-320	SOL-SPB-PLC-061	SOL-WAS-PSL-320A	THIN SLUDGE PUMP NO. 2	PRESSURE LOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-PSH-PAH-320	SOL-SPB-PLC-061	SOL-WAS-PSH-320B	THIN SLUDGE PUMP NO. 2	PRESSURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-VLV-ZSO-321	SOL-SPB-PLC-061	SOL-WAS-VLV-321	TS PUMP NO. 2 SUCTION VALVE	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-VLV-ZSO-321	SOL-SPB-PLC-061	SOL-WAS-VLV-321	TS PUMP NO. 2 SUCTION VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-VLV-YA-321A	SOL-SPB-PLC-061	SOL-WAS-VLV-321	TS PUMP NO. 2 SUCTION VALVE FAILED TO OPEN	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-VLV-YA-321B	SOL-SPB-PLC-061	SOL-WAS-VLV-321	TS PUMP NO. 2 SUCTION VALVE FAILED TO CLOSE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-PMP-MD-330	SOL-SPB-PLC-061	SOL-WAS-PMP-330	THIN SLUDGE PUMP NO. 3	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y702	
SOL-WAS-PMP-HS-330A	SOL-SPB-PLC-061	SOL-WAS-PMP-330	THIN SLUDGE PUMP NO. 3	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-PMP-HS-330B	SOL-SPB-PLC-061	SOL-WAS-PMP-330	THIN SLUDGE PUMP NO. 3	IN-LOCAL	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-PMP-MN-330	SOL-SPB-PLC-061	SOL-WAS-PMP-330	THIN SLUDGE PUMP NO. 3	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-PMP-TAH-330A	SOL-SPB-PLC-061	SOL-WAS-PMP-330	THIN SLUDGE PUMP NO. 3 MOTOR	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y702	
SOL-WAS-PMP-TAH-330B	SOL-SPB-PLC-061	SOL-WAS-PMP-330	THIN SLUDGE PUMP NO. 3 STATOR	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y702	
SOL-WAS-PMP-YA-330	SOL-SPB-PLC-061	SOL-WAS-PMP-330	THIN SLUDGE PUMP NO. 3	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-PMP-SC-330	SOL-SPB-PLC-061	SOL-WAS-PMP-330	THIN SLUDGE PUMP NO. 3	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y702	
SOL-WAS-PMP-SI-330	SOL-SPB-PLC-061	SOL-WAS-PMP-330	THIN SLUDGE PUMP NO. 3	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y702	
SOL-WAS-PMP-II-330	SOL-SPB-PLC-061	SOL-WAS-PMP-330	THIN SLUDGE PUMP NO. 3	CURRENT	AI	COMM	N/A	AMPS	N/A	N/A	Y702	
SOL-WAS-PSL-PAL-330	SOL-SPB-PLC-061	SOL-WAS-PSL-330A	THIN SLUDGE PUMP NO. 3	PRESSURE LOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-PSH-PAH-330	SOL-SPB-PLC-061	SOL-WAS-PSH-330B	THIN SLUDGE PUMP NO. 3	PRESSURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-VLV-ZSO-331	SOL-SPB-PLC-061	SOL-WAS-VLV-331	TS PUMP NO. 3 SUCTION VALVE	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-VLV-ZSO-331	SOL-SPB-PLC-061	SOL-WAS-VLV-331	TS PUMP NO. 3 SUCTION VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-VLV-YA-331A	SOL-SPB-PLC-061	SOL-WAS-VLV-331	TS PUMP NO. 3 SUCTION VALVE FAILED TO OPEN	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-VLV-YA-331B	SOL-SPB-PLC-061	SOL-WAS-VLV-331	TS PUMP NO. 3 SUCTION VALVE FAILED TO CLOSE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-AIT-AI-301	SOL-SPB-PLC-061	SOL-WAS-AIT-301	THIN SLUDGE PUMPING	TS	AI	4-20mA	0-5	%	4-WIRE	FIELD	Y702	
SOL-WAS-FIT-FI-301	SOL-SPB-PLC-061	SOL-WAS-FIT-301	THIN SLUDGE PUMPING	FLOW	AI	4-20mA	0-600	GPM	4-WIRE	FIELD	Y702	
SOL-WAS-FIT-FA-301	SOL-SPB-PLC-061	SOL-WAS-FIT-301	THIN SLUDGE PUMPING	REVERSE FLOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	10
SOL-WAS-AIT-AI-302	SOL-SPB-PLC-061	SOL-WAS-AIT-302	THIN SLUDGE PUMPING	TS	AI	4-20mA	0-5	%	4-WIRE	FIELD	Y702	
SOL-WAS-FIT-FI-302	SOL-SPB-PLC-061	SOL-WAS-FIT-302	THIN SLUDGE PUMPING	FLOW	AI	4-20mA	0-600	GPM	4-WIRE	FIELD	Y702	
SOL-WAS-FIT-FA-302	SOL-SPB-PLC-061	SOL-WAS-FIT-302	THIN SLUDGE PUMPING	REVERSE FLOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	10

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SOL-STH-FIT-FI-131	SOL-SPB-PLC-061	SOL-STH-FIT-131	THICKENED SLUDGE PUMPING	FLOW	AI	4-20mA	0-200	GPM	4-WIRE	FIELD	Y703	
SOL-STH-FIT-FA-131	SOL-SPB-PLC-061	SOL-STH-FIT-131	THICKENED SLUDGE PUMPING	REVERSE FLOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y703	10
SOL-STH-AIT-AI-131	SOL-SPB-PLC-061	SOL-STH-AIT-131	THICKENED SLUDGE PUMPING	TS	AI	4-20mA	0-5	%	4-WIRE	FIELD	Y703	
SOL-STH-FIT-FI-231	SOL-SPB-PLC-061	SOL-STH-FIT-231	THICKENED SLUDGE PUMPING	FLOW	AI	4-20mA	0-200	GPM	4-WIRE	FIELD	Y703	
SOL-STH-FIT-FA-231	SOL-SPB-PLC-061	SOL-STH-FIT-231	THICKENED SLUDGE PUMPING	REVERSE FLOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y703	10
SOL-STH-AIT-AI-231	SOL-SPB-PLC-061	SOL-STH-AIT-231	THICKENED SLUDGE PUMPING	TS	AI	4-20mA	0-5	%	4-WIRE	FIELD	Y703	
SOL-STH-PMP-MD-130	SOL-SPB-PLC-061	SOL-STH-PMP-130	THICKENED SLUDGE PUMP NO. 1	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y703	
SOL-STH-PMP-HS-130A	SOL-SPB-PLC-061	SOL-STH-PMP-130	THICKENED SLUDGE PUMP NO. 1	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y703	
SOL-STH-PMP-HS-130B	SOL-SPB-PLC-061	SOL-STH-PMP-130	THICKENED SLUDGE PUMP NO. 1	IN-LOCAL	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y703	
SOL-STH-PMP-MN-130	SOL-SPB-PLC-061	SOL-STH-PMP-130	THICKENED SLUDGE PUMP NO. 1	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y703	
SOL-STH-PMP-TAH-130A	SOL-SPB-PLC-061	SOL-STH-PMP-130	THICKENED SLUDGE PUMP NO. 1 STATOR	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y703	
SOL-STH-PMP-TAH-130B	SOL-SPB-PLC-061	SOL-STH-PMP-130	THICKENED SLUDGE PUMP NO. 1 MOTOR	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y703	
SOL-STH-PMP-YA-130	SOL-SPB-PLC-061	SOL-STH-PMP-130	THICKENED SLUDGE PUMP NO. 1	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y703	
SOL-STH-PMP-SC-130	SOL-SPB-PLC-061	SOL-STH-PMP-130	THICKENED SLUDGE PUMP NO. 1	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y703	
SOL-STH-PMP-SI-130	SOL-SPB-PLC-061	SOL-STH-PMP-130	THICKENED SLUDGE PUMP NO. 1	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y703	
SOL-STH-PMP-II-130	SOL-SPB-PLC-061	SOL-STH-PMP-130	THICKENED SLUDGE PUMP NO. 1	CURRENT	AI	COMM	N/A	AMPS	N/A	N/A	Y703	
SOL-STH-PMP-PAH-130	SOL-SPB-PLC-061	SOL-STH-PMP-130	THICKENED SLUDGE PUMP NO. 1	PRESSURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y703	
SOL-STH-PMP-MD-230	SOL-SPB-PLC-061	SOL-STH-PMP-230	THICKENED SLUDGE PUMP NO. 2	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y703	
SOL-STH-PMP-HS-230A	SOL-SPB-PLC-061	SOL-STH-PMP-230	THICKENED SLUDGE PUMP NO. 2	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y703	
SOL-STH-PMP-HS-230B	SOL-SPB-PLC-061	SOL-STH-PMP-230	THICKENED SLUDGE PUMP NO. 2	IN-LOCAL	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y703	
SOL-STH-PMP-MN-230	SOL-SPB-PLC-061	SOL-STH-PMP-230	THICKENED SLUDGE PUMP NO. 2	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y703	
SOL-STH-PMP-TAH-230A	SOL-SPB-PLC-061	SOL-STH-PMP-230	THICKENED SLUDGE PUMP NO. 2 STATOR	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y703	
SOL-STH-PMP-TAH-230B	SOL-SPB-PLC-061	SOL-STH-PMP-230	THICKENED SLUDGE PUMP NO. 2 MOTOR	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y703	
SOL-STH-PMP-YA-230	SOL-SPB-PLC-061	SOL-STH-PMP-230	THICKENED SLUDGE PUMP NO. 2	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y703	
SOL-STH-PMP-SC-230	SOL-SPB-PLC-061	SOL-STH-PMP-230	THICKENED SLUDGE PUMP NO. 2	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y703	
SOL-STH-PMP-SI-230	SOL-SPB-PLC-061	SOL-STH-PMP-230	THICKENED SLUDGE PUMP NO. 2	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y703	
SOL-STH-PMP-II-230	SOL-SPB-PLC-061	SOL-STH-PMP-230	THICKENED SLUDGE PUMP NO. 2	CURRENT	AI	COMM	N/A	AMPS	N/A	N/A	Y703	
SOL-STH-PMP-PAH-230	SOL-SPB-PLC-061	SOL-STH-PMP-230	THICKENED SLUDGE PUMP NO. 2	PRESSURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y703	

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SOL-STH-MIX-HS-110	SOL-SPB-PLC-061	SOL-STH-MCP-100	FLOCCULATION TANK NO. 1 (STH-MIX-110)	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-MIX-MN-110	SOL-SPB-PLC-061	SOL-STH-MCP-100	FLOCCULATION TANK NO. 1 (STH-MIX-110)	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-MIX-YA-110	SOL-SPB-PLC-061	SOL-STH-MCP-100	FLOCCULATION TANK NO. 1 (STH-MIX-110)	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-MIX-SI-110	SOL-SPB-PLC-061	SOL-STH-MCP-100	FLOCCULATION TANK NO. 1 (STH-MIX-110)	SPEED	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-LSH-LAH-110	SOL-SPB-PLC-061	SOL-STH-MCP-100	FLOCCULATION TANK NO. 1 (STH-MIX-110)	LEVEL HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-RDT-HS-120	SOL-SPB-PLC-061	SOL-STH-MCP-100	ROTARY THICKENER NO. 1 (STH-RDT-120)	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-RDT-MN-120	SOL-SPB-PLC-061	SOL-STH-MCP-100	ROTARY THICKENER NO. 1 (STH-RDT-120)	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-RDT-YA-120	SOL-SPB-PLC-061	SOL-STH-MCP-100	ROTARY THICKENER NO. 1 (STH-RDT-120)	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-RDT-SI-120	SOL-SPB-PLC-061	SOL-STH-MCP-100	ROTARY THICKENER NO. 1 (STH-RDT-120)	SPEED	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-SSL-SAL-120	SOL-SPB-PLC-061	SOL-STH-MCP-100	ROTARY THICKENER NO. 1 (STH-RDT-120)	SPEED-LOW	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-LSH-LAH-120	SOL-SPB-PLC-061	SOL-STH-MCP-100	DISCHARGE HOPPER NO. 1	LEVEL	AI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-LIT-LI-120	SOL-SPB-PLC-061	SOL-STH-MCP-100	DISCHARGE HOPPER NO. 1	LEVEL HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-PSL-PAL-120	SOL-SPB-PLC-061	SOL-STH-MCP-100	WASH WATER	PRESSURE LOW	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-HS-ES-120	SOL-SPB-PLC-061	SOL-STH-MCP-100	SLUDGE THICKENING SYSTEM NO. 1	EMERGENCY STOP	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-MCP-MN-100	SOL-SPB-PLC-061	SOL-STH-MCP-100	SLUDGE THICKENING SYSTEM NO. 1 RUNNING IN-AUTO	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-MCP-YA-100	SOL-SPB-PLC-061	SOL-STH-MCP-100	SLUDGE THICKENING SYSTEM NO. 1	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-MCP-MN-100	SOL-SPB-PLC-061	SOL-STH-MCP-100	SLUDGE THICKENING SYSTEM NO. 1 INHIBIT	ENABLE/DISABLE	DO	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-MIX-HS-210	SOL-SPB-PLC-061	SOL-STH-MCP-200	FLOCCULATION TANK NO. 2 (STH-MIX-210)	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-MIX-MN-210	SOL-SPB-PLC-061	SOL-STH-MCP-200	FLOCCULATION TANK NO. 2 (STH-MIX-210)	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-MIX-YA-210	SOL-SPB-PLC-061	SOL-STH-MCP-200	FLOCCULATION TANK NO. 2 (STH-MIX-210)	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-MIX-SI-210	SOL-SPB-PLC-061	SOL-STH-MCP-200	FLOCCULATION TANK NO. 2 (STH-MIX-210)	SPEED	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-LSH-LAH-210	SOL-SPB-PLC-061	SOL-STH-MCP-200	FLOCCULATION TANK NO. 2 (STH-MIX-210)	LEVEL HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-RDT-HS-220	SOL-SPB-PLC-061	SOL-STH-MCP-200	ROTARY THICKENER NO. 2 (STH-RDT-220)	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-RDT-MN-220	SOL-SPB-PLC-061	SOL-STH-MCP-200	ROTARY THICKENER NO. 2 (STH-RDT-220)	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-RDT-YA-220	SOL-SPB-PLC-061	SOL-STH-MCP-200	ROTARY THICKENER NO. 2 (STH-RDT-220)	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-RDT-SI-220	SOL-SPB-PLC-061	SOL-STH-MCP-200	ROTARY THICKENER NO. 2 (STH-RDT-220)	SPEED	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-SSL-SAL-220	SOL-SPB-PLC-061	SOL-STH-MCP-200	ROTARY THICKENER NO. 2 (STH-RDT-220)	SPEED-LOW	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-LSH-LAH-220	SOL-SPB-PLC-061	SOL-STH-MCP-200	DISCHARGE HOPPER NO. 2	LEVEL	AI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-LIT-LI-220	SOL-SPB-PLC-061	SOL-STH-MCP-200	DISCHARGE HOPPER NO. 2	LEVEL HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-PSL-PAL-220	SOL-SPB-PLC-061	SOL-STH-MCP-200	WASH WATER	PRESSURE LOW	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-HS-ES-220	SOL-SPB-PLC-061	SOL-STH-MCP-200	SLUDGE THICKENING SYSTEM NO. 2	EMERGENCY STOP	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-MCP-MN-200	SOL-SPB-PLC-061	SOL-STH-MCP-200	SLUDGE THICKENING SYSTEM NO. 2	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-MCP-YA-200	SOL-SPB-PLC-061	SOL-STH-MCP-200	SLUDGE THICKENING SYSTEM NO. 2	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-MCP-MN-200	SOL-SPB-PLC-061	SOL-STH-MCP-200	SLUDGE THICKENING SYSTEM NO. 2 INHIBIT	ENABLE/DISABLE	DO	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-SCIN-LSH-LAH-101	SOL-SPB-PLC-061	SOL-SCIN-LSH-101	THICKENED SLUDGE TANK NO. 1	LEVEL HIGH	DI	N.O. CONTACT	931	FEET(MSL)	N/A	SYSTEM	Y704	2, 8
SOL-SCIN-LIT-LI-101	SOL-SPB-PLC-061	SOL-SCIN-LIT-101	THICKENED SLUDGE TANK NO. 1	LEVEL	AI	4-20mA	0-25	FEET	2-WIRE	SYSTEM	Y704	2, 8
SOL-SCIN-FIT-FI-111	SOL-SPB-PLC-061	SOL-SCIN-FIT-111	THICKENED SLUDGE TANK NO. 1	FLOW	AI	4-20mA	0-200	GPM	4-WIRE	FIELD	Y704	
SOL-SCIN-FIT-FA-111	SOL-SPB-PLC-061	SOL-SCIN-FIT-111	THICKENED SLUDGE TANK NO. 1	REVERSE FLOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	10
SOL-SCIN-LSH-LAH-201	SOL-SPB-PLC-061	SOL-SCIN-LSH-201	THICKENED SLUDGE TANK NO. 2	LEVEL HIGH	DI	N.O. CONTACT	931	FEET(MSL)	N/A	SYSTEM	Y704	2, 8
SOL-SCIN-LIT-LI-201	SOL-SPB-PLC-061	SOL-SCIN-LIT-201	THICKENED SLUDGE TANK NO. 2	LEVEL	AI	4-20mA	0-25	FEET	2-WIRE	SYSTEM	Y704	2, 8

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SOL-SCIN-FIT-FI-211	SOL-SPB-PLC-061	SOL-SCIN-FIT-211	THICKENED SLUDGE TANK NO. 2	FLOW	AI	4-20mA	0-200	GPM	4-WIRE	FIELD	Y704	
SOL-SCIN-FIT-FA-211	SOL-SPB-PLC-061	SOL-SCIN-FIT-211	THICKENED SLUDGE TANK NO. 2	REVERSE FLOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	10
SOL-SCIN-PMP-MD-110	SOL-SPB-PLC-061	SOL-SCIN-PMP-110	SLUDGE LOADOUT PUMP NO. 1	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y704	
SOL-SCIN-PMP-MN-110A	SOL-SPB-PLC-061	SOL-SCIN-PMP-110	SLUDGE LOADOUT PUMP NO. 1	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-PAL-110	SOL-SPB-PLC-061	SOL-SCIN-PMP-110	SLUDGE LOADOUT PUMP NO. 1	PRESSURE LOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-PAH-110	SOL-SPB-PLC-061	SOL-SCIN-PMP-110	SLUDGE LOADOUT PUMP NO. 1	PRESSURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-HS-110A	SOL-SPB-PLC-061	SOL-SCIN-PMP-110	SLUDGE LOADOUT PUMP NO. 1	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-HS-110B	SOL-SPB-PLC-061	SOL-SCIN-PMP-110	SLUDGE LOADOUT PUMP NO. 1	IN-LOCAL	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-HS-110C	SOL-SPB-PLC-061	SOL-SCIN-PMP-110	SLUDGE LOADOUT PUMP NO. 1	STOP	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-ES-110	SOL-SPB-PLC-061	SOL-SCIN-PMP-110	SLUDGE LOADOUT PUMP NO. 1	EMERGENCY STOP	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-TAH-110A	SOL-SPB-PLC-061	SOL-SCIN-PMP-110	SLUDGE LOADOUT PUMP NO. 1 STATOR	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-TAH-110B	SOL-SPB-PLC-061	SOL-SCIN-PMP-110	SLUDGE LOADOUT PUMP NO. 1 MOTOR	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-YA-110	SOL-SPB-PLC-061	SOL-SCIN-PMP-110	SLUDGE LOADOUT PUMP NO. 1	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-VLV-HS-112	SOL-SPB-PLC-061	SOL-SCIN-VLV-112	SLUDGE RECIRCULATION VALVE NO. 1	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-VLV-YA-112	SOL-SPB-PLC-061	SOL-SCIN-VLV-112	SLUDGE RECIRCULATION VALVE NO. 1	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-VLV-ZSC-112	SOL-SPB-PLC-061	SOL-SCIN-VLV-112	SLUDGE RECIRCULATION VALVE NO. 1	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-VLV-ZC-112	SOL-SPB-PLC-061	SOL-SCIN-VLV-112	SLUDGE RECIRCULATION VALVE NO. 1	POSITION CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y704	
SOL-SCIN-VLV-ZI-112	SOL-SPB-PLC-061	SOL-SCIN-VLV-112	SLUDGE RECIRCULATION VALVE NO. 1	POSITION	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y704	
SOL-SCIN-VLV-HS-113	SOL-SPB-PLC-061	SOL-SCIN-VLV-113	SLUDGE LOADOUT VALVE NO. 1	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-VLV-YA-113	SOL-SPB-PLC-061	SOL-SCIN-VLV-113	SLUDGE LOADOUT VALVE NO. 1	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-VLV-ZSC-113	SOL-SPB-PLC-061	SOL-SCIN-VLV-113	SLUDGE LOADOUT VALVE NO. 1	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-VLV-ZC-113	SOL-SPB-PLC-061	SOL-SCIN-VLV-113	SLUDGE LOADOUT VALVE NO. 1	POSITION CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y704	
SOL-SCIN-VLV-ZI-113	SOL-SPB-PLC-061	SOL-SCIN-VLV-113	SLUDGE LOADOUT VALVE NO. 1	POSITION	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y704	
SOL-SCIN-PMP-MD-210	SOL-SPB-PLC-061	SOL-SCIN-PMP-210	SLUDGE LOADOUT PUMP NO. 2	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y704	
SOL-SCIN-PMP-MN-210A	SOL-SPB-PLC-061	SOL-SCIN-PMP-210	SLUDGE LOADOUT PUMP NO. 2	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-PAL-210	SOL-SPB-PLC-061	SOL-SCIN-PMP-210	SLUDGE LOADOUT PUMP NO. 2	PRESSURE LOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-PAH-210	SOL-SPB-PLC-061	SOL-SCIN-PMP-210	SLUDGE LOADOUT PUMP NO. 2	PRESSURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-HS-210A	SOL-SPB-PLC-061	SOL-SCIN-PMP-210	SLUDGE LOADOUT PUMP NO. 2	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-HS-210B	SOL-SPB-PLC-061	SOL-SCIN-PMP-210	SLUDGE LOADOUT PUMP NO. 2	IN-LOCAL	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-HS-210C	SOL-SPB-PLC-061	SOL-SCIN-PMP-210	SLUDGE LOADOUT PUMP NO. 2	STOP	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-ES-210	SOL-SPB-PLC-061	SOL-SCIN-PMP-210	SLUDGE LOADOUT PUMP NO. 2	EMERGENCY STOP	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-TAH-210A	SOL-SPB-PLC-061	SOL-SCIN-PMP-210	SLUDGE LOADOUT PUMP NO. 2 STATOR	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-TAH-210B	SOL-SPB-PLC-061	SOL-SCIN-PMP-210	SLUDGE LOADOUT PUMP NO. 2 MOTOR	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-YA-210	SOL-SPB-PLC-061	SOL-SCIN-PMP-210	SLUDGE LOADOUT PUMP NO. 2	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	

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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SOL-SCIN-VLV-HS-212	SOL-SPB-PLC-061	SOL-SCIN-VLV-212	SLUDGE RECIRCULATION VALVE NO. 2	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-VLV-YA-212	SOL-SPB-PLC-061	SOL-SCIN-VLV-212	SLUDGE RECIRCULATION VALVE NO. 2	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-VLV-ZSC-212	SOL-SPB-PLC-061	SOL-SCIN-VLV-212	SLUDGE RECIRCULATION VALVE NO. 2	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-VLV-ZC-212	SOL-SPB-PLC-061	SOL-SCIN-VLV-212	SLUDGE RECIRCULATION VALVE NO. 2	POSITION CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y704	
SOL-SCIN-VLV-ZI-212	SOL-SPB-PLC-061	SOL-SCIN-VLV-212	SLUDGE RECIRCULATION VALVE NO. 2	POSITION	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y704	
SOL-SCIN-VLV-HS-213	SOL-SPB-PLC-061	SOL-SCIN-VLV-213	SLUDGE LOADOUT VALVE NO. 2	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-VLV-YA-213	SOL-SPB-PLC-061	SOL-SCIN-VLV-213	SLUDGE LOADOUT VALVE NO. 2	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-VLV-ZSC-213	SOL-SPB-PLC-061	SOL-SCIN-VLV-213	SLUDGE LOADOUT VALVE NO. 2	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-VLV-ZC-213	SOL-SPB-PLC-061	SOL-SCIN-VLV-213	SLUDGE LOADOUT VALVE NO. 2	POSITION CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y704	
SOL-SCIN-VLV-ZI-213	SOL-SPB-PLC-061	SOL-SCIN-VLV-213	SLUDGE LOADOUT VALVE NO. 2	POSITION	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y704	
SOL-SCIN-LCP-YA-101	SOL-SPB-PLC-061	SOL-SCIN-LCP-101	MIXING VALVE PANEL NO. 1	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	2
SOL-SCIN-LCP-YA-201	SOL-SPB-PLC-061	SOL-SCIN-LCP-201	MIXING VALVE PANEL NO. 2	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	2
SOL-WAS-BLOW-MD-410	SOL-SPB-PLC-061	SOL-WAS-BLOW-410	SLUDGE BLOWER NO. 1	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y705	
SOL-WAS-BLOW-MN-410	SOL-SPB-PLC-061	SOL-WAS-BLOW-410	SLUDGE BLOWER NO. 1	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-HS-410A	SOL-SPB-PLC-061	SOL-WAS-BLOW-410	SLUDGE BLOWER NO. 1	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-HS-410B	SOL-SPB-PLC-061	SOL-WAS-BLOW-410	SLUDGE BLOWER NO. 1	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y705	
SOL-WAS-BLOW-TAH-410	SOL-SPB-PLC-061	SOL-WAS-BLOW-410	SLUDGE BLOWER NO. 1	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-PDAH-411	SOL-SPB-PLC-061	SOL-WAS-BLOW-410	SLUDGE BLOWER NO. 1	DIFFERENTIAL PRESSURE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-TAH-411	SOL-SPB-PLC-061	SOL-WAS-BLOW-410	SLUDGE BLOWER NO. 1	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-YA-410	SOL-SPB-PLC-061	SOL-WAS-BLOW-410	SLUDGE BLOWER NO. 1	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-SC-410	SOL-SPB-PLC-061	SOL-WAS-BLOW-410	SLUDGE BLOWER NO. 1	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y705	
SOL-WAS-BLOW-SI-410	SOL-SPB-PLC-061	SOL-WAS-BLOW-410	SLUDGE BLOWER NO. 1	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y705	
SOL-WAS-BLOW-II-410	SOL-SPB-PLC-061	SOL-WAS-BLOW-410	SLUDGE BLOWER NO. 1	CURRENT	AI	COMM		AMPS	N/A	N/A	Y705	

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SOL-WAS-BLOW-MD-420	SOL-SPB-PLC-061	SOL-WAS-BLOW-420	SLUDGE BLOWER NO. 2	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y705	
SOL-WAS-BLOW-MN-420	SOL-SPB-PLC-061	SOL-WAS-BLOW-420	SLUDGE BLOWER NO. 2	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-HS-420A	SOL-SPB-PLC-061	SOL-WAS-BLOW-420	SLUDGE BLOWER NO. 2	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-HS-420B	SOL-SPB-PLC-061	SOL-WAS-BLOW-420	SLUDGE BLOWER NO. 2	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y705	
SOL-WAS-BLOW-TAH-420	SOL-SPB-PLC-061	SOL-WAS-BLOW-420	SLUDGE BLOWER NO. 2	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-PDAH-421	SOL-SPB-PLC-061	SOL-WAS-BLOW-420	SLUDGE BLOWER NO. 2	DIFFERENTIAL PRESSURE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-TAH-421	SOL-SPB-PLC-061	SOL-WAS-BLOW-420	SLUDGE BLOWER NO. 2	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-YA-420	SOL-SPB-PLC-061	SOL-WAS-BLOW-420	SLUDGE BLOWER NO. 2	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-SC-420	SOL-SPB-PLC-061	SOL-WAS-BLOW-420	SLUDGE BLOWER NO. 2	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y705	
SOL-WAS-BLOW-SI-420	SOL-SPB-PLC-061	SOL-WAS-BLOW-420	SLUDGE BLOWER NO. 2	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y705	
SOL-WAS-BLOW-II-420	SOL-SPB-PLC-061	SOL-WAS-BLOW-420	SLUDGE BLOWER NO. 2	CURRENT	AI	COMM		AMPS	N/A	N/A	Y705	
SOL-WAS-BLOW-MD-430	SOL-SPB-PLC-061	SOL-WAS-BLOW-430	SLUDGE BLOWER NO. 3	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y705	
SOL-WAS-BLOW-MN-430	SOL-SPB-PLC-061	SOL-WAS-BLOW-430	SLUDGE BLOWER NO. 3	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-HS-430A	SOL-SPB-PLC-061	SOL-WAS-BLOW-430	SLUDGE BLOWER NO. 3	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-HS-430B	SOL-SPB-PLC-061	SOL-WAS-BLOW-430	SLUDGE BLOWER NO. 3	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y705	
SOL-WAS-BLOW-TAH-430	SOL-SPB-PLC-061	SOL-WAS-BLOW-430	SLUDGE BLOWER NO. 3	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-PDAH-431	SOL-SPB-PLC-061	SOL-WAS-BLOW-430	SLUDGE BLOWER NO. 3	DIFFERENTIAL PRESSURE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-TAH-431	SOL-SPB-PLC-061	SOL-WAS-BLOW-430	SLUDGE BLOWER NO. 3	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-YA-430	SOL-SPB-PLC-061	SOL-WAS-BLOW-430	SLUDGE BLOWER NO. 3	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-SC-430	SOL-SPB-PLC-061	SOL-WAS-BLOW-430	SLUDGE BLOWER NO. 3	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y705	
SOL-WAS-BLOW-SI-430	SOL-SPB-PLC-061	SOL-WAS-BLOW-430	SLUDGE BLOWER NO. 3	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y705	
SOL-WAS-BLOW-II-430	SOL-SPB-PLC-061	SOL-WAS-BLOW-430	SLUDGE BLOWER NO. 3	CURRENT	AI	COMM		AMPS	N/A	N/A	Y705	
SOL-WAS-PDS-PDAH-401	SOL-SPB-PLC-061	SOL-WAS-PDS-401	INTAKE FILTER	DIFFERENTIAL PRESSURE	DI	N.O. CONTACT		PSIG	N/A	SYSTEM	Y705	
SOL-SCIN-AIRC-MN-310	SOL-SPB-PLC-061	SOL-SCIN-AIRC-310	SLUDGE MIXING AIR COMPRESSOR NO. 1	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y706	2
SOL-SCIN-AIRC-YA-310A	SOL-SPB-PLC-061	SOL-SCIN-AIRC-310	SLUDGE MIXING AIR COMPRESSOR NO. 1	WARNING	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y706	2
SOL-SCIN-AIRC-YA-310B	SOL-SPB-PLC-061	SOL-SCIN-AIRC-310	SLUDGE MIXING AIR COMPRESSOR NO. 1	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y706	2

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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SOL-SCIN-AIRC-MN-320	SOL-SPB-PLC-061	SOL-SCIN-AIRC-320	SLUDGE MIXING AIR COMPRESSOR NO. 2	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y706	2
SOL-SCIN-AIRC-YA-320A	SOL-SPB-PLC-061	SOL-SCIN-AIRC-320	SLUDGE MIXING AIR COMPRESSOR NO. 2	WARNING	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y706	2
SOL-SCIN-AIRC-YA-320B	SOL-SPB-PLC-061	SOL-SCIN-AIRC-320	SLUDGE MIXING AIR COMPRESSOR NO. 2	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y706	2
SOL-POL-PMP-MD-110	SOL-SPB-PLC-061	SOL-POL-PMP-110	POLYMER FEED SKID NO. 1, PUMP NO. 1	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y707	
SOL-POL-PMP-MD-120	SOL-SPB-PLC-061	SOL-POL-PMP-120	POLYMER FEED SKID NO. 1, PUMP NO. 2	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y707	
SOL-POL-PMP-MN-110	SOL-SPB-PLC-061	SOL-POL-PMP-110	POLYMER FEED SKID NO. 1, PUMP NO. 1	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y707	
SOL-POL-PMP-MN-120	SOL-SPB-PLC-061	SOL-POL-PMP-120	POLYMER FEED SKID NO. 1, PUMP NO. 2	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y707	
SOL-POL-LCP-HS-100	SOL-SPB-PLC-061	SOL-POL-LCP-100	POLYMER FEED SKID NO. 1	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y707	
SOL-POL-LCP-YA-100	SOL-SPB-PLC-061	SOL-POL-LCP-100	POLYMER FEED SKID NO. 1	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y707	
SOL-POL-PMP-SC-110	SOL-SPB-PLC-061	SOL-POL-PMP-110	POLYMER FEED PUMP NO. 1-1	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	FIELD	Y707	
SOL-POL-PMP-SI-110	SOL-SPB-PLC-061	SOL-POL-PMP-110	POLYMER FEED PUMP NO. 1-1	SPEED	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y707	
SOL-POL-PMP-SC-120	SOL-SPB-PLC-061	SOL-POL-PMP-120	POLYMER FEED PUMP NO. 1-2	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	FIELD	Y707	
SOL-POL-PMP-SI-120	SOL-SPB-PLC-061	SOL-POL-PMP-120	POLYMER FEED PUMP NO. 1-2	SPEED	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y707	
SOL-POL-LIT-LI-101	SOL-SPB-PLC-061	SOL-POL-LIT-101	POLYMER TOTE	LEVEL	AI	4-20mA		FEET	2-WIRE	SYSTEM	Y707	
SOL-POL-PMP-MD-210	SOL-SPB-PLC-061	SOL-POL-PMP-210	POLYMER FEED SKID NO. 2, PUMP NO. 1	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y707	
SOL-POL-PMP-MD-220	SOL-SPB-PLC-061	SOL-POL-PMP-220	POLYMER FEED SKID NO. 2, PUMP NO. 2	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y707	
SOL-POL-PMP-MN-210	SOL-SPB-PLC-061	SOL-POL-PMP-210	POLYMER FEED SKID NO. 2, PUMP NO. 1	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y707	
SOL-POL-PMP-MN-220	SOL-SPB-PLC-061	SOL-POL-PMP-220	POLYMER FEED SKID NO. 2, PUMP NO. 2	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y707	
SOL-POL-LCP-HS-200	SOL-SPB-PLC-061	SOL-POL-LCP-200	POLYMER FEED SKID NO. 2	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y707	
SOL-POL-LCP-YA-200	SOL-SPB-PLC-061	SOL-POL-LCP-200	POLYMER FEED SKID NO. 2	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y707	
SOL-POL-PMP-SC-210	SOL-SPB-PLC-061	SOL-POL-PMP-210	POLYMER FEED PUMP NO. 2-1	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	FIELD	Y707	
SOL-POL-PMP-SI-210	SOL-SPB-PLC-061	SOL-POL-PMP-210	POLYMER FEED PUMP NO. 2-1	SPEED	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y707	
SOL-POL-PMP-SC-220	SOL-SPB-PLC-061	SOL-POL-PMP-220	POLYMER FEED PUMP NO. 2-2	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	FIELD	Y707	
SOL-POL-PMP-SI-220	SOL-SPB-PLC-061	SOL-POL-PMP-220	POLYMER FEED PUMP NO. 2-2	SPEED	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y707	
SOL-POL-LIT-LI-201	SOL-SPB-PLC-061	SOL-POL-LIT-201	POLYMER TOTE	LEVEL	AI	4-20mA		FEET	2-WIRE	SYSTEM	Y707	

TODD CREEK
WWTP
I/O LIST

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SOL-ODR-MCP-PI-100A	SOL-SPB-PLC-061	SOL-ODR-MCP-100	ODOR CONTROL ENCLOSURE - OZONE	PRESSURE	AI	COMM		PSI	N/A	N/A	Y802	2, 4, 6
SOL-ODR-MCP-PI-100B	SOL-SPB-PLC-061	SOL-ODR-MCP-100	ODOR CONTROL ENCLOSURE - WATER	PRESSURE	AI	COMM		PSI	N/A	N/A	Y802	2, 4, 6
SOL-ODR-MCP-PI-100C	SOL-SPB-PLC-061	SOL-ODR-MCP-100	ODOR CONTROL ENCLOSURE - AIR	PRESSURE	AI	COMM		PSI	N/A	N/A	Y802	2, 4, 6
SOL-ODR-MCP-FAL-100	SOL-SPB-PLC-061	SOL-ODR-MCP-100	ODOR CONTROL ENCLOSURE - OZONE	FLOW LOW	DI	COMM	N/A	N/A	N/A	N/A	Y802	2, 4, 6
SOL-ODR-MCP-TAH-100	SOL-SPB-PLC-061	SOL-ODR-MCP-100	ODOR CONTROL ENCLOSURE	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y802	2, 4, 6
SOL-ODR-MCP-MN-100	SOL-SPB-PLC-061	SOL-ODR-MCP-100	ODOR CONTROL ENCLOSURE	ENABLE/DISABLE	DO	COMM	N/A	N/A	N/A	N/A	Y802	2
SOL-ODR-MCP-YA-100	SOL-SPB-PLC-061	SOL-ODR-MCP-100	ODOR CONTROL ENCLOSURE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y802	2
SOL-SPB-FS-YA-001	SOL-SPB-PLC-061	SOL-SPB-FS-001	EMERGENCY EYEWASH/SHOWER	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
SOL-SPB-FACP-YA-001A	SOL-SPB-PLC-061	SOL-SPB-FACP-071	SPB FIRE ALARM CONTROL UNIT	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		10
SOL-SPB-FACP-YA-001B	SOL-SPB-PLC-061	SOL-SPB-FACP-071	SPB FIRE ALARM CONTROL UNIT	TROUBLE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		10
SOL-SPB-FACP-YA-001C	SOL-SPB-PLC-061	SOL-SPB-FACP-071	SPB FIRE ALARM CONTROL UNIT	SUPERVISORY	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		10
PRE-SPB-CTRL-TAH-001	SOL-SPB-PLC-061	PRE-SPB-CTRL-001	SPB ELECTRICAL ROOM	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-SPB-CTRL-YA-001A	SOL-SPB-PLC-061	PRE-SPB-CTRL-001	DIRTY FILTER	WARNING	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-SPB-CTRL-YA-001B	SOL-SPB-PLC-061	PRE-SPB-CTRL-001	HVAC CONTROL SYSTEM	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-SPB-CTRL-YA-001C	SOL-SPB-PLC-061	PRE-SPB-CTRL-001	VENTILATION FAILURE	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-SPB-CTRL-YA-001D	SOL-SPB-PLC-061	PRE-SPB-CTRL-001	SMOKE ALARM	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
SOL-SPB-SWB-EI-021AN	SOL-SPB-PLC-061	SOL-SPB-SWB-021	SWITCHBOARD A-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SOL-SPB-SWB-EI-021BN	SOL-SPB-PLC-061	SOL-SPB-SWB-021	SWITCHBOARD B-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SOL-SPB-SWB-EI-021CN	SOL-SPB-PLC-061	SOL-SPB-SWB-021	SWITCHBOARD C-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SOL-SPB-SWB-EI-021AB	SOL-SPB-PLC-061	SOL-SPB-SWB-021	SWITCHBOARD A-B PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SOL-SPB-SWB-EI-021BC	SOL-SPB-PLC-061	SOL-SPB-SWB-021	SWITCHBOARD B-C PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SOL-SPB-SWB-EI-021CA	SOL-SPB-PLC-061	SOL-SPB-SWB-021	SWITCHBOARD C-A PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SOL-SPB-SWB-II-021A	SOL-SPB-PLC-061	SOL-SPB-SWB-021	SWITCHBOARD A LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
SOL-SPB-SWB-II-021B	SOL-SPB-PLC-061	SOL-SPB-SWB-021	SWITCHBOARD B LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
SOL-SPB-SWB-II-021C	SOL-SPB-PLC-061	SOL-SPB-SWB-021	SWITCHBOARD C LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
SOL-SPB-SWB-JI-021A	SOL-SPB-PLC-061	SOL-SPB-SWB-021	SWITCHBOARD AVERAGE APPARENT	POWER	AI	COMM		KVA	N/A	N/A		4, 6
SOL-SPB-SWB-JI-021R	SOL-SPB-PLC-061	SOL-SPB-SWB-021	SWITCHBOARD AVERAGE REAL	POWER	AI	COMM		KW	N/A	N/A		4, 6
SOL-SPB-SWB-JQ-021	SOL-SPB-PLC-061	SOL-SPB-SWB-021	SWITCHBOARD TOTAL	ENERGY	AI	COMM		KWh	N/A	N/A		4, 6
SOL-SPB-SWB-JN-021	SOL-SPB-PLC-061	SOL-SPB-SWB-021	SWITCHBOARD AVERAGE	POWER FACTOR	AI	COMM		PF	N/A	N/A		4, 6
SOL-SPB-SWB-SI-021	SOL-SPB-PLC-061	SOL-SPB-SWB-021	SWITCHBOARD	FREQUENCY	AI	COMM		HERTZ	N/A	N/A		4, 6

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SOL-SPB-UPS-JA-051	SOL-SPB-PLC-061	SOL-SPB-UPS-051	UPS SYSTEM REPLACE BATTERY	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SOL-SPB-UPS-JAL-051	SOL-SPB-PLC-061	SOL-SPB-UPS-051	UPS SYSTEM LOW BATTERY	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SOL-SPB-UPS-YA-051A	SOL-SPB-PLC-061	SOL-SPB-UPS-051	UPS SYSTEM	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
SOL-SPB-UPS-YN-051	SOL-SPB-PLC-061	SOL-SPB-UPS-051	UPS SYSTEM ON BATTERY	STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
SOL-SPB-UPS-ZS-051	SOL-SPB-PLC-061	SOL-SPB-UPS-051	UPS SYSTEM BYPASS	STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
SOL-SPB-NSW-YA-061A	SOL-SPB-PLC-061	SOL-SPB-NSW-061	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SOL-SPB-NSW-YA-061B	SOL-SPB-PLC-061	SOL-SPB-NSW-061	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SOL-SPB-NSW-YA-061C	SOL-SPB-PLC-061	SOL-SPB-NSW-061	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SOL-SPB-NSW-TI-061	SOL-SPB-PLC-061	SOL-SPB-NSW-061	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		4, 9
SOL-SPB-NSW-YA-062A	SOL-SPB-PLC-061	SOL-SPB-NSW-062	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SOL-SPB-NSW-YA-062B	SOL-SPB-PLC-061	SOL-SPB-NSW-062	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SOL-SPB-NSW-YA-062C	SOL-SPB-PLC-061	SOL-SPB-NSW-062	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SOL-SPB-NSW-TI-062	SOL-SPB-PLC-061	SOL-SPB-NSW-062	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		4, 9
SOL-SPB-NSW-YA-071A	SOL-SPB-PLC-061	SOL-SPB-NSW-071	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SOL-SPB-NSW-YA-071B	SOL-SPB-PLC-061	SOL-SPB-NSW-071	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SOL-SPB-NSW-YA-071C	SOL-SPB-PLC-061	SOL-SPB-NSW-071	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SOL-SPB-NSW-TI-071	SOL-SPB-PLC-061	SOL-SPB-NSW-071	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		4, 9

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
BLGR-ADM-FS-YA-001	BLGR-ADM-PLC-061	BLGR-ADM-FS-001	EMERGENCY EYEWASH/SHOWER	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
BLGR-ADM-CTRL-TAH-001	BLGR-ADM-PLC-061	BLGR-ADM-CTRL-001	ADMIN ELECTRICAL ROOM	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
BLGR-ADM-CTRL-YA-001A	BLGR-ADM-PLC-061	BLGR-ADM-CTRL-001	DIRTY FILTER	WARNING	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
BLGR-ADM-CTRL-YA-001B	BLGR-ADM-PLC-061	BLGR-ADM-CTRL-001	HVAC CONTROL SYSTEM	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
BLGR-ADM-CTRL-YA-001D	BLGR-ADM-PLC-061	BLGR-ADM-CTRL-001	SMOKE ALARM	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
BLGR-ADM-SWB_52U1-HS-001	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 CIRCUIT BREAKER 52-U1	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A		6
BLGR-ADM-SWB_52U1-YA-001A	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 CIRCUIT BREAKER 52-U1 TRIP	ALARM	DI	COMM	N/A	N/A	N/A	N/A		6
BLGR-ADM-SWB_52U1-YA-001B	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 CIRCUIT BREAKER 52-U1 OPEN/CLOSE	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A		6
BLGR-ADM-SWB_52U1-YN-001	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 SOURCE AVAILABLE	STATUS	DI	COMM	N/A	N/A	N/A	N/A		6
BLGR-ADM-SWB_52U1-ZSC-001	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 CIRCUIT BREAKER 52-U1	CLOSED	DI	COMM	N/A	N/A	N/A	N/A		6
BLGR-ADM-SWB_52U1-ZSO-001	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 CIRCUIT BREAKER 52-U1	OPEN	DI	COMM	N/A	N/A	N/A	N/A		6
BLGR-ADM-SWB_52U1-EI-001AN	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 A-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U1-EI-001BN	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 B-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U1-EI-001CN	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 C-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U1-EI-001AB	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 A-B PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U1-EI-001BC	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 B-C PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U1-EI-001CA	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 C-A PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U1-II-001A	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 A LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U1-II-001B	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 B LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U1-II-001C	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 C LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U1-JI-001A	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 AVERAGE APPARENT	POWER	AI	COMM		KVA	N/A	N/A		4, 6
BLGR-ADM-SWB_52U1-JI-001R	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 AVERAGE REAL	POWER	AI	COMM		KW	N/A	N/A		4, 6
BLGR-ADM-SWB_52U1-JQ-001	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 TOTAL	ENERGY	AI	COMM		KWh	N/A	N/A		4, 6
BLGR-ADM-SWB_52U1-JN-001	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 AVERAGE	POWER FACTOR	AI	COMM		PF	N/A	N/A		4, 6
BLGR-ADM-SWB_52U1-SI-001	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1	FREQUENCY	AI	COMM		HERTZ	N/A	N/A		4, 6
BLGR-ADM-SWB_52U2-HS-001	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 CIRCUIT BREAKER 52-U2	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A		6
BLGR-ADM-SWB_52U2-YA-001A	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 CIRCUIT BREAKER 52-U2 TRIP	ALARM	DI	COMM	N/A	N/A	N/A	N/A		6
BLGR-ADM-SWB_52U2-YA-001B	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 CIRCUIT BREAKER 52-U2 OPEN/CLOSE	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A		6
BLGR-ADM-SWB_52U2-YN-001	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 SOURCE AVAILABLE	STATUS	DI	COMM	N/A	N/A	N/A	N/A		6
BLGR-ADM-SWB_52U2-ZSC-001	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 CIRCUIT BREAKER 52-U2	CLOSED	DI	COMM	N/A	N/A	N/A	N/A		6
BLGR-ADM-SWB_52U2-ZSO-001	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 CIRCUIT BREAKER 52-U2	OPEN	DI	COMM	N/A	N/A	N/A	N/A		6
BLGR-ADM-SWB_52U2-EI-001AN	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 A-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U2-EI-001BN	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 B-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U2-EI-001CN	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 C-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U2-EI-001AB	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 A-B PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U2-EI-001BC	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 B-C PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U2-EI-001CA	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 C-A PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U2-II-001A	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 A LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U2-II-001B	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 B LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U2-II-001C	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 C LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6

TODD CREEK
WWTP
I/O LIST

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
BLGR-ADM-SWB_52U2-JI-001A	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 AVERAGE APPARENT	POWER	AI	COMM		KVA	N/A	N/A		4, 6
BLGR-ADM-SWB_52U2-JI-001R	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 AVERAGE REAL	POWER	AI	COMM		KW	N/A	N/A		4, 6
BLGR-ADM-SWB_52U2-JQ-001	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 TOTAL	ENERGY	AI	COMM		KWh	N/A	N/A		4, 6
BLGR-ADM-SWB_52U2-JN-001	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 AVERAGE	POWER FACTOR	AI	COMM		PF	N/A	N/A		4, 6
BLGR-ADM-SWB_52U2-SI-001	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2	FREQUENCY	AI	COMM		HERTZ	N/A	N/A		4, 6
BLGR-ADM-UPS-JA-051	BLGR-ADM-PLC-061	BLGR-ADM-UPS-051	UPS SYSTEM REPLACE BATTERY	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
BLGR-ADM-UPS-JAL-051	BLGR-ADM-PLC-061	BLGR-ADM-UPS-051	UPS SYSTEM LOW BATTERY	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
BLGR-ADM-UPS-YA-051A	BLGR-ADM-PLC-061	BLGR-ADM-UPS-051	UPS SYSTEM	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
BLGR-ADM-UPS-YN-051	BLGR-ADM-PLC-061	BLGR-ADM-UPS-051	UPS SYSTEM ON BATTERY	STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
BLGR-ADM-UPS-ZS-051	BLGR-ADM-PLC-061	BLGR-ADM-UPS-051	UPS SYSTEM BYPASS	STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
BLGR-ADM-NSW-YA-061A	BLGR-ADM-PLC-061	BLGR-ADM-NSW-061	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
BLGR-ADM-NSW-YA-061B	BLGR-ADM-PLC-061	BLGR-ADM-NSW-061	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
BLGR-ADM-NSW-YA-061C	BLGR-ADM-PLC-061	BLGR-ADM-NSW-061	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
BLGR-ADM-NSW-TI-061	BLGR-ADM-PLC-061	BLGR-ADM-NSW-061	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		4, 9
BLGR-ADM-NSW-YA-062A	BLGR-ADM-PLC-061	BLGR-ADM-NSW-062	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
BLGR-ADM-NSW-YA-062B	BLGR-ADM-PLC-061	BLGR-ADM-NSW-062	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
BLGR-ADM-NSW-YA-062C	BLGR-ADM-PLC-061	BLGR-ADM-NSW-062	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
BLGR-ADM-NSW-TI-062	BLGR-ADM-PLC-061	BLGR-ADM-NSW-062	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		4, 9
BLGR-ADM-NSW-YA-071A	BLGR-ADM-PLC-061	BLGR-ADM-NSW-071	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
BLGR-ADM-NSW-YA-071B	BLGR-ADM-PLC-061	BLGR-ADM-NSW-071	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
BLGR-ADM-NSW-YA-071C	BLGR-ADM-PLC-061	BLGR-ADM-NSW-071	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
BLGR-ADM-NSW-TI-071	BLGR-ADM-PLC-061	BLGR-ADM-NSW-071	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		4, 9

TODD CREEK
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NOTES:

1. "SYSTEM" - POWER FROM ASSOCIATED PANEL. "FIELD" - POWER FROM OTHER SOURCE INDICATED ELSEWHERE.

2. PROVIDE SURGE PROTECTION DEVICE (SPD) FOR I/O POINT.

3. PROVIDE TEMPERATURE SWITCH INSTALLED IN THE PLC CABINET. SEE SPECIFICATIONS FOR REQUIREMENTS.

4. RANGE SHALL BE COORDINATED WITH THE EQUIPMENT SUPPLIER.

5. PROVIDE 120VAC POWER SOURCE FROM PLC PANEL FOR INSTRUMENT.

6. INDICATED POINTS SHALL BE CONSUMED BY THE PLANT CONTROL SYSTEM FROM THE MANUFACTURER SUPPLIED PLC.

7. INDICATED POINTS SHALL BE CONSUMED BY THE MANUFACTURER SUPPLIED PLC FROM THE PLANT CONTROL SYSTEM.

8. PROVIDE INTRINSICALLY SAFE BARRIER FOR I/O POINT.

9. WHERE ETHERNET/IP COMMUNICIATIONS IS NOT AVAILABLE, COMMS TO PCS SHALL BE UTILIZE SIMPLE NETWORK MANAGEMENT PROTOCOL (SNMP). UTILIZE SNMP TO OPC GATEWAY SOFTWARE AS REQUIRED.

10. PROVIDE AN INTERPOSING RELAY TO CONSUME THE INDICATED I/O POINT. SUPPLY VOLTAGE SHALL BE 24VDC SOURCED FROM THE ASSOCIATED PCS PLC CABINET.

Todd Creek
WWTP - Instrument List

INSTRUMENT TAG NUMBER		TYPE	DESCRIPTION	FUNCTION	LOCATION	PROCESS CONNECTION(S)	MOUNTING		OUTPUT	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER	DRAWING	SPECIAL NOTES
TRANSMITTER	ELEMENT						TRANSMITTER	ELEMENT							
N/A	IPS-LSH-001	LEVEL SWITCH - FLOAT	INFLUENT COARSE SCREEN CHANNEL	LEVEL - HIGH	INFLUENT COARSE SCREEN CHANNEL	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	10.0	FEET	N/A	N/A	Y201	2, 4
IPS-AIT-001	IPS-AE-001	GAS LEVEL TRANSMITTER	COARSE SCREEN BUILDING COMBUSTIBLE GAS	LEVEL	COARSE SCREENS BUILDING	N/A	WALL	3/4"NPT	4-20mA	0-100	%LEL	3-WIRE	120VAC	Y201	
IPS-AIT-001	IPS-AE-003	GAS LEVEL TRANSMITTER	COARSE SCREEN BUILDING H2S GAS	LEVEL	COARSE SCREENS BUILDING	N/A	WALL	3/4"NPT	4-20mA	0-2000	PPM	3-WIRE	120VAC	Y201	
IPS-AIT-002	IPS-AE-002	GAS LEVEL TRANSMITTER	COARSE SCREEN BUILDING OZONE GAS	LEVEL	COARSE SCREENS BUILDING	N/A	WALL	N/A	4-20mA	0-1	O3 PPM	4-WIRE	120VAC	Y201	
IPS-LT-010A	IPS-LIT-010	LEVEL TRANSMITTER	COARSE SCREEN CHANNEL NO. 1	LEVEL	COARSE SCREEN CHANNEL NO. 1	N/A	ENCLOSURE	BRACKET	4-20mA	0 - 40	FEET	4-WIRE	120VAC	Y201	2, 6
IPS-LT-010B		LEVEL TRANSMITTER	COARSE SCREEN CHANNEL NO. 1	LEVEL	COARSE SCREEN CHANNEL NO. 1	N/A		BRACKET	4-20mA	0 - 40	FEET	4-WIRE	120VAC	Y201	2, 6
N/A	IPS-HRN-001	ALARM HORN	COARSE SCREEN BUILDING COMBUSTIBLE GAS	AUDIBLE ANNUNCIATION	COARSE SCREENS BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	IPS-HRN-002	ALARM HORN	COARSE SCREEN BUILDING COMBUSTIBLE GAS	AUDIBLE ANNUNCIATION	COARSE SCREENS BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	IPS-STB-001	ALARM STROBE	COARSE SCREEN BUILDING COMBUSTIBLE GAS	VISUAL ANNUNCIATION	COARSE SCREENS BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	IPS-STB-002	ALARM STROBE	COARSE SCREEN BUILDING COMBUSTIBLE GAS	VISUAL ANNUNCIATION	COARSE SCREENS BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
IPS-LIT-101	N/A	RADAR LEVEL TRANSMITTER	INFLUENT WET WELL NO. 1	LEVEL	INFLUENT WET WELL NO. 1	N/A	FLANGE	N/A	4-20mA	0 - 45	FEET	2-WIRE	LOOP	Y202	2, 5
IPS-LIT-102	N/A	RADAR LEVEL TRANSMITTER	INFLUENT WET WELL NO. 2	LEVEL	INFLUENT WET WELL NO. 2	N/A	FLANGE	N/A	4-20mA	0 - 45	FEET	2-WIRE	LOOP	Y202	2, 5
N/A	IPS-LSLL-101	LEVEL SWITCH - FLOAT	INFLUENT WET WELL NO. 1	LEVEL - LOW-LOW	INFLUENT WET WELL NO. 1	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	2.5	FEET	N/A	N/A	Y202	2, 4
N/A	IPS-LSL-101	LEVEL SWITCH - FLOAT	INFLUENT WET WELL NO. 1	LEVEL - LOW	INFLUENT WET WELL NO. 1	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	3.0	FEET	N/A	N/A	Y202	2, 4
N/A	IPS-LSH-101	LEVEL SWITCH - FLOAT	INFLUENT WET WELL NO. 1	LEVEL - HIGH	INFLUENT WET WELL NO. 1	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	8.5	FEET	N/A	N/A	Y202	2, 4
N/A	IPS-LSHH-101	LEVEL SWITCH - FLOAT	INFLUENT WET WELL NO. 1	LEVEL - HIGH-HIGH	INFLUENT WET WELL NO. 1	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	11.0	FEET	N/A	N/A	Y202	2, 4
N/A	IPS-LSLL-102	LEVEL SWITCH - FLOAT	INFLUENT WET WELL NO. 2	LEVEL - LOW-LOW	INFLUENT WET WELL NO. 2	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	2.5	FEET	N/A	N/A	Y202	2, 4
N/A	IPS-LSL-102	LEVEL SWITCH - FLOAT	INFLUENT WET WELL NO. 2	LEVEL - LOW	INFLUENT WET WELL NO. 2	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	3.0	FEET	N/A	N/A	Y202	2, 4
N/A	IPS-LSH-102	LEVEL SWITCH - FLOAT	INFLUENT WET WELL NO. 2	LEVEL - HIGH	INFLUENT WET WELL NO. 2	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	8.5	FEET	N/A	N/A	Y202	2, 4
N/A	IPS-LSHH-102	LEVEL SWITCH - FLOAT	INFLUENT WET WELL NO. 2	LEVEL - HIGH-HIGH	INFLUENT WET WELL NO. 2	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	11.0	FEET	N/A	N/A	Y202	2, 4
IPS-PIT-110	N/A	PRESSURE TRANSMITTER	IP NO. 1 DISCHARGE	PRESSURE	VALVE VAULT	2" FLANGE	PROCESS PIPE	N/A	4-20mA	0 - 150	PSI	2-WIRE	LOOP	Y202	2
IPS-PI-110	N/A	PRESSURE GAUGE	IP NO. 1 DISCHARGE	PRESSURE	VALVE VAULT	2" FLANGE	N/A	N/A	N/A	0 - 150	PSIG	N/A	N/A	Y202	
IPS-PIT-120	N/A	PRESSURE TRANSMITTER	IP NO. 2 DISCHARGE	PRESSURE	VALVE VAULT	2" FLANGE	PROCESS PIPE	N/A	4-20mA	0 - 150	PSI	2-WIRE	LOOP	Y202	2
IPS-PI-120	N/A	PRESSURE GAUGE	IP NO. 2 DISCHARGE	PRESSURE	VALVE VAULT	2" FLANGE	N/A	N/A	N/A	0 - 150	PSIG	N/A	N/A	Y202	
IPS-PIT-130	N/A	PRESSURE TRANSMITTER	IP NO. 3 DISCHARGE	PRESSURE	VALVE VAULT	2" FLANGE	PROCESS PIPE	N/A	4-20mA	0 - 150	PSI	2-WIRE	LOOP	Y202	2
IPS-PI-130	N/A	PRESSURE GAUGE	IP NO. 3 DISCHARGE	PRESSURE	VALVE VAULT	2" FLANGE	N/A	N/A	N/A	0 - 150	PSIG	N/A	N/A	Y202	
IPS-PIT-140	N/A	PRESSURE TRANSMITTER	IP NO. 4 DISCHARGE	PRESSURE	VALVE VAULT	2" FLANGE	PROCESS PIPE	N/A	4-20mA	0 - 150	PSI	2-WIRE	LOOP	Y202	2
IPS-PI-140	N/A	PRESSURE GAUGE	IP NO. 4 DISCHARGE	PRESSURE	VALVE VAULT	2" FLANGE	N/A	N/A	N/A	0 - 150	PSIG	N/A	N/A	Y202	
IPS-PIT-150	N/A	PRESSURE TRANSMITTER	IP NO. 5 DISCHARGE	PRESSURE	VALVE VAULT	2" FLANGE	PROCESS PIPE	N/A	4-20mA		PSI	2-WIRE	LOOP	Y202	2
IPS-PI-150	N/A	PRESSURE GAUGE	IP NO. 5 DISCHARGE	PRESSURE	VALVE VAULT	2" FLANGE	N/A	N/A	N/A	0 - 150	PSIG	N/A	N/A	Y202	
H2O2-LT-101	N/A	RADAR LEVEL TRANSMITTER	HYRDOGEN SULFIDE STORAGE	LEVEL	HYRDOGEN SULFIDE BULK TANK	N/A	FLANGE	N/A	4-20mA	TBD	FEET	2-WIRE	LOOP	Y204	
GRSC-PIT-001	N/A	PRESSURE TRANSMITTER	HEADWORKS PROCESS WATER	PRESSURE	HEADWORKS BUILDING	1/2" NPT	PROCESS PIPE	N/A	4-20mA	0 - 200	PSI	2-WIRE	LOOP	Y601	
GRSC-FIT-001	GRSC-FE-001	20-INCH MAGNETIC FLOW METER W/ INTEGRAL XMTR	INFLUENT PUMPING	FLOW	HEADWORKS BUILDING	FLANGE	INTEGRAL	PROCESS PIPE	4-20mA	0 - 15,000	GPM	4-WIRE	120VAC	Y301	2, 5

INSTRUMENT TAG NUMBER		TYPE	DESCRIPTION	FUNCTION	LOCATION	PROCESS CONNECTION(S)	MOUNTING		OUTPUT	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER	DRAWING	SPECIAL NOTES
TRANSMITTER	ELEMENT						TRANSMITTER	ELEMENT							
N/A	GRSC-LSH-100	POINT LEVEL SWITCH	INFLUENT SCREEN CHANNEL NO. 1	LEVEL - HIGH	INFLUENT SCREEN CHANNEL NO. 1	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	10.0	FEET	N/A	N/A	Y301	4, 6
GRSC-LE-100A	GRSC-LIT-100	ULTRASONIC LEVEL TRANSDUCER	INFLUENT SCREEN CHANNEL NO. 1	LEVEL	INFLUENT SCREEN CHANNEL NO. 1	N/A	ENCLOSURE	BRACKET	4-20mA	0 - 38	FEET	4-WIRE	120VAC	Y301	6
GRSC-LE-100B		ULTRASONIC LEVEL TRANSDUCER	INFLUENT SCREEN CHANNEL NO. 1	LEVEL	INFLUENT SCREEN CHANNEL NO. 1	N/A		BRACKET	4-20mA	0 - 38	FEET	4-WIRE	120VAC	Y301	6
N/A	GRSC-LSH-200	POINT LEVEL SWITCH	INFLUENT SCREEN CHANNEL NO. 2	LEVEL - HIGH	INFLUENT SCREEN CHANNEL NO. 2	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	10.0	FEET	N/A	N/A	Y301	4, 6
GRSC-LE-200A	GRSC-LIT-200	ULTRASONIC LEVEL TRANSDUCER	INFLUENT SCREEN CHANNEL NO. 2	LEVEL	INFLUENT SCREEN CHANNEL NO. 2	N/A	ENCLOSURE	BRACKET	4-20mA	0 - 38	FEET	4-WIRE	120VAC	Y301	6
GRSC-LE-200B		ULTRASONIC LEVEL TRANSDUCER	INFLUENT SCREEN CHANNEL NO. 2	LEVEL	INFLUENT SCREEN CHANNEL NO. 2	N/A		BRACKET	4-20mA	0 - 38	FEET	4-WIRE	120VAC	Y301	6
GRSC-AIT-001	GRSC-AE-001	GAS LEVEL TRANSMITTER	HEADWORKS BUILDING COMBUSTIBLE GAS	LEVEL	HEADWORKS BUILDING LEVEL 1	N/A	WALL	3/4"NPT	4-20mA	0-100	%LEL	3-WIRE	120VAC	Y302	
	GRSC-AE-002	GAS LEVEL TRANSMITTER	HEADWORKS BUILDING COMBUSTIBLE GAS	LEVEL	HEADWORKS BUILDING LEVEL 2	N/A	WALL	3/4"NPT	4-20mA	0-100	%LEL	3-WIRE	120VAC	Y301	
N/A	GRSC-HRN-001	ALARM HORN	HEADWORKS BUILDING COMBUSTIBLE GAS	AUDIBLE ANNUNCIATION	HEADWORKS BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	GRSC-HRN-002	ALARM HORN	HEADWORKS BUILDING COMBUSTIBLE GAS	AUDIBLE ANNUNCIATION	HEADWORKS BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	GRSC-HRN-003	ALARM HORN	HEADWORKS BUILDING COMBUSTIBLE GAS	AUDIBLE ANNUNCIATION	HEADWORKS BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	GRSC-HRN-004	ALARM HORN	HEADWORKS BUILDING COMBUSTIBLE GAS	AUDIBLE ANNUNCIATION	HEADWORKS BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	GRSC-STB-001	ALARM STROBE	HEADWORKS BUILDING COMBUSTIBLE GAS	VISUAL ANNUNCIATION	HEADWORKS BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	GRSC-STB-002	ALARM STROBE	HEADWORKS BUILDING COMBUSTIBLE GAS	VISUAL ANNUNCIATION	HEADWORKS BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	GRSC-STB-003	ALARM STROBE	HEADWORKS BUILDING COMBUSTIBLE GAS	VISUAL ANNUNCIATION	HEADWORKS BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	GRSC-STB-004	ALARM STROBE	HEADWORKS BUILDING COMBUSTIBLE GAS	VISUAL ANNUNCIATION	HEADWORKS BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	GRSC-STB-005	ALARM STROBE	HEADWORKS BUILDING COMBUSTIBLE GAS	VISUAL ANNUNCIATION	HEADWORKS BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	GRSC-STB-006	ALARM STROBE	HEADWORKS BUILDING COMBUSTIBLE GAS	VISUAL ANNUNCIATION	HEADWORKS BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	GRSC-STB-007	ALARM STROBE	HEADWORKS BUILDING COMBUSTIBLE GAS	VISUAL ANNUNCIATION	HEADWORKS BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	GRSC-VLV-125	THREE-WAY SOLENOID	INFLUENT SCREEN NO. 1 WASH WATER	VALVE	HEADWORKS BUILDING LEVEL 2	PROCESS PIPE	N/A	PROCESS PIPE	N/A	N/A	N/A	N/A	120VAC	Y301	
N/A	GRSC-VLV-225	THREE-WAY SOLENOID	INFLUENT SCREEN NO. 2 WASH WATER	VALVE	HEADWORKS BUILDING LEVEL 2	PROCESS PIPE	N/A	PROCESS PIPE	N/A	N/A	N/A	N/A	120VAC	Y301	
N/A	GRSC-PSL-001	PRESSURE SWITCH W/ GAUGE	HEADWORKS PROCESS WATER	PRESSURE - LOW	HEADWORKS BUILDING	ISOLATION VALVE W/ 1/2" NPT	N/A	PROCESS PIPE	N.O. CONTACT	40	PSIG	N/A	N/A	Y601	2, 4
N/A	GRSC-PSH-312	PRESSURE SWITCH W/ GAUGE	GRIT PUMPING DISCHARGE	PRESSURE - HIGH	HEADWORKS BUILDING	WAFER	N/A	PROCESS PIPE	N.O. CONTACT	5.0	PSIG	N/A	N/A	Y302	2, 4
N/A	GRSC-LSH-301	LEVEL SWITCH - FLOAT	GRIT SYSTEM EFFLUENT	LEVEL - HIGH	GRIT EFFLUENT CHANNEL	IMMERSION	N/A	SUSPENDED	N.O. CONTACT		FEET	N/A	N/A	Y302	2, 4
GRSC-FIT-311	GRSC-FE-311	4-INCH MAGNETIC FLOW METER W/ REMOTE XMTR	GRIT PUMPING DISCHARGE	FLOW	HEADWORKS BUILDING	FLANGE	WALL	PROCESS PIPE	4-20mA	0 - 500	GPM	4-WIRE	120VAC	Y302	2
N/A	GRSC-PI-311	PRESSURE GAUGE	GRIT PUMPING INTAKE	PRESSURE	HEADWORKS BUILDING	1/4" NPT	N/A	PROCESS PIPE	N/A	-15 to +15	PSIG	N/A	N/A	Y301	
N/A	**AGS-HRN-001**	**ALARM HORN**	**AGS BUILDING VENTILATION FAILURE**	**AUDIBLE ANNUNCIATION**	**AGS PROCESSING BUILDING**	**N/A**	**N/A**	**WALL**	**N/A**	**N/A**	**N/A**	**N/A**	**120VAC**	**N/A**	
N/A	**AGS-HRN-002**	**ALARM HORN**	**AGS BUILDING VENTILATION FAILURE**	**AUDIBLE ANNUNCIATION**	**AGS PROCESSING BUILDING**	**N/A**	**N/A**	**WALL**	**N/A**	**N/A**	**N/A**	**N/A**	**120VAC**	**N/A**	
N/A	**AGS-HRN-003**	**ALARM HORN**	**AGS BUILDING VENTILATION FAILURE**	**AUDIBLE ANNUNCIATION**	**AGS PROCESSING BUILDING**	**N/A**	**N/A**	**WALL**	**N/A**	**N/A**	**N/A**	**N/A**	**120VAC**	**N/A**	
N/A	**AGS-HRN-004**	**ALARM HORN**	**AGS BUILDING VENTILATION FAILURE**	**AUDIBLE ANNUNCIATION**	**AGS PROCESSING BUILDING**	**N/A**	**N/A**	**WALL**	**N/A**	**N/A**	**N/A**	**N/A**	**120VAC**	**N/A**	
N/A	**AGS-HRN-005**	**ALARM HORN**	**AGS BUILDING VENTILATION FAILURE**	**AUDIBLE ANNUNCIATION**	**AGS PROCESSING BUILDING**	**N/A**	**N/A**	**WALL**	**N/A**	**N/A**	**N/A**	**N/A**	**120VAC**	**N/A**	
N/A	**AGS-HRN-006**	**ALARM HORN**	**AGS BUILDING VENTILATION FAILURE**	**AUDIBLE ANNUNCIATION**	**AGS PROCESSING BUILDING**	**N/A**	**N/A**	**WALL**	**N/A**	**N/A**	**N/A**	**N/A**	**120VAC**	**N/A**	
N/A	**AGS-STB-001**	**ALARM STROBE**	**AGS BUILDING VENTILATION FAILURE**	**VISUAL ANNUNCIATION**	**AGS PROCESSING BUILDING**	**N/A**	**N/A**	**WALL**	**N/A**	**N/A**	**N/A**	**N/A**	**120VAC**	**N/A**	

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Todd Creek
WWTP - Instrument List

INSTRUMENT TAG NUMBER		TYPE	DESCRIPTION	FUNCTION	LOCATION	PROCESS CONNECTION(S)	MOUNTING		OUTPUT	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER	DRAWING	SPECIAL NOTES
TRANSMITTER	ELEMENT						TRANSMITTER	ELEMENT							
N/A	AGS-STB-002	ALARM STROBE	AGS BUILDING VENTILATION FAILURE	VISUAL ANNUNCIATION	AGS PROCESSING BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	AGS-STB-003	ALARM STROBE	AGS BUILDING VENTILATION FAILURE	VISUAL ANNUNCIATION	AGS PROCESSING BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	AGS-STB-004	ALARM STROBE	AGS BUILDING VENTILATION FAILURE	VISUAL ANNUNCIATION	AGS PROCESSING BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	AGS-STB-005	ALARM STROBE	AGS BUILDING VENTILATION FAILURE	VISUAL ANNUNCIATION	AGS PROCESSING BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	AGS-STB-006	ALARM STROBE	AGS BUILDING VENTILATION FAILURE	VISUAL ANNUNCIATION	AGS PROCESSING BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	AGS-STB-007	ALARM STROBE	AGS BUILDING VENTILATION FAILURE	VISUAL ANNUNCIATION	AGS PROCESSING BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
AGS-AIT-001	AGS-AE-001	TSS ANALYZER	AGS INFLUENT	TSS	AGS UTILITY CORRIDOR	IMMERSION	WALL	PROCESS PIPE	4-20mA	0 - 10,000	mg/L	4-WIRE	120VAC	Y401	2
AGS-FIT-101	AGS-FE-101	30" MAGNETIC FLOW METER W/ REMOTE XMTR	AGS REACTOR NO. 1 INFLUENT	FLOW	AGS UTILITY CORRIDOR	FLANGE	RACK-MOUNT	PROCESS PIPE	4-20mA	0 - 15,000	GPM	4-WIRE	120VAC	Y401	2
AGS-FIT-201	AGS-FE-201	30" MAGNETIC FLOW METER W/ REMOTE XMTR	AGS REACTOR NO. 2 INFLUENT	FLOW	AGS UTILITY CORRIDOR	FLANGE	RACK-MOUNT	PROCESS PIPE	4-20mA	0 - 15,000	GPM	4-WIRE	120VAC	Y401	2
AGS-FIT-301	AGS-FE-301	30" MAGNETIC FLOW METER W/ REMOTE XMTR	AGS REACTOR NO. 3 INFLUENT	FLOW	AGS UTILITY CORRIDOR	FLANGE	RACK-MOUNT	PROCESS PIPE	4-20mA	0 - 15,000	GPM	4-WIRE	120VAC	Y401	2
AGS-FIT-401	AGS-FE-401	30" MAGNETIC FLOW METER W/ REMOTE XMTR	AGS REACTOR NO. 4 INFLUENT	FLOW	AGS UTILITY CORRIDOR	FLANGE	RACK-MOUNT	PROCESS PIPE	4-20mA	0 - 15,000	GPM	4-WIRE	120VAC	Y401	2
AGS-LI-101	N/A	DIGITAL PANEL METER INDICATOR	AGS BASIN NO. 1	LEVEL	AGS BASIN NO. 2	N/A	RACK-MOUNT	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y402	2, 5
AGS-LI-201	N/A	DIGITAL PANEL METER INDICATOR	AGS BASIN NO. 2	LEVEL	AGS BASIN NO. 2	N/A	RACK-MOUNT	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y402	2, 5
AGS-LI-301	N/A	DIGITAL PANEL METER INDICATOR	AGS BASIN NO. 3	LEVEL	AGS BASIN NO. 3	N/A	RACK-MOUNT	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y403	2, 5
AGS-LI-401	N/A	DIGITAL PANEL METER INDICATOR	AGS BASIN NO. 4	LEVEL	AGS BASIN NO. 4	N/A	RACK-MOUNT	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y403	2, 5
AGS-FIT-601	AGS-FE-601	8" MAGNETIC FLOW METER W/ REMOTE XMTR	SLUDGE BUFFER SUPERNATANT RETURN	FLOW	AGS PUMPING ROOM	FLANGE	WALL	PROCESS PIPE	4-20mA	0 - 1,200	GPM	4-WIRE	120VAC	Y405	2
AGS-FIT-701	AGS-FE-701	4" MAGNETIC FLOW METER W/ INTEGRAL XMTR	SLUDGE BUFFER SLUDGE PUMPING	FLOW	AGS PUMPING ROOM	FLANGE	INTEGRAL	PROCESS PIPE	4-20mA	0 - 500	GPM	4-WIRE	120VAC	Y405	2
AGS-FIT-801	AGS-FE-801	6" MAGNETIC FLOW METER W/ INTEGRAL XMTR	WLC TANK RETURN	FLOW	AGS UTILITY CORRIDOR	FLANGE	INTEGRAL	PROCESS PIPE	4-20mA	0 - 5,000	GPM	4-WIRE	120VAC	Y406	2
N/A	AGS-PI-610	PRESSURE GAUGE	SUPERNATANT PUMP NO. 1 DISCHARGE	PRESSURE	AGS PUMPING ROOM	1/4" NPT	N/A	PROCESS PIPE	N/A	0 - 50	PSIG	N/A	N/A	Y405	
N/A	AGS-PI-620	PRESSURE GAUGE	SUPERNATANT PUMP NO. 2 DISCHARGE	PRESSURE	AGS PUMPING ROOM	1/4" NPT	N/A	PROCESS PIPE	N/A	0 - 50	PSIG	N/A	N/A	Y405	
N/A	AGS-PI-630	PRESSURE GAUGE	SUPERNATANT PUMP NO. 3 DISCHARGE	PRESSURE	AGS PUMPING ROOM	1/4" NPT	N/A	PROCESS PIPE	N/A	0 - 50	PSIG	N/A	N/A	Y405	
N/A	AGS-PI-710	PRESSURE GAUGE	SLUDGE PUMP NO. 1 DISCHARGE	PRESSURE	AGS PUMPING ROOM	1/4" NPT	N/A	PROCESS PIPE	N/A	0 - 50	PSIG	N/A	N/A	Y405	
N/A	AGS-PI-720	PRESSURE GAUGE	SLUDGE PUMP NO. 2 DISCHARGE	PRESSURE	AGS PUMPING ROOM	1/4" NPT	N/A	PROCESS PIPE	N/A	0 - 50	PSIG	N/A	N/A	Y405	
N/A	AGS-PI-730	PRESSURE GAUGE	SLUDGE PUMP NO. 3 DISCHARGE	PRESSURE	AGS PUMPING ROOM	1/4" NPT	N/A	PROCESS PIPE	N/A	0 - 50	PSIG	N/A	N/A	Y405	
AGS-LI-510	N/A	DIGITAL PANEL METER INDICATOR	SLUDGE BUFFER TANK NO. 1	LEVEL	SLUDGE BUFFER TANK NO. 1	N/A	RACK-MOUNT	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y405	2, 5
AGS-LI-520	N/A	DIGITAL PANEL METER INDICATOR	SLUDGE BUFFER TANK NO. 2	LEVEL	SLUDGE BUFFER TANK NO. 2	N/A	RACK-MOUNT	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y405	2, 5
N/A	AGS-PI-810	PRESSURE GAUGE	WLC PUMP NO. 1 DISCHARGE	PRESSURE	AGS PUMPING ROOM	1/4" NPT	N/A	PROCESS PIPE	N/A	0 - 50	PSIG	N/A	N/A	Y406	
N/A	AGS-PI-820	PRESSURE GAUGE	WLC PUMP NO. 2 DISCHARGE	PRESSURE	AGS PUMPING ROOM	1/4" NPT	N/A	PROCESS PIPE	N/A	0 - 50	PSIG	N/A	N/A	Y406	
AGS-LI-801	N/A	DIGITAL PANEL METER INDICATOR	WLC TANK	LEVEL	WLC TANK	N/A	RACK-MOUNT	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y406	2, 5
UV-FIT-301	N/A	RADAR FLOW TRANSMITTER	PARSHALL FLUME	FLOW	EFFLUENT STRUCTURE	N/A	REMOTE	BRACKET	4-20mA	0 - 15,000	GPM	2-WIRE	LOOP	Y601	2
UV-FI-301	N/A	DIGITAL PANEL METER INDICATOR	PARSHALL FLUME	FLOW	EFFLUENT STRUCTURE	N/A	RACK-MOUNT	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y601	2

Todd Creek
WWTP - Instrument List

INSTRUMENT TAG NUMBER		TYPE	DESCRIPTION	FUNCTION	LOCATION	PROCESS CONNECTION(S)	MOUNTING		OUTPUT	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER	DRAWING	SPECIAL NOTES
TRANSMITTER	ELEMENT						TRANSMITTER	ELEMENT							
N/A	PW-PI-111	PRESSURE GAUGE	PW PUMP NO. 1 DISCHARGE	PRESSURE	UV DISINFECTION BUILDING	1/4" NPT	N/A	PROCESS PIPE	N/A	0 - 200	PSIG	N/A	N/A	Y601	
N/A	PW-PI-121	PRESSURE GAUGE	PW PUMP NO. 2 DISCHARGE	PRESSURE	UV DISINFECTION BUILDING	1/4" NPT	N/A	PROCESS PIPE	N/A	0 - 200	PSIG	N/A	N/A	Y601	
N/A	PW-PI-131	PRESSURE GAUGE	PW PUMP NO. 3 DISCHARGE	PRESSURE	UV DISINFECTION BUILDING	1/4" NPT	N/A	PROCESS PIPE	N/A	0 - 200	PSIG	N/A	N/A	Y601	
PW-FIT-101	PW-FE-101	4" MAGNETIC FLOW METER W/ INTEGRAL XMTR	PROCESS WATER PUMPING	FLOW	UV BUILDING	FLANGE	INTEGRAL	PROCESS PIPE	4-20mA	0 - 600	GPM	4-WIRE	120VAC	Y601	
UV-AIT-010	UV-AE-011	UV TRANSMITTANCE ANALYZER	UV DISINFECTION	UVT	UV INFLUENT CHANNEL	IMMERSION	WALL	BRACKET	4-20mA	0 -100	%	4-WIRE	120VAC	Y601	
PW-PIT-101	N/A	PRESSURE TRANSMITTER	PROCESS WATER PUMPING - UPSTREAM OF STRAINER	PRESSURE	UV BUILDING	1/2" NPT	PROCESS PIPE	N/A	4-20mA	0 - 200	PSI	2-WIRE	LOOP	Y601	
N/A	PW-PI-102	PRESSURE GAUGE	PRESSURE UPSTREAM OF STRAINER	PRESSURE	UV DISINFECTION BUILDING	1/4" NPT	N/A	PROCESS PIPE	N/A	0 - 200	PSIG	N/A	N/A	Y601	
PW-PIT-103	N/A	PRESSURE TRANSMITTER	PROCESS WATER PUMPING - DOWNSTREAM OF STRAINER	PRESSURE	UV BUILDING	1/2" NPT	PROCESS PIPE	N/A	4-20mA	0 - 200	PSI	2-WIRE	LOOP	Y601	
N/A	PW-PI-103	PRESSURE GAUGE	PRESSURE DOWNSTREAM OF STRAINER	PRESSURE	UV DISINFECTION BUILDING	1/4" NPT	N/A	PROCESS PIPE	N/A	0 - 200	PSIG	N/A	N/A	Y601	
N/A	PW-LSL-101	LEVEL SWITCH - FLOAT	PROCESS WATER PUMPING	LEVEL - LOW	PROCESS WATER WET WELL	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	2.5	FEET	N/A	N/A	Y601	
N/A	PW-LSH-101	LEVEL SWITCH - FLOAT	PROCESS WATER PUMPING	LEVEL - HIGH	PROCESS WATER WET WELL	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	8.0	FEET	N/A	N/A	Y601	
N/A	UV-LSL-101	LEVEL SWITCH	UV CHANNEL NO. 1	LEVEL - LOW	UV CHANNEL NO. 1	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	4.5	FEET	N/A	N/A	Y601	6
N/A	UV-LSL-201	LEVEL SWITCH	UV CHANNEL NO. 2	LEVEL - LOW	UV CHANNEL NO. 2	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	4.5	FEET	N/A	N/A	Y601	6
SPB-PIT-001	N/A	PRESSURE TRANSMITTER	SOLIDS PROCESSING BUILDING PROCESS WATER	PRESSURE	SOLIDS PROCESSING BUILDING	1/2" NPT	PROCESS PIPE	N/A	4-20mA	0 - 200	PSI	2-WIRE	LOOP	Y601	
N/A	SPB-PSL-001	PRESSURE SWITCH W/ GAUGE	PROCESS WATER AT SOLIDS PROCESSING BUILDING	PRESSURE - LOW	SOLIDS PROCESSING BUILDING	ISOLATION VALVE W/ 1/2" NPT	N/A	PROCESS PIPE	N.O. CONTACT	40	PSIG	N/A	N/A	Y601	
N/A	SPB-HRN-001	ALARM HORN	SOLIDS PROCESSING BUILDING VENTILATION FAILURE	AUDIBLE ANNUNCIATION	SOLIDS PROCESSING BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	SPB-HRN-002	ALARM HORN	SOLIDS PROCESSING BUILDING VENTILATION FAILURE	AUDIBLE ANNUNCIATION	SOLIDS PROCESSING BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	SPB-HRN-003	ALARM HORN	SOLIDS PROCESSING BUILDING VENTILATION FAILURE	AUDIBLE ANNUNCIATION	SOLIDS PROCESSING BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	SPB-STB-001	ALARM STROBE	SOLIDS PROCESSING BUILDING VENTILATION FAILURE	VISUAL ANNUNCIATION	SOLIDS PROCESSING BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	SPB-STB-002	ALARM STROBE	SOLIDS PROCESSING BUILDING VENTILATION FAILURE	VISUAL ANNUNCIATION	SOLIDS PROCESSING BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	SPB-STB-003	ALARM STROBE	SOLIDS PROCESSING BUILDING VENTILATION FAILURE	VISUAL ANNUNCIATION	SOLIDS PROCESSING BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	SPB-STB-004	ALARM STROBE	SOLIDS PROCESSING BUILDING VENTILATION FAILURE	VISUAL ANNUNCIATION	SOLIDS PROCESSING BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	SPB-STB-005	ALARM STROBE	SOLIDS PROCESSING BUILDING VENTILATION FAILURE	VISUAL ANNUNCIATION	SOLIDS PROCESSING BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
WAS-LIT-101	N/A	RADAR LEVEL TRANSMITTER	THIN SLUDGE TANKS	LEVEL	THIN SLUDGE TANK NO. 1	N/A	BRACKET	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y702	2, 4
WAS-LI-101	N/A	DIGITAL PANEL METER INDICATOR	THIN SLUDGE TANKS	LEVEL	THIN SLUDGE TANK NO. 1	N/A	RACK-MOUNT	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y702	2
WAS-AIT-101	WAS-AE-101	DISSOLVED OXYGEN ANAYLYZER	THIN SLUDGE TANKS	DISSOLVED OXYGEN	THIN SLUDGE TANK NO. 1	IMMERSION	RACK-MOUNT	POLE	4-20mA	0 - 10	mg/L	4-WIRE	120VAC	Y702	2, 5
N/A	WAS-LSH-101	LEVEL SWITCH - FLOAT	THIN SLUDGE TANKS	LEVEL - HIGH	THIN SLUDGE TANK NO. 1	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	22.0	FEET	N/A	N/A	Y702	2, 3, 4
N/A	WAS-LSL-101	LEVEL SWITCH - FLOAT	THIN SLUDGE TANKS	LEVEL - LOW	THIN SLUDGE TANK NO. 1	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	2.0	FEET	N/A	N/A	Y702	2, 3, 4
WAS-LIT-201	N/A	RADAR LEVEL TRANSMITTER	THIN SLUDGE TANKS	LEVEL	THIN SLUDGE TANK NO. 2	N/A	BRACKET	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y702	2, 4
WAS-LI-201	N/A	DIGITAL PANEL METER INDICATOR	THIN SLUDGE TANKS	LEVEL	THIN SLUDGE TANK NO. 1	N/A	RACK-MOUNT	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y702	2

INSTRUMENT TAG NUMBER		TYPE	DESCRIPTION	FUNCTION	LOCATION	PROCESS CONNECTION(S)	MOUNTING		OUTPUT	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER	DRAWING	SPECIAL NOTES
TRANSMITTER	ELEMENT						TRANSMITTER	ELEMENT							
WAS-AIT-201	WAS-AE-201	DISSOLVED OXYGEN ANAYLYZER	THIN SLUDGE TANKS	DISSOLVED OXYGEN	THIN SLUDGE TANK NO. 2	IMMERSION	RACK-MOUNT	POLE	4-20mA	0 - 10	mg/L	4-WIRE	120VAC	Y702	2, 5
N/A	WAS-LSH-201	LEVEL SWITCH - FLOAT	THIN SLUDGE TANKS	LEVEL - HIGH	THIN SLUDGE TANK NO. 2	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	22.0	FEET	N/A	N/A	Y702	2, 3, 4
N/A	WAS-LSL-201	LEVEL SWITCH - FLOAT	THIN SLUDGE TANKS	LEVEL - LOW	THIN SLUDGE TANK NO. 2	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	2.0	FEET	N/A	N/A	Y702	2, 3, 4
N/A	WAS-PSL-310a	PRESSURE SWITCH W/ GAUGE	THIN SLUDGE PUMP NO. 1 SUCTION	PRESSURE - LOW	THIN SLUDGE PUMP NO. 1	WAFER	N/A	PROCESS PIPE	N.O. CONTACT	-5.0	PSIG	N/A	N/A	Y702	6
N/A	WAS-PSH-310B	PRESSURE SWITCH W/ GAUGE	THIN SLUDGE PUMP NO. 1 DISCHARGE	PRESSURE - HIGH	THIN SLUDGE PUMP NO. 1	WAFER	N/A	PROCESS PIPE	N.O. CONTACT	35.0	PSIG	N/A	N/A	Y702	6
N/A	WAS-PSL-320A	PRESSURE SWITCH W/ GAUGE	THIN SLUDGE PUMP NO. 2 SUCTION	PRESSURE - LOW	THIN SLUDGE PUMP NO. 2	WAFER	N/A	PROCESS PIPE	N.O. CONTACT	-5.0	PSIG	N/A	N/A	Y702	6
N/A	WAS-PSH-320B	PRESSURE SWITCH W/ GAUGE	THIN SLUDGE PUMP NO. 2 DISCHARGE	PRESSURE - HIGH	THIN SLUDGE PUMP NO. 2	WAFER	N/A	PROCESS PIPE	N.O. CONTACT	35.0	PSIG	N/A	N/A	Y702	6
N/A	WAS-PSL-330A	PRESSURE SWITCH W/ GAUGE	THIN SLUDGE PUMP NO. 3 SUCTION	PRESSURE - LOW	THIN SLUDGE PUMP NO. 3	WAFER	N/A	PROCESS PIPE	N.O. CONTACT	-5.0	PSIG	N/A	N/A	Y702	6
N/A	WAS-PSH-330B	PRESSURE SWITCH W/ GAUGE	THIN SLUDGE PUMP NO. 3 DISCHARGE	PRESSURE - HIGH	THIN SLUDGE PUMP NO. 3	WAFER	N/A	PROCESS PIPE	N.O. CONTACT	35.0	PSIG	N/A	N/A	Y702	6
WAS-AIT-301	WAS-AE-301	TOTAL SOLIDS ANALYZER - MICROWAVE	RDT FEED	TS	RDT NO. 1 FEED LINE	FLANGE	INTEGRAL	PROCESS PIPE	4-20mA	0 - 5	%	4-WIRE	120VAC	Y702	5
WAS-AIT-302	WAS-AE-302	TOTAL SOLIDS ANALYZER - MICROWAVE	RDT FEED	TS	RDT NO. 2 FEED LINE	FLANGE	INTEGRAL	PROCESS PIPE	4-20mA	0 - 5	%	4-WIRE	120VAC	Y702	5
WAS-FIT-301	WAS-FE-301	4" MAGNETIC FLOW METER W/ INTEGRAL XMTR	RDT FEED	FLOW	RDT NO. 1 FEED LINE	FLANGE	INTEGRAL	PROCESS PIPE	4-20mA	0 - 600	GPM	4-WIRE	120VAC	Y702	
WAS-FIT-302	WAS-FE-302	4" MAGNETIC FLOW METER W/ INTEGRAL XMTR	RDT FEED	FLOW	RDT NO. 2 FEED LINE	FLANGE	INTEGRAL	PROCESS PIPE	4-20mA	0 - 600	GPM	4-WIRE	120VAC	Y702	
STH-AIT-131	STH-AE-131	TOTAL SOLIDS ANALYZER - MICROWAVE	THICKENED SLUDGE PUMPING	TS	THICKENED SLUDGE PUMP NO. 1	FLANGE	RACK-MOUNT	PROCESS PIPE	4-20mA	0 - 5	%	4-WIRE	120VAC	Y703	5
N/A	STH-PSH-130	PRESSURE SWITCH W/ GAUGE	THICKENED SLUDGE PUMPING	PRESSURE - HIGH	THICKENED SLUDGE PUMP NO. 1	WAFER	N/A	PROCESS PIPE	N.O. CONTACT	95.0	PSIG	N/A	N/A	Y703	6
STH-FIT-131	STH-FE-131	4" MAGNETIC FLOW METER W/ INTEGRAL XMTR	THICKENED SLUDGE PUMPING	FLOW	THICKENED SLUDGE PUMP NO. 1	FLANGE	INTEGRAL	PROCESS PIPE	4-20mA	0 - 200	GPM	4-WIRE	120VAC	Y703	
STH-AIT-231	STH-AE-231	TOTAL SOLIDS ANALYZER - MICROWAVE	THICKENED SLUDGE PUMPING	TS	THICKENED SLUDGE PUMP NO. 2	FLANGE	RACK-MOUNT	PROCESS PIPE	4-20mA	0 - 5	%	4-WIRE	120VAC	Y703	5
N/A	STH-PSH-230	PRESSURE SWITCH W/ GAUGE	THICKENED SLUDGE PUMPING	PRESSURE - HIGH	THICKENED SLUDGE PUMP NO. 2	WAFER	N/A	PROCESS PIPE	N.O. CONTACT	95.0	PSIG	N/A	N/A	Y703	6
STH-FIT-231	STH-FE-231	4" MAGNETIC FLOW METER W/ INTEGRAL XMTR	THICKENED SLUDGE PUMPING	FLOW	THICKENED SLUDGE PUMP NO. 2	FLANGE	INTEGRAL	PROCESS PIPE	4-20mA	0 - 200	GPM	4-WIRE	120VAC	Y703	
SCIN-LIT-101	N/A	RADAR LEVEL TRANSMITTER	THICKENED SLUDGE STORAGE	LEVEL	THICKENED SLUDGE TANK NO. 1	N/A	FLANGE	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y704	2,4
N/A	SCIN-LSH-101	LEVEL SWITCH - FLOAT	THICKENED SLUDGE STORAGE	LEVEL - HIGH	THICKENED SLUDGE TANK NO. 1	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	22.0	FEET	N/A	N/A	Y704	2, 3, 4
SCIN-LIT-201	N/A	RADAR LEVEL TRANSMITTER	THICKENED SLUDGE STORAGE	LEVEL	THICKENED SLUDGE TANK NO. 2	N/A	FLANGE	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y704	2,4
N/A	SCIN-LSH-201	LEVEL SWITCH - FLOAT	THICKENED SLUDGE STORAGE	LEVEL - HIGH	THICKENED SLUDGE TANK NO. 2	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	22.0	FEET	N/A	N/A	Y704	2, 3, 4
N/A	SCIN-PSL-110	PRESSURE SWITCH W/ GAUGE	THICKENED SLUDGE PUMPING	PRESSURE - LOW	SLUDGE LOADOUT PUMP NO. 1	WAFER	N/A	PROCESS PIPE	N.O. CONTACT	-5.0	PSIG	N/A	N/A	Y704	6
N/A	SCIN-PSH-110	PRESSURE SWITCH W/ GAUGE	THICKENED SLUDGE PUMPING	PRESSURE - HIGH	SLUDGE LOADOUT PUMP NO. 1	WAFER	N/A	PROCESS PIPE	N.O. CONTACT	75.0	PSIG	N/A	N/A	Y704	6
SCIN-FIT-111	SCIN-FE-111	8" MAGNETIC FLOW METER W/ REMOTE XMTR	THICKENED SLUDGE PUMPING	FLOW	SLUDGE LOADOUT PUMP NO. 1	FLANGE	WALL	PROCESS PIPE	4-20mA	0 - 600	GPM	4-WIRE	120VAC	Y704	
SCIN-FI-111	N/A	LARGE DISPLAY PROCESS INDICATOR	THICKENED SLUDGE PUMPING	FLOW	SLUDGE LOADOUT PUMP NO. 1 EXTERIOR	N/A	WALL	N/A	4-20mA	0 - 600	GPM	4-WIRE	120VAC	Y704	
N/A	SCIN-PSL-210	PRESSURE SWITCH W/ GAUGE	THICKENED SLUDGE PUMPING	PRESSURE - LOW	SLUDGE LOADOUT PUMP NO. 2	WAFER	N/A	PROCESS PIPE	N.O. CONTACT	-5.0	PSIG	N/A	N/A	Y704	6
N/A	SCIN-PSH-210	PRESSURE SWITCH W/ GAUGE	THICKENED SLUDGE PUMPING	PRESSURE - HIGH	SLUDGE LOADOUT PUMP NO. 2	WAFER	N/A	PROCESS PIPE	N.O. CONTACT	75.0	PSIG	N/A	N/A	Y704	6
SCIN-FIT-211	SCIN-FE-211	8" MAGNETIC FLOW METER W/ REMOTE XMTR	THICKENED SLUDGE PUMPING	FLOW	SLUDGE LOADOUT PUMP NO. 2	FLANGE	WALL	PROCESS PIPE	4-20mA	0 - 600	GPM	4-WIRE	120VAC	Y704	
SCIN-FI-211	N/A	LARGE DISPLAY PROCESS INDICATOR	THICKENED SLUDGE PUMPING	FLOW	SLUDGE LOADOUT PUMP NO. 2 EXTERIOR	N/A	WALL	N/A	4-20mA	0 - 600	GPM	4-WIRE	120VAC	Y704	
N/A	WAS-PDS-401	PRESSURE DIFFERENTIAL SWITCH	SLUDGE BLOWERS INTAKE	PRESSURE - HIGH	SLUDGE BLOWERS ROOM	N/A	N/A	FILTER	N.O. CONTACT	-	PSIG	N/A	N/A	Y705	

Todd Creek
WWTP - Instrument List

INSTRUMENT TAG NUMBER		TYPE	DESCRIPTION	FUNCTION	LOCATION	PROCESS CONNECTION(S)	MOUNTING		OUTPUT	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER	DRAWING	SPECIAL NOTES
TRANSMITTER	ELEMENT						TRANSMITTER	ELEMENT							
POL-LIT-101	N/A	RADAR LEVEL TRANSMITTER	POLYMER TOTE NO. 1	LEVEL	POLYMER TOTE NO. 1	N/A	BRACKET	N/A	4-20mA	TBD	FEET	2-WIRE	LOOP	Y707	
POL-LI-101	N/A	DIGITAL PANEL METER INDICATOR	POLYMER TOTE NO. 1	LEVEL	POLYMER TOTE NO. 1	N/A	RACK-MOUNT	N/A	4-20mA	TBD	FEET	2-WIRE	LOOP	Y707	
POL-LIT-201	N/A	RADAR LEVEL TRANSMITTER	POLYMER TOTE NO. 2	LEVEL	POLYMER TOTE NO. 2	N/A	BRACKET	N/A	4-20mA	TBD	FEET	2-WIRE	LOOP	Y707	
POL-LI-201	N/A	DIGITAL PANEL METER INDICATOR	POLYMER TOTE NO. 2	LEVEL	POLYMER TOTE NO. 2	N/A	RACK-MOUNT	N/A	4-20mA	TBD	FEET	2-WIRE	LOOP	Y707	
PSEW-LIT-101	N/A	RADAR LEVEL TRANSMITTER	PLANT SEWER RETURN PUMP STATION WET WELL	LEVEL	PLANT SEWER RETURN PUMP STATION WE T WELL	N/A	FLANGE	N/A	4-20mA	0 - 15	FEET	2-WIRE	LOOP	Y801	2, 5
N/A	PSEW-LSHH-101	LEVEL SWITCH - FLOAT	PLANT SEWER RETURN PUMP STATION WET WELL	LEVEL - HIGH-HIGH	PLANT SEWER RETURN PUMP STATION WE T WELL	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	12.0	FEET	N/A	N/A	Y801	2, 3, 4
N/A	PSEW-LSH-101	LEVEL SWITCH - FLOAT	PLANT SEWER RETURN PUMP STATION WET WELL	LEVEL - HIGH	PLANT SEWER RETURN PUMP STATION WE T WELL	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	10.0	FEET	N/A	N/A	Y801	2, 3, 4
N/A	PSEW-LSL-101	LEVEL SWITCH - FLOAT	PLANT SEWER RETURN PUMP STATION WET WELL	LEVEL - LOW	PLANT SEWER RETURN PUMP STATION WE T WELL	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	2.0	FEET	N/A	N/A	Y801	2, 3, 4
N/A	PSEW-LSLL-101	LEVEL SWITCH - FLOAT	PLANT SEWER RETURN PUMP STATION WET WELL	LEVEL - LOW-LOW	PLANT SEWER RETURN PUMP STATION WE T WELL	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	1.5	FEET	N/A	N/A	Y801	2, 3, 4
PSEW-FIT-101	PSEW-FE-101	8" MAGNETIC FLOW METER W/ REMOTE XMTR	PLANT SEWER RETURN PUMPING	FLOW	HEADWORKS BUILDING	FLANGE	WALL	PROCESS PIPE	4-20mA	0 - 1,000	GPM	4-WIRE	120VAC	Y301	2

Todd Creek
WWTP - Instrument List

INSTRUMENT TAG NUMBER		TYPE	DESCRIPTION	FUNCTION	LOCATION	PROCESS	MOUNTING		OUTPUT	RANGE/	ENGINEERING	XMTR	POWER	DRAWING	SPECIAL
TRANSMITTER	ELEMENT					CONNECTION(S)	TRANSMITTER	ELEMENT		SET POINT	UNIT	TYPE			NOTES
AGS-FIT-102	AGS-FE-102	THERMAL MASS FLOW METER W/ INTEGRAL XMTR	AGS BASIN NO. 1 PROCESS AIR	FLOW	AGS BASIN NO. 1 WALKWAY	1" NPT INSERTION	INTEGRAL	PROCESS PIPE	4-20mA	0 - 15,000	SCFM	4-WIRE	120VAC	Y402	2, 6
AGS-PIT-101	N/A	PRESSURE TRANSMITTER	AGS BASIN NO. 1	PRESSURE	AGS BASIN NO. 1	1/2" NPT	PROCESS PIPE	N/A	4-20mA	0 - 25	PSIG	2-WIRE	LOOP	Y402	2, 6
AGS-LT-101	N/A	SUBMERSIBLE LEVEL TRANSDUCER	AGS BASIN NO. 1	LEVEL	AGS BASIN NO. 1	N/A	PIPE	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y402	2,4, 6
AGS-AIT-110	AGS-AE-111	NH4 TRANSMITTER	AGS BASIN NO. 1	NH4	AGS BASIN NO. 1	IMMERSION	RACK-MOUNT	POLE	4-20mA	0 - 100	mg/L	4-WIRE	120VAC	Y402	2, 6
1 **AGS-AIT-120**	**AGS-AE-121**	**pH ANALYZER**	**AGS BASIN NO. 1**	**pH**	**AGS BASIN NO. 1**	**IMMERSION**	**RACK-MOUNT**	**POLE**	**4-20mA**	**0 - 14**	**SU**	**4-WIRE**	**120VAC**	**Y402**	**2, 6**
	AGS-AE-122	**DISSOLVED OXYGEN ANALYZER**	**AGS BASIN NO. 1**	**DISSOLVED OXYGEN**	**AGS BASIN NO. 1**	**IMMERSION**		**POLE**	**4-20mA**	**0 - 10.0**	**mg/L**	**4-WIRE**		**Y402**	
AGS-AIT-130	**AGS-AE-131**	**TSS ANALYZER**	**AGS BASIN NO. 1**	**TSS**	**AGS BASIN NO. 1**	**IMMERSION**	**RACK-MOUNT**	**POLE**	**4-20mA**	**0 - 50,000**	**mg/L**	**4-WIRE**	**120VAC**	**Y402**	**2, 6**
	AGS-AE-132	**ORP ANALYZER**	**AGS BASIN NO. 1**	**ORP**	**AGS BASIN NO. 1**	**IMMERSION**		**POLE**	**4-20mA**	**-1,500 - 1,500**	**mV**	**4-WIRE**		**Y402**	
AGS-AIT-140	**AGS-AE-141**	**NO3 ANALYZER**	**AGS BASIN NO. 1**	**NO3**	**AGS BASIN NO. 1**	**IMMERSION**	**RACK-MOUNT**	**POLE**	**4-20mA**	**0.5 - 20**	**mg/L**	**4-WIRE**	**120VAC**	**Y402**	**2, 6**
N/A	AGS-LSH-101	LEVEL SWITCH - FLOAT	AGS BASIN NO. 1	LEVEL - HIGH	AGS BASIN NO. 1	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	24	FEET	N/A	N/A	Y402	2, 4, 6
AGS-FIT-202	AGS-FE-202	THERMAL MASS FLOW METER W/ INTEGRAL XMTR	AGS BASIN NO. 2 PROCESS AIR	FLOW	AGS BASIN NO. 2 WALKWAY	1" NPT INSERTION	INTEGRAL	PROCESS PIPE	4-20mA	0 - 15,000	SCFM	4-WIRE	120VAC	Y402	2, 6
AGS-PIT-201	N/A	PRESSURE TRANSMITTER	AGS BASIN NO. 2	PRESSURE	AGS BASIN NO. 2	1/2" NPT	PROCESS PIPE	N/A	4-20mA	0 - 25	PSIG	2-WIRE	LOOP	Y402	2, 6
AGS-LT-201	N/A	SUBMERSIBLE LEVEL TRANSDUCER	AGS BASIN NO. 2	LEVEL	AGS BASIN NO. 2	N/A	PIPE	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y402	2,4, 6
AGS-AIT-210	AGS-AE-211	NH4 TRANSMITTER	AGS BASIN NO. 2	NH4	AGS BASIN NO. 2	IMMERSION	RACK-MOUNT	POLE	4-20mA	0 - 100	mg/L	4-WIRE	120VAC	Y402	2, 6
1 **AGS-AIT-220**	**AGS-AE-221**	**pH ANALYZER**	**AGS BASIN NO. 2**	**pH**	**AGS BASIN NO. 2**	**IMMERSION**	**RACK-MOUNT**	**POLE**	**4-20mA**	**0 - 14**	**SU**	**4-WIRE**	**120VAC**	**Y402**	**2, 6**
	AGS-AE-222	**DISSOLVED OXYGEN ANALYZER**	**AGS BASIN NO. 2**	**DISSOLVED OXYGEN**	**AGS BASIN NO. 2**	**IMMERSION**		**POLE**	**4-20mA**	**0 - 10.0**	**mg/L**	**4-WIRE**		**Y402**	
AGS-AIT-230	**AGS-AE-231**	**TSS ANALYZER**	**AGS BASIN NO. 2**	**TSS**	**AGS BASIN NO. 2**	**IMMERSION**	**RACK-MOUNT**	**POLE**	**4-20mA**	**0 - 50,000**	**mg/L**	**4-WIRE**	**120VAC**	**Y402**	**2, 6**
	AGS-AE-232	**ORP ANALYZER**	**AGS BASIN NO. 2**	**ORP**	**AGS BASIN NO. 2**	**IMMERSION**		**POLE**	**4-20mA**	**-1,500 - 1,500**	**mV**	**4-WIRE**		**Y402**	
AGS-AIT-240	**AGS-AE-241**	**NO3 ANALYZER**	**AGS BASIN NO. 2**	**NO3**	**AGS BASIN NO. 2**	**IMMERSION**	**RACK-MOUNT**	**POLE**	**4-20mA**	**0.5 - 20**	**mg/L**	**4-WIRE**	**120VAC**	**Y402**	**2, 6**
N/A	AGS-LSH-201	LEVEL SWITCH - FLOAT	AGS BASIN NO. 2	LEVEL - HIGH	AGS BASIN NO. 2	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	24	FEET	N/A	N/A	Y402	2, 4, 6
AGS-FIT-302	AGS-FE-302	THERMAL MASS FLOW METER W/ INTEGRAL XMTR	AGS BASIN NO. 3 PROCESS AIR	FLOW	AGS BASIN NO. 3 WALKWAY	1" NPT INSERTION	INTEGRAL	PROCESS PIPE	4-20mA	0 - 15,000	SCFM	4-WIRE	120VAC	Y403	2, 6
AGS-PIT-301	N/A	PRESSURE TRANSMITTER	AGS BASIN NO. 3	PRESSURE	AGS BASIN NO. 3	1/2" NPT	PROCESS PIPE	N/A	4-20mA	0 - 25	PSIG	2-WIRE	LOOP	Y402	2, 6
AGS-LT-301	N/A	SUBMERSIBLE LEVEL TRANSDUCER	AGS BASIN NO. 3	LEVEL	AGS BASIN NO. 3	N/A	PIPE	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y403	2,4, 6
AGS-AIT-310	AGS-AE-311	NH4 TRANSMITTER	AGS BASIN NO. 3	NH4	AGS BASIN NO. 3	IMMERSION	RACK-MOUNT	POLE	4-20mA	0 - 100	mg/L	4-WIRE	120VAC	Y403	2, 6
1 **AGS-AIT-320**	**AGS-AE-321**	**pH ANALYZER**	**AGS BASIN NO. 3**	**pH**	**AGS BASIN NO. 3**	**IMMERSION**	**RACK-MOUNT**	**POLE**	**4-20mA**	**0 - 14**	**SU**	**4-WIRE**	**120VAC**	**Y403**	**2, 6**
	AGS-AE-322	**DISSOLVED OXYGEN ANALYZER**	**AGS BASIN NO. 3**	**DISSOLVED OXYGEN**	**AGS BASIN NO. 3**	**IMMERSION**		**POLE**	**4-20mA**	**0 - 10.0**	**mg/L**	**4-WIRE**		**Y403**	
AGS-AIT-330	**AGS-AE-331**	**TSS ANALYZER**	**AGS BASIN NO. 3**	**TSS**	**AGS BASIN NO. 3**	**IMMERSION**	**RACK-MOUNT**	**POLE**	**4-20mA**	**0 - 50,000**	**mg/L**	**4-WIRE**	**120VAC**	**Y403**	**2, 6**
	AGS-AE-332	**ORP ANALYZER**	**AGS BASIN NO. 3**	**ORP**	**AGS BASIN NO. 3**	**IMMERSION**		**POLE**	**4-20mA**	**-1,500 - 1,500**	**mV**	**4-WIRE**		**Y403**	
AGS-AIT-340	**AGS-AE-341**	**NO3 ANALYZER**	**AGS BASIN NO. 3**	**NO3**	**AGS BASIN NO. 3**	**IMMERSION**	**RACK-MOUNT**	**POLE**	**4-20mA**	**0.5 - 20**	**mg/L**	**4-WIRE**	**120VAC**	**Y403**	**2, 6**
N/A	AGS-LSH-301	LEVEL SWITCH - FLOAT	AGS BASIN NO. 3	LEVEL - HIGH	AGS BASIN NO. 3	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	24	FEET	N/A	N/A	Y403	2, 4, 6

Todd Creek
WWTP - Instrument List

INSTRUMENT TAG NUMBER		TYPE	DESCRIPTION	FUNCTION	LOCATION	PROCESS CONNECTION(S)	MOUNTING		OUTPUT	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER	DRAWING	SPECIAL NOTES
TRANSMITTER	ELEMENT						TRANSMITTER	ELEMENT							
AGS-FIT-402	AGS-FE-402	THERMAL MASS FLOW METER W/ INTEGRAL XMTR	AGS BASIN NO. 4 PROCESS AIR	FLOW	AGS BASIN NO. 4 WALKWAY	1" NPT INSERTION	INTEGRAL	PROCESS PIPE	4-20mA	0 - 15,000	SCFM	4-WIRE	120VAC	Y403	2, 6
AGS-PIT-401	N/A	PRESSURE TRANSMITTER	AGS BASIN NO. 4	PRESSURE	AGS BASIN NO. 4	1/2" NPT	PROCESS PIPE	N/A	4-20mA	0 - 25	PSIG	2-WIRE	LOOP	Y402	2, 6
AGS-LT-401	N/A	SUBMERSIBLE LEVEL TRANSDUCER	AGS BASIN NO. 4	LEVEL	AGS BASIN NO. 4	N/A	PIPE	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y403	2,4, 6
AGS-AIT-410	AGS-AE-411	NH4 TRANSMITTER	AGS BASIN NO. 4	NH4	AGS BASIN NO. 4	IMMERSION	RACK-MOUNT	POLE	4-20mA	0 - 100	mg/L	4-WIRE	120VAC	Y403	2, 6
1 **AGS-AIT-420**	**AGS-AE-421**	**pH ANALYZER**	**AGS BASIN NO. 4**	**pH**	**AGS BASIN NO. 4**	**IMMERSION**	**RACK-MOUNT**	**POLE**	**4-20mA**	**0 - 14**	**SU**	**4-WIRE**	**120VAC**	**Y403**	**2, 6**
	AGS-AE-422	**DISSOLVED OXYGEN ANALYZER**	**AGS BASIN NO. 4**	**DISSOLVED OXYGEN**	**AGS BASIN NO. 4**	**IMMERSION**		**POLE**	**4-20mA**	**0 - 10.0**	**mg/L**	**4-WIRE**		**Y403**	
AGS-AIT-430	**AGS-AE-431**	**TSS ANALYZER**	**AGS BASIN NO. 4**	**TSS**	**AGS BASIN NO. 4**	**IMMERSION**	**RACK-MOUNT**	**POLE**	**4-20mA**	**0 - 50,000**	**mg/L**	**4-WIRE**	**120VAC**	**Y403**	**2, 6**
	AGS-AE-432	**ORP ANALYZER**	**AGS BASIN NO. 4**	**ORP**	**AGS BASIN NO. 4**	**IMMERSION**		**POLE**	**4-20mA**	**-1,500 - 1,500**	**mV**	**4-WIRE**		**Y403**	
AGS-AIT-440	**AGS-AE-441**	**NO3 ANALYZER**	**AGS BASIN NO. 4**	**NO3**	**AGS BASIN NO. 4**	**IMMERSION**	**RACK-MOUNT**	**POLE**	**4-20mA**	**0.5 - 20**	**mg/L**	**4-WIRE**	**120VAC**	**Y403**	**2, 6**
N/A	AGS-LSH-401	LEVEL SWITCH - FLOAT	AGS BASIN NO. 4	LEVEL - HIGH	AGS BASIN NO. 4	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	24	FEET	N/A	N/A	Y403	2, 4, 6
AGS-AIT-701	AGS-AE-701	TSS ANALYZER	SLUDGE BUFFER SLUDGE PUMPING	TSS	AGS PUMPING ROOM	INSERTION	RACK-MOUNT	PROCESS PIPE	4-20mA	0 - 50,000	mg/L	4-WIRE	120VAC	Y302	6
AGS-LT-510	N/A	SUBMERSIBLE LEVEL TRANSDUCER	SLUDGE BUFFER TANK NO. 1	LEVEL	SLUDGE BUFFER TANK NO. 1	N/A	PIPE	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y301	2,4, 6
N/A	AGS-LSH-510	LEVEL SWITCH - FLOAT	SLUDGE BUFFER TANK NO. 1	LEVEL - HIGH	SLUDGE BUFFER TANK NO. 1	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	16.0	FEET	N/A	N/A	Y405	2, 3, 4, 6
N/A	AGS-LSL-510	LEVEL SWITCH - FLOAT	SLUDGE BUFFER TANK NO. 1	LEVEL - LOW	SLUDGE BUFFER TANK NO. 1	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	1.5	FEET	N/A	N/A	Y405	2, 3, 4, 6
N/A	AGS-LSLL-510	LEVEL SWITCH - FLOAT	SLUDGE BUFFER TANK NO. 1	LEVEL - LOW-LOW	SLUDGE BUFFER TANK NO. 1	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	1.0	FEET	N/A	N/A	Y405	2, 3, 4, 6
AGS-LT-520	N/A	SUBMERSIBLE LEVEL TRANSDUCER	SLUDGE BUFFER TANK NO. 2	LEVEL	SLUDGE BUFFER TANK NO. 2	N/A	PIPE	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y405	2, 4, 6
N/A	AGS-LSH-520	LEVEL SWITCH - FLOAT	SLUDGE BUFFER TANK NO. 2	LEVEL - HIGH	SLUDGE BUFFER TANK NO. 2	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	16.0	FEET	N/A	N/A	Y405	2, 3, 4, 6
N/A	AGS-LSL-520	LEVEL SWITCH - FLOAT	SLUDGE BUFFER TANK NO. 2	LEVEL - LOW	SLUDGE BUFFER TANK NO. 2	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	1.5	FEET	N/A	N/A	Y405	2, 3, 4, 6
N/A	AGS-LSLL-520	LEVEL SWITCH - FLOAT	SLUDGE BUFFER TANK NO. 2	LEVEL - LOW-LOW	SLUDGE BUFFER TANK NO. 2	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	1.0	FEET	N/A	N/A	Y405	2, 3, 4, 6
AGS-LT-801	N/A	SUBMERSIBLE LEVEL TRANSDUCER	WLC TANK	LEVEL	WLC TANK	N/A	PIPE	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y406	2, 4, 6
N/A	AGS-LSHH-801	LEVEL SWITCH - FLOAT	WLC TANK	LEVEL - HIGH-HIGH	WLC TANK	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	18.0	FEET	N/A	N/A	Y406	2, 3, 4, 6
N/A	AGS-LSH-801	LEVEL SWITCH - FLOAT	WLC TANK	LEVEL - HIGH	WLC TANK	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	16.0	FEET	N/A	N/A	Y406	2, 3, 4, 6
N/A	AGS-LSL-801	LEVEL SWITCH - FLOAT	WLC TANK	LEVEL - LOW	WLC TANK	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	1.5	FEET	N/A	N/A	Y406	2, 3, 4, 6

Todd Creek
WWTP - Instrument List

INSTRUMENT TAG NUMBER		TYPE	DESCRIPTION	FUNCTION	LOCATION	PROCESS CONNECTION(S)	MOUNTING		OUTPUT	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER	DRAWING	SPECIAL NOTES
TRANSMITTER	ELEMENT						TRANSMITTER	ELEMENT							
N/A	AGS-LSLL-801	LEVEL SWITCH - FLOAT	WLC TANK	LEVEL - LOW-LOW	WLC TANK	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	1.0	FEET	N/A	N/A	Y406	2, 3, 4, 6
AGS-PIT-901	N/A	PRESSURE TRANSMITTER	AERATION BLOWER HEADER	PRESSURE	AERATION BLOWER HEADER	1/2" NPT	PROCESS PIPE	N/A	4-20mA	0 - 25	PSIG	2-WIRE	LOOP	Y408	2, 6
N/A	AGS-PDS-912	PRESSURE DIFFERENTIAL SWITCH	AERATION BLOWERS INTAKE NO. 1	PRESSURE - HIGH	EXTERIOR BLOWER BUILDING	N/A	N/A	FILTER	N.O. CONTACT	PER SUPPLIER	PSIG	N/A	N/A	Y407	6
N/A	AGS-PDS-922	PRESSURE DIFFERENTIAL SWITCH	AERATION BLOWERS INTAKE NO. 2	PRESSURE - HIGH	EXTERIOR BLOWER BUILDING	N/A	N/A	FILTER	N.O. CONTACT	PER SUPPLIER	PSIG	N/A	N/A	Y407	6
N/A	AGS-PDS-932	PRESSURE DIFFERENTIAL SWITCH	AERATION BLOWERS INTAKE NO. 3	PRESSURE - HIGH	EXTERIOR BLOWER BUILDING	N/A	N/A	FILTER	N.O. CONTACT	PER SUPPLIER	PSIG	N/A	N/A	Y407	6
N/A	AGS-PDS-942	PRESSURE DIFFERENTIAL SWITCH	AERATION BLOWERS INTAKE NO. 4	PRESSURE - HIGH	EXTERIOR BLOWER BUILDING	N/A	N/A	FILTER	N.O. CONTACT	PER SUPPLIER	PSIG	N/A	N/A	Y408	6
N/A	AGS-PDS-952	PRESSURE DIFFERENTIAL SWITCH	AERATION BLOWERS INTAKE NO. 5	PRESSURE - HIGH	EXTERIOR BLOWER BUILDING	N/A	N/A	FILTER	N.O. CONTACT	PER SUPPLIER	PSIG	N/A	N/A	Y408	6
UV-AIT-020	UV-AIT-021	TOTAL PHOSPHATE ANALYZER	UV DISINFECTION	TP	UV INFLUENT CHANNEL	SAMPLE LINE	WALL	WALL	4-20mA	TBD	TBD	4-WIRE	120VAC	Y601	2, 6

NOTES:

1. 120VAC POWER SOURCE FOR INSTRUMENT TRANSMITTER SHALL BE SUPPLIED FROM WITHIN THE ASSOCIATED PLC CABINET
2. PROVIDE SURGE PROTECTIVE DEVICE(S) (SPD) FOR INSTRUMENT.
3. RANGE INDICATED IS DESIGN BASIS. COORDINATE FINAL INSTRUMENT RANGE WITH ACTUAL TANK SUPPLIED
4. INSTALL INTRINSICALLY SAFE BARRIER (DISCRETE SIGNAL) IN THE ASSOCIATED CONTROL PANEL/PLC CABINET FOR THE INDICATED INSTRUMENT. POWER FOR INSTRINSICALLY SAFE BARRIER SHALL BE SUPPLIED FROM THE ASSOCIATED CABINE˙
5. SUPPLY INSTRUMENT WITH MANUFACTURER CABLE FOR CONNECTION OF ELEMENT TO TRANSMITTER AS SPECIFIED
6. INSTRUMENT IS SUPPLIED BY VENDOR OF THE PROCESS SYSTEM. RANGE/SETPOINT TO BE DETERMINED BY VENDOR.

SECTION 46 53 60 – GRANULAR SLUDGE BIOLOGICAL TREATMENT SYSTEM

PART 1 - GENERAL

1.01 SUMMARY:

A. This section contains the requirements to furnish the design and equipment for a Granular Sludge Biological Treatment System (Treatment System) for the treatment of domestic wastewater. This section also specifies the overall performance requirements of the supplied Treatment System and includes the procurement, installation and operation of the biological treatment system and related services from the Equipment Supplier in accordance with the information contained herein. The Supplier will be responsible for the confirmation of the design of the bioreactors and provide a performance warranty of the biological process to meet permit requirements.

B. Description of Overall Treatment Process:

1. The system is for use in treating wastewater at the Todd Creek Wastewater Treatment Plant (TCWWTP).
2. Raw wastewater enters the treatment process at the existing influent screening structure, which includes an automatically cleaned, 1/4-inch-spaced mechanical bar screen. Screened effluent is discharged into a new influent wet well and subsequently pumped to the new wastewater treatment plant site. Influent wastewater passes through 1/4-inch automatically cleaned perforated plate screens and a stacked tray grit removal system. Screened and degritted influent flows into a header that serves the Treatment System. The Treatment System consists of four AGS Basins operated in parallel, with influent fed to one reactor at a time. The Equipment Supplier shall provide all non-concrete tank internals, pumps, instrumentation, and automatic valves required for complete operation of the treatment system.
3. Each basin in the Treatment System shall be capable of operating independently of all other basins including influent flow, effluent discharge, sludge withdrawal, and water level correction withdrawal, as outlined in these Specifications and on the Contract Drawings. The basins shall be synchronized to prevent sludge withdrawal from simultaneously occurring in more than one basin.

C. Requirements and materials not specified herein shall be selected by the Equipment Supplier for specified performance requirements and environmental conditions based on standard practice. The Equipment Supplier shall provide the required major equipment components, including but not limited to:

1. Biological process design calculations to assure the Treatment System can meet all performance requirements listed in this specification. Any process equipment provided by Others shall be recommended and approved by the Equipment Supplier for use as a single point of responsibility of the performance guarantee.
2. All motor-actuated and/or automatic valves required for a complete functional system:
    a. Influent header motor-actuated plug valves for each reactor (1 duty / 1 standby for each basin, 8 total).
    b. Air header motor-actuated air flow control valves (1 per basin, 4 total).
    c. Small air supply motor-actuated valves (2 per basin, 8 total).
    d. Sludge withdrawal and water level correction motor-actuated plug valves for each reactor (2 per basin, 8 total).
    e. Motor-actuated plug valves for influent to each of two (2) Sludge Buffer Tanks (2 total).
3. All internal reactor piping and connections as coordinated with Design Engineer.
4. Fine bubble diffuser grids for each AGS Basin, including drop leg to top of reactor wall.

5. Sludge / liquid withdrawal piping grid for each AGS Basin with any required air piping connections to top of reactor wall.
6. Effluent overflow weir launder system for each AGS Basin.
7. Five (5) positive displacement blowers in a 4 duty / 1 standby configuration.
8. Intake silencers for installation interior of the Blower Building for each blower provided.
9. Intake filter / silencer assemblies for installation exterior of the Blower Building for each blower provided.
10. Pumps for sludge processing system:
    a. Three (3) Sludge Pumps.
    b. Three (3) Supernatant Pumps.
11. Two (2) Water Level Correction (WLC) Pumps.
12. Furnish a complete operations and instrumentation package to control the Treatment System. The package shall consist of the following at a minimum:
    a. Furnish packaged equipment and devices with instrumentation and controls as specified.
    b. Furnish all instruments, meters, gauges, switches, controllers, thermometers, indicators, and transmitters as required for a complete system.
    c. Furnish instrumentation as required to properly monitor and control the equipment supplied by this Contract in a fully automatic mode. Include instrumentation for all equipment operation including startup, normal and shutdown modes.
    d. Design, shop install, and test all skid-mounted instruments.
    e. Furnish all materials for complete installation of shipped-loose instrumentation. Coordinate the physical arrangement and mechanical connections with equipment and structures furnished in this Section with the Design Engineer.
    f. Furnish and program a Programmable Logic Controller and Operator Interface Terminal (OIT) as specified for proper control and operation of the system. Design and factory acceptance test the complete main control panel.
    g. Provide controls integration for the complete system.

D. Work by Others:
1. Concrete Treatment System Basins.
    a. Four (4) AGS Basins, including concrete center effluent trough.
    b. Two (2) Sludge Buffer Tanks.
    c. One (1) Water Level Correction Tank.
2. Utility corridor with influent, sludge, and water level correction piping and appurtenances as required, including the following components.
    a. Influent check valves.
    b. Influent flow meters.
    c. Influent wastewater TSS instrument.
3. Utility corridor for pumping systems including the following components:
    a. Check valves.
    b. Sludge, supernatant, and WLC flow meters.
4. Air piping between blowers and reactor, up to the top of interior basin wall.
5. Sludge and WLC piping exterior of the AGS Basins.
6. All manually-operated valves shall be provided by Contractor.
7. Motor control centers, motor starters, and variable frequency drives shall be provided by the Contractor for all equipment without integral control equipment.
8. Configuration of the plant control system network.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 01
B. Section 01433 – Manufacturers Field Services
C. Section 01664 - Training
D. Section 01757 – Commissioning
E. Section 09 90 00 – Protective Coatings.
F. Section 33 11 00 – Pressure Piping.
G. Section 33 12 16 – Utility Valves and Accessories.
H. Section 40 66 00 – Process Control Networks.
I. Section 40 67 00 – Process Control Panels and Hardware.
J. Section 40 70 00 – Instrumentation For Process Systems.
K. Section 43 11 33 – Positive Displacement Blowers.
L. Section 46 05 13 – Common Motor Requirements for Water and Wastewater Equipment.

1.03 EXCEPTIONS TO WORK SPECIFIED ELSWHERE:

A. Aqua Aerobics International standard training, commissioning, and startup services shall take precedent over Div 1.

1.04 REFERENCES:

A. Applicable Standards:
   1. American National Standards Institute (ANSI).
   2. American Water Works Association (AWWA).
   3. National Sanitation Foundation (NSF).

1.05 SUBMITTALS:

A. Furnish submittals in accordance with SECTION 01300 - SUBMITTALS.
B. Initial Design Deliverables shall be submitted according to the schedule provided in the Bid Form.
   1. Biological design information on the following at a minimum:
      a. Process Flow Diagram.
      b. Tank Configuration and Volumes.
      c. Equipment Confirmation and Sizing.
      d. Sludge, WLC withdrawal rates.
      e. Sludge, supernatant, and WLC design flow ranges.
      f. Oxygen Demand.
      g. Sludge Production.
      h. SRT/HRT.
      i. BioWin Model demonstrating treatment at maximum month design loading.
   2. Assembly and installation drawings including arrangement, layout, and dimensions of all basin/tank internal components. Provide plan elevation views of all major components and subsystems, detailing orientation of equipment, piping, fittings, and valves (including valve actuators) and necessary supports for the equipment.
   3. Three-dimensional models of all equipment. Electronic copies of all models shall be provided in Revit Version 2024 or compatible alternative.
   4. P&ID drawings clearly identifying the termination points for piping connections, and electrical connections on the P&ID drawings where interfacing of the Treatment System supplied equipment and Contractor supplied equipment and/or piping exists.

5. Complete Bill of Materials including quantity, manufacturer, and custom tag number referenced to the P&IDs. The custom tags shall be developed by the Design Engineer and Owner. The Equipment Supplier shall not create their own tagging system.
    a. Equipment Supplier shall provide literature and Engineering data and specifications including dimensions, materials, size, and weight of major components.
6. Hydraulic calculations for reactor influent distribution grids and sludge/WLC withdrawal grids across the range of anticipated flows in tabular form.
7. Detailed design specifications, design criteria, and design calculations for pumps, blowers, and other ancillary equipment.
8. Basin dimensional requirements.
9. Anchorage requirements and details for all supplied mechanical equipment, influent distribution grids, sludge/WLC withdrawal grids, and effluent launders.
10. Detailed control package summary including detailed control equipment cabinets layouts, associated cabinet wiring diagrams, I/O lists, alarms, control loops, and integration of associated ancillary equipment.
11. Detailed Control Narrative describing how the Treatment System operation works. The control narrative should describe the operation of the system in various operating modes including Hand and Auto.

C. Shop Drawings:
1. Provide setting drawings, templates for the installation of anchor bolts and other anchorage systems.
2. Final P&IDs, General Arrangement Drawings.
3. Complete power and control wiring diagrams and schematics with all field revisions.
4. Bill of Materials with Quantities for major electrical and control components like PLCs, OITs, Ethernet Switches etc.
5. Product Data: Submit the following for each type of product specified and included as minimum:
    a. Data sheets for all control panel components furnished.
6. PLC Control Panels: Provide the following as minimum:
    a. Fabrication drawings, front elevation, wiring diagrams, and bills of material for control panels.
    b. Electrical connection diagrams showing termination locations for all field wiring. External connection diagrams shall indicate cable number and wire color for field cables terminated at the panel.
    c. Engraving schedule and physical dimensions for nameplates.
    d. Provide heat dissipation calculations for all panels containing programmable logic controllers. Include calculation for ventilation fans if required.
7. Operator Interface Terminal (OIT) touch screen layouts (for each screen) subject to Owner and Engineer approval.
8. Testing Protocol. Submit to the Contractor and Owner, the Treatment System testing protocol as indicated below.
9. I/O list for SI programming of client SCADA system.
10. Final PLC program copy with complete documentation to be submitted after startup and acceptance of the system. The program shall be provided with the final O&M materials and stored on flash media.

D. Quality Control Submittals
1. Equipment Supplier’s Certificate of Proper Installation
2. Special shipping, storage and protection, and handling instructions for all components.
3. Equipment Supplier’s written/printed installation instructions.

4. Routine maintenance requirements prior to plant startup.
5. Two (2) hard copies and one (1) electronic copies of the Operation and Maintenance Manuals for the Treatment System and all associated equipment O&M Manuals. The Manuals shall include complete operations and maintenance manuals, maintenance procedures, spare parts lists, and field procedures according to SECTION 01300 – SUBMITTALS.
6. The Equipment Supplier's instructions for the handling, long and short-term storage, installation, maintenance, and cleaning of all provided equipment.
7. Maintenance procedures spare parts lists, and field procedures.

1.06 SITE CONDITIONS:

A. All Equipment provided as part of this system shall be rated for the temperature, seismic and elevations as specified in Section 01810 – Project Design Criteria and its appendices.

1.07 SYSTEM WARRANTIES:

A. A Process Performance Warranty shall be provided by Equipment Supplier for the Treatment System per the requirements outlined in Section 2.02 Treatment System Design Criteria, Section 3.03 Performance Test and Section 3.04 Monitored Test Period. This warranty shall include the required effluent values for BOD, TSS, TN, NH_3-N, and TP. The Process Performance Warranty shall be based on demonstrating the specified performance during a 60-day Performance Test, and maintenance of performance through the Monitored Test Period. The warranty shall include a protocol for provisions to make process adjustments, replace equipment and make any other modifications necessary to maintain plant performance through the warranty period.
   1. Equipment Supplier shall furnish a two-year, non-prorated, Process Performance Warranty. Required effluent values for BOD, TSS, TN, NH_3-N, and TP shall be met as long as Influent Wastewater Quality is maintained at or below the values listed in Section 2.02.
   2. The two-year warranty shall commence after the Performance Test has been successfully completed. The Equipment Supplier shall retroactively set the beginning of the warranty period at the date with which the process met and maintained the effluent requirements, up to a maximum of 60 days prior to the end of the Performance Test.

B. Equipment Supplier shall furnish a two-year, non-prorated, materials and workmanship warranty for all components comprising the Treatment System unless otherwise noted. Warranty shall be for two (2) years from the date of successful completion of commissioning activities as described in Section 3.02.

PART 2 - PRODUCTS

2.01 ACCEPTABLE TREATMENT SYSTEMS:

A. Aerated Granular Sludge (AGS) treatment system package, as provided by Aqua Nereda / Aqua Aerobics Systems, Inc.

2.02 TREATMENT SYSTEM DESIGN CRITERIA:

A. The Equipment Supplier shall provide the biological system design calculations to assure the Treatment System can meet all performance requirements listed in this specification.

B. Treatment System shall provide biological phosphorus removal without incorporation of a chemical phosphorus removal system.

C. The Treatment System shall be designed to remove phosphorus, biological oxygen demand, ammonia, and total nitrogen at a maximum month flow of 7.96 MGD. The biological system shall meet the following design criteria:
   1. Design Conditions:
      a. Average Day Flow (ADF): 4.59 MGD
      b. Maximum Month Flow (MMF): 7.96 MGD
      c. Peak Day Flow (PDF): 12.3 MGD
      d. Minimum Temperature: 10°C
      e. pH: 6.5-8.5
      f. Site Elevation: 915 ft
   2. Influent Wastewater Characteristics:

	Average Day	**Maximum Month**	**Peak Day**
BOD_5, lbs/d	7,200	13,300	16,800
TSS, lbs/d	7,600	15,400	23,500
TKN, lbs/d	1,600	2,230	3,180
TP, lbs/d	270	380	540

   3. Effluent Wastewater Quality Requirements:

Parameter, Units	**30-Day Avg**	**7-Day Avg**	**Daily Max**
pH, su	-	-	6.0-9.0
BOD_5, mg/L	15	15	-
TSS, mg/L	20	30	-
Oil and Grease, mg/L	10	-	15
Ammonia, mg/L	1.8 (Jan) 1.8 (Feb) 1.8 (Mar) 1.4 (Apr) 1.2 (May) 0.6 (June) 0.4 (July) 0.6 (Aug) 0.7 (Sept) 1.3 (Oct) 1.8 (Nov) 1.8 (Dec)	-	8.4 (Jan) 8.4 (Feb) 8.4 (Mar) 6.9 (Apr) 8.4 (May) 6.9 (June) 6.9 (July) 8.4 (Aug) 6.9 (Sept) 6.9 (Oct) 8.4 (Nov) 8.4 (Dec)
Total Phosphorus, mg/L	1.0	-	-
Total Nitrogen, mg/L	8.0	-	-

D. Include biological design information on the following, at a minimum:
   1. Process flow diagram.
   2. Tank configuration and volumes.
   3. Sludge and WLC withdrawal flows.
   4. Oxygen demand.
   5. Sludge production.
   6. SRT/HRT.

E. Treatment System shall be designed for four (4) AGS Basins, each with the dimensions below:

1. Reactor Width: 75 feet
2. Reactor Length: 80 feet
3. Maximum Sidewater Depth: 22 feet
4. Aeration Sidewater Depth: 21 feet
5. Top of Reactor Wall: 24 feet

F. Treatment System sludge processing system shall be designed for two (2) Sludge Buffer Tanks, each with the dimensions below:
1. Reactor Width: 20 feet
2. Reactor Length: 28 feet
3. Maximum Sidewater Depth: 14.2 feet
4. Top of Reactor Wall: 24 feet

G. Treatment System water level correction system shall be designed for one (1) WLC Tank with the dimensions below:
1. Reactor Width: 20 feet
2. Reactor Length: 20 feet
3. Maximum Sidewater Depth: 14.4 feet
4. Top of Reactor Wall: 24 feet

2.03 AERATION EQUIPMENT:

A. Equipment Supplier shall design aeration control system based on a common air discharge header with modulating control valves at each basin to balance air between basins as needed to meet process performance demands. A control system with blowers dedicated to individual basins shall not be acceptable.

B. Butterfly valves for air service:
1. All butterfly valves shall be provided with stainless steel disc, and FKM valve seat. All internal materials must be compatible with the highest anticipated blower discharge temperature and 25 degrees F safety factor.
2. Equipment Supplier shall provide four (4) electrically operated, modulating service butterfly valves for controlling airflow to each basin.
   a. Valves shall be 10-inch with lug-style or flanged connections.
   b. Electric motor actuators shall be 460V, 3ph, 60Hz service.
   c. Actuators shall include motor winding protection, integral disconnect switch (NEMA 4X), manual override and limit switch feedback to allow monitoring of valve position and whether valve is open or closed.
   d. Actuators shall include local controls, including push buttons for opening / closing, selector switches for placing actuator in hand or remote, and indicator lights to identify if valve is open / closed and if the valve is in a fault mode.
   e. Modulating electric motor actuator shall include the following control signals, at minimum:
      (1) Discrete outputs:
         (a) Dry contacts rated 5A, 120Vac.
         (b) Signals:
            i) Open limit switch.
            ii) Closed limit switch.
            iii) In-Remote status.
      (2) Discrete inputs:
            i) Open/Close.
      (3) Analog output:
         (a) 4-20mA range.

i) Position control.
ii) Position feedback.

3. Equipment Supplier shall provide eight (8) electrically operated, open/close service butterfly valves for use with the air supply at each basin.
   a. Valves shall be 4-inch with lug-style or flanged connection.
   b. Electric motor actuators shall be 460V, 3ph, 60Hz service.
   c. Actuators shall include motor winding protection, integral disconnect switch, manual override and limit switch feedback to allow determination whether valve is open or closed.
   d. Actuators shall include local controls, including push buttons for opening / closing, selector switches for placing actuator in hand or remote, and indicator lights to identify if valve is open / closed and if the valve is in a fault mode.
   e. Open/close electric motor actuator shall include the following control signals, at minimum:
      (1) Discrete outputs:
         (a) Dry contacts rated 5A, 120Vac.
         (b) Signals:
            i) Open limit switch.
            ii) Closed limit switch.
            iii) In-Remote status.
      (2) Discrete inputs:
            i) Open/Close.

C. Aeration Blowers:
   1. Equipment supplier shall provide blowers sized to accommodate projected peak day loadings into the WWTP, as indicated in Section 2.02C.1. The blowers shall be provided with a 4 Duty / 1 Standby arrangement. Other blower arrangements shall be subject to Design Engineer Approval.
   2. Aeration Blowers shall be positive displacement type and shall be as specified in Section 43 11 33 Positive Displacement Blowers.

D. Aeration Blower Intake Filter / Silencer Assemblies:
   1. Equipment supplier shall provide five (5) intake filter / silencer assemblies, as specified in Section 43 11 33 under Series 400 Blowers.

E. Aeration Blower Intake Silencer Assemblies:
   1. Equipment supplier shall provide five (5) intake silencer assemblies, as specificed in Section 43 11 33 under Series 400 Blowers.
   2. Equipment supplier shall coordinate connections to blower piping with Design Engineer.

F. Air Flowmeter:
   1. Function: Continuously measure, indicate, and transmit signals proportional to air flow being supplied to each AGS Basin. Each air flow meter shall be integrated with the Equipment Supplier PLC for monitoring, data recording, and process control.
   2. Provide one (1) air flowmeter for each AGS Basin as specified in Section 2.11.

2.04 AGS BASIN, SLUDGE BUFFER TANK, AND WLC TANK INTERNALS

A. Treatment System shall be provided with tank internals required for a complete system. All piping connections shall be within 48 inches of reactor wall, and shall be coordinated with Design Engineer.

B. Fixed Fine Bubble Diffuser System:
   1. Equipment Supplier shall provide a complete fine bubble membrane diffuser system for each AGS Basin, with flanged dropleg connection located at the top of the reactor wall

for transition to contractor provided piping. Equipment Supplier shall provide dropleg connection for each independent diffuser grid provided.

2. Dropleg shall be minimum SCH10 304L stainless steel with 150# flange connection at top of dropleg.
3. Provide a manifold for connection to the air distribution headers. Fabricate maximum 30 feet long manifolds with threaded union or flanged joints to connect manifold sections and to connect to the air distribution headers to prevent rotation and blow apart. Fabricate manifolds of Schedule 40 CPVC conforming to ASTM D1784, D1785 and D2466. Design piping, pipe joints and supports to resist expansion/contraction thrust forces of the air distribution headers over a temperature range of 250°F. CPVC components to be produced from CPVC compound with a minimum tensile strength of 7000 psi. Design manifolds to withstand 180° F mean wall temperature. CPVC components shall have minimum 1.5 percent titanium dioxide to minimize ultraviolet light degradation. Factory solvent weld all CPVC joints and diffuser holders.
4. Fabricate maximum 24 feet long air distribution headers with diffuser holders factory solvent welded to the crown of the pipe for positive air seal and strength. Fabricate minimum 4-inch diameter air distribution headers conforming to ASTM D3915 and D3034. Connect air distribution header sections with threaded union or flange joints to prevent blow apart and rotation. Design joints with mating halves factory solvent welded to the ends of the air distribution header. Design threaded union joints with spigot and socket ends joined with a threaded ring and sealed with an O-ring gasket. Design union joints with threads of a minimum of 0.013 square inches to provide adequate strength of the socket and retainer ring. Design flange joints with an angle face ring, follower flange with 150 lb drilling and stainless-steel hardware. Diffuser holders shall have a continuous contact area of 13 square inches minimum to ensure structural integrity. Air distribution headers and diffuser holders to resist a dead load of 200 lbs applied vertically to the outer edge of the diffuser holder. Provide end caps at the end of each air distribution header.
5. Provide complete pipe support system for entire manifold and header assembly, including dropleg connections along reactor wall. Support spacing to be limited to a maximum of 8 feet. Design all supports to allow for thermal expansion and contraction forces over a temperature range of 125° F and to minimize stress build up in the piping system. Design supports shall be adjustable without removing the air distribution header from the support. Design supports shall include hold down guide straps, support structure and two anchor bolts. Design guide straps with a 2-inch minimum width to eliminate point load on manifold and minimize binding. Design support for a total of 4-inch vertical adjustment for leveling of manifold within ¼ inch of a common plane.
6. Provide guide and fixed type supports for air distributors and manifolds to allow expansion/contraction. Design supports to include hold down straps, support structure, locating plate and single anchor bolt. To prevent improper installation, the locating plate shall be able to be installed in either of two directions relative to the support. Design support for a total of 3-inch vertical adjustment for leveling air distribution headers within 1/4-inch of a common plane. Guide straps shall have 1 1/2-inch wide top and bottom contoured bearing surface with chamfered edges to minimize binding and resistance to movement of air distributor under full buoyant uplift load. Design strap with 1/8-inch clearance around distributor so strap is self-limiting and cannot be over tightened.
7. All supports shall be 304 stainless steel construction.

8. Provide diffuser assemblies including diffuser, holder, retaining ring, and air flow control orifice. Incorporate integral check valve into the membrane diffuser.
    a. Test diffuser using primary sampling criteria outlined in Military Standard 105E. Manufacture circular membrane diffuser with integral O-ring of EPDM synthetic rubber compound with precision die formed slits. Add carbon black to the material for resistance to ultraviolet light. Design diffuser as one piece injection molded part with a minimum thickness of 0.080 inches for 9 inch diameter unit. Extractable oil content shall not exceed 10%. Limit the maximum tensile strength of the diffuser to 10 psi when operating at 2.4 SCFM/sq. ft. of material.
    b. Visual Uniformity: Observe diffusers for uniform air distribution across the active surface of the diffuser at 1.0 SCFM/diffuser and 2 inches submergence. Active surface shall be defined as the perforated horizontal projected area of the diffuser. Factory test diffusers for a dynamic wet pressure (DWP) of 12 inches ± 20% water column @ 1.0 SCFM/diffuser and 2 inches submergence.

C. Influent Distribution System:
1. Equipment Supplier shall provide one (1) influent distribution system for each AGS Basin. System shall consist of PVC and HDPE components.
2. Complete support system shall be provided, including anchors. All support components shall be of 304 stainless-steel construction.
3. Influent distribution system shall connect to 36” flange provided by Contractor. Connection shall be internal to the tank and within 48 inches of interior wall as shown in the CONTRACT DRAWINGS.

D. Solids / WLC Waste Assembly:
1. Equipment Supplier shall provide one (1) HDPE withdrawal manifold for each AGS Basin to facilitate removal of sludge and WLC during applicable operational cycles.
2. Complete support system shall be provided, including anchors. All support components shall be of 304 stainless steel construction.
3. Solids / WLC waste assembly shall connect to 24” flange provided by Contractor. Connection shall be internal to the tank and within 24 inches of interior wall as shown in the Contract Drawings.

E. Effluent Weir Assembly:
1. Furnish one (1) effluent weir system for each AGS Basin, consisting of maximum eight (8) finger weirs to be installed between basin exterior concrete walls and center concrete effluent trough.
2. Effluent weirs shall be 304 stainless steel.
3. Complete support system shall be provided, inlcuding anchors. All support compoenents shall be of 304 stainless steel construction.

F. Solids Buffer Tank Sludge Withdrawal Assembly:
1. Furnish one (1) solids withdrawal assembly for each Sludge Buffer Tank.
2. Manifold shall be of PVC and HDPE construction and shall be provided with 10” flanged connection internal to each tank for connection to Contractor piping connection.
3. Supply all required supports and anchors. Supports and anchors shall be 304 stainless steel construction.

G. Tank internals shall be installed by Contractor per Equipment Supplier instructions and guidelines.

2.05 UTILITY CORRIDOR VALVES:

A. Influent Header Control Valves:

1. Equipment Supplier shall provide two (2) electronically actuated 30-inch plug valves for each AGS Basin (total of 8 valves). The valves shall be intended for use in 1 Duty / 1 Standby service.
2. Valve construction shall conform to Section 33 12 16 – Utility Valves and Accessories.
3. Electric motor actuators shall be 460V, 3ph, 60Hz service.
4. Actuators shall include motor winding protection, integral disconnect switch (NEMA 4X), manual override and limit switch feedback to allow monitoring of valve position and whether valve is open or closed.
5. Actuators shall include local controls, including push buttons for opening / closing, selector switches for placing actuator in hand or remote, and indicator lights to identify if valve is open / closed and if the valve is in a fault mode.
6. Open/close electric motor actuator shall include the following control signals, at minimum:
    a. Discrete outputs:
        (1) Dry contacts rated 5A, 120Vac.
        (2) Signals:
            (a) Open limit switch.
            (b) Closed limit switch.
            (c) In-Remote status.
    b. Discrete inputs:
            (a) Open/Close.

B. Sludge and WLC Modulating Control Valves
1. Equipment supplier shall provide two (2) electronically actuated 20-inch plug valves for each AGS Basin (total of 8 valves). The valves shall be intended for modulating service.
2. Equipment Supplier shall provide two (2) electronically actuated 20-inch plug valves to serve the Sludge Buffer Tanks. The valves shall be intended for open / close service.
3. Valve construction shall conform to Section 33 12 16 – Utility Valves and Accessories.
4. Electric motor actuators shall be 460V, 3ph, 60Hz service.
5. Actuators shall include motor winding protection, integral disconnect switch (NEMA 4X), manual override and limit switch feedback to allow monitoring of valve position and whether valve is open or closed.
6. Actuators shall include local controls, including push buttons for opening / closing, selector switches for placing actuator in hand or remote, and indicator lights to identify if valve is open / closed and if the valve is in a fault mode.
7. Modulating electric motor actuators shall include the following control signals, at minimum:
    a. Discrete outputs:
        (1) Dry contacts rated 5A, 120Vac.
        (2) Signals:
            (a) Open limit switch.
            (b) Closed limit switch.
            (c) In-Remote status.
    b. Discrete inputs:
            (a) Open/Close.
    c. Analog output:
        (1) 4-20mA range.
            (a) Position control.
            (b) Position feedback.

2.06 HORIZONTAL END-SUCTION CENTRIFUGAL PUMPS:

A. Equipment supplier shall furnish the following horizontal end-suction centrifugal pumps for sludge, supernatant, and WLC service.

B. All pumps shall be manufactured by Gorman Rupp.

C. Materials of Construction:

1. Construct motor housing, pump casing, and major pump components of cast iron conforming to ASTM A48.
2. Casing:
   a. Designed to withstand a hydrostatic pressure of 150% of the shutoff head.
   b. Single-stage, single-suction, volute type.
   c. Provide flanged hand hole for inspection of casing interior.
   d. Inside face contoured to match volute.
   e. Bolted to casing.
   f. Provide with rigid mounting assembly to support motor weight, assure proper pump and motor alignment, and dampen vibration within the specific tolerance.
   g. Provide flanged suction and discharge flanges to match the connecting pipe flanges.
   h. Provided with casing vent and drain connections
3. Impeller:
   a. Open design with smooth water passages to prevent clogging.
   b. Balanced statically and dynamically to eliminate vibration and minimize hydraulic end thrust.
   c. Castings shall not have been repaired by plugging, welding, or other means.
   d. Securely fitted and keyed or screwed to the shaft
4. Shaft:
   a. Ample diameter to assure first critical speed will occur at not less than 150% of rated pump speed.
   b. Provide shaft with sleeves designed to prevent water leakage between shaft and sleeves. Adequately anchor sleeves to the shaft to prevent rotation relative to shaft.
   c. Completely encase shaft along its entire length within the pump by the impeller and sleeves.
   d. Proportioned to transmit all loads and torque without deflection or twisting.
5. Bearings:
   a. Bearings shall be permanently lubricated.
   b. Inboard bearings shall be roller, while outboard bearings may be ball or roller.
   c. Designed for all radial and thrust loads imposed by hydraulically unbalanced impellers.
   d. Have provisions for shaft and casing expansion movement.
   e. Designed for a minimum L-10 life of 100,000-hour minimum in accordance with ABMA standards.
6. Shaft Seals:
   a. Pump shall have a single self-contained mechanical seal.
7. Drive Coupling:
   a. Provide adequate spacer length to allow removal of end suction pump internals or mechanical seal from horizontal split-case pumps without disturbing casing.
   b. Rigidly fastened to the base plate. Guard shall be arranged to allow ease of disassembly or removal for access to the coupling.
   c. Prevent any thrust from being transmitted to the drive motor shaft under any operating condition.
   d. Rated for at least 150% of drive motor horsepower.

8. Base Plate:
   a. Provide each pumping unit with a separate base plate.
   b. Provide for rigid anchoring of pump, motor, coupling guard including all blocks and leveling plates.
   c. Have a raised drip lip around the perimeter with a threaded drain connection.
   d. Provide all necessary bolting to attach all components to the base plate.
   e. Cast-iron or steel base plates shall be designed rigid enough for no grout, but shall be suitable for field grouting under the entire plate.
9. Motors:
   a. Shall be in accordance with Section 46 05 13 and herein.
   b. All motors shall be of single-speed, premium-efficient, squirrel cage induction design.
   c. All motors shall be rated for 480V, 3-phase, 60-Hz operation with the service factor of 1.15. RPM rating shall be as required.
   d. Designed for operation with variable frequency drive.
   e. Provide two normally closed temperature switches embedded in each phase winding for high temperature protection. Switches shall be rated for use with 120Vac.
   f. Provide factory installed, maintenance free, circumferential, conductive micro fiber shaft grounding ring to discharge shaft currents to ground.
   g. Rated horsepower as required at 40° C ambient with Class F insulation.
   h. Comply with the applicable provision of NEMA with a minimum B-10 bearing life of 100,000 hours.
10. Materials:
   a. The materials specified below indicate a standard of quality. Substitutions may be made or recommended by Supplier upon approval of Purchaser, if deemed necessary due to quality of fluid being pumped, start-up system flushing chemical additives, or other reasons.
      (1) Base Plate: ASTM A36 structural steel or ASTM A48 cast iron.
      (2) Casing: Cast iron, cast steel, or ductile iron.
      (3) Impeller: ASTM A395 or ASTM A536 cast-ductile iron.
      (4) Shaft: AISI 1045 carbon steel or ASTM A322 Grade 4140.
      (5) Shaft Sleeve: ASTM A276 Type 416 Condition A.

D. Sludge Pumps:
1. Description of Service: Sludge pumps shall be used to transfer thickened sludge layer from Sludge Buffer Tanks to the Thin Sludge Tanks (provided by Others). Pumps shall be provided with one unit dedicated to each of two (2) Sludge Buffer Tanks, with a third pump available as a standby unit.
2. Number of Units: 3 Pumps (2 Duty / 1 Standby).
3. Design Capacity, each:
   a. Flow: 185 gpm.

E. Total Dynamic Head: 42.3 feet.
1. Maximum Motor Size: 7.5 HP.

F. Supernatant Pumps:
1. Description of Service: Supernatant pumps shall be used to transfer supernatant layer from Sludge Buffer Tanks following withdrawal of the thickened sludge layer. Supernatant shall be pumped to the AGS Influent Header (provided by Others). Pumps shall be provided with one unit dedicated to each of two (2) Sludge Buffer Tanks, with a third pump available as a standby unit.
2. Number of Units: 3 Pumps (2 Duty / 1 Standby).

3. Design Capacity, each:
   a. Flow: 740 gpm.
   b. Total Dynamic Head: 30 feet.
4. Maximum Motor Size: 15 HP.

G. WLC Pumps:
1. Description of Service: WLC pumps shall be used to transfer liquid from the WLC tank. WLC liquid shall be pumped to the AGS Influent Header (provided by Others). Pumps shall be provided in a 1 Duty / 1 Standby configuration.
2. Number of Units: 2 Pumps (1 Duty / 1 Standby).
3. Design Capacity, each:
   a. Flow: 485 gpm.
   b. Total Dynamic Head: 30 feet.
4. Maximum Motor Size: 15 HP.

2.07 ELECTRICAL:

A. Electrical material and equipment shall have UL listing wherever standards have been established by that agency.
B. Complete electrical assembly shall meet all requirements of the National Electrical Code, the National Electrical Manufactures Association (NEMA), the National Fire Protection Association (NFPA), all applicable state and local codes.
C. Three phase, 480V, 60 Hz power will be available for all Treatment System equipment, except instruments.
D. Unless specifically noted otherwise, all the power distribution equipment including the motor control center, variable frequency drives, motor starters and panelboards etc. for the Treatment System equipment shall be provided by Others.

2.08 PROCESS CONTROL PANEL:

A. Provide and program a Programmable Logic Controller (PLC) based system with an operator interface to control the operation of the Treatment System including all ancillary equipment as specified in this section.
B. Programmable Logic Controllers (PLC):
1. Refer to Section 40 67 00 – Process Control Panels and Hardware for all requirements of the AGS control system PLC.
2. Provide Allen-Bradley ControlLogix series PLC hardware as specified and required for application.
3. The PLC shall communicate with the Plant Control System over an EtherNet/IP communications network.
4. The PLC shall each include spare parts as well as memory sufficient to implement all application software plus 100% spare capacity as minimum.
5. The PLC should be capable of communicating and controlling the following treatment processes at the minimum in addition to the Treatment System.
   a. All automatic valves that are associated with the Treatment System.
   b. Aeration Blowers.
   c. Sludge Pumps.
   d. Supernatant Pumps.
   e. WLC Pumps.
   f. Instrumentation, sampling pumps, and sampling panels, as required.

C. PLC I/O:

1. Refer to the I/O List at the end of this Section for a list of I/O required to be provided for the AGS control system.
2. Refer to Section 40 67 00 for requirements of PLC input and output modules for the consumption of all AGS PLC I/O.

D. Main Control Panel (AGS-MCP-001):
1. Provide a Main Control Panel (MCP) to house the PLC and associated control panel components that conform to Section 40 67 00 – Process Control Panels and Hardware.
   a. The MCP shall operate from a 120 VAC, single phase, 60Hz power supply.
   b. MCP shall be NEMA 12 rated cabinet located in a dedicated electrical room in the Blower Building.
   c. Motor and valve controls shall be a combination of hardwired control and network controls via the plant control system connection. The communications shall be by EtherNet/IP protocols. Refer to plans and schematics for specific control cabling and communication requirements.
2. Provide and configure an Operator Interface Terminal (OIT) installed within the door of the Main Control Panel. The OIT shall be as specified in Section 40 67 00 – Process Control Panels and Hardware.
3. Provide and configure a panel mount managed Ethernet switch within the main control panel for connection of the Plant Control System and all applicable AGS equipment. The network switch shall be as specified in Section 40 66 00 Process Control Networks.
4. Spare Parts: In addition to the general spare parts defined by Section 40 70 00, the following shall be provided specifically for the supplied main control panel PLC.
   a. One spare ControlLogix PLC processor as specified in Section 40 67 00.
   b. One spare I/O module of each type used.

E. Process Control
1. Unless otherwise specified, all equipment shall be capable of being controlled at the OIT and local controls including push buttons and pilot devices with the following functionality as minimum:
   a. For each Aeration Blower:
      (1) Manual/Auto.
      (2) Start/Stop.
      (3) Alarm reset.
      (4) Speed adjustment.
   b. For each Pump:
      (1) Manual/Auto.
      (2) Start/Stop.
      (3) Alarm reset.
      (4) Speed adjustment.
   c. For each Motor-Actuated Valve:
      (1) Manual/Auto.
      (2) Open/Close.
      (3) Alarm reset.
      (4) Position adjustment (for modulating valves).
2. The PLC shall be capable of receiving initial run-time values for existing and proposed equipment. Initial run-time shall not automatically be assumed to be zero.
3. Unless otherwise specified, all flows and equipment run-times shall be totalized in the PLC and displayed on the HMI for current day, prior day, weekly, monthly, and annual totals.

F. HMI Screen Development:

1. Refer to Section 40 61 96 - Process Control Software Programming and Reports for requirements of HMI operator screen development.
2. HMI screens shall be developed for control interface and monitoring of AGS systems and related equipment.
3. The AGS System Supplier shall coordinate with the Systems Integrator to establish HMI development standards to ensure the HMI screens developed by the AGS supplier and the System Integrator share the same typical graphics, faceplates, and function blocks to meet the project standards.
4. The AGS System Supplier shall develop and provide a complete set of HMI screens with all system application files to the Systems Integrator. The screens shall be integrated into the Plant Control System HMI screen set.
5. The AGS System Supplier shall provide the necessary coordination with the Systems Integrator to ensure a fully functional application. Refer to Part 3 of this Section for minimum coordination requirements with the Systems Integrator.

2.09 AQUANEREDA SERVER:

A. Provide a Process System Server for monitoring, calculations, and modification of control system parameters.
B. The server shall communicate control system updates to the main control panel PLC over the Ethernet network.
C. The servers shall be rack mount design and provided with sliding rack rails. The server shall be installed in the plant control system network rack (by others). The server shall include the following as minimum.
   1. The processor shall be an Intel® Xeon E2334, 3.4GHz, 8MB Cache or greater.
   2. Provide 132.0 Gigabytes (minimum) of registered UDIMM.
   3. Provide a minimum of two fully rated power supplies for redundant operation.
   4. Provide with dual on-board 10/100/1000 Base-T network interface card. The dual NIC card shall be configurable to serve as a primary and secondary fail-over.
   5. Provide Dell Power Edge R250 Server or approved equal.
D. The graphics card shall be integrated with a minimum of 16 MB of video memory.
E. Disk Drives:
   1. Provide two (2) 1TB SATA Drives, 7200 rpm, 6Gbps, 3.5”.
   2. Provide C22, RAID 1 for S140 SATA.
F. Operating System and Software:
   1. Provide Microsoft Windows Server 2022 with five client access licenses (CAL’s) as necessary. Provide and install the latest service packs and patches available that are compatible with the supplied control software.
   2. The servers shall have a clean install of the operating system and hardware drivers. Non-essential applications, such as manufacturer provided trial software and utilities, shall not be loaded on the system.
   3. Provide Remote Desktop Services (RDS) client access licenses (CAL’s) as required.
   4. Provide one copy of the latest version of Microsoft Office Professional for each server.

2.10 DESCRIPTION OF OPERATIONS:

A. Equipment Supplier shall provide any additional automatic valves and instrumentation as required to provide a complete, functional system. Any additional items shall be coordinated with the Design Engineer and Contractor to be incorporated into this Section and Contract Drawings, including Process & Instrumentation Diagrams.

B. Equipment Supplier shall tag all provided equipment as specified herein, and as shown on the Contract Drawings and Section 40 70 00. Any additional items required by Equipment Supplier shall be coordinated with Design Engineer to develop appropriate tagging.

C. System Components and Functions:
   1. Equipment denoted with "*" symbols is to be provided by the Contractor / System Integrator. Refer to Section 40 61 96 and Section 40 70 00 for additional requirements.
   2. AGS Main Control Panel AGS-MCP-001.
      a. Equipment Supplier provided control panel for control of the Treatment System containing a PLC, operator interface, and other ancillaries necessary for control of the equipment.
   3. AGS Nereda Controller AGS-SVR-001.
      a. Equipment Supplier provided software-based controller running on a host server located in the Blower Building Electrical Room network rack.
   4. AGS Influent Header:
      a. *Influent Header Analytical Transmitter AGS-AIT-001 for the following*:
         (1) *Analytical element AGS-AE-001 for measuring influent total suspended solids*.
   5. AGS Basins:
      a. AGS Basin No. 1:
         (1) Basin No. 1 Influent Valve A AGS-VLV-101:
            (a) Motor actuated valve with open/close service.
         (2) Basin No. 1 Influent Valve B AGS-VLV-103:
            (a) Motor actuated valve with open/close service.
         (3) *Basin No. 1 Influent Flow Meter Transmitter AGS-FIT-101 for monitoring the following*:
            (a) *Basin No. 1 Influent Flow Meter AGS-FE-101*:
               i) Magnetic flow meter for measuring influent flow into the basin.
         (4) Basin No. 1 Thermal Mass Flow Meter AGS-FIT-101:
            (a) Measures process air flow to Basin No. 1.
         (5) Basin No. 1 Aeration Header Air Valve AGS-VLV-105 :
            (a) Motor actuated valve with modulating service.
         (6) Basin No. 1 Air Valve AGS-VLV-108:
            (a) Motor actuated valve with open/close service.
         (7) Basin No. 1 Air Valve AGS-VLV-109:
            (a) Motor actuated valve with open/close service.
         (8) Basin No. 1 Sludge Withdrawal Valve AGS-VLV-110:
            (a) Motor actuated valve with modulating service.
         (9) Basin No. 1 WLC Withdrawal Valve AGS-VLV-111:
            (a) Motor actuated valve with modulating service.
         (10) Basin No. 1 Level Indicating Transmitter AGS-LIT-101:
            (a) Submersible pressure transducers for measuring basin water level.
         (11) Basin No. 1 Analytical Transmitter AGS-AIT-110:
            (a) Transmitter/controller for monitoring the following basin probes:
               i) Analytical element AGS-AE-111 for measuring Ammonium (NH_4^+).
         (12) Basin No. 1 Analytical Transmitter AGS-AIT-120:
            (a) Transmitter/controller for monitoring the following basin probes:
               i) Analytical element AGS-AE-121 for measuring pH/Temperature.

ii) Analytical element AGS-AE-122 for measuring dissolved oxygen (DO).

(13) Basin No. 1 Analytical Transmitter AGS-AIT-130:
(a) Transmitter/controller for monitoring the following basin probes:
i) Analytical element AGS-AE-131 for measuring total suspended solids (TSS).
ii) Analytical element AGS-AE-132 for measuring oxidation-reduction potential (ORP).

(14) Basin No. 1 Analytical Transmitter AGS-AIT-140
(a) Transmitter/controller for monitoring the following basin probes:
i) Analytical Elements AGS-AE-141 for measuring nitrates.

b. AGS Basin No. 2:
(1) Basin No. 2 Influent Valve A AGS-VLV-201:
(a) Motor actuated valve with open/close service.
(2) Basin No. 2 Influent Valve B AGS-VLV-203:
(a) Motor actuated valve with open/close service.
(3) *Basin No. 2 Influent Flow Meter Transmitter AGS-FIT-201 for monitoring the following*:
(a) *Basin No. 2 Influent Flow Meter AGS-FE-201*:
i) Magnetic flow meter for measuring influent flow into the basin.
(4) Basin No. 2 Thermal Mass Flow Meter AGS-FIT-201:
(a) Measures process air flow to Basin No. 2.
(5) Basin No. 2 Aeration Header Air Valve AGS-VLV-205:
(a) Motor actuated valve with modulating service.
(6) Basin No. 2 Air Valve AGS-VLV-208:
(a) Motor actuated valve with open/close service.
(7) Basin No. 2 Air Valve AGS-VLV-209:
(a) Motor actuated valve with open/close service.
(8) Basin No. 2 Sludge Withdrawal Valve AGS-VLV-210:
(a) Motor actuated valve with modulating service.
(9) Basin No. 2 WLC Withdrawal Valve AGS-VLV-211:
(a) Motor actuated valve with modulating service.
(10) Basin No. 2 Level Indicating Transmitter AGS-LIT-201:
(a) Submersible pressure transducers for measuring basin water level.
(11) Basin No. 2 Analytical Transmitter AGS-AIT-210:
(a) Transmitter/controller for monitoring the following basin probes:
i) Analytical element AGS-AE-211 for measuring NH_4^+.
(12) Basin No. 2 Analytical Transmitter AGS-AIT-220:
(a) Transmitter/controller for monitoring the following basin probes:
i) Analytical element AGS-AE-221 for measuring pH/Temperature.
ii) Analytical element AGS-AE-222 for measuring DO.
(13) Basin No. 2 Analytical Transmitter AGS-AIT-230
(a) Transmitter/controller for monitoring the following basin probes:
i) Analytical element AGS-AE-231 for measuring TSS.
ii) Analytical element AGS-AE-232 for measuring ORP.
(14) Basin No. 2 Analytical Transmitter AGS-AIT-240
(a) Transmitter/controller for monitoring the following basin probes:
i) Analytical Elements AGS-AE-241 for measuring nitrates.

c. AGS Basin No. 3:

(1) Basin No. 3 Influent Valve A AGS-VLV-301:
(a) Motor actuated valve with open/close service.
(2) Basin No. 3 Influent Valve B AGS-VLV-303:
(a) Motor actuated valve with open/close service.
(3) *Basin No. 3 Influent Flow Meter Transmitter AGS-FIT-301 for monitoring the following*:
(a) *Basin No. 3 Influent Flow Meter AGS-FE-301*:
i) Magnetic flow meter for measuring influent flow into the basin.
(4) Basin No. 3 Thermal Mass Flow Meter AGS-FIT-301:
(a) Measures process air flow to Basin No. 3.
(5) Basin No. 3 Aeration Header Air Valve AGS-VLV-305:
(a) Motor actuated valve with modulating service.
(6) Basin No. 3 Air Valve AGS-VLV-308:
(a) Motor actuated valve with open/close service.
(7) Basin No. 3 Air Valve AGS-VLV-309:
(a) Motor actuated valve with open/close service.
(8) Basin No. 3 Sludge Withdrawal Valve AGS-VLV-310:
(a) Motor actuated valve with modulating service.
(9) Basin No. 3 WLC Withdrawal Valve AGS-VLV-311:
(a) Motor actuated valve with modulating service.
(10) Basin No. 3 Level Indicating Transmitter AGS-LIT-301:
(a) Submersible pressure transducers for measuring basin water level.
(11) Basin No. 3 Analytical Transmitter AGS-AIT-310:
(a) Transmitter/controller for monitoring the following basin probes:
i) Analytical element AGS-AE-311 for measuring NH_4^+.
(12) Basin No. 3 Analytical Transmitter AGS-AIT-320:
(a) Transmitter/controller for monitoring the following basin probes:
i) Analytical element AGS-AE-321 for measuring pH/Temperature.
ii) Analytical element AGS-AE-322 for measuring DO.
(13) Basin No. 3 Analytical Transmitter AGS-AIT-330
i) Analytical element AGS-AE-331 for measuring TSS.
ii) Analytical element AGS-AE-332 for measuring ORP.
(14) Basin No. 3 Analytical Transmitter AGS-AIT-340
(a) Transmitter/controller for monitoring the following basin probes:
i) Analytical Elements AGS-AE-341 for measuring nitrates.

d. AGS Basin No. 4:
(1) Basin No. 4 Influent Valve A AGS-VLV-401:
(a) Motor actuated valve with open/close service.
(2) Basin No. 4 Influent Valve B AGS-VLV-403:
(a) Motor actuated valve with open/close service.
(3) *Basin No. 4 Influent Flow Meter Transmitter AGS-FIT-401 for monitoring the following*:
(a) *Basin No. 4 Influent Flow Meter AGS-FE-401*:
i) Magnetic flow meter for measuring influent flow into the basin
(4) Basin No. 4 Thermal Mass Flow Meter AGS-FIT-401:
(a) Measures process air flow to Basin No. 4.
(5) Basin No. 4 Aeration Header Air Valve AGS-VLV-405 :
(a) Motor actuated valve with modulating service.
(6) Basin No. 4 Air Valve AGS-VLV-408:

(a) Motor actuated valve with open/close service.

(7) Basin No. 4 Air Valve AGS-VLV-409:
(a) Motor actuated valve with open/close service.

(8) Basin No. 4 Sludge Withdrawal Valve AGS-VLV-410:
(a) Motor actuated valve with modulating service.

(9) Basin No. 4 WLC Withdrawal Valve AGS-VLV-411:
(a) Motor actuated valve with modulating service.

(10) Basin No. 4 Level Indicating Transmitter AGS-LIT-401:
(a) Submersible pressure transducers for measuring basin water level.

(11) Basin No. 4 Analytical Transmitter AGS-AIT-410:
(a) Transmitter/controller for monitoring the following basin probes:
i) Analytical element AGS-AE-411 for measuring NH_4^+.

(12) Basin No. 4 Analytical Transmitter AGS-AIT-420:
(a) Transmitter/controller for monitoring the following basin probes:
i) Analytical element AGS-AE-421 for measuring pH/Temperature.
ii) Analytical element AGS-AE-422 for measuring DO.

(13) Basin No. 4 Analytical Transmitter AGS-AIT-430
(a) Transmitter/controller for monitoring the following basin probes:
i) Analytical element AGS-AE-431 for measuring TSS.
ii) Analytical element AGS-AE-432 for measuring ORP.

(14) Basin No. 4 Analytical Transmitter AGS-AIT-440
(a) Transmitter/controller for monitoring the following basin probes:
i) Analytical Elements AGS-AE-441 for measuring nitrates.

e. The AGS Basins receive and treat influent wastewater. The basins include Equipment Supplier provided instrumentation and all required tank internals for a complete functional system.

6. Sludge Buffer Tanks:
a. Sludge Buffer Tank No. 1:
(1) Waste Sludge Header Valve AGS-VLV-511
(a) Motor actuated valve with open/close service.
(2) Sludge Buffer Tank No. 1 Level Transmitter AGS-LIT-510.
(a) Submersible pressure transducers for measuring the Sludge Buffer Tank level.
(3) Sludge Buffer Tank No. 1 Level Switches AGS-LSLL-510, AGS-LSL-510, and AGS-LSH-510.
(a) Float level switches for tank level alarms and automatic shutoff of the Sludge Pumps and Supernatant Pumps in REMOTE AUTO.

b. Sludge Buffer Tank No. 2:
(1) Waste Sludge Header Valve AGS-VLV-521
(a) Motor actuated valve with open/close service.
(2) Sludge Buffer Tank No. 1 Level Transmitter AGS-LIT-520.
(a) Submersible pressure transducers for measuring the Sludge Buffer Tank level.
(3) Sludge Buffer Tank No. 1 Level Switches AGS-LSLL-520, AGS-LSL-520, and AGS-LSH-520.
(a) Float level switches for tank level alarms and automatic shutoff of the Sludge Pumps and Supernatant Pumps in REMOTE AUTO.

c. Sludge is wasted from the AGS Basins to the Sludge Buffer Tanks for gravity thickening and subsequent pumping of sludge and supernatant.

7. Supernatant Pumps:
    a. Supernatant Pump No. 1 AGS-PMP-610:
        (1) Horizontal centrifugal pump controlled by a VFD (by Others).
        (2) Associated with Sludge Buffer Tank No. 1.
    b. Supernatant Pump No. 2 AGS-PMP-620:
        (1) Horizontal centrifugal pump controlled by a VFD (by Others).
        (2) Associated with Sludge Buffer Tank No. 1 or Sludge Buffer Tank No. 2, dependent on position of manual pump valves and Operator selection at the Equipment Supplier HMI.
    c. Supernatant Pump No. 3 AGS-PMP-630:
        (1) Horizontal centrifugal pump controlled by a VFD (by Others).
        (2) Associated with Sludge Buffer Tank No. 2.
    d. *Supernatant Flow Transmitter AGS-FIT-601 for monitoring the following*:
        (1) *Supernatant Flow Meter AGS-FE-701*:
            (a) Magnetic flow meter for measuring supernatant flow from Sludge Buffer Tanks.
    e. Supernatant Pumps transfer supernatant from the Sludge Buffer Tanks to the AGS Influent Header after the sludge layer has been discharged to the Solids Processing Building.
8. Sludge Pumps:
    a. Sludge Pump No. 1 AGS-PMP-710:
        (1) Horizontal centrifugal pump controlled by a VFD (by Others).
        (2) Associated with Sludge Buffer Tank No. 1.
    b. Sludge Pump No. 2 AGS-PMP-720:
        (1) Horizontal centrifugal pump controlled by a VFD (by Others).
        (2) Associated with Sludge Buffer Tank No. 1 or Sludge Buffer Tank No. 2, dependent on position of manual pump valves and Operator selection at the Equipment Supplier HMI.
    c. Sludge Pump No. 3 AGS-PMP-730:
        (1) Horizontal centrifugal pump controlled by a VFD (by Others).
        (2) Associated with Sludge Buffer Tank No. 2.
    d. Sludge discharge header Analytical Transmitter AGS-AIT-701 for monitoring the following probes:
        (1) Sludge discharge header Analytical Element AGS-AE-701 for measuring TSS.
    e. *Sludge Flow Transmitter AGS-FIT-701 for monitoring the following*:
        (1) *Sludge Flow Meter AGS-FE-701*.
            (a) Magnetic flow meter for measuring waste sludge flow from Sludge Buffer Tanks.
    f. Sludge Pumps transfer thickened sludge from the Sludge Buffer Tanks to the Solids Processing Building.
9. Water Level Correction (WLC) Tank:
    a. WLC Tank Level Transmitter AGS-LIT-801.
        (1) Submersible pressure transducers for measuring the WLC Tank level.
    b. WLC Tank Level Switches AGS-LSLL-801, AGS-LSL-801, and AGS-LSH-801.
        (1) Float level switches for tank level alarms and low water cutoff of the WLC Pumps.
    c. WLC is transferred from the AGS Basins to the WLC Tank for reprocessing through the Treatment System.

10. WLC Pumps:
    a. WLC Pump No. 1 AGS-PMP-810:
        (1) Horizontal centrifugal pump controlled by a VFD (by Others).
    b. WLC Pump No. 2 AGS-PMP-820:
        (1) Horizontal centrifugal pump controlled by a VFD (by Others).
    c. *WLC Return Flow Transmitter AGS-FIT-801 for monitoring the following*:
        (1) *WLC Return Flow Meter AGS-FE-801*:
            (a) Magnetic flow meter for measuring WLC return from WLC Tank.
    d. WLC Pumps transfer liquid from the WLC Tank to the AGS Influent Header.
11. Aeration Blowers:
    a. Aeration Blower No. 1 AGS-BLOW-910.
        (1) Rotary lobe blower package controlled by a VFD (by Others).
    b. Aeration Blower No. 2 AGS BLOW-920.
        (1) Rotary lobe blower controlled by a VFD (by Others).
    c. Aeration Blower No. 3 AGS-BLOW-930.
        (1) Rotary lobe blower controlled by a VFD (by Others).
    d. Aeration Blower No. 4 AGS-BLOW-940.
        (1) Rotary lobe blower controlled by a VFD (by Others).
    e. Aeration Blower No. 5 AGS-BLOW-950.
        (1) Rotary lobe blower controlled by a VFD (by Others).
    f. Aeration Header Pressure Transmitter AGS-PIT-901:
        (1) Pressure transmitter used for monitoring common aeration header pressure.

D. Description of Operation:
1. Equipment Supplier shall provide complete control system for integrating all process equipment, instrumentation, and required control sequences for complete operation of the Treatment System. The following descriptions of operation are not intended to be complete. Equipment Supplier shall incorporate functionality described herein and coordinate with Design Engineer on any items that conflict with ability of Equipment Supplier control system to perform properly.
2. AGS Basin Feed System:
    a. Equipment Supplier shall develop operating sequences for controlling AGS Basin Influent Valves based on influent conditions and historical treatment performance.
    b. When transitioning influent feed to a subsequent AGS Basin, the programming shall not allow the previous AGS Basin Influent Valve to close until the current AGS Basin valve is confirmed. For example, if the control system is transitioning between AGS Basin No. 1 and AGS Basin No. 2, the following sequence shall be considered:
        (1) AGS Basin No. 2 Influent Valve A AGS-VLV-201 shall be called to open. Once confirmed open, AGS Basin No. 1 Influent Valve A AGS-VLV-101 shall be called to close.
    c. AGS Influent Valve Automatic Rotation
        (1) The two (2) AGS Influent Valves associated with each AGS Basin shall be programmed in a Duty and Standby configuration.
        (2) The Duty valve shall be automatically opened and closed as needed per the Equipment Supplier's control requirements.
        (3) The Duty valve shall operate as the control valve for an adjustable number of hours prior to automatic alternation of the Influent Valves. The timer shall be adjustable by the operator and initially set at 168 hours.

(4) The Influent Valves shall be rotated automatically by the Equipment Supplier control system. Manual rotation of the Influent Valves shall also be available to the plant operator at the Equipment Supplier operator workstation.
(a) When the rotation timer elapses, the control system shall queue the rotation of the valves and perform the transition during the next influent cycle when both valves are in the open position. At the end of that cycle, the previous Standby valve shall transition to the Duty valve and close as required.
(5) The Standby valve shall be maintained open at all times during normal operation.

3. AGS Basin Cycle Times:
a. Equipment Supplier shall develop operating sequence for controlling all cycle times, including fill/draw phase, react phase (including aerated and non-aerated operation, as necessary), and settle / decant phase.
b. Equipment Supplier shall provide operator adjustable setpoints for process inputs, including DO, ORP, pH, TSS or other parameters that are assocaited with automatic control of air flow, cycle time, or settling time.

4. AGS Basin Air Flow Control and Blower Control:
a. Equipment Supplier shall include air flow control process for a common aeration header serving all reactors. Each reactor shall utilize the dedicated modulating Aeration Header Valve to deliver air as needed.
b. Blower Control:
(1) Equipment Supplier shall provide complete control system for managing air flow to the AGS Basins.
(2) The Aeration Blowers shall be capable of being controlled at the associated blower VFD or remotely by the Equipment Supplier control system when the LOCAL/OFF/REMOTE switch is in REMOTE.
(3) Local Control:
(a) When the blowers are in LOCAL control, starting, stopping, and speed adjustment shall be controlled at the associated VFD.
(4) Remote Control:
(a) When the blowers are in REMOTE control, starting, stopping, and speed adjustment shall be controlled from the Equipment Supplier main control panel (AGS-MCP-001) PLC.
(b) When a run command associated with the blower is communicated to the VFD, the corresponding blower shall start and run. When a stop command associated with the pump is communicated to the VFD, the corresponding pump shall stop.
(c) HMI screens shall be developed to allow the operators to select from the following modes of operation:
(d) Remote Manual Control Mode:
i) Starting and stopper of each of the blowers is initiated by the operator at the MCP OIT.
ii) The operator shall set the speed as a percentage of full speed for each of the VFD controlled blowers.
(e) Remote Automatic Control Mode:
i) The control system shall automatically start, stop, and adjust the speed of the blowers based on DO, ORP, pH, ammonium, or other

parameters as required by the Equipment Supplier to maintain process performance.

ii) The blowers shall be configured in a four (4) Duty and one (1) Standby configuration. At Equipment Supplier's discretion, the blowers may be programmed to allow all five (5) blowers to operate simultaneously if recommended for process performance.

iii) The blowers shall be rotated automatically by the control system. All available blowers shall be assigned a sequential priority. After each blower stop cycle, the stopped blower shall automatically be moved to the last priority assignment, with remaining blowers moving up one priority assignment.

5. AGS Water Level Correction (WLC) and Sludge Withdrawal:
   a. Equipment Supplier shall provide programming to automatically open/close/modulate the WLC and sludge withdrawal automatic valves as needed during the settling phase of the biological process.
   b. Valve percent open setpoints shall be developed by Equipment Supplier during commissioning and startup.
6. Sludge Pump Control:
   a. Equipment Supplier shall provide complete control system for managing sludge withdrawal from the Sludge Buffer Tanks. All Sludge Pumps are configured to pump into a shared discharge header. Flow monitoring is available on the shared discharge header only.
   b. The sludge pumping system is provided with one (1) common TSS analytical element installed on the common sludge discharge header.
   c. The pumps shall be capable of being controlled at the associated pump VFD or remotely by the Equipment Supplier control system when the LOCAL/OFF/REMOTE switch is in REMOTE.
   d. Local Control:
      (1) When the pumps are in LOCAL control, starting, stopping, and speed adjustment shall be controlled at the associated VFD.
   e. Remote Control:
      (1) When the pumps are in REMOTE control, starting, stopping, and speed adjustment shall be controlled from the Equipment Supplier main control panel (AGS-MCP-001) PLC.
      (2) When a run command associated with the pump is communicated to the VFD, the corresponding pump shall start and run. When a stop command associated with the pump is communicated to the VFD, the corresponding pump shall stop.
      (3) HMI screens shall be developed to allow the operators to select from the following modes of operation:
      (4) Remote Manual Control Mode:
         (a) Starting and stopper of each of the pumps is initiated by the operator at the MCP OIT.
         (b) The operator shall set the speed as a percentage of full speed for each of the VFD controlled pumps.
      (5) Remote Automatic Control Mode:
         (a) The control system shall automatically start, stop, and adjust the speed of the pumps based on tank level, total suspended solids, and/or sludge discharge flow.

(b) No more than one (1) pump shall be called to run at a time.
(c) Sludge Pumps shall be shut off if low low level is reached in the associated Sludge Buffer Tank. Sludge Pump No. 2 shall shut off only if the tank it is assigned to reaches low low level.

(6) Sludge Pump No. 2 (AGS-PMP-720) operation:
(a) The HMI screen shall allow the operator to select the Sludge Buffer Tank with which the pump is associated. The allowable assignments shall be as previously defined in the System Components and Functions section above.
i) A warning pop-up shall be programmed to ensure the operator has confirmed the manual valve changes for the selected pump assignment. The pop-up shall read as follows:
a) "Warning: Pump assignment change requires operator confirmation of manual valve positions for intended usage! Are valve positions correct (YES) (NO)?"
b) If "YES" is selected the assignment change shall be executed. If "NO" is selected the assignment change shall be ignored and remain unchanged.
(b) When two (2) pumps are assigned to one (1) Sludge Buffer Tank, the following automatical controls shall be additionally applicable to other automatic operations:
i) The two (2) pumps shall be programmed in a Duty and Standby Configuration.
ii) The pumps shall be rotated automatically by the control system or manually by the operator. Selections shall be made available on the OIT for enabling and disabling this function.
a) If automatic rotation is enabled, the pumps shall rotate Duty and Standby assignment ater each pump stop cycle.
b) If automatic rotation is disabled, the pumps shall rotate Duty and Standby assignment manually by the operator.

7. Supernatant Pump Control:
a. Equipment Supplier shall provide complete control system for managing supernatant withdrawal from the Sludge Buffer Tanks. All Supernatant Pumps are configured to pump into a shared discharge header. Flow monitoring is available on the shared discharge header only.
b. The pumps shall be capable of being controlled at the associated pump VFD or remotely by the Equipment Supplier control system when the LOCAL/OFF/REMOTE switch is in REMOTE.
c. Local Control:
(1) When the pumps are in LOCAL control, starting, stopping, and speed adjustment shall be controlled at the associated VFD.
d. Remote Control:
(1) When the pumps are in REMOTE control, starting, stopping, and speed adjustment shall be controlled from the Equipment Supplier main control panel (AGS-MCP-001) PLC.
(2) When a run command associated with the pump is communicated to the VFD, the corresponding pump shall start and run. When a stop command associated with the pump is communicated to the VFD, the corresponding pump shall stop.

(3) HMI screens shall be developed to allow the operators to select from the following modes of operation:
(4) Remote Manual Control Mode:
(a) Starting and stopping of each of the pumps is initiated by the operator at the MCP OIT.
(b) The operator shall set the speed as a percentage of full speed for each of the VFD controlled pumps.
(5) Remote Automatic Control Mode:
(a) The control system shall automatically start, stop, and adjust the speed of the pumps based on tank level, and/or supernatant discharge flow.
(b) No more than one (1) pump shall be called to run at a time.
(c) Supernatant Pumps shall be shut off if low low level is reached in the associated Sludge Buffer Tank. Supernatant Pump No. 2 shall shut off only if the tank it is assigned to reaches low low level.
(6) Supernatant Pump No. 2 (AGS-PMP-620) operation:
(a) The HMI screen shall allow the operator to select the Sludge Buffer Tank with which the pump is associated. The allowable assignments shall be as previously defined in the System Components and Functions section above.
i) A warning pop-up shall be programmed to ensure the operator has confirmed the manual valve changes for the selected pump assignment. The pop-up shall read as follows:
a) "Warning: Pump assignment change requires operator confirmation of manual valve positions for intended usage! Are valve positions correct (YES) (NO)?"
b) If "YES" is selected the assignment change shall be executed. If "NO" is selected the assignment change shall be ignored and remain unchanged.
(b) When two (2) pumps are assigned to one (1) Sludge Buffer Tank, the following automatical controls shall be additionally applicable to other automatic operations:
i) The two (2) pumps shall be programmed in a Duty and Standby Configuration.
ii) The pumps shall be rotated autoatically by the control system or manually by the operator. Selections shall be made available on the OIT for enabling and disabling this function.
a) If automatic rotation is enabled, the pumps shall rotate Duty and Standby assignment ater each pump stop cycle.
b) If automatic rotation is disabled, the pumps shall rotate Duty and Standby assignment manually by the operator.

8. WLC Pump Control:
a. Equipment Supplier shall provide complete control system for managing liquid withdrawal from the WLC Tank. All WLC Pumps are configured to pump into a shared discharge header. Flow monitoring is available on the shared discharge header only.
b. The pumps shall be capable of being controlled at the associated pump VFD or remotely by the Equipment Supplier control system when the LOCAL/OFF/REMOTE switch is in REMOTE.

c. Level switches associated with the WLC Tank will be incorporated into an external low water cutoff (LWCO) system to shut the WLC Pumps off if the low low level is reached.
d. Local Control:
(1) When the pumps are in LOCAL control, starting, stopping, and speed adjustment shall be controlled at the associated VFD.
e. Remote Control:
(1) When the pumps are in REMOTE control, starting, stopping, and speed adjustment shall be controlled from the Equipment Supplier main control panel (AGS-MCP-001) PLC.
(2) When a run command associated with the pump is communicated to the VFD, the corresponding pump shall start and run. When a stop command associated with the pump is communicated to the VFD, the corresponding pump shall stop.
(3) HMI screens shall be developed to allow the operators to select from the following modes of operation:
(4) Remote Manual Control Mode:
(a) Starting and stopping of each of the pumps is initiated by the operator at the MCP OIT.
(b) The operator shall set the speed as a percentage of full speed for each of the VFD controlled pumps.
(5) Remote Automatic Control Mode:
(a) The control system shall automatically start, stop, and adjust the speed of the pumps based on tank level, and/or discharge flow.
(b) No more than one (1) pump shall be called to run at a time.
(c) The two (2) pumps shall be programmed in a Duty and Standby configuration.
i) The pumps shall be rotated autoatically by the control system or manually by the operator. Selections shall be made available on the OIT for enabling and disabling this function.
a) If automatic rotation is enabled, the pumps shall rotate Duty and Standby assignment ater each pump stop cycle.
b) If automatic rotation is disabled, the pumps shall rotate Duty and Standby assignment manually by the operator.

E. Setpoints and Ranges:
1. For air flow meters, level transmitters, and all analytical devices, Equipment Supplier shall provide a display of instrument range with measurement on HMI screens.

F. System Upsets and Procedures for Recovery:
1. If an abnormal system condition is detected, the control system shall alarm the operator via the operator workstation. Abnormal system conditions shall be as recommended by the Equipment Supplier and the following as minimum:
a. Analytical instrument measurement is out of normal operating range.
b. High level for each basin.
c. Low level for each basin.
d. Reverse flow.
e. Pump, valve, or blower failure.
2. System in Remote Automatic control mode:
a. If a low level is detected by either sludge buffer or water level correction basin level transmitter while the basin is in service, all associated pumps shall be called to stop

pumping. The associated pumps shall be allowed to run when the level rises above the pump run setpoint.

b. If a low-low level is detected by either sludge buffer or water level correction basin level switch while the basin is in service, all associated pumps shall be called to stop pumping. The associated pumps shall be allowed to run if the level switch returns to normal state and the alarm is cleared at the operator workstation.

c. In the event a Duty pump becomes unavailable, fails to start, or drops off-line, the Standby pump in the starting sequence shall be automatically selected to operate as the lead pump.

d. In the event an influent valve fails or becomes unavailable, the available valve shall close and the reactor operation shall stop. The AGS control system shall alarm the operator via the operator workstation. The reactor shall be allowed to resume automatic operation after the operator has acknowledged the following message: "Has the malfunctioning influent valve been manually opened and locked out?" If the operator selects "Yes", the available valve shall be selected as duty and the reactor processes shall restart. If the operator selects "No", the reactor shall remain out of operation.

3. Unless otherwise specified, all equipment shall automatically restart after a power failure utilizing adjustable start delay timers in PLC control logic. Unless otherwise specified, all PLC control strategies shall be based upon automatic restart after a power failure and shall return to a normal control mode upon restoration of power. Monitoring of power failure shall be through the plant control system network communications.

a. If operating prior to the power failure in automatic mode, the Aeration Blowers shall be sequentially restarted by the AGS control system. No more than one blower shall be started simultaneously. Operator adjustable time delays shall be programmed between the enabling of each blower to operate.

2.11 INSTRUMENTATION:

A. All instrumentation shall be as specified in Section 40 70 00. Provide instruments as specified herein and as shown on the AGS Instrument List provided as an Appendix to this Section.

B. All analytical instrumentation shall be manufactured by Hach, unless otherwise specified.

C. Temperature/pH Transmitter:

1. Function: Continuously, measure, indicate, and transmit water temperature and pH of AGS Basin. Each temperature/pH transmitter shall be integrated with the Equipment Supplier PLC for monitoring, data recording, and process control.

2. Provide one temperature / differential pH transmitter for each AGS Basin. The probe shall use two measuring electrodes to compare the process value to a stable internal reference. The sensor shall have a built-in preamplifier, and include an integral temperature sensor. The pH sensor shall automatically compensate measured values for changes in temperature.

3. Temperature/pH instrument shall be provided with pole mount assembly and handrail support attachments. Equipment Suppler shall provide complete mounting and support assembly.

4. The probe shall be suitable for installation within a Class I, Division 2 area.

D. Dissolved Oxygen Transmitter:

1. Function: Continuously, measure, indicate, and transmit dissolved oxygen (DO) concentration of AGS Basin. Each DO transmitter shall be integrated with the Equipment Supplier PLC for monitoring, data recording, and process control.

2. DO probe shall be a continuous-reading probe utilizing luminescent sensor technology, and shall provide electrolyte-free operation without requiring sample conditioning.
3. DO probe shall be provided with pole mount assembly and handrail support attachments. Equipment Suppler shall provide complete mounting and support assembly.
4. The probe shall be suitable for installation within a Class I, Division 2 area.

E. Level Transmitters/Switches:
1. Function: Continuously measure, indicate, and transmit the level of water in each AGS Basin, Sludge Buffer Tank, and WLC Tank.
2. Provide one (1) submersible pressure transducer for each reactor, sludge buffer basin, and water level correction basin as indicated. The transducers shall provide continuous level monitoring for each location
3. Provide the transducers and accessories as follows:
   a. Transducer body shall be constructed of stainless steel.
   b. Loop-powered, 4-20mA signal output.
   c. Transducer model shall be Keller Levelrat or Engineer-approved equal.
   d. Provide a local display indicator within a NEMA 4X 304 SST enclosure as a complete and pre-wired assembly.
   e. Provide moisture-excluding bellows supplied loose for installation in the display indicator enclosure. The Contractor shall install the bellows in the enclosure per manufacturer recommendations.
   f. All mounting and support materials shall be 304 stainless steel.
   g. Equipment Supplier shall provide complete mounting and support assembly per recommendations, unless otherwise indicated. The Contractor shall be responsible for installing the mounting and support assembly per manufacturer recommendations, Specifications, and Contract Drawings.
4. Provide level switches as follows and as indicated:.
   a. One (1) level switch for each reactor.
   b. Three (3) level switches for each sludge buffer basin.
   c. Four (4) level switches for each water level correction basin.
   d. Level switch shall be float-type as specified in Section 40 70 00. Provide with the indicated mounting brackets and weight kits for locations indicated. Suspending float switches from support masts shall not be allowed.

F. Oxidation-Reduction Potential Transmitter:
1. Function: Continuously measure, indicate, and transmit the ORP of the liquid in the AGS Basins. Each ORP transmitter shall be integrated with the Equipment Supplier PLC for monitoring, data recording, and process control.
2. Provide one ORP probe per AGS Basin.
3. ORP probe shall use two measuring electrodes to compare the process value to a stable internal reference. The sensor shall have a built-in preamplifier, and include an integral temperature sensor.
4. ORP probe shall be provided with pole mount assembly and handrail support attachments. Equipment Suppler shall provide complete mounting and support assembly.
5. The probe shall be suitable for installation within a Class I, Division 2 area.

G. Ammonium Probe:
1. Function: Continuously measure, indicate, and transmit the ammonia concentration of the liquid in the AGS Basins. Each ammonium probe shall be integrated with the Equipment Supplier PLC for monitoring, data recording, and process control.
2. Provide one Ammonium Probe per basin.

3. Ammonium probe shall be model HC-200NH, as manufactured by Horiba Process & Environmental.
4. Ammonium probe shall be provided with pole mount assembly and handrail support. Equipment Supplier shall provide complete mounting and support assembly.
5. The probe shall be suitable for installation within a Class I, Division 2 area.

H. Nitrate Probe:
1. Function: Continuously measure, indicate, and transmit the nitrate concentration of the liquid in the AGS Basins. Each nitrate probe shall be integrated with the Equipment Supplier PLC for monitoring, data recording, and process control.
2. Prove one Nitrate Probe per basin.
3. Nitrate probe shall be Nitratax 2 mm path length, as manufactured by Hach. Probe shall utilize UV absorption technology, and shall provide reagent-free operation. Sensor shall include self-cleaning device.
4. Nitrate probe shall be provided with pole mount assembly and handrail support. Equipment Supplier shall provide complete mounting and support assembly.
5. The probe shall be suitable for installation within a Class I, Division 2 area.

I. Orthophosphate Analyzer
1. Function: Provide routine measurement, indication, and transmittance of orthophosphate concentration of the liquid in a common AGS effluent location. Each orthophosphate analyzer shall be integrated with the Equipment Supplier PLC for monitoring, data recording, and process control.
2. Provide one Orthophosphate Analyzer to be installed in the UV Disinfection influent channel.
3. The analyzer shall be an Phosphax sc Orthophosphate Analyzer, as manufactured by Hach. The analyzer shall include an ASA UV-resistant, lockable housing, rated to IP55. It shall feature automatic cleaning and calibration, and adjustable extensive self-diagnostics.
4. Furnish one (1) Hach Filtrax sampling system to be installed for use with the Phosphax analyzer. The sampling system shall consist of a IP55 rated control unit with 120V power supply, submersible module holder and sample delivery hose. Sample hose shall be heated type that is powered from the control unit enclosure. Unit shall be provided with minimum 20 feet of heated suction tubing and 60 feet of heated discharge tubing.

J. Total Suspended Solids Probe:
1. Function: Provide routine measurement, indication, and transmittance of total suspended solids in each AGS Reactor and the discharge of the sludge pumping system. Each total solids probe shall be integrated with the Equipment Supplier PLC for monitoring, data recording, and process control.
2. Provide four (4) immersion-style total solids probes to be installed in AGS Basins No. 1 through No. 4, and one (1) pipe insertion-style total solids probe to be installed on the sludge discharge line.
3. The immersion-stype probes shall be Hach model TSS EX1 sc sensor. The insertion style probe shall be Hach model Solitax sc with wiper.
4. Each immersion-style probe shall be provided with pole mounting kit to be field mounted.
5. Each pipe-insertion-style probe shall be provided with installation armature and isolation valve to allow removal of probe from service. Equipment Supplier shall coordinate installation detail with Contractor.
6. The probe shall be suitable for installation within a Class I, Division 2 area.

K. Universal Controller Probe Modules:

1. AGS Basins:
    a. Three (3) Hach SC4500 Multi-Parameter Universal Controller Probe Module shall be provided for each AGS Basin. The probe modules shall receive inputs from all Hach instrument sensors provided in each basin.
    b. Each basin controller shall be rated for use with Class I, Division 2 rated probes. All accessories to achieve C1D2 probe rating shall be provided.
2. Sludge Pumping:
    a. One (1) Hach SC4500 Universal Controller Probe Module shall be provided for use with the Solitax sc inline probe adajcent to the Sludge Pumps.
3. Effluent Sampling:
    a. One (1) Hach SC4500 Universal Controller Probe Module shall be provided for use with the Phosphax analyzer mounted in the UV Disinfection Building.
    b. Provide all required accessories for connection of Phosphax instrument to SC4500 Controller, including power junction box.
4. An analog output (4-20mA) card in the probe module shall provide analytical instrumentation signals to the PLC. Quantity of analog outputs per module shall be as required by the instrument and I/O lists. The probe module shall be provided in IP65 enclosure with corrosion resistant finish. Probe module shall include internal 125 VAC power supply and EEPROM memory back-up.

L. Universal Controller Probe Modules – Horiba:
1. One (1) Horiba HD-200NH transmitter shall be provided for each AGS Reactor Basin. The probe module shall receive input from each Horiba instrument sensor.

M. Air Flow Meter:
1. Function: Continuously measure, indicate, and transmit signals proportional to air flow being supplied to each AGS Basin. Each air flow meter shall be integrated with the Equipment Supplier PLC for monitoring, data recording, and process control.
2. Provide one (1) air flowmeter for each AGS Basin.
3. Air flow meter shall be thermal dispersion type, with 1/2-inch compression fitting fabricated of stainless steel and appropriate for pipe insertion into a 14” SCH STD carbon steel pipe. Equipment Supplier shall coordinate appropriate length of insertion probe with Contractor to ensure flow meter manufacturer requirements are met.
4. Each air flow meter shall be provided with integral transmitter. Refer to Contract Drawings for location of meter and transmitter.
    a. Power supply to the transmitter shall be rated for 120Vac, single phase, 60Hz operation.
5. All cable fittings required for a complete installation to the transmitter shall be supplied.
6. Aeration piping design includes 24-feet of unobstructed straight pipe run upstream of flow meter and 12-feet of unobstructed straight pipe run downstream of flow meter. Flow conditioners shall not be used unless approved by Design Engineer.
7. Air flowmeter shall be Model ST51A as fabricated by Fluid Components International.
8. Air flowmeter shall be configured to allow mounting to sidewall of 14-inch aeration pipe.

2.12 SPECIAL TOOLS AND SPARE PARTS:

A. Provide the following spare parts at a minimum:
1. Refer to Section 43 11 13 for blower spare parts requirements.
2. Spare diffuser assemblies totaling a minimum of 3% of installed diffuser count.
3. Minimum ten (10) diffuser grid joint assemblies and couplings.
4. One (1) crimping tool.

5. One set of new and unused special tools required for installation, operation, and maintenance.
6. Provide electric motor actuator manufacturer recommended shelf spare parts to limit downtime following actuator failure.
7. One complete set of reagents/chemicals, calibration sets, and spare parts as specified for individual equipment items or instruments.
8. Provide one (1) spare, fully-programmed, and operation-ready PLC controller such that a malfunctioning controller may be replaced in-place and the AGS system will immediately resume operation.
9. Provide at least one (1) spare for each piece of PLC Equipment provided, including but not limited to:
    a. Power supply.
    b. Communications interface module.
10. Provide spare I/O cards in quantities corresponding to 10% (rounded up) of the total quantity of each type of card provided. At least one (1) spare shall be provided for each type of I/O card.
11. Two spare LED indicating lamps for each type and color used.
12. Two spare indicating light assemblies.
13. Provide ten (10) spare fuses of each type used including those used in power supplies, processor, and I/O cards.
14. Ethernet Switches: Provide one (1) spare of each type of switch used.

B. Provide a list of critical recommended and maintenance parts with pricing.
C. Provide prices for all replaceable parts associated with the Treatment System.
D. Guarantee availability of appropriate spare parts as listed above for a period no less than 20 years. If the company or product line no longer exists, the Supplier shall make provisions such that the Treatment System shall continue to operate at the spcified conditions using comparable equipment or products.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. The installing Contractor shall install the Treatment System in strict accordance with Equipment Supplier's instructions and recommendations. Equipment Supplier shall provide written instructions with their submittal on installation requirements.
B. The Equipment Supplier shall provide to the Purchaser a listing of Goods that require protection. Special storage, protection, and handling instructions shall be provided.
C. The Equipment Supplier shall supply all necessary control system addresses, control logic, and OIT screens in order for the Owner's System Integrator to program the plant control system operator screens, database, trends, reports, and alarms, as applicable.
D. Equipment Supplier shall provide a Certificate of Proper Installation to the Owner following installation to certify that the system (inclusive of all equipment specified herein) has been installed correctly.
E. Equipment Supplier shall coordinate exchange of information to the Owner's System Integrator to allow for integration of Treatment System into client SCADA system.

3.02 COMMISSIONING:

A. Refer to SECTION 01757 for additional commissioning requirements.
B. Once written Certification of Proper Installation has been issued, the Equipment Supplier shall coordinate with the Purchaser to perform functional testing of the Treatment System. It will be

the responsibility of the Equipment Supplier to coordinate with the Contractor and Owner to arrange the times for testing and startup activities.

C. The Equipment Supplier shall check all valves, controls, and other devices to ensure they are functional and ready for performance testing.
D. The Equipment Supplier shall field calibrate all instruments and be responsible for integration with the Equipment Supplier software programming.
E. Commissioning shall not be considered complete until influent wastewater has been processed through the Treatment System and all equipment and instrumentation has been verified to be working properly.
F. The Equipment Supplier shall complete all commissoning to the satisfaction of the Contractor and Owner prior to commencing the Performance Test.
G. The purpose of commissioning shall be to demonstrate the effectiveness of the following AGS system components and features:
    1. Automatic flow control of the Treatment System, including proper transition between AGS Basins.
    2. Start and stop of air system, and modulation of air flow control valves to maintain operational parameters.
    3. Monitoring of operating data as allowed by Owner.
    4. All control functions.
    5. Operation of all monitoring instruments.
    6. Operation of all associated pumping systems for the sludge blend tank and water level correction tank.

3.03 PERFORMANCE TEST:

A. Following completion of commissioning, the installing Contractor shall conduct the Performance Test (PT) with supervision assistance provided by the Equipment Supplier.
B. Successful completion of the PT shall constitute Initial Acceptance and commence warranty.
C. The Equipment Supplier shall provide the IPT Report within 7 days of completion of the test period.
D. To perform the test, the Equipment Supplier shall assist with operation of the system continuously over a sixty (60) calendar day test period, and collect and summarize data to demonstrate that the system meets the performance test requirements as specified in the warranty.
E. Water quality sampling shall be completed by the Contractor for the PT period.
F. In all cases, compliance with the requirements of this specification shall be determined for each calendar day, and to successfully pass the test, the Treatment System must comply with the requirements for each of the 60 calendar days of the PT.
G. Successful completion of the PT shall be defined as 60 continuous calendar days of operation without a major failure in the system and demonstration that the Treatment System meets all performance requirements established herein. A major failure in the system is one that interrupts system operation for more than 1 hour.
H. If the Treatment System fails to successfully complete the PT, the Equipment Supplier shall have the option of repeating the test over a second 60-day period. All water quality testing during a second, or subsequent PT period shall be the responsibility of the Equipment Supplier. If the system fails to successfully complete the PT during the second test period, the Equipment Supplier shall prepare a written plan for modifying or supplementing the system to meet all test requirements. The Equipment Supplier shall submit the written plan within 7 calendar days after the second unsuccessful test period ends.

I. During the PT, the Owner shall have the option of collecting samples for independent analyses to confirm measurements and analyses conducted by the Equipment Supplier. The Contractor and Owner shall have the option of witnessing all testing performed by the Equipment Supplier. The Equipment Supplier shall notify the Contractor a minimum of two weeks in advance of testing.

3.04 MONITORED TEST PERIOD (MTP):

A. Compliance with the requirements for treatment capacity, and Treatment system effluent water quality use shall be determined during the Monitored Test Period (MTP).
B. The MTP shall begin immediately after successful completion of the PT.
C. Duration shall be 180 calendar days.
D. The Owner shall operate the plant during the MTP; however, the Equipment Supplier shall be allowed to provide onsite or remote assistance.
E. The Equipment Supplier is responsible for monitoring the operating conditions and performance during the MTP. The Owner shall be responsible for providing the Equipment Supplier access to plant data under agreed upon authorized window times. Additionally, the Owner shall be responsible for providing water quality testing data and transfer of logged process data to the Equipment Supplier.
F. The Equipment Supplier shall summarize the data at the end of the MTP and report the results in writing to the Contractor and Owner. The report shall include a narrative description, tables and graphs of influent and effluent water quality parameters, air flow, and flow rates for all monitored liquid streams to document the performance of the system. The Equipment Supplier shall submit the report within 30 days following the end of the MTP.
G. The Treatment System shall exhibit development of granulation by the end of the MTP. To be considered a granular sludge, ninety (90) percent of the sludge shall have a particle size greater than 200 um.
H. The Contractor and Owner may conduct their own monitoring and record-keeping during the MTP. Any monitoring and record-keeping data shall be provided to the Equipment Supplier if requested.
I. The following parameters shall be evaluated during the MTP to determine compliance with the Equipment Suppliers stated performance in the Bidding Documents and submittals. Penalties that shall be owed to the Owner by the Equipment Supplier are as described below.
    1. Effluent Water Quality and Treatment Capacity: If the system fails to comply with the requirements for effluent water quality and treatment capacity as shown in Section 2.02 Biological System Design Criteria, the Equipment Supplier shall provide to the Purchaser a written plan of modifications to the Treatment System (such as repairing damaged components, replacing seals, complete replacement of components, etc.) to achieve compliance with the requirements. Upon implementation of the plan of modifications, the MTP shall recommence in its entirety.

3.05 ONSITE SERVICES:

A. The Equipment Supplier shall furnish qualified field personnel to observe and guide the installation, testing and placement of the Treatment System into successful operation. Trips in excess of those described below, which are required for placement of the Treatment System into successful operation shall be at Equipment Supplier's sole expense. The field personnel shall demonstrate experience with installation, start-up, and operation of Treatment Systems of comparable size, application, and complexity.
B. Equipment Supplier's Representative: In addition to the time necessary to complete the requirements established elsewhere within these Specifications, the Equipment Supplier's

Representative shall also provide onsite services at times designated by the Owner, for the minimum person-days listed below. Equipment Supplier shall account for travel time outside of these days in their Proposal. The Equipment Supplier's Representative shall be a qualified individual who has previously provided onsite services for the installation, testing, and startup of identical unit processes at a minimum of one wastewater treatment plant of similar size.

1. Electrical/I&C
   a. 4 trips, 16 days. Includes 1 float trip.
   b. Approx. 3.5 days per reactor, 1 day for SB/WLC
   c. Includes:
      (1) Electrical/I&C checkout – aeration system, valves, instrumentation
   d. Electrical/I&C checkout – controller/PLC installation, wiring, phase checks
   e. Manufacture Standard SAT – Site Acceptance Testing – controller and PLC final checkout
2. Mechanical
   a. 4 trips, 16 days. Includes 1 float trip.
   b. Approx. 3.5 days per reactor, 1 day for SB/WLC
   c. Includes:
      (1) Mechanical checkout, dry – basin internal piping, aeration system, valves
      (2) Mechanical checkout – instrumentation
      (3) Mechanical checkout – clean water submerged
3. Process
   a. 4 trips, 16 days. Includes 1 float trip.
   b. Approx. 3.5 days per reactor, 1 day for SB/WLC
      (1) Includes:
      (2) Process startup, checkout
      (3) Process training, sampling, classroom & field instruction
      (4) Seeding – oversight, process optimization

3.06 COORDINATION WITH THE SYSTEM INTEGRATOR:

1. The HMI screens associated with the AGS system shall be developed by the AGS System supplier.
2. The AGS System supplier shall coordinate with the System Integrator to establish HMI development standards to ensure the HMI screens developed by the AGS supplier and the System Integrator share the same typical graphics, faceplates, and function blocks to meet the project standards.
3. The System Integrator and AGS supplier shall work together to ensure required control and monitoring signals are communicated correctly between the AGS PLC and the plant PLCs.
4. The AGS system "AquaNereda Controller" shall be supplied by the AGS System Supplier in the form of a rack mounted host server. The server shall be installed and connected to the network by the SI. The AGS supplier shall be responsible for programming and configuration of the server. Coordination shall be provided for this work as required.
5. The System Integrator shall work with the AGS system supplier to establish communication with the aeration drive VFDs.
6. As a minimum the AGS system supplier and System Integrator shall participate in three web conferences setup by the System Integrator and attended by the Engineer to determine programming standards, verify proper application of the standards and coordinate communicated signals.

a. The first web conference shall occur a minimum of one month prior to the System Integrator or AGS system supplier starting system development and shall serve to discuss development standards and develop an action item list for information needed to properly develop the systems.
b. The second web conference shall occur one week prior to the AGS system supplier starting system development and shall serve as the meeting to communicate development standards to all parties.
c. The third web conference shall occur after the oxidation system supplier has completed their initial screen development and PLC program and shall serve as a review meeting to verify that proper standards have been followed and proper points are being communicated.
d. Follow up conferences shall occur as required during development and after initial development is completed to ensure the agreed to standards are being followed, discuss progress, verify communicated points and address any outstanding communication questions.

3.07 TREATMENT SYSTEM TRAINING:

A. Refer to SECTION 01664 for additional training requirements.
B. Training for the AGS system will take place at Aqua-Aerobic Systems, Inc. (AASI) in Loves Park, IL.
C. On-site training will take place at the Four Rivers Sanitation Authority (FRSA) in Rockford, IL.
D. Training sessions at AASI and FRSA will not conform to the format and content requirements specified in SECTION 01664 and must be approved by the Owner.
E. The Equipment Supplier shall furnish the services of qualified field personnel for 10 person-days to formally instruct the Owner's personnel on proper operation, installation, sampling, cleaning, maintenance, and troubleshooting for the Treatment System. Time spent with the Owner's personnel during the functional testing and PT does not count toward the training requirements. The training provided by the Equipment Supplier shall be recorded by the Contractor (provide 2 DVD copies and 2 thumb drives containing video files) for further use by the Owner. Equipment Supplier shall cover the following topics at a minimum:
    1. Process Overview
        a. Provide introductory training on Treatment System including:
            (1) Definitions.
            (2) Advantages.
            (3) Limitations.
            (4) Required pretreatment.
        b. Discuss the performance criteria, including treatment capacity, and water quality.
        c. Provide a detailed overview of the entire process and the purpose of each process component.
        d. Describe independent processes in detail.
    2. Equipment and System Controls:
        a. OIT:
            (1) Provide training on the features and use of each OIT.
            (2) Summarize and demonstrate features provided on each control screen.
        b. Integration with plant controls:
            (1) Discuss fail-safe features, alarms, and integration of the Treatment System with other process equipment.

(2) Discuss integration with the remainder of plant controls. The Purchaser can assist with this portion of the training.

c. Local control:
   (1) Demonstrate/discuss use of local controls for each component.

d. Instrumentation maintenance/calibration:
   (1) Provide "hands-on" training and discuss maintenance requirements as defined in the O&M manual for each unique instrument provided as part of this Procurement Agreement Document.
   (2) Demonstrate calibration of each type of instrument.
   (3) Review/identify documentation provided in O&M manuals

3. Operation:
   a. System Startup/Shutdown Procedures:
      (1) Discuss startup of the Treatment System and level of automation.
      (2) Provide detailed procedures for inspection during and after startup.
      (3) Discuss appropriate shutdown procedures.
      (4) Discuss automated shutdown procedures.
   b. Normal operation:
      (1) Provide detailed sample control screens demonstrating 'normal operation', and displaying the position of each valve during normal operation.
      (2) Discuss operational activities that must be conducted during normal operation to ensure proper operation of the system.
   c. Manual operation:
      (1) Describe/demonstrate operation of any components equipped with manual features.
   d. Typical Treatment Cycle:
      (1) Describe purpose of each treatment cycle.
      (2) Discuss process variables and monitoring aspects of each cycle.
      (3) Conduct field observation of all system transitions.
4. Monitoring/Troubleshooting:
   a. Describe methods of troubleshooting process equipment.
   b. Discuss parameters considered critical when troubleshooting problems.
5. Inspection Procedures/Maintenance:
   a. Review inspection procedures for critical components
   b. Review routine maintenance requirements for the entire Treatment System and ancillary components.
6. Proper record keeping:
   a. Discuss the importance of record keeping.
   b. Discuss critical parameters to be monitored and recorded.
   c. Provide sample forms.
7. Interpretation of data relative to operation:
   a. Discuss methods for interpreting data and identifying operational problems based on recorded data. This shall include (but not be limited to) changes in the following parameters:
      (1) Sludge granule size.
      (2) Effluent total solids.
8. Discuss any deficiencies identified during PT.
9. Provide contact information (including the toll-free number) where Owner's personnel can obtain assistance with operation/maintenance issues that may arise.

3.08 LONG-TERM OPERATIONS ASSISTANCE:

A. Equipment Supplier shall provide monitoring and remote operations support for a period of one (1) year after successful commissioning of the Treatment System, at no cost to the Owner.

END OF SECTION 46 53 60

SECTION 46 71 33 – ROTARY DRUM THICKENER EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section covers design calculations, process guarantee, labor, materials, equipment, and incidentals required for delivery to the project site ready for installation, testing and startup for two (2) complete rotary drum thickener systems, with components and accessories, as specified herein.

B. The equipment package shall include:
   1. Two complete rotary drum thickeners (RDTs) with motors, drives, flocculation tanks, spare parts, sludge hoppers, and special tools.
   2. Each complete RDT package shall include a dedicated main control panel and a remote OIT control panel.
   3. Any additional equipment accessories not specified but that are required to achieve the minimum specified performance.

C. The RDT system will be served by three (3) Thin Sludge Pumps. Pump No. 1 will be dedicated to RDT No. 1, and Pump No. 3 will be dedicated to RDT No. 2. Pump No. 2 will be a swing pump capable of feeding either RDT. Thin sludge will be transferred from aerated Thin Sludge Storage Tanks. The RDT will be located in the Solids Processing Building. Construction materials shall be as specified and as required for corrosion resistance.

D. The specified equipment furnished under this section shall be fabricated, assembled, and tested in full conformity with the Specifications, engineering data, instructions and recommendations of the equipment Manufacturer.

E. Related Work Elsewhere:
   1. Painting and Coating: Section 09 90 00.
   2. Pressure Piping: Section 33 11 00.
   3. Process Control Panels and Hardware: Section 40 67 00.
   4. Instrumentation for Process Systems Section 40 70 00.
   5. Progressive Cavity Pumps Section 43 23 57.
   6. Rotary Lobe Pumps: Section 43 23 58.
   7. Common Motor Requirements for Water and Wastewater Equipment: Section 46 05 13.
   8. Polymer Preparation and Feed System: Section 46 33 33.

1.02 REFERENCES:

A. American Society for Testing and Materials (ASTM):
   1. ASTM A36 - Standard Specifications for Structural Steel.
   2. ASTM A48 – Standard Specifications for Gray Iron Castings.
   3. ASTM A120 – Standard Specification for Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless, for Ordinary Uses.
   4. ASTM A123 – Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   5. ASTM A167 - Standard Specifications for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
   6. ASTM A395 – Ferritic Ductile Iron Pressure Retaining Castings for Use at Elevated Temperatures.
   7. ASTM A500 – Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
   8. ASTM A536 – Ductile Iron Castings.
   9. ASTM D349 – Standard Test Methods for Laminated Round Rods Used for Electrical Insulation.

B. American National Standards Institute (ANSI):

1. ANSI B16.1 – Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800.

C. The Society for Protective Coatings (SSPC):
1. SSPC SP-10 – Near White Blast Cleaning.

D. National Electrical Manufacturers Association (NEMA):
1. NEMA MG-1 – Motors and Generators.
2. NEMA – Control Panel Enclosures.

E. American Welding Society (AWS).
F. American Gear Manufacturers Association (AGMA).
G. American Federation of Bearing Manufacturers Association (AFBMA).
H. Underwriters Laboratory (UL).
I. American Institute of Steel Construction (AISC).
J. Standard Methods for the Examination of Water and Wastewater.

1.03 SUBMITTALS:

A. Submit in accordance with Division 1.
B. All submittal data shall be labeled in English units. All Drawings shall be drawn to scale, and text shall be in English.
C. Submit contact names, addresses, and telephone numbers of at least two (2) similar municipal wastewater installations that have been in operation in North America for at least two (2) years. Referenced installations shall have RDT specifically designed for municipal thickening of waste activated sludge only (no primary or blended sludge).
D. Submit copies of process performance testing requirements and performance guarantee.
E. Manufacturer shall provide a statement indicating the Manufacturer's understanding of the warranty requirements.
F. Submittals shall include, but not limited to, the following:
1. Dimensional layout for RDT, flocculation tank, sludge hopper, bypass system components, and electrical components, including control panels.
2. Manufacturer's specifications.
3. Rated capacity for all components under anticipated operating conditions. Manufacturers that submit a RDT rated capacity not adequate per design requirements will not be accepted.
4. Fabrication and erection drawings.
5. Detailed equipment drawings.
6. Detailed equipment foundation drawing sealed by Missouri Licensed Engineer.
7. Parts listing.
8. Protective coating systems.
9. Electrical schematic control diagrams, wiring diagrams.
a. All diagrams shall be complete and have uniquely numbered terminals, wires and devices.
b. Control wiring diagram showing wiring terminations for all external connections.
c. External connection diagrams between plant and vendor control panels.
10. Process and instrumentation diagrams (P&IDs).
11. Control panel layout with devices and nameplates shown.
12. Motor nameplate data.
13. Performance Testing Program.
14. Operating weight of unit and load distribution.
15. Past performance test on sludge type being dewatered, that shows unit meeting performance requirement of this specification.
16. Bearing life calculations based on design load sealed by Missouri Licensed Engineer.

17. Catalog cut sheets for all electrical devices which completely indicate all electrical ratings.
18. Electronic and paper copy of the PLC operating program, control screens and complete documentation for approval and Owner's use in installation and integration with the plant control system.
19. Submit a complete list of all PLC I/O addresses used. Each address shall have description that completely identifies what the corresponding address represents, (i.e. "Drum Drive Speed") and what the status of this address corresponds to.
20. Written work plan for field erection.
21. Refer to Section 40 67 00 for additional submittal requirements pertaining to control panels.
22. Refer to Section 46 05 13 for additional submittal requirements pertaining to motors.

G. Operation and Maintenance Manuals.
   1. The manuals shall be prepared specifically for this installation and shall include all required catalog cuts, drawings, equipment lists, descriptions, and other information that is required to instruct operation and maintenance personnel unfamiliar with such equipment.
   2. Special shipping, storage, protection, and handling instructions including dimensions of each container or package shipped.
   3. Recommended unloading method at project site including implement (e.g., forklift, etc.) and maximum container or package weight.
   4. Manufacturer’s printed installation instructions.
   5. Descriptions of system components.
   6. Overview of RDT design that meet these Specifications, including, but not limited to:
      a. Feed capacity.
      b. Acceptable loading conditions.
      c. Design flow and total solids for thickener feed, filtrate, and thickened solids under design operating conditions.
      d. Typical polymer feed rates.
      e. Wash water supply requirements.
   7. Specific instructions for typical laboratory procedures for operation control testing or references to published sources of such instructions.
   8. Descriptions of process control systems.

H. Manufacturer’s Certificate of Proper Installation in accordance with Section 01757 - Commissioning.

I. Submit complete, signed report of results of field inspection, operation, adjustments, and tests. Include the Manufacturer’s certificate that, as a result of Manufacturer’s inspection(s), the Manufacturer’s equipment has been found to be ready for permanent operation and is installed in accordance with the Manufacturer’s instructions.

1.04 QUALITY ASSURANCE:

A. All items of equipment specified herein shall be furnished by one Manufacturer. This Manufacturer shall have the responsibility of providing the equipment, accessories, installation supervision, and testing services required to provide a functioning system.

B. Like items of equipment provided hereunder shall be the end products of one Manufacturer in order to achieve standardization for appearance, operation, maintenance, spare parts, and manufacturer's service.

1.05 DELIVERY:

A. Equipment shall be shipped pre-assembled to the degree that is practicable.

B. Manufacturer shall provide storage instructions indicating specific requirements to ensure there is no damage to or deterioration of components.

1.06 PERFORMANCE GUARANTEE:

A. Provide a written guarantee that the thickener shall meet the specified operating requirements described in PART 2.

B. The ability of the equipment to accomplish the results stipulated shall be determined by a performance testing program using laboratory tests by standard laboratory procedures as outlined in the latest edition of Standard Methods.

C. Performance testing program shall be as described in PART 3.

1.07 WARRANTY:

A. The manufacturer shall warrant that all Equipment shall be free of defects caused by faulty material or workmanship and shall replace those parts for at least a period of one (1) year from the date of start-up.

B. Multiple warranties for individual components shall not be acceptable.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Materials, equipment, and accessories specified in this section shall be products of, or provided by:

1. FKC.
2. Parkson.
3. Andritz
4. JWC.

2.02 GENERAL:

A. The RDT shall thicken sludge by means of a rotating wedge-wire or perforated drum. The rotary drum thickener shall continuously receive and thicken sludge, passing filtrate through the openings in the drum. The thickened sludge shall be conveyed towards the discharge end of the drum. Thickened sludge will discharge at the end of the drum and be directed to an attached sludge hopper. The sludge hopper discharge shall consist of a 6-inch flanged connection.

B. Each rotary drum thickener shall be a complete thickening unit consisting of, but not limited to:

1. A structural frame, support structure.
2. A flocculation tank with variable speed mixer.
3. A thickening drum with variable speed drive.
4. An automatic drum wash system.
5. A drainage system.
6. Main Control Panel with PLC and OIT.
7. Remote Mounted OIT Control Panel.
8. All appurtenances required for the operation of the unit.

C. Primary control for the rotary drum thickner, and polymer preparation and metering system shall be through the rotary drum thickener control system. The RDT Control System will have

the ability to control all elements of the thickening process including: the Thin Sludge Pumps, flocculation tank, rotary drum thickener, polymer feed system, and wash water system.

1. The RDT Control System will interface with the polymer system local control panel for feed start/stop, system fail, metering pump feed rate, and polymer pacing rate via an Ethernet/IP communication link

D. All equipment shall be furnished by the manufacturer of the rotary drum thickener. The manufacturer shall provide a standard design, modified as necessary to meet the specifications herein.

E. The rotary drum thickener manufacturer shall be responsible for the proper operation and integration of all equipment provided under this Section.

F. The thickener shall be designed for disassembly of all components, including removal of rollers, and to provide accessibility for lubrication, inspection, mechanical adjustment, replacement of parts, and all other maintenance activities.

2.03 DESIGN AND PERFORMANCE CRITERIA:

A. Sludge Characteristics:

1. The wastewater treatment plant includes influent screening by 6 mm perforated plate screens, grit removal, and granular activated sludge biological treatment. Sludge from the biological treatment system is stored in the aerated Thin Sludge Holding Tanks prior to thickening.
    a. The rotary drum thickener system will be designed to receive waste sludge from the Thin Sludge Holding Tanks, with a total solids concentration between 0.5-2.0% wt.

B. Design Criteria (for each Rotary Drum Thickener unit):

1. Feed Sludge (Thin Sludge):
    a. Design Solids Loading: 1250 dry lbs/hr.
    b. Expected Feed Solids: 0.5-2.0%.
    c. Maximum Hydraulic Loading: 250 gpm.
    d. Minimum Thickener Solids Recovery: 95%.
    e. Minimum Thickened Solids Concentration: 5%.
2. Maximum Polymer Consumption: 14 lbs/dry ton solids based on 100% active product. Polymer consumption shall be determined by the quotient of the actual weight of polymer used/dry ton solids divided by the published % active product and the specific gravity of the emulsion.
3. Thickener Solids Recovery:
    a. Minimum 95% solids recovery with feed solids between 0.5-1.0% total solids.
    b. Minimum 97% solids recovery with feed solids between 1.0-2.0% total solids.
    c. Minimum 98% solids recovery with feed solids greater than 2.0% total solids.
4. Thickener shall be able to operate at a feed solids concentration up to 3.5% total solids at a reduced hydraulic loading rate.

2.04 MATERIALS OF CONSTRUCTION:

A. Materials used during manufacture of the RDT equipment shall be on the highest quality used in general commercial practice. Material shall be free from all defects and imperfections that may affect serviceability of the finished product. Used equipment, material, or parts will not be allowed.

B. Structural steel support members supplied by the rotary drum thickener manufacturer shall be 304L stainless steel.

C. Materials used shall conform to ASTM standards where such standards exist. Materials used shall be selected based on their continuous and successful use under similar service conditions.

D. Structural frames, plates, and shapes shall have a minimum thickness of 1/4-inch, unless otherwise specified. Bolts shall have a minimum diameter of 5/16-inch.
E. All wetted components, including, but not limited to, frames, flocculation tank, thickener cover, drain pans/trays, drain piping, wash piping, wash shower header and nozzles, and discharge hopper shall be fabricated of Type 304L stainless steel, or be of other, engineer-approved acceptable corrosion-resistant material.
F. All fasteners, pins, anchor bolts, washers and other hardware shall be Type 304L stainless steel.

2.05 SLUDGE CONDITIONING:

A. General:
1. The rotary drum thickener shall be furnished with a sludge conditioning system, designed to efficiently mix polymer with thickener feed sludge and to adequately condition the sludge for optimum thickener performance.
2. Sludge conditioning shall be initiated by injection of polymer through an injection ring located directly upstream of flocculation tank on the sludge feed piping. An additional polymer feed injection point is provided around 20-25-ft upstream of the flocculation tank. Sludge conditioning shall be completed in the flocculation tank upstream of the rotary drum thickener.
3. The manufacturer shall supply the polymer injection ring loose for installation by Contractor.
4. All wetted parts of the sludge conditioning system shall be constructed of 304L stainless steel.
   a. Aluminum shall not be acceptable.
5. All parts requiring regular maintenance, operational adjustment, lubrication or cleaning shall be readily accessible.
6. Components associated with polymer injection ring shall be hydrostatically tested by the manufacturer at the factory. Any components that associated with the polymer injection ring that exhibit leaking or decreases in pressure under field testing shall be repaired or replaced by the rotary drum thickener manufacturer at no additional cost to the Owner. Repaired systems shall be retested.

B. Polymer Injection Ring:
1. The injection ring shall have four separate injection points located 90 degress from each other for injection of polymer solution into the sludge feed piping.

C. Polymer Manifold:
1. The polymer manifold shall split the polymer feed line into four distinct injection lines for connection to the polymer injection ring.

D. Flocculation Tank:
1. The flocculation tank shall be constructed of 304L stainless steel throughout. The flocculation tank shall be self-supporting and shall have furnished stainless steel supports as required. The final dimensions of the concrete pad shall be coordinated during shop drawing review.
2. The flocculation tank will be designed for a hydraulic retention time of one (1) minute or greater under the design conditions specified herein.
3. The flocculation tank shall be equipped with a 6-inch flanged inlet connection located at or near the bottom of the tank, and a 6-inch outlet connection between the flocculation tank and rotary drum thickener. Final elevation of the inlet and oulet connection shall be coordinated during Submittal review.

4. The flocculation tank shall be supplied with a double vertical, flat blade impeller, mechanical mixer.
5. The mixer shall be equipped with a drive motor in accordance with Section 46 05 13.
   a. Provide two normally closed temperature switches embedded in each phase winding for high temperature protection. A high temperature detection shall be interlocked to prevent the VFD from powering the motor.
   b. Provide motor shaft grounding ring to discharge shaft currents to ground.
6. The mixer motor speed shall be adjustable with a manufacturer supplied VFD.
7. The top of the flocculation tank shall be covered with a removable, hinged access cover to allow regular inspection and maintenance. The access cover shall be facing south. Refer to drawings for orientation of floc tank.
8. Provide a point level switch with 2" NPT connection on tank lid for detection of high tank level. Manufacturer shall provide necessary equipment and recommendations for install to prevent false high level readings from splashing of liquid. Refer to Section 40 70 00 for other point level instrument requirements.Flocculation tank shall be connected to the rotary drum thickener in a manner that allows foul air to flow with the sludge to the hopper.

E. Thickener Distribution:
   1. The thickener inlet shall be designed to evenly distribute flow to the rotary drum thickener. Rods or bars that will trap stringy material shall not be used.

2.06 ROTARY DRUM THICKENER:

A. Main Structural Frame:
   1. The main structural frame shall be of electrical weld construction fabricated of 304 stainless steel structural members of sufficient design to support all components and accessories.
   2. The stainless steel frame shall be designed in accordance with the AISC Manual of Steel Construction, 15th Edition, ANSI/AISC 360-16, and AISC Design Guide 27 – Structural Stainless Steel, as applicable. Frame shall be designed for the loading from the equpiment under all possible opreations states, and for loadign as specified in ASCE 7-16.
   3. The structural frame shall be designed for installation on multiple 304L stainless steel legs anchored to a grout leveling pad with anchor bolts. The final dimensions of the stainless-steel support legs shall be coordinated during shop drawing review.
   4. Base frame disassembly shall not be required for removal of the drum or other mechanical components.
   5. No disassembled component, excluding the thickener frame, shall weigh more than 6,000 pounds. Lifting lugs shall be provided as necessary, but shall not restrict maintenance access points for the thickener.

B. Spray Shields/Cover:
   1. The drum shall be fully enclosed by removable spray shields located along each side of the thickener and a removable cover shall be mounted on the top. The cover hood shall be fabricated with handles to allow manual removal.
   2. The spray shields shall be designed to contain any fugitive spray and minimize mist emissions.
   3. The spray shields and cover shall be constructed of 304L stainless steel, with minimum 14-gauge thickness. Inspection doors shall be provided with neoprene seals around all openings to provide a water-tight fit. The thickener enclosure shall be equipped with a 6-inch diameter, flanged port on top of the cover to accommodate a future vent connection. A 6-inch blind flange and neoprene gasket shall be provided.

4. Manually removable doors or covers shall be equipped with handles and fastened with wing nuts, or another fastening system that allows for operator removal without special tools. If special tools are required for removal, manufacturer shall provide tools required for removal of doors or covers.

C. Rotary Drum System:
1. The drum shall be fabricated with a filter screen on the drum support structure, which rotates horizontally around a center feed assembly. The filter screen shall consist of stainless steel woven-wire mesh, wedge wire, or other filter material selected on the basis of porosity or percent openness, the opening size, and wire diameter used in the weaving process. The wire mesh, wedge wire, or other filter material shall be selected on the basis of maximizing flow and producing a high-quality filtrate.
2. The filter screen shall be changed from the drum support structure with simple tools. If special tools are required, manufacturer shall provide tools for complete disassembly of filter screen.
3. The rotary drum structure shall be constructed of 304L stainless steel.
4. The rotary system shall be equipped with internal mechanisms to influence shear, water release, and drainage rate independent of flow.
5. The inside of the drum shall have a series of angled flights welded to the interior to transport solids through the length of the drum.
6. Trunnion wheels, if required, shall be constructed of high-density polymer with an aluminum hub and dual-sealed, press fit steel tapered roller bearings. The bearings shall be lubricated by means of an external grease zerk and internal grease cavity located in the trunnion wheel shafts. The bearings shall remain sealed on the outer face with lubrication seals. Grease relief ports shall be provided to the exterior unit to confirm that proper lubrication of the bearing has been achieved.
7. The trunnion wheels shall be removable without the need for the drum to be removed from the unit. Cantilevered trunnion wheels shall not be allowed.
8. The drum may be constructed with a structural shaft along the centerline of the drum supported by pillow blocks and bearings on either end of the machine outside the process environment. The center shaft design shall not require internal trunnion wheels.
9. The rotary drum shall be equipped with a drive motor in accordance with Section 46 05 13.
    a. Provide two normally closed temperature switches embedded in each phase winding for high temperature protection. A high temperature shall prevent the VFD from powering the motor.
    b. Provide motor shaft grounding ring to discharge shaft currents to ground.
10. The rotary drum motor speed shall be adjustable with a manufacturer-supplied VFD.

D. Thickened Sludge Discharge Hopper:
1. Thickener manufacturer shall provide fully removable thickened sludge discharge hopper.
2. The thickened sludge hopper shall be constructed of minimum 14 gauge 304L stainless steel.
3. The structural design of the hopper, connections to the rotary drum thickener,and/or its floor supports shall be designed in accordance with the requirements for structural steel.
4. The hopper shall be designed to be supported off the rotary drum thickener frame, or with floor supports. At design conditions, the weight of the hopper and its contents shall not be transferred to the connected thickened sludge piping or pumps.

5. Hopper interior and exterior surfaces shall be smooth and free of sharp edges and burrs. All welds shall be ground smooth.
6. The discharge end of the thickener shall be supplied with covers which prevent splashing of thickened sludge outside of the hopper. The covers shall be hinged and gasketed to allow observation and inspection of the thickened sludge discharge.
7. The sludge discharge hopper shall be designed and fabricated by the thickener manufacturer. The discharge hopper shall be constructed with one (1) 6-inch diameter flanged connection at the bottom of the hopper to connect to the suction piping for thickened sludge pumps. The flanged connection at the bottom hopper shall be at an elevation approxiamtely 32 inches from finished floor. Final elevation shall be coordinated during Submittal review.
8. The discharge hopper shall be sized to provide adequate working volume for operating thickened sludge pumps without running dry.
9. At the top of discharge hopper, a conductive type point level switch for high sludge levels shall be provided. Manufacturer shall provide necessary equipment and recommendations for install to prevent false high level readings from splashing of sludge. During startup and commissioning, the switch on each hopper shall be field verified to function. Refer to Section 40 70 00 for other point level instrument requirements.
10. Thickener manufacturer shall provide one (1) minimum 2-inch flanged connections on discharge hopper for mouting of a hydrostatic pressure transducers. Manufacturer shall provide pressure transducer in accordance with requirements of Section 40 70 00.
11. Thickener manufacture shall provide one (1) 1 ½-inch NPT connection for a wash water connection on the discharge hopper.
12. Discharge hopper shall be designed to allow near-complete drainage through bottom flanged connections.
13. The final sizing and dimensions of the thickened sludge discharge hopper shall be coordinated during shop drawing submittal review.

E. Drum Wash System:
1. The washing system shall be designed to utilize:
    a. Process water (wastewater treatment plant effluent), supplied at a minimum pressure of 50 psig and maximum pressure of 75 psig.
    b. If wash water system requires a pressure greater than 75 psig, a booster pump shall be provided with the RDT system.
2. If necessary, design and supply for Contractor installation, a pressure reducing valve and 40 mesh strainer system.
    a. Pressure reducing valve shall be capable of reducing maximum potable water or plant service process water pressure to required pressure.
    b. Strainer shall be oversized to accommodate the flow equivalent to twice the normally required wash water flow. Strainer shall be easy to remove for inspection and maintenance cleaning.
3. The spray tube and nozzle assembly shall be readily removable.
4. Nozzle spacing and spray pattern shall be such that the spray patterns from adjacent nozzles overlap one another at the drum surface.
5. Wash water supply to the drum and sludge hopper shall each be automatically controlled with a dedicated manufacturer-supplied solenoid valve.
    a. Solenoid valve shall have minimum NEMA Type 4X enclosure, 120 VAC operation, and minimum Class F coil insulation.
    b. Solenoid valve shall be furnished with manual/bypass operators.

6. Spray header shall be fitted with stainless steel pressure gauge, liquid filled type with a 1/4-inch NPT back connection, 2-1/2 inches dial scaled at 0/160 psi.
7. Washing system shall include an adjustable flow or pressure switch that shall relay an alarm if the solenoid valves on the the wash water system fails and water can no longer be supplied to the spray header or sluge hopper.
8. All structrual components of the wash system shall be constructed of 304L stainless steel.

F. Filtrate Drainage:
1. A drainage pan shall be designed and attached to the structural frame underneath all elements of the rotary drum system and supporting frame. The pan shall be accessible for cleaning.
2. The drainage pan shall be constructed of 304L stailess steel. Drainage piping shall be corrosion resistant and rigidly secured to the frame.
3. Drainage pan shall be of adequate thickeness and have suitable reinforcement to not allow bending, creasing, or tearing from water loads during design conditions and from removing from the frame for service or access.
4. Delivery of collected filtrate water shall be by gravity through one 8-inch flanged pipe stub. Provide a 1-inch flange stub on the bottom of the filtrate drain pipe connection for sampling purposes.

G. Zero Speed Detection:
1. The rotary drive shall be provided with a zero-motion detector. In the event that movement is not detected, an alarm shall be relayed from the zero-motion detector.
2. The zero-motion detector shall be calibrated to operate between the minimum and maximum recommended speeds of the rotary drum system.

2.07 ROTARY DRUM THICKENER CONTROL PANELS:

A. Main Control Panel:
1. Two (2) main control panels shall be furnished in accordance with Section 40 67 00.
   a. Panel mounted combination main disconnect switch and circuit breaker shall be accessible without opening the door.
2. The control panels shall adhere to the following specifications:
   (1) Enclosure Rating: NEMA 12, painted steel, ventilated.
   (2) Voltage: 480 Volt.
   (3) Phase: 3 Phase.
   (4) Frequency: 60 Hz.
   (5) SCCR: 65 kA.
   (6) Mounting: Free Standing or Floor Mounted.
   (7) Logic: PLC.
3. Each Control panel shall contain all timers, starters, VFDs, switches, indicator lights, and other components necessary to operate the following equipment:
   (1) One (1) Flocculation Tank Mixer Motor.
   (2) One (1) RDT Drum Drive Motor.
   (3) One (1) Drum Wash System.
   (4) One (1) Hopper Flush Water System.
4. The point level switch control relays shall be installed within the associated main control panel.
5. Control panel shall be PLC based.
   a. PLC shall be Allen-Bradley CompactLogix according to Section 40 67 00.
6. The main control panel shall contain a door mounted OIT for local control.
   a. OIT shall be Allen-Bradley Panel View. Refer to Section 40 67 00.

b. All manufacturer supplied graphics and applications shall be developed with FactoryTalk View Machine Edition.
c. The screens developed shall utilize a "High Performance" design conforming to ISA 101.01 – Human Machine Interfaces for Process Automation Systems to provide situational awareness to the operator. HMI design and associated color schemes shall conform to those listed in Section 40 61 96 – 3.02 HMI STANDARDS AND SCREEN DEVELOPMENT.
d. In addition to controlling the Manufacturers equipment the supplied PLC and OIT shall be used for interfacing specified I/O with the Plant Control System screens.
(1) Coordinate with the Systems Integrator for exchange of the necessary I/O.
e. The RDT supplier shall provide a copy of the supplied OIT screens for use in the plant control system operator screens.
(1) Manufacturer shall provide the necessary coordination with the Systems Integrator to ensure a fully functional application for use in remote monitoring.

7. The RDT control panel PLC shall communicate with the plant control system PLC via an Ethernet/IP network, all controller I/O shall be accessible via the Ethernet network to the Plant Control System.
8. The control panel shall be supplied with a 480-120V control power transformer to provide power to 120V devices in the panel.
9. The control panel shall include provisions for connection of one (1) 120Vac, 20-Amp field supplied circuit and the internal derived 120Vac circuit from the specified 480V-120V CPT. The CPT derived circuit shall be used as "House" power for lights, fans, receptacles, etc. The field connected circuit shall be derived from the centralized UPS system and shall power all PLC, network, OIT, and control system related loads within the control panel.
10. The following devices shall also be provided in the control panel door at minimum.
a. Push-to-test Power On indicating light.
b. System Emergency Stop push button.

B. The control panel shall be supplied with applicable control relays and time delay relays with a minimum one extra normally closed and one extra normally opened contact is provided for each relay.

C. Remote OIT Enclosure:
1. Each RDT shall be supplied with a remote OIT enclosure for local control of the RDT equipment. The enclosure shall include the following as minimum:
a. Operator interface terminal mounted to the face of the enclosure.
b. Door mounted push-to-test control power indicating light.
c. Emergency stop push button.
d. Additional physical interfaces may be provided as recommended by the manufacturer.
e. Provide with the necessary 120Vac main circuit breaker, Power Supply, Terminal Blocks, OIT, and other internally mounted accessories as required.
f. Enclosure and all externally-mounted accessories shall be rated NEMA 4X SST. Refer to Section 40 67 00 - Process Control Panels and Hardware for enclosure requirements.

D. RDT System OIT:
2. All local operator interface with the rotary drum thickener shall be accomplished via an operator interface panel mounted in the face of the RDT Main Control Panel in

accordance with Section 40 67 00. Each RDT shall be provided with a Remote OIT Enclosure that can access the same functionality.

3. As a minimum, the following control functions shall be accessible via the OIT interface:
   a. System:
      (1) Alarm silence and reset.
      (2) Hand/Off/Auto selector switch.
      (3) Auto Start and Stop buttons.
      (4) System reset push button.
      (5) Emergency stopped indication.
      (6) Elapsed time meter.
   b. Washdown/Wash water System:
      (1) Hand/Off/Auto selector switch.
      (2) Cycle on indication.
      (3) Start and Stop (open) buttons.
      (4) Valve open indication.
      (5) Failure indication.
      (6) Low pressure alarm.
   c. Hopper water flush system:
      (1) Hand/Off/Auto selector switch.
      (2) Cycle on indication.
      (3) Start and Stop (open) buttons.
      (4) Valve open indication.
      (5) Failure indication.
   d. Rotary drum thickener:
      (1) Hand/Off/Auto selector switch.
      (2) Start and Stop buttons.
      (3) Speed adjustment.
      (4) Speed indication.
      (5) Thickener ready indicator.
   e. Flocculation tank:
      (1) Hand/Off/Auto selector switch.
      (2) Start and Stop buttons.
      (3) Running indication.
      (4) Speed adjustment.
      (5) Speed indication.
      (6) Alarm/failure indication.
   f. Polymer system:
      (1) Pump No. 1 selection.
      (2) Pump No. 2 selection.
      (3) Hand/Off/Auto selector switch.
      (4) Start and Stop push buttons.
      (5) Running indication.
      (6) Speed adjustment.
      (7) Speed indication (0-100%).
      (8) Alarm/failure.

E. The following I/O points will be read/write from others to the RDT control panel via an Ethernet/IP communication link. Each point shall be changeable via the OIT.
   a. Thickened Sludge Pumps:
      (1) Thickened Sludge Pump Remote Manual Start (Discrete).

(2) Thickened Sludge Pump Remote Auto Start (Discrete).
(3) Thickened Sludge Pump Off (Discrete).
(4) Thickened Sludge Pump Speed Control (Analog, 0-100%).

F. The following signal inputs will be provided by the RDT control panel to others via an Ethernet/IP communication link.
   a. System:
      (1) Emergency stopped indication (Discrete).
      (2) System failure (Discrete).
      (3) System Running In-Auto (Discrete).
   b. Washdown/Wash water System:
      (1) Low pressure alarm (Discrete).
   c. Discharge Hopper:
      (1) Level (Analog, 4-20mA)
      (2) High level alarm (Discrete).
   d. Rotary drum thickener:
      (1) In-Auto indication (Discrete).
      (2) Running indication (Discrete).
      (3) Common alarm (Discrete).
      (4) Zero speed alarm (Discrete).
      (5) Speed indication (Analog, 0-100%).
   e. Flocculation tank:
      (1) In-Auto indication (Discrete).
      (2) Running indication (Discrete).
      (3) Common alarm (Discrete).
      (4) High level alarm (Discrete).
      (5) Speed indication (Analog, 0-100%).
   f. Thin Sludge Feed:
      (1) Thin Sludge Pump Start/Stop (Discrete).
      (2) Thin Sludge Pump Speed Control (Analog, 0-100%).
   g. Polymer System:
      (1) Feed Pump No. 1 Start/Stop (Discrete).
      (2) Feed Pump No. 1 Speed Control (Analog, 0-100%).
      (3) Feed Pump No. 2 Start/Stop (Discrete).
      (4) Feed Pump No. 2 Speed Control (Analog, 0-100%).

G. The following signal inputs will be provided by others to the RDT control panel via an Ethernet/IP communication link.
   a. System:
      (1) System Inhibit.
         (a) Discrete signal which prevents all associated system equipment from running.
   b. Polymer system:
      (1) Feed pump run status.
      (2) Feed pump failure.
      (3) Feed pump in "AUTO" mode.
      (4) Feed pump motor overload.
   c. Thin Sludge Feed:
      (1) Thin Sludge Pump run status.
      (2) Thin Sludge Pump speed indication (0-100%).
      (3) Thin Sludge Pump failure.

(4) Thin Sludge Pump in "AUTO" mode.
(5) Thin Sludge Flow.
(6) Thin Sludge TS Concentration.

d. Thickened Sludge Feed:
(1) Thickened Sludge Pump run status.
(2) Thickened Sludge Pump speed indication (0-100%).
(3) Thickened Sludge Pump failure.
(4) Thickened Sludge Pump in "REMOTE" mode.
(5) Thickened Sludge Flow.
(6) Thickened Sludge TS Concentration.

H. The panel manufacturer shall provide a data/memory map to the project's systems integrator which includes all produced tags and coordinated IP addresses as required in order to enable communication between the control panel and the communication network.
1. The manufacturer shall be responsible for coordinating, programming, and verifying the IP Addresses, Subnet, and Default Gateways, when applicable, for all devices on the network.
2. The network IP addresses shall be defined based on the Ethernet Network TCP/IP addresses provided by the Systems Integrator.

2.08 RDT CONTROL SYSTEM DESCRIPTION OF OPERATION:

A. Each RDT control panel shall include a control system capable of independent operation.
B. Each rotary drum thickening system and associated components shall be started and stopped at the HMI by Hand/Off/Auto operation selection.
C. In general, each piece of equipment is provided with a Hand / Off / Auto switch. To operate the system from the Thickener HMI, all equipment should be placed in "AUTO". During normal operation, the switches will be left in the Auto position. There is a light indication for each item if it is running.
D. HAND Mode:
1. When any RDT equipment is in HAND control, starting and stopping of motors, the speed of motors, and opening and closing of valves shall be manually controlled at the control panel HMI.
E. AUTO Mode:
1. The following equipment shall be confirmed to be In-Auto before initiating the AUTO operation sequence:
a. Flocculation Tank Mixer Drive
b. Rotary Drum Thickener Drive
c. Wash Water Solenoid Valves
2. The following equipment shall be confirmed to be remotely available via the Plant Control System before initiating the AUTO operation sequence:
a. Thin Sludge Pumps
b. Polymer Feed System
c. Thickened Sludge Pumps
3. The rotary drum thickening control system AUTO mode shall be initiated at manufacturer control panel HMI.
4. Once the start sequence is activated, the Thin Sludge Pumps, Polymer Feed System, and the Flocculation Tank shall start.
a. The manufacturer provided PLC shall send a start command to Thin Sludge Pumps with the pump speed input selected via the PCS.

b. The manufacturer PLC shall send a start command the flocculation tank mixer. The flocculation tank speed is based on the user defined setpoint at the RDT control panel HMI.

c. The polymer feed system shall receive control signals from the RDT control panel via the PCS to initiate pump start and pump speed. The pump speed will be based on the user defined setpoint as a ratio of the sludge flow.

(1) When "Polymer Pacing Mode" is selected, the polymer pump speed shall be determined by the following equations to be included in the PLC:

(a) $$Neat\ Polymer\ Flow\ Rate\ (0-5gph) = Polymer\ Ratio\ \left(\frac{lbs\ active\ polymer}{DT\ of\ WAS}\right) * \frac{1DT}{2000\ lbs} * Influent\ Flow\ (gpm) * \frac{60\ minutes}{hour} * \frac{Influent\ Total\ Solids\ \left(\frac{mg}{L}\right)}{119826\ (conversion\ factor)} * \frac{1}{Specific\ Gravity * 8.34\frac{lbs}{gal}} * \frac{1}{Active\ Polymer\ Content\ (\%)}$$

(b) $$Polymer\ Pump\ Speed\ from\ RDT\ Control\ Panel\ (0\%-100\%) = \frac{Calculated\ Neat\ Polymer\ Flow\ Rate}{Pump\ Capacity\ at\ 100\%}$$

(c) $$Dilution\ Water\ Flow\ Rate\ (gpm) = Neat\ Polymer\ (gph) * \frac{1}{\%\ Polymer\ Diltuion} * \frac{1\ hr}{60\ minutes}$$

(2) In "Polymer Pacing Mode", the feed flow and total solids inputs into the control loops shall be relayed by 4-20 mA signals from the PCS to the RDT control system. There shall be an option in the RDT control system to manually input a total solids value (0-80,000 mg/L) for control rather than a communicated value from the PCS.

d. The rotary drum thickener shall start with the Thin Sludge Pumps, Polymer System, and Flocculation Tank. The speed of the thickener will be based on the user defined speed setpoint at the RDT control panel HMI.

e. The Thickened Sludge Pumps shall have the option to be operated independently from the rest of the system and shall operate based on level in the hopper. These pumps shall vary their speed to maintain the volume of solids in the discharge hopper based on the operator level setpoint.

f. The solenoid valve controlling wash water for rotary drum thickener shall open when the thickening is running.

5. The operator interface display shall have a readout of the following but not limited to:
   a. Neat Polymer feed rate (0-5 gph)
   b. % Speed of the rated capacity of the polymer feed pumps (0%-100%)
   c. Recommended dilution water flowrate for polymer feed system(gpm).
6. The submenu in the PLC shall have the following inputs but not limited to and shall be adjustable at the RDT control panel HMI:
   a. Active polymer ratio (0-14 lbs of active polymer / dry ton of solids)
   b. Polymer specific gravity (1.00-1.20)
   c. Active polymer content (0%-100%)
   d. Dilution water % (0-1%)
7. The rotary drum thickening control system and associated equipment shall have three options for shutdown, all of which are operator selected.
   a. Manual Shut-Off
      (1) The system shall stop when the "System Stop" is selected at the RDT control panel HMI.

b. Timed Shut-Off
   (1) The system shall stop after an operation timer has elapsed. Timer shall be adjustable from 0-24 hrs.
c. Totalized Flow Shut-Off
   (1) The system shall stop after an operator-adjustable, totalized thin sludge flow set point has been reached.

8. The normal shutdown sequence shall stop the sludge pump, polymer system and flocculation tank. The rotary drum thickener shall run for the additional time manually inputted and adjusted at the RDT control panel HMI (Thickener Shut-down Delay) and then set to off. The wash water solenoid valve for the rotary drum thickener shall automatically close when the thickener is off but shall remain on during the system clean out delay shutdown sequence. The thickened pump will continue to run until the volume in the hopper reaches the desired hopper level setpoint.
   a. When "Flush Mode" is enabled, the solenoid valve supplying wash water to the sludge hopper shall open after Thickener Shut-down Delay timer has elapsed.
   b. The solenoid valve shall close after an adjustable Flush Mode wash water timer has elapsed.

2.09 PAINTING:

A. All steel surfaces, excluding the structural frame and those specified to be stainless steel or galvanized, shall be completely painted in the shop with the protective coating normally recommended by the manufacturer for the service intended.
B. Provide field touch-up paint kit for each manufacturers coating system used.

2.10 SPARE PARTS:

A. Manufacturer shall provide a complete parts list, showing current price and anticipated delivery time for each part. Prices shall be held firm for at least one year after the date of equipment startup.
B. The manufacturer shall furnish recommended spare parts and special tools required to minimize rotary drum thickener system downtime. All tools and spare parts shall be packaged and labeled as to be clearly identified for their intended purpose and as labeled as spare parts.
C. One set (each) of any other parts recommended by manufacturer.
D. If specials tools are required for the service and maintenance of any component furnished by the rotary drum thickener system manufacturer, one complete set of special tools shall be provided.
E. All spare parts shall be in waterproof packages suitable for export service labeled with the description and parts number. Each item or set of parts expected to be installed at one time shall be individually packaged.
F. Furnish all required lubricants along with a maintenance schedule showing the required maintenance and frequency of maintenance for the first year of operation, including standard oils and grease, break-in lubricants, special lubricants, and required containers, pumps, hand pumps, or other devices necessary to store and apply the lubricants.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. The rotary drum thickener and accessory equipment as specified herein shall be installed as recommended by the manufacturer. Any additional power, piping or accessories recommended

by the thickener manufacturer shall be provided by the Contractor and shall be the responsibility of the Contractor.

B. Equipment delivered to the site in advance of installation shall be stored in accordance with the manufacturer's requirements and in accordance with the requirements of Division 1.

C. Factory representative shall be present when rotary drum thickener are initially moved into the Sludge Process Building and shall provide a written certificate of no machine damage upon completion of the move. The manufacturer shall coordinate all PLC programming with the installing contractor for verification and checkout of all I/O addressing prior to equipment startup.

3.02 PERFORMANCE TESTING:

A. After installation and prior to performance testing, the rotary drum thickeners shall be completely tested functionally in both AUTOMATIC and HAND modes. Included in the testing shall be a complete test of the PLC and interlock functions.

B. Performance tests shall be run to ensure that each rotary drum thickener perform as specified for peak loading conditions.

C. Performance testing shall be conducted to simulate peak solids and hydraulic loading, as permitted by field conditions. The rotary drum thickener shall be run at the maximum hydraulic loading rate as specified in this specification.

D. Performance testing shall establish the peak hydraulic flow rate, up to the rated capacity of the feed pumps, through the rotary drum thickener without degrading the thickener performance.

E. During the testing period, the rotary drum thickener shall be operated by the Owner's personnel under the direction of the supplier's field representative.

F. Performance testing shall include selection of optimal polymer and determination of optimal polymer dosing rate.

G. Testing period shall begin only after the manufacturer's field representative has instructed the Owner's personnel on equipment operation and the field representative confirms that these personnel are qualified to operate the equipment.

H. Testing period shall begin after the rotary drum thickener is in full operation.

I. Performance Testing:

1. Testing program shall consist of tests taken during a consecutive two-day period of operation. Duration of test each day shall be four hours.
    a. Samples shall be grab samples taken hourly during working day.
    b. Locations of where samples are to be taken shall be determined by the Engineer at the beginning of the testing program.
2. Laboratory tests shall be done by an Engineer-approved independent testing laboratory. Engineer shall receive a copy of laboratory test results direct from laboratory.
3. Laboratory tests shall be those required to determine if the design requirements specified in PARTS 2 and 3 are met.
4. Solids concentrations shall be based on total solids.
5. Chemicals and power supplied by Owner. Any other costs associated with the performance testing will be the responsibility of the Contractor.

J. Submit four copies of a written report of the results to the Engineer within 10 days after completion of the testing program. Report shall include all data required to calculate unit performance.

K. If the results of the performance tests are unsatisfactory, the Contractor shall make the necessary modifications to comply with the requirements at no additional cost to the Owner. After the modifications are made, the performance tests shall be repeated at no

additional cost to the Owner up to three times in order to meet performance requirements. If the results of the performance tests are unsatisfactory after three trials the Owner may at his option keep all or part of the performance withholding.

L. If the equipment fails to meet the requirements of the performance tests, the Contractor may, at his option, install equipment of another manufacturer in order to meet the performance tests. Any equipment changes and additional performance testing shall be done at no additional cost to the Owner.

M. Unsatisfactory performance shall be determined by Engineer based on written report and laboratory data of performance testing, for minimum thickened solids concentration, minimum solids recovery and polymer requirements as specified in PART 2.

N. Compliance with the performance requirements of these specifications will not relieve the Contractor from his responsibilities to supply a rotary drum thickener with the structural, mechanical and operational characteristics specified.

3.03 MANUFACTURER'S FIELD SERVICE:

A. Field service shall be provided by experienced representatives of the equipment supplier.

B. Services are to be provided:

1. As required during installation to ensure proper installation of the equipment. To include, but not be limited to, four (4) 8-hour days.
2. As required to ensure proper start-up to include but not limited to two (2) 8-hour days.
3. During the full length of the performance testing period.
4. Training of Owner's personnel in operation and maintenance of equipment shall be prior to performance testing and shall be a minimum of one (1) 8-hour day.

END OF SECTION 46 71 33

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

ADDENDUM NUMBER 004

Project/Contract Number: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrade

ISSUE DATE: **1/30/2026**

Bidders are hereby notified that the Bidding and Contract Documents for the above project, for which Bids are to be received on **February 24, 2026**, are amended as follows:

Information to Bidders The following is provided to Bidders for information only:

Specification Section 46 21 16 – COARSE SCREENING EQUIPMENT is changed as follows:

1. Section 46 21 16 – Coarse Screening Equipment
   a. Subparagraph 2.03.B.4
      i. Change the design screenings volume rate of 15 ft^3 per MG to "*minimum of 10 ft^3 per MG*".
   b. Subparagraph 2.04 Protective Coatings
      i. Subparagraph number 2.04 is duplicated and will be changed to "*2.05 PROTECTIVE COATINGS*".
   c. Subparagraph 2.05 Screen System Controls and Instrumentation
      i. Subparagraph number 2.05 is now duplicated with the change previously mentioned above and will be changed to "*2.06 SCREEN SYSTEM CONTROLS AND INSTRUMENTATION*".
   d. Subparagraph 2.06.K.
      i. There is no information listed and will be removed resulting in the following subparagraph numbering changes:
         1. 2.06.L Source Quality Control will change to "*2.06.K Source Quality Control*".
         2. 2.06.M Accessories will change to "*2.06.L Accessories*".

Q1.	Regarding Insurance section 5.08.B – We are requesting section 5.08.B's language be amended to the following "Any insured loss under the property insurance will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds and give notice to such other insureds that adjustment and settlement of a claim is in progress."
A1.	**The City does not agree to amend this section. The language in Section 00700 – Construction General Conditions 5.08B already provides a way for a party in interest to object to the City negotiating with the insurer as long as notice is given within fifteen (15) days after the occurrence of loss, and the party in interest and the insurer can reach an agreement.**

Q2.	Please confirm whether bidding contractors are to select and pay for onsite field testing for concrete testing and soils testing or if the test lab will be selected and paid for by the Owner/Engineer.
A2.	**Contractors are required to pay for on-site field testing for concrete and soil testing.**
Q3.	Please confirm whether bidding contractors are to select and pay for onsite inspections or if the inspections will be provided by the Owner/Engineer
A3.	**The City will provide RPR services. This does not relieve the contractor from providing a QA/QC Manager and Quality Assurance/Quality Control Plan outlined in 00210 Instruction to Bidders.**
Q4.	Please confirm whether or not the Americal Iron Standard (AIS) or any BABA requirements will be required for the project
A4.	**This project is required to follow AIS but has been granted a waiver to follow any BABA requirements.**
Q5.	Please confirm the fence height will be 6ft and no barb wire per Sheet C136
A5.	**Fence mesh should be 8' with 12" of 3 strand barbed wire angled 30 to 45 above the horizon facing away from the facility. Specifications and drawings will be updated in a later addendum.**
Q6.	Please confirm the gate height is 7ft and no barb wire. This gate would be taller than the fence per Sheet C136
A6.	**Gates should match the fencing. Specification and drawings will be updated in a later addendum.**
Q7.	Please verify the Holdback post would not be in the center of closed position per Sheet C136
A7.	**Correct, holdback posts are for open position to prevent excessive gate swing. Include 2, one for each side of the gate per INTERURBAN ROAD GATE AND MONUMENT SIGN LOCATIONS enlarged view on C136.**
Q8.	Drawing C111 indicated 12 lockable gate. Please confirm this is a double swing gate 24ft
A8.	**Correct, double swing gate, 12' each side for total opening width of 24'.**
Q9.	Spec section 03300 3.09.E.1 references Spec Section 01480 for Water Leakage Testing. Section 01480 was not provided with project specifications, please provide if leak testing is required.
A9.	**01480 Water Leakage has been added to this addendum.**
Q10.	Sheet D204 shows 6 slide gates (IPS-GATE-011, 012, 021, 022, 031, 032). These are shown as 3x8' on the schedule. Looking at D207 and estimating the height of these from the difference between the channel wall top (832.00) and the floor (813.67), it looks like these would be around 15' high. Need clarification.
A10.	**Yes, those gates are 3'x8' as shown in the schedule. With the travel distance of this size of gate, the frame is approximately shown around 16-ft'; however, there is 18.33' between the top of the wall and the bottom of the channel to install the**

	framing as required by the supplier to install a 3' x 8' gate that can be raised the entire height of the gate to provide an 8' opening when fully raised.
Q11.	SECTION 13 34 23 - FIBERGLASS BUILDINGS AND ENCLOSURES Would a 3-sided shelter work? It would have a flange to attach to the host structure.
A11.	**No - The current set up has independent foundations systems that are placed at different bearing depths since the structure is sitting on top of a valve vault. The potential for differential settlement would be of concern.**
Q12.	SECTION 13 34 23 - FIBERGLASS BUILDINGS AND ENCLOSURES Can the roof slope down to 3 sides (not towards the host structure)?
A12.	**Yes**
Q13.	SECTION 13 34 23 - FIBERGLASS BUILDINGS AND ENCLOSURES What size is the roof hatch? 4’ x what? What is the Bilco part number for that size? Is the hatch powder-coated carbon steel?
A13.	**The proposed is based on all aluminum Bilco. Carbon steel is not allowed. It doesn't have to be from that manufacturer nor be aluminum. Architect will consider other materials especially if the enclosure manufacture has a hatch option.**
Q14.	SECTION 13 34 23 - FIBERGLASS BUILDINGS AND ENCLOSURES Sheet 123 calls for gutters and downspouts. We do not recommend gutters/downspouts for this construction. Can the gutters/downspouts be waived?
A14.	**Yes**
Q15.	SECTION 13 34 23 - FIBERGLASS BUILDINGS AND ENCLOSURES Door 603A appears to have a custom frame with electrical hardware. Is it your intention for the FRP shelter manufacturer only to provide a formed opening for the Kansas City contractor to provide and install the frame and door with electrical hardware? Door as specified is an FRP man door.
A15.	**It is acceptable to have a man door by the enclosure manufacturer. The characteristics must align with the specification, i.e. not steel, low-profile threshold. The door as spec'd will require a card reader. Changes can be discussed after bid.**
Q16.	SECTION 13 34 23 - FIBERGLASS BUILDINGS AND ENCLOSURES Sheet E651 shows the corner camera mounted 10’ AFF, but the wall height is only 8’. Should the camera bracket be mounted 7’-6” AFF? Bracket and camera are by others, correct?
A16.	**Correct, by others. Mounting at a lower wall height is acceptable.**
Q17	13 34 23 para. 1.06.A refers to welding certifications. Should this requirement be waived/deleted for an FRP structure?
A17.	**If no welding is required for a particular manufacturer then no submittal is required.**
Q18	13 34 23 para. 1.06.B calls for test reports. Test reports of what, exactly?
A18	**Can be omitted if manufacturer doesn’t provide test reports.**

Q19	13 34 23 para. 1.08.A calls for shrink wrap. Can shrink wrap be waived?
A19	**Can be revised to be protective coverings instead. Enclosure would generally need protection during shipping/transport.**
Q20	13 34 23 para. 1.010 calls for 1-year warranty. To provide the Owner with the best long-term value, we suggest all FRP surfaces have a minimum 10-year warranty on materials and workmanship.
A20	**10 year warranty is acceptable**
Q21	13 34 23 para. 2.03.A calls for high gloss. Is matte also acceptable?
A21	**Yes**
Q22	13 34 23 para. 2.03.A.4.a calls for stitch mat within anchoring flange. Can this be waived?
A22	**Yes**
Q23	Section 46 05 13 - Sub Section 2.01.B & 2.07D - Please excuse small HP motors from this shaft grounding ring requirement. Shaft grounding rings on small motors are unnecessary as well as very expensive custom add-ons that increase the lead time significantly.
A23	**An acceptable alternative to shaft grounding would be CoolBLUE inductive absorber rings in lieu of the shaft grounding rings. The CoolBLUE rings can be installed on the control panels rather than on the motors themselves. Simply omitting excessive current protection is not acceptable.**
Q24	Section 46 21 13 - Sub Section 2.03.B.4 - For a ¼-inch bar opening, WEF MOP 8 reports a typical screenings volume of approximately 10 ft^3 per MG. Please confirm this is acceptable.
A24	**That is acceptable.**
Q 25	To pass 15 MGD through each screen a downstream water level of 6' is required. Please confirm this is acceptable.
A25	**Yes – As long as allowable headloss at peak flow is less than 6" at 30% blinding.**
Q26	Section 46 21 13 – Sub Section 2.04.7 - The screen MOC is 304 SSTL. Please confirm that fasteners can be 304 SSTL.
A26	**Subsection 2.03D states the screen MOC is 304L SSTL, unless specified elsewhere. Several components are specified as 316 including the teardrop-shaped bars making up the screen (2.04.A.1 and 2.04.B.2.b), fasteners, bolts, and nuts (2.04.A.7), and chain links (2.04.B.3.a). Supplier shall abide by the MOC for the screen components as specified in each sub section.**
Q27	Section 46 21 13 – Sub Section 2.04.B.4.e- Staging scraper will be UHMW, thru bar scrapers will be stainless steel. Please confirm this is acceptable.
A27	**That is acceptable**
Q28	Section 46 21 13 – 2.04.B.10.c- Handles will be plastic. Please confirm this is acceptable.
A28	**No. Handles shall meet stated specification and shall be 304/L stainless steel.**

Q29	Section 46 21 13 – 2.05.C.1 - Controls for both bar screens will be located in the same panel. Please clarify this is acceptable.
A29	**This is not acceptable. Independent control panels are required for failure redundancy and maintenance.**

Bidding Requirements: N/A

Contracting Requirements: N/A

Specifications:

1. Delete and replace the following section(s):
    a. Delete Section 46 21 16 – COARSE SCREENING EQUIPMENT and replace with the following Section 46 21 16 – COARSE SCREENING EQUIPMENT
2. Add the following section(s):
    a. Document, Section 01480 WATER LEAKAGE TESTING

Drawings: N/A

NOTE: Bidders must acknowledge receipt of this Addendum by listing the number and date, where provided, on the Bid Form - Document 00410.

SECTION 46 21 13 – COARSE SCREENING EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes the supply of two screens and all associated control systems as shown on the Drawings and specified herein. The treatment objective for the screens is to capture and remove particles from raw wastewater. The screenings are to be collected in a roll-off dumpster.

B. All equipment specified in this Section shall be suitable for installation in the structures as indicated. Any revisions necessary to accommodate the equipment furnished shall be the responsibility of the Supplier.

C. Related Work Specified Elsewhere:
   1. Contract Drawings.
   2. General Requirements: Division 1.
   3. Painting: Division 9.
   4. Section 40 66 00 – Process Control Networks
   5. Section 40 67 00 – Process Control Panels and Hardware
   6. Section 40 70 00 – Instrumentation for Process Systems
   7. Section 46 05 13 – Common Motor Requirements for Water and Wastewater Equipment

1.02 REFERENCES:

A. Applicable Standards:
   1. American Bearing Manufacturers Association (ABMA).
   2. American Gear Manufacturers Association (AGMA).
   3. American Iron and Steel Institute (AISI).
   4. American National Standards Institute (ANSI).
   5. American Society of Mechanical Engineers (ASME)
   6. American Society for Testing and Materials (ASTM):
      a. A36 - Structural Steel.
      b. A126 - Gray Iron Castings.
   7. National Electric Code (NEC)
   8. National Electrical Manufacturers Association (NEMA).
   9. National Fire Protection Association (NFPA).
   10. Occupational Safety and Health Act (OSHA).
   11. Underwriters Laboratories (UL).
   12. Institute of Electrical and Electronic Engineers (IEEE).

1.03 QUALITY ASSURANCE:

A. Refer to Division 01 for requirements.

1.04 SUPPLIER SUBMITTALS:

A. Submit as specified in DIVISION 01.

B. Includes, but is not limited to the following:
   1. Complete manufacturer's data, specifications, and detailed drawings for all equipment and materials which shall include complete descriptive data to define materials sizes, capacities, types, models, accessories, etc. Drawings and other information shall be suitable for erection and installation of equipment and materials.
   2. Recommended spare parts list.

3. Electric power requirements, wiring diagrams, and schematics for all electrical equipment and devices.
4. Control panel HMI screens.
5. All structural loads imparted to the structure.
6. Anchoring details.
7. Submit screen headloss calculations at peak and design flows. The calculations shall include clean screen 0% blinded and 30% of screen panel area blinded.
8. Manufacturer's surface preparation, shop priming, and machined metal surface rust inhibitive compound requirements.
9. List of installations, as described in Quality Assurance, including current Owner representative name, address, telephone number, and email.

C. Operation and Maintenance Manual includes, but not limited to, the following:
1. Special shipping, storage, protection, and handling instructions including dimensions of each container or package shipped.
2. Recommended unloading method at project site including implement (e.g., forklift, etc.) and maximum container or package weight.
3. Manufacturer’s printed installation instructions.
4. The manual shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, etc. that are required to instruct operating and maintenance personnel unfamiliar with such equipment. The maintenance instructions shall include trouble shooting data, full preventative maintenance schedule and complete spare parts lists with order information. In addition, the manuals shall include the following at a minimum:
   a. Complete parts list cross-referenced to an exploded view assembly or equivalent drawing.
   b. Dimensional drawings of all provided equipment with component weights.
   c. Complete preventative maintenance procedures (including recommended intervals).
   d. Alignment, adjustment, and repair instructions.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Deliver, store and handle all equipment and materials in accordance with the requirements in Division 01.

1.06 WARRANTY:

A. Shall be as specified in DIVISION 01.

PART 2 - PRODUCTS

2.01 ACCEPTABLE SUPPLIERS:

A. Subject to compliance with the specifications, provide one of the following suppliers:
1. Screens:
   a. Duperon Corporation.
   b. Parkson Corporation.

2.02 SERVICE CONDITIONS:

A. The screening system shall be used to screen raw domestic wastewater gravity fed from the collection system and prior to influent pumping.
B. Screenings captured and collected from the screens are to be collected in a roll-off dumpster supplied by the Owner.
C. Equipment to be installed indoors in Kansas City, Missouri.

2.03 DESIGN AND PERFORMANCE REQUIREMENTS:

A. Screens:
   1. Number of units: 2.
   2. Maximum effective spacing: 1/4 inch.
   3. Angle of screen: 80 degrees from horizontal.

B. Design Flows and Screenings Load:
   1. Peak flow per screen: 15 MGD.
   2. Current average daily plant flow: 2.2 MGD.
   3. Design average daily plant flow: 4.6 MGD
   4. Minimum design screenings volume rate: 10 ft^3 per MG.

C. Dimensions and Elevations:
   1. Screen channel width: 3 feet.
   2. Screen channel depth: 42.33 feet (from screening structure floor to channel invert).
   3. Water level downstream at design average daily plant flow: 1.80 feet
   4. Water level downstream at peak flow: 2.75 feet.
   5. Maximum allowable hydraulic headloss at peak flow (at 30% blinding): 6 inches.
   6. Channel bottom elevation: 813.67 feet.
   7. Screen Room operating floor elevation: 856.0 feet. Screening equipment supports shall be mounted on 6-inch concrete bases.

D. All materials shall be 304L stainless steel unless otherwise specified.

2.04 MECHANICALLY CLEANED BAR SCREEN:

A. General:
   1. The mechanically cleaned screen shall be a stainless-steel link driven, front-cleaning, front-return type mechanically cleaned bar screen. The screen will be self-contained and shall capture and transport wastewater debris to the discharge point. The screen shall consist of 316SSTL teardrop shaped bars, spaced to create a fabricated and stiffened grid which is carried on supports spanning the channel. Back cleaned or rear-return type mechanically cleaned screens will not be acceptable.
   2. The screenings are mechanically cleaned from the bar rack by rakes with tine plates mounted on carriers attached to the links of the roller chains on each side of the screen. The complete screen is constructed such that it forms a strong and rigid integral structure which is secured to the support beams which span the width of the chamber.
   3. The mechanically cleaned screen shall clean continuously, from bottom to top, the entire width of the rake. The debris will be removed from the bar racks by the cleaning rakes, conveyed up the dead plate to the discharge point where the rakes will be cleaned by the rake wiper.
   4. The bar screen will include: cleaning rakes, rake wiper, links, shafts, bearings, drive unit complete with reducer, motor, side frames with lifting lugs, bar rack, dead plate, discharge chute, head section, side wall sealing plates, controls, and any other appurtenances required for a complete operating system.
   5. Wear parts requiring periodic inspection, maintenance, and replacement should be fully replaceable without having to remove the screen from the channel.
   6. The screen frame shall be supplied in one piece requiring no field assembly other than that necessitated by shipping requirements and protection of the equipment.
   7. All fasteners, bolts, and nuts shall be of AISI Type 316 stainless steel and furnished by the supplier. Anchor bolts shall be AISI Type 316 stainless steel and at least 1/2-inch diameter. Anchor bolts shall be provided by supplier.
   8. All non-corrosive materials shall be used in components traveling underwater.

9. The design shall be such to enable all maintenance to be accomplished at the operating floor level.

B. System Components:
   1. Side Frames:
      a. The side frames will be constructed of minimum 1/4 inch thick type 304 stainless steel plate and braced as required.
      b. The side frame will have a stainless steel guide system for both the carrying and return run of the screen chain. The guides will provide minimal clearance to prevent debris from coming in contact with the screen chains.
      c. Lower return guides shall allow for proper alignment of rakes as they engage the bar screen.
      d. Closures shall be provided to assure that there is no space wider than the opening between the bars, to prevent passage of larger solids, than allowed through the screen. Closures shall be incorporated into the side fabrication framework and return guides.
      e. Side wall seal plates with 1/4-inch thick neoprene strip will be furnished with the screen to close off the area between the side frames and channel walls. Stainless steel may be used in lieu of neoprene for closeout between side frame and channel wall as long as no opening greater the 1/4-inch is present. The seal plates will be not less than 14 gauge type 304L stainless steel and extend from the channel floor to at least 12-inches above maximum sewage depth.
      f. Lifting lugs or pick points will be provided on the side frames near the channel floor.
   2. Bar Screen:
      a. The bar rack will extend from the invert of the channel to the height indicated in Part 2.03.C where it will be connected to a dead plate on which the screenings will be lifted to the discharge apex prior to discharging into dumpster.
      b. The bar screen shall be of AISI Type 316 stainless steel and shall be spaced to maintain a 1/4 inch clear opening. The bar screen shall be able to withstand a 2 foot head differential.
      c. The bar screen anchors and fasteners shall be of stainless steel.
      d. Bars shall be removable from the bar rack assembly in individual bars or multiple bar subassemblies. Bars shall not be welded in place. Bar racks that use welded bars are not acceptable.
   3. Link System:
      a. The chain links shall be 316 stainless steel and shall be joined with stainless steel pins.
      b. The drive shaft will be stainless steel and be supported on each side by grease lubricated take-up bearing assemblies. The bearings may also be self-lubricating.
   4. Rakes:
      a. The rakes will be stainless steel, reinforced, and bolted to the stainless steel links on each side.
      b. The stainless steel rake tines shall penetrate into the screen bar spacing to such that screenings are completely cleared during each lifting operation. The rake tines shall be suitable shape to effectively clean the front and sides of the bars and shall have adequate stiffness and strength to cope with the specified duty cycle. The rake bar will be at least 1/4 inch thick stainless steel and shall be replaceable.
      c. Spacing between rakes shall be as determined by supplier to effectively remove the design screenings volume rate listed in part 2.03.D.
      d. The rake speed shall be as determined by the supplier to effectively remove the design screenings volume rate listed in part 2.03.D.

e. If scrapers are included, they shall be made of 1" thick wide UV resistant UHMW-PE and span the width of the bar rack. Scrapers shall have a serrated edge designed to clean the face of the bar rack. Units shall be provided with a stainless steel backing angle.

5. Dead Plate:
   a. Dead plate shall be at least 1/4 inch thick, AISI Type 304L stainless steel. Dead plate shall span the entire width of the screen and transition from bar rack to discharge point.
   b. The rake head teeth shall ride no closer than 1/16-inch from the dead plate and no further than ¼-inch from the dead plate.
6. Rake Wiper/Debris Blade:
   a. The wiper will be 304L stainless steel, pivoting and be easily adjustable.
   b. The wiper will have a replaceable UHMW Polyethylene blade.
   c. The design shall be such that the rack repositions the wiper mechanism. The wiper mechanism design shall allow the rake assembly to operate in reverse, through the wiper mechanism, without the need to manually lift the wiper assembly.
7. Discharge Chute:
   a. An enclosed discharge chute of minimum 11 gauge (1/8 inch) AISI Type 304 stainless steel shall be bolted or welded to the dead plate per supplier's recommendation and will discharge to the roll-off dumpster.
   b. The height of the discharge chute will be as required to accommodate roll-off dumpster as shown on Drawings.
8. Side Shields:
   a. Side shields shall be stainless steel 304L and shall be present from intermediate deck to operating deck.
9. Channel Bottom Plate:
   a. An AISI Type 304L stainless steel channel bottom plate shall be utilized as recommended by the supplier to fully engage rakes in the bar screen at the bottom of the channel.
   b. The channel bottom plate may require anchoring dependent upon site configuration and as recommended by the supplier.
10. Screen Enclosure:
    a. The portion of the screen above the top of operating level will have stainless steel guards.
    b. The guards will provide quick access panels for equipment maintenance.
    c. The panels shall be manufactured of 304L stainless steel held in place by latches. Each panel shall be provided with handles for panel removal/replacement. All handles and latches shall be 304L stainless steel.
11. Upper Bearings:
    a. Bearing shall be a non-lubricated no maintenance engineered polymer Thordon® or Vesconite® bearings and shall have a PV value that is less than the limiting PV value of the material. Bearings containing grease are not acceptable.
12. Drive Unit:
    a. Each mechanically cleaned screen unit shall operate independently and will have its own drive unit and driven components.
    b. The electric motor shall be TEFC, NEMA Design B with Class F insulation, rated for Class I, Division 2, Group D hazardous environment. The motor shall be no larger than 1 Hp, and run from a 460V, 3-phase, 60-hertz electrical supply.
    c. The enclosure shall be of weather protected design.

d. The drive unit speed reducer will be of the helical gear or spiral bevel type, fully housed, running in oil or grease, with anti-friction bearings throughout.
e. The drive unit will be assembled by the Supplier and shipped as a complete assembly to ensure proper assembly of all components.
f. Refer to the Drawings for orientation of drive units.

13. Spare Parts and Special Tools:
    a. Refer to 40 67 00
    b. One (1) wiper blade.
    c. Ten (10) retaining rings.
    d. Four (4) chain pins.
    e. Four (4) rake screws, nuts, and hardware.
    f. Four (4) scraper screws, nuts, and hardware.
    g. One (1) tube of Never Seez.
    h. Any additional recommended spare parts.

2.05 PROTECTIVE COATINGS:

A. Motor, gear reducer, and all metallic surfaces except aluminum and stainless steel shall be factory painted with the Supplier's standard coating equal to the 09 90 00 E-1 system and field touched-up.
B. Coatings other than those listed in 09 90 00, System E-1 may be submitted but must receive the approval of the Purchaser.
C. Provide field touch-up paint kit.

2.06 SCREEN SYSTEM CONTROLS AND INSTRUMENTATION:

A. The Screen System shall be supplied with a main system control panel designed to house all components required to control the screen system and associated equipment.
B. The screening equipment supplier shall provide all control components and instruments as specified herein.
C. System Components and Function:
    1. Screen System Main Control Panels: IPS-MCP-010, IPS-MCP-020.
        a. As described below.
    2. Bar Screens: IPS-SCR-010, IPS-SCR-020.
        a. Mechanical screen designed to remove solids and debris from the liquid stream
    3. Radar Level Transmitters as defined in the following table:

Bar Screen	Upstream Level Sensor	Downstream Level Sensor	Level Indicating Transmitter	High-Level Switch
IPS-SCR-010	IPS-LT-010A	IPS-LT-010B	IPS-LIT-010	IPS-LSH-010
IPS-SCR-020	IPS-LT-020A	IPS-LT-020B	IPS-LIT-010	IPS-LSH-020

D. Description of Operation
    1. The screening equipment shall be provided with a control panel equipped with a PLC and an operator interface for setpoint adjustment and monitoring.
    2. The system shall have control stations provided and mounted adjacent to the equipment to allow for local operation of the equipment.
    3. The supplier supplied control panel shall serve as the primary control point for the equipment and all controls described shall be available through an operator interface screen (HMI).

4. Bar Screens IPS-SCR-010 and IPS-SCR-020
   a. The screens shall be started and stopped at the HMI by Hand/Off/Auto operation selection. The functionality described below shall be per screen (i.e. each screen will have a dedicated differential measurement and control sequence)
      (1) In HAND mode, the equipment will run continuously until stopped by the operator.
      (2) In OFF mode the equipment will not run.
      (3) In AUTO mode, the equipment will be started and stopped by the screen system PLC. The PLC programming shall be as described below.
         (a) The screen shall be started and stopped by the system PLC based upon channel head differential across the screens as measured by the corresponding level transmitters.
         (b) The screen system shall start at normal speed when the upstream level reaches start level setpoint. An operator-adjustable start level setpoint shall be programmed.
         (c) The screen system shall run at high speed when the calculated differential level reaches differential level setpoint. An operator adjustable level differential setpoint shall be programmed.
         (d) The screen system shall operate continuously at high speed until the differential level falls below the differential level setpoint. The screen should then return to normal speed.
         (e) The screen system shall operate at normal speed until the upstream level falls below the start level setpoint. The screen system shall then operate for an operator adjustable length of time before stopping.
         (f) A backup timer shall be provided to operate the screens periodically and if a failure occurs with the level controls, the timer setpoint shall be adjustable through the operator interface mounted on the face of the main control panel.
         (g) The parameters for the upstream start level, channel head differential level, and cycle time between operations shall be set at the supplier provided operator interface on the main control panel.
         (h) A “CYCLE START” operator soft push button shall be provided on the face of the local control panel. If the CYCLE START push button is depressed, the PLC shall immediately initiate a screen cycle for the associated screen.
         (i) High Flow Mode and Remote Cycle:
            1) While in AUTO, the screen system shall accept a start signal from the plant control system for remote start capability.
   b. System Upsets and Procedures for Recovery:
      (1) If a screen failure occurs, the control system shall alarm the operator via the operator workstation.
      (2) If a power failure occurs, the equipment that was in operation prior to the power failure shall be automatically restarted by the manufacturer-provided control panel.
      (3) If a level transmitter signal is lost, the control system shall alarm the operator via the operator workstation.
      (4) If a jam or over-torque condition occurs in the screen that cannot be cleared by the system, the associated equipment shall automatically stop and initiate a failure alarm at the operator workstation.
      (5) Safety Devices:

(a) Emergency stop push buttons and pull cord switches, as applicable, shall be interlocked with the corresponding screen starting circuit.
(b) In the event of an emergency stop push activation, the corresponding equipment will shut down and alarm the operator. The emergency stops shall require a manual reset to restart the equipment.
(c) An emergency stop condition shall initiate an e-stop alarm at the operator workstation.

c. The upstream and downstream levels for each of the screens shall be available for display on the operator interface in units of feet. Operator adjustable upstream and differential level alarms shall be programmed for the screen.

E. Setpoints and Ranges:
1. Level Transmitters
a. All level transmitters shall be calibrated and configured to provide a range of measurement from the blanking distance of the transmitter to the bottom of the channel.
2. Screen System Operator Interface:
a. Screen Level Transmitters
(1) Display range measure value in feet for each level transmitter.
(2) High level alarm adjustable between 0-1 feet, initially set at 0.8 feet for the upstream level transmitter.
(3) Differential level setpoint adjustable between 0.25-2.00 feet, initially set at 0.5 feet for each screen.
b. Backup cycle timer adjustable between 0-30 minutes, initially set at 15 minutes.
3. System Upsets and Procedures for Recovery:
a. The system shall send an alarm for the screen to the Process Control System under any of the following conditions:
(1) Any motor or other component critical to the operation of the screens is faulted.
(2) If a level transmitter signal is lost.
(3) If a jam is not cleared.
b. If a power failure occurs, the screen shall be automatically restarted by the supplier provided main control panel without requiring a manual reset.
c. If a jam occurs in a screen, the screen control system shall automatically initiate the supplier standard reversing sequence and attempt to clear the jam. If the jam is not cleared, the control system shall initiate a failure alarm at the operator workstation.
d. If an overload occurs in the screen, the screen shall automatically stop and initiate and failure alarm at the operator workstation.
e. System in AUTO mode:
(1) If a level signal is lost, the screen shall operate on a timer. If the level signal is restored, the screen shall be returned to normal operation.
f. Safety Devices:
(1) Emergency stops shall be interlocked with all motor circuits in the screen.
(2) In the event of an emergency stop situation, the equipment will shut down and alarm the operator via the operator workstation.
(3) The system shall not restart until the operator clears the alarm from the equipment and/or the main control panel as applicable.
(a) The emergency stop pushbuttons require a manual reset to deactivate the alarm.

F. The screening equipment supplier shall provide all control components and instruments as specified herein.

G. Screen System Control Panel:
   1. Control panels and components shall conform to Section 40 67 00.
   2. The control panel shall be designed for installation within a conditioned electrical room.
   3. The control panel shall be a NEMA 12 rated enclosure with use of ventilation for thermal management as required.
   4. The control panel shall be equipped with an Allen-Bradley CompactLogix PLC to provide control and monitoring of the supplied equipment.
   5. The supplier supplied PLC shall be connected to the Plant Control System through an Ethernet network connection. Provide a network switch as required for communicating the Screen system data over an Ethernet/IP network as well as providing connectivity to the operator interface. The panel programmer shall provide a data/memory map to the project's systems integrator which includes all produced tags and assigned IP addresses as required to enable communication between the control panel and the communication network. Provide a network switch as required to provide a complete and functional system as specified in 40 66 00.
   6. IP address assigned to PLC for uplink to plant network shall be reconfigurable and on a separate subnet than the Screen System's local network.
   7. The enclosure width shall not exceed 3'-0".
   8. The control panel shall be powered from a single 480V, 3-phase power source.
   9. The control panel shall be supplied with a 480-120V control power transformer to provide power to 120V devices in the panel.
   10. The control panel shall include provisions for connection of one (1) 120Vac, 20-Amp field supplied circuit and the internal derived 120Vac circuit from the specified 480V-120V CPT. The CPT derived circuit shall be used as "House" power for lights, fans, receptacles, etc. The field connected circuit shall be derived from the centralized UPS system and shall power all PLC, network, OIT, and control system related loads within the control panel.
   11. The control panel shall contain all required components for complete control and monitoring of the screening units, level controls and other associated equipment. As a minimum, the following components shall be installed in the panel:
       a. Door interlocked main disconnect circuit breaker.
       b. Motor starters with solid state overloads and/or VFD's for the screen units.
       c. Control power transformer.
       d. Programmable Logic Controller (PLC).
       e. Operator interface touch screen.
       f. Required circuit breakers, control relays, power supplies, selector switches and indicating lights.
   12. Operator Interface Touch Screen:
       a. The control panel shall include a 15-inch operator interface touch screen.
       b. Provide an Allen-Bradley PanelView Plus as specified in Section 40 67 00.
       c. All supplier supplied graphics and applications shall be developed with FactoryTalk View Machine Edition.
       d. The screens developed shall utilize high performance graphic styles using gray scale color palettes for all equipment when possible.
       e. In addition to controlling the Suppliers equipment the supplied touch screen shall be used for interfacing with the Plant Control System. Supplier shall provide the developed screen system application files to the Systems Integrator to allow further development and addition of the screens.

f. Supplier shall provide the necessary coordination with the Systems Integrator to ensure a fully functional application.

13. All devices shall be factory installed, wired and tested. Terminal blocks shall be provided and labeled as required for power, control and instrumentation.
14. The Screen System Control Panel shall provide the following discrete signals for use by the Plant Control System. The signals shall be communicated via the Ethernet/IP network.
    a. Screen "Auto" Mode for both screens.
    b. Screen "Hand" Mode for both screens.
    c. Screen Run Status for both screens.
    d. Screen Emergency Stop for both screens.
    e. Screen Failure for both screens (Common alarm for all associated equipment with the associated screen).
15. The Screen System Control Panel shall provide the following analog values over the Ethernet/IP network for use by the Plant Control System.
    a. Screen Influent Level for both screens.
    b. Screen Effluent Level for both screens.
16. As a minimum the following functionality shall be available via the operator interface screen:
    a. Hand/Off/Auto switch position for each piece of equipment.
    b. Power On indication for each piece of equipment.
    c. Forward indication for each piece of equipment.
    d. Reverse indication for each screen.
    e. Fault or Failure indication for each piece of equipment.
    f. Motor overtemperature indication for each motor.
17. Additional status points and adjustment of set points and operating parameters shall be available via the operator interface screen. As a minimum, the following parameters and status points shall be viewable and/or adjustable via the operator interface screen:
    a. Upstream Start Level for each screen.
    b. Screen Head Differential for each screen.
    c. Screen Head Differential Set Point for each screen.
    d. Backup Timer Setting.
    e. Run Time.
    f. Run Status indication for all equipment.
    g. Identify cause of equipment Failure.

H. Screening Unit Local Control Station (one per screen):
1. Refer to Section 40 67 00 for control station requirements and component specifications.
2. The panel shall be a NEMA Type 4X 304 SST enclosure to be installed outside adjacent to each screen. All selector switches, pushbuttons, and indicators shall be hermetically sealed for installation in a Class I, Division 2, Group D area.
3. The panel shall contain all required components to implement the control functionality specified and allow for the electrical connection of the skid mounted equipment to the main control panel. As a minimum, the following components shall be installed in the face of the panel:
    a. Hand, Off, Auto selector switch
    b. Run/Stop indicating lights.
    c. Emergency stop pushbutton.
    d. Control Station Identification Label.
4. As a minimum the following shall be installed inside the panel.
    a. Terminal blocks for all field connections required.

I. Screen Level Sensors:
   1. The screening units shall be provided with radar level transmitters or laser level transmitters. The level transmitters shall initiate screen operation based on channel head differential and the parameters set in the operator interface.
      a. The PLC logic shall determine differential levels using signals from two separately mounted level transmitters.
      b. The first transmitter shall be installed upstream of the screen and measures the screen upstream head. The second transmitter shall be installed downstream of the screen and measures the downstream head of the screen.
      c. The head in front (upstream) of the screen shall be compared to the head downstream of the screen to determine the head differential.
   2. Level Transmitter IPS-LIT-010 and IPS-LIT-020:
      a. Provide a level transmitter mounted for each screening unit.
      b. The upstream and downstream sensors' 4-20mA level signal instrumentation cables shall terminate to the transmitter. The transmitter shall provide upstream and downstream levels to the main control panel via 4-20mA outputs. The transmitter shall display upstream, downstream, and differential level.
      c. The transmitter shall be rated for installation in a Class I, Division 2, Group D area. The transmitter shall provide intrinsically safe connections for the level transducers.
      d. Power for the level transmitter shall be provided from the main control panel via thermal magnetic circuit breaker.
   3. Level sensors shall be a 2-wire device and perform non-contacting liquid level measurements with signal outputs of 4-20mA to the screen system PLC.
   4. The level sensors shall be intrinsically safe and suitable for installation in a Class I, Division 2, Group D area. Required intrinsically safe barriers shall be installed in the main control panel if required for the indicating transmitter.
   5. Refer to Section 40 70 00 for level transmitter specifications. Provide quantity of sensors and transmitters as required with measurement ranges and blanking distances necessary for the measurement in the indicated screen channels.

J. High Level Probe:
   1. Provide a high-level conductivity probe for installation in each channel, upstream of each screen.
   2. The probes shall be intrinsically safe and suitable for installation in a Class I, Division 2, Group D area. Where required, provide and install intrinsically safe barriers in the main control panel.
   3. Provide and install an intrinsically safe control relay for each probe in the main control panel. Relay shall provide an alarm to the PLC via a N.O. and N.C. output contact upon high level detection by probe.
   4. Provide the necessary stainless steel hardware, mounting brackets or fittings, manufacturer cables, and strain relief for securing the probes in the channel. Installation shall be coordinated with the channel grating to allow access and removal.
   5. Refer to Section 40 70 00 – Instrumentation for Process Systems for conductivity probe specifications.

K. Source Quality Control:
   1. The Screen System and controller shall be factory tested to ensure satisfactory operation.

L. Accessories:
   1. Provide all templates and special wrenches or tools necessary for proper installation and maintenance of equipment.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Motor, gear reducer, and all metallic surfaces except aluminum and stainless steel shall be factory painted for shipping purposes. Stainless steel and aluminum surfaces shall not be painted. Prepare surfaces in shop and finish all surfaces as specified in Division 9.
B. Store all Equipment as specified in Division 1 and as required to prevent damage.
C. Assemble and test drive units in factory.

3.02 INSTALLATION:

A. In accordance with manufacturer's instructions and as indicated.
B. Install all electrical conduits, wires, tubing, instrumentation and other appurtenances as required for satisfactory operation.
C. Prepare surface and paint or touch up all surfaces as specified herein and in Division 9.

3.03 FIELD QUALITY CONTROL AND ADJUSTMENTS:

A. Manufacturer's Field Services: Provide all services as specified in Division 1 and as follows:
B. The equipment suppliers shall furnish the services of a factory-trained representative on site for a period of no less than four days and two trips. The representative shall inspect, adjust, calibrate and place the system into operation. If additional services are required to produce a fully operational system, they shall be provided at no cost to the Owner.
C. Training:
    1. The on-site services provided by the factory-trained representative shall include training.
    2. The representative shall provide two complete training sessions to the Owner operating personnel in equipment operation and maintenance. Sessions shall be a minimum of two hours in length, or as required to complete the entire training.
    3. One of the sessions shall be video recorded, placed on a USB, and transmitted to Owner for use in training future personnel.
D. After installation and after all equipment and components are in operable condition, a field mechanical and electrical performance test shall be performed in the presence of the Engineer.
    1. Each piece of equipment shall be tested for normal start, stop, and emergency stop cycles.
    2. Each piece of equipment shall be field tested, and the equipment calibrated to demonstrate to the Engineer that all equipment will satisfactorily perform the functions and criteria specified.
    3. Furnish test forms and procedures for field testing and provide all test apparatus required at no additional cost to the Owner.
    4. Follow testing procedures recommended by the equipment manufacturer and approved by the Engineer.
    5. The equipment supplier shall modify or replace any equipment necessary to obtain satisfactory performance.
E. All labor, materials, and test apparatus necessary for conducting the above tests shall be furnished by the Contractor at no additional cost to the Owner, unless stated otherwise.

END OF SECTION 46 21 16

SECTION 01480 – WATER TIGHTNESS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes hydrostatic leakage testing for concrete water-containing structures.

1.02 REFERENCES

A. Section 03 30 00 – Concrete
B. Section 31 20 50 – Site Preparation and Earthwork

1.03 DEFINITIONS

A. Damp spots: Surfaces where visible moisture can be picked up by a dry hand.
B. Containment structure, lined: Liquid-containing structure with barrier coating or membrane applied to the inside surfaces to prevent leaking of contents to the outside.
C. Containment structure, unlined: Liquid containing structure where only the concrete structure itself is used to prevent leaking of contents to the outside.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination.
B. Pre-installation meetings.
C. Sequencing.
D. Scheduling.

1.05 SUBMITTALS

A. Shop drawings:
    1. Description and details of each evaporation/precipitation-measuring device anticipated for use during the test.
B. Tests and evaluation reports:
    1. Results of water leakage test for each structure and for each portion of a structure designated for testing.
C. Special procedure submittals:
    1. Testing plan for each structure, or portion thereof, required to be tested.
        a. Describe methods of obtaining water for testing and of releasing water for disposal, including provisions for dechlorination if required.
        b. Include plans showing locations where measurements will be made and locations of evaporation/precipitation-measuring device.
        c. Indicate plans for filling and draining structure(s).
        d. Include schedule showing duration of test for each structure or cell to be tested, date and time for start of each test, dates and times of observations and measurements during the test, dates and times for closeout of testing procedures, and date for submittal of final results.
    2. Proposed procedures and products for repair of leaks.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 GENERAL

A. Test structures and portions of structures listed in the following paragraphs for water leakage.
    1. Unless otherwise specified, the Contractor shall:
        a. Obtain all required permits for discharging testing water.
        b. Provide dechlorination of such water if required by the permits.
        c. Prepare and fill the structures.
        d. Provide access and equipment required for testing and for recording test results.
        e. Take measurements and make observations required for testing.
    2. At all times during testing, the Engineer shall have access to observe measurements by others or to make independent measurements.
B. Test the following concrete structures for water leakage:
    1. Influent Pump Station Wet Well
    2. Headworks Screening Channels.
    3. Grit Basin.
    4. Grit Basin Effluent Channel.
    5. Splitter Box between Headworks and AGS basins
    6. AGS basins
    7. UV channels
    8. TWAS basins
    9. WAS basins
C. Required preparation for testing is designated in this Section. Waiver of, or failure to complete preparations shall not change the testing criteria or approval criteria for the areas tested.
D. Retest structures and portions of structures until the evaluation criteria are satisfied.

3.02 TEST WATER SOURCE AND DISPOSAL

A. Water used for the first filling of the tank will be furnished by Owner.
    1. Contractor shall obtain water for leakage testing from:
        a. Disinfected effluent between April 1 and October 31.
        b. Secondary effluent between November 1 and March 31.
B. In the event that retesting is required, Contractor shall bear the cost of refilling the tank for subsequent tests.
C. After leakage testing is complete, Contractor shall dispose of water by discharging to Primary Treatment.

3.03 PREPARATION

A. For each structure to be tested, prepare and submit a plan showing schedule and sequence of activities, method of filling, and methods of disposing of test water.
B. Sequencing requirements:

1. Complete construction of concrete structure and cure concrete to obtain minimum specified 28-day compressive strength as specified in Section 03 30 00 - Concrete.
    a. Do not begin tests until all portions of structure are complete and have reached their minimum specified 28-day compressive strength.
    b. Do not begin tests until at least 14 days have passed since completion of the last concrete placement.
2. Complete tests before:
    a. Covering any surface of the structure with materials that might mask the location of leaks or obscure damp concrete surfaces. Such coverings include, but are not limited to basin bottom grout, masonry veneer, stucco, plaster, and other coatings.
    b. Installation of equipment, unless otherwise approved by the Engineer.
    c. Backfilling structures to elevations above the limits indicated in the following paragraphs.
3. Liners and coatings:
    a. Field-coated or installed liners and coatings shall be applied in strict conformance to manufacturer's standards.
    b. Install liners that are mechanically locked to the concrete surface during placement of plastic concrete and before leakage testing.
        (1) Examine liners for pinholes, tears, and partially fused splices, complete all required liner integrity testing, and make required repairs before commencing leakage testing.
    c. Unless otherwise specified, do not install surface-applied protective or decorative coatings and linings until leakage tests have been completed.

C. Weather requirements:
1. Tests on structures with tops open to the atmosphere shall not be scheduled for periods when the 10-day weather forecast indicates a substantial change in weather patterns.
2. Measurements of water surface levels in the structure shall not be scheduled for periods when the weather forecast indicates a difference of more than 35 degrees Fahrenheit between the ambient temperature readings at the times of initial and final measurements.
3. Tests shall not be scheduled for periods when the 10-day weather forecast indicates that the water surface may freeze before the test is complete.

D. Groundwater requirements:
1. Bring groundwater to a level not higher than 3 feet below the bottom of the structure and maintain at that level for the duration of the test.

E. Clean interior of structure:
1. Remove dirt, contaminants, and construction debris.
2. Flush floors and sumps to provide clean surfaces.
3. Remove standing water that would interfere with examination of surfaces, cracks, or joints.

F. Observe the structure, or portions of the structure being tested, for potential leak locations.
1. Give particular attention to cracks, open joints, voids, and honeycombed and repaired surfaces.
2. Visually observe openings, fitting, and pipe penetrations in the structure at both faces, if possible.
3. Repair potential leak locations in accordance with these Specifications and as approved by the Engineer.
4. Backfill excavations to the top of the structure foundation. Do not place backfill against water-bearing walls or over footings unless approved in advance by the Engineer.

a. If requesting backfilling of walls before testing, include a description of methods that will be used to detect leakage in the backfilled areas.
b. Engineer's approval of backfilling before testing shall not relieve Contractor of the responsibility to conduct leakage tests, to satisfy the leakage acceptance criteria for the structure, or to repair leaking portions of the structure, including those portions below or behind the backfill.

5. See Drawings and Section 31 20 50 - Site Preparation and Earthwork for requirements to provide wall stability before backfilling.

G. Inlets to/outlets from the structure:
1. Inlets to and outlets from the structure shall be watertight.
a. Include valves, sluice, and/or slide gate valves and temporary bulkheads as required.
b. Inlets and outlets not required to be operable may be temporarily sealed before testing the compartments to which they open.
c. Secure inlets used to fill the structure for testing to ensure that no water is entering or leaving the structure once it has been filled to the test level.
2. Adjustments to measured leakage at inlets and outlets based on manufacturers or Contractor's estimates will not be allowed.
a. Adjustments to measured leakage may be permitted by the Engineer, and, at their discretion, only when the Contractor makes specific measurements of leakage at each individual inlet and outlet using methods approved by the Engineer.

3.04 HYDROSTATIC LEAKAGE TEST FOR OPEN OR COVERED CONTAINMENT STRUCTURES

A. Isolate sections of water-holding structures that can be isolated in actual operation. Fill and test sections for leakage separately.
1. Fill structures and sections of structures scheduled for testing to the normal operating water level indicated on the Hydraulic Profile indicated on the Drawings.

B. Initial rate for filling of structures shall not exceed 8 feet in 24 hours.

C. HST-100 testing includes 2 parts, "Qualitative Testing," and "Quantitative Testing," as described in the following paragraphs:
1. HST-100, Part 1 - Qualitative Testing:
a. During the first 24 hours after structures are filled, examine exposed concrete surfaces for damp spots or flowing water.
(1) Make observations in early morning, at midday, and in late afternoon.
(2) Continue observations through the duration of the Quantitative Testing period.
(3) Pay particular attention to conditions at joints, honeycombed areas, cracks, and repaired portions of the structure.
b. Evaluation criteria:
(1) The structure shall be considered to have failed these Qualitative Testing requirements if any of the following conditions are observed.
(a) Water droplets or moist areas on an outside surface that could only have originated inside the structure.
(b) Water is flowing or seeping from joints, cracks, or surfaces.

(i) Exception: Dampness or wetness on top of a footing, in the absence of flowing water, shall not be considered as failure to meet this criterion.

(c) Moisture can be transferred to a dry hand from the outside surfaces of the filled area.

c. Repairs and retesting:

(1) Where damp spots or flowing water as described in the preceding paragraphs are observed, mark locations, provide repairs, and retest the structure as specified in subsequent paragraphs.

2. HST-100 - Part 2: Quantitative Testing:

a. If approved by the Engineer, Quantitative Testing may begin before repairs are made to areas failing Part 1 of this test; however:

(1) Adjustments to volume loss calculations of Quantitative Testing based on observed leakage will not be permitted.

(2) All defects identified for repair during Qualitative Testing shall be repaired to the satisfaction of the Engineer before approval of the structure.

b. Report the results of Quantitative Testing on "Leakage Test Report" included as Figure A at the end of this Section, or similar form prepared by the Contractor and containing at least the information included in Figure A.

c. Unlined concrete structures:

(1) Fill to the designated water surface elevation. Maintain that level for at least 72 hours before recording initial water levels for leakage test.

(2) Duration of test:

(a) Theoretical time required to lower the water surface in the structure by 3/8 inch when leakage is occurring at the maximum allowable rate specified in subsequent paragraphs of this Section.

(b) The duration ("D") of the test in days is determined by the following equation:

$$D = \frac{.375\ inches}{0.005\ in/in/day\ \times H\ ft\ \times 12\ in/ft}$$

$$Where\ H = Maximum\ Liquid\ Depth$$

(i) Round results upward to the next full 24-hour period (day).

(ii) Minimum duration of test: 24 hours (1 day).

(iii) Maximum duration of test: 120 hours (5 days).

d. Lined concrete structures and secondary containment areas:

(1) Fill to the designated water surface elevation. Recording of water levels for leakage tests may begin as soon as the designated water surface level is reached and the water surface is calm. 2) Duration of test: 72 hours (3 days).

e. Measurements: Water level:

(1) Record water levels at 24-hour intervals for the full duration of the test period.

(2) Measure water levels at not less than 2 locations on opposite ends of the structure, and preferably at 4 locations spaced equally around the structure. Mark locations on the structure and take measurements at the same locations throughout the duration of the test.

(3) Measure, to an accuracy of 1/16 inch, the vertical distance to the water surface from a fixed point on the structure above.

f. Measurements: Temperatures:
   (1) As part of the first and last sets of level measurements, record water temperature at a depth of 18 inches below the water surface. Measure temperature at the same locations where level measurements are taken.
   (2) Record ambient temperature at the time of each water level measurement.

g. Measurements: Evaporation and precipitation:
   (1) Measure evaporation and precipitation by floating pans inside the structures during testing.
      (a) For uncovered structures, measure both evaporation and precipitation.
      (b) For covered structures that are well ventilated, measure evaporation.
   (2) Measure using specially constructed clear containers:
      (a) Provide clear plastic, calibrated, open-top containers not less than 18 inches in diameter and 18-inches deep.
      (b) Partially fill containers with water and float inside the structure. Make provisions to hold containers in place at each measurement location, but away from structure walls and items passing overhead, such as beams or pipes.
      (c) Measure initial depth of water in each device. Measure changes in water level in each device at the same time measurements of the water level inside the structure are taken.

h. Restart of test:
   (1) The Engineer may order a restart of the test when, in the Engineer's opinion, measurements have become unreliable due to unusual precipitation or other factors.
   (2) If measurements or observed leakage during the testing period indicate that the allowable leakage requirements will be exceeded, the test may be terminated before completion of the full test period. Take appropriate actions to correct problems before restarting the test.

i. Calculations of leakage test results:
   (1) For each section of the structure tested, use water surface level records to calculate average loss of volume per 24-hour interval.
      (a) For each 24-hour interval during the test, calculate the average of all measured drops in water level around the structure.
      (b) Use the average drop thus determined to calculate an average loss of volume for each 24-hour interval.
   (2) Adjustments to leakage calculations:
      (a) For uncovered basins, calculations shall be corrected for precipitation added to the structure.
      (b) Calculations may be corrected for evaporation and water temperature.

j. Evaluation criteria:
   (1) Unless otherwise specified, the average loss of volume during any 24-hour interval shall not exceed the limits shown in Table A.

Table A - Loss of Volume Criteria for Leakage Tests	
Structure Type	**Maximum Loss of Water Volume**
• Structure fully lined prior to leakage test. • Secondary containment areas.	No measurable loss over 72-hour test period.
• Structure with monolithically placed membrane floor slab.	0.0125 percent of volume per 24-hour period.
• Concrete paved canals, drying beds, lagoons, and similar structures.	0.100 percent of volume per 24-hour period.
• Other containment structures.	0.050 percent of volume per 24-hour period.

k. Repairs and retesting:
   (1) Structures and portions of structures that have satisfied the qualitative requirements of HST-100, but have failed to satisfy the quantitative requirements of HST-100 may be immediately retested for volume loss.
      (a) If the structure fails the second test for volume loss, the structure shall be drained, and the Contractor shall observe the interior for probable areas of leakage.
      (b) The structure shall not be retested until repairs to the probable areas of leakage are complete.

3.05 REPAIRS FOR RETESTING

A. Locations showing damp spots or flowing water:
   1. Mark locations of visible leaks and damp spots.
   2. Drain structures for repair.
   3. Repair defects causing damp spots and flowing water using methods specified in Section 03 30 00 - ~~Cast-in-Place~~ Concrete and approved by the Engineer.
      a. Repair both interior and exterior surfaces and make structures watertight.
      b. Submit proposed repair products and procedures for Engineer's review.
      c. Refill structures for retesting.
   4. Repeat filling, observations, and repairs until no leaks or damp spots appear.
B. Structures for which loss of water volume loss exceeds the limits specified after adjustments for evaporation, and precipitation:
   1. Determine cause of volume loss.
   2. Drain structures of water.
   3. Repair defects causing loss of water volume using methods specified in Section 03 30 00 - ~~Cast-in-Place~~ Concrete and approved by the Engineer.
      a. Submit proposed repair products and procedures for Engineer's review.
   4. Refill water-holding structures.
   5. Repeat testing and repairs until volume loss does not exceed specified limits.

End of Section

FIGURE A

WATERTIGHTNESS TEST REPORT

PROJECT: _____ SUBMITTED BY:

STRUCTURE: _____ WITNESSED BY:

AREA: _____ TEST DATES:

TEST DURATION: TEST DURATION:

Surface area of structure tested: _____ (square feet)

Volume of structure tested: _____ (cubic feet)

Volume of structure tested: _____ (gallons)

Measured loss through gates, etc.: _____ (gallons / day)

Allowable loss of water volume: _____ (per day)

Allowable loss of water volume: _____ (% in 24 hours) Allowable

measured loss over test duration (inches): _____

Measured loss of water: _____ (gallons / day - From E below)

Measured loss of water volume (%): _____ (in 24 hours - From E below)

Water Temperature: Start of test: °F End of test: °F

			Water Surface Elevation (top of structure to top of water)				
			Location #1	Location #2	Location #3	Location #4	Initials**
Day	Date	Time	(inches)	(inches)	(inches)	(inches)	
1							
2							
3							
4							
5							
Changes in Level:							

A. Average change in level (feet): (Average of total charges for all locations)

B. Correction for precipitation:
(Measured from pan)

(Measured from pan)

C. Correction for evaporation:

D. Corrected change in level (CL):

E. Total days tested:

Average measured % water loss in 24 F. hours: = (CL) x (surface area) x 100 / (initial water volume) x (number of test days)

Notes and field observations□□

□□ Place date and initials at the beginning of each entry

CITY OF FOUNTAINS
HEART OF THE NATION
KANSAS CITY
MISSOURI

ADDENDUM NUMBER 005

Project/Contract Number: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrade

ISSUE DATE: **February 5, 2026**

Bidders are hereby notified that the Bidding and Contract Documents for the above project, for which Bids are to be received on **February 24, 2026**, are amended as follows:

Information to Bidders The following is provided to Bidders for information only:

Specification Changes:

Section 40 60 00 – Process Control and Instrumentation General Requirements

a. Add subparagraph 1.06.C.f

f. System Integrator shall possess an active and valid Rockwell Automation PlantPAx System Integrator Badge.

(1) Badge must be traceable and verifiable through the Rockwell Automation PartnerNetwork™ portal.

(2) Badge must correspond to the PlantPAx System Release used for the project (e.g., PlantPAx 5.0+).

(3) System Integrator shall have documented experience implementing Rockwell Automation PlantPAx process control systems.

(4) System Integrator shall have completed PlantPAx projects of similar size and complexity. Provide project resumes, including the following:

(a) Project name and owner

(b) Description of scope

(c) Quantity and type of controllers (ControlLogix, CompactLogix)

(d) HMI platforms

(e) I/O counts

(f) Process areas served (water, wastewater, etc.)

(5) Reference Standards:

(a) Rockwell Automation PlantPAx® System Release (latest version at time of bid).

(b) Rockwell Automation Library of Process Objects (latest version at time of bid).

(c) Rockwell Automation Product Compatibility and Download Center (PCDC).

2. Section 33 31 11 – Gravity Piping

a. Delete Subparagraph 2.03-A.1, Gravity Piping Schedule line 1, Class 150/SDR 26.

b. Replace with Subparagraph 2.03-A.1, Gravity Piping Schedule line 1, Class 150/DR-32.5.

Drawing Changes:

1. C106 – Added settlement plate marker location
2. C109 – Added settlement plate marker location
3. C110 – Added settlement plate marker location
4. C111 – Added settlement plate marker location
5. C137A – Added settlement plate marker location
6. C128 – Modified Note 1 to include double/triple wall polypropylene
7. C129 – Modified Note 1 to include double/triple wall polypropylene
8. C130 – Modified Note 1 to include double/triple wall polypropylene
9. C131 – Modified Note 1 to include double/triple wall polypropylene
10. C132 – Modified Note 1 to include double/triple wall polypropylene
11. C133 – Modified Note 1 to include double/triple wall polypropylene
12. E010 - Typical Electrical Details Sheet 4: Added clarification cable tray detail notes.
13. E131 - Electrical Duct Bank Sections Sheet 1: Site duct bank section schedule Site-EDB-001 added three 4-inch spare conduits, added three feeders.
14. E132 - Electrical Duct Bank Sections Sheet 2: Site duct bank section schedules UV-EDB-001 and UV-EDB-002, 15 conduits (some spare feeders) were added for Addendum 3 but not clouded. These are now clouded.
15. E221 - Influent Screening Building Electrical Power Plan: Added cloud to note that refers to conduit support detail.
16. E401 - AGS Electrical One-Line Diagram Service #3 Sheet 1 of 2: Added spare breakers for future equipment.
17. E412 - AGS Basin Electrical Grounding Plan Area: Added ground ring connections to stairs.
18. E413 - AGS Basin Electrical Grounding Plan Area B: Added ground ring connections to stairs.
19. E422 - AGS Basin Electrical Power Plan Area A: Added 120V circuit connection to the 8 AIT's added to AGS.
20. E423 - AGS Basin Electrical Power Plan Area B: Added 120V circuit connection to the 8 AIT's added to AGS.

21. E611 - UV Disinfection Electrical Grounding Plan: Added clarification for equipment rack location and grounding at plant sewer pump and VFD in electrical room.

22. E621 - UV Disinfection Building Electrical Power Plan: Clouded disconnect and conduit for future UV. These were part of Addendum 3 but not clouded.

23. E621 - UV Disinfection Building Electrical Power Plan: Added note and location for UV-VFD-110 that feeds AHU.

24. E711 - Solids Processing Building Electrical Grounding Plan 1 of 2: Added Unistrut rack locations to ground plan and ground connection to them.

25. E712 - Solids Processing Building Electrical Grounding Plan 2 of 2: Added ground connection to odor control Unistrut rack.

26. E721 - Solids Processing Building Electrical Power Plan 1 of 2: Added cloud to note 6 and related switch. This was in Addendum 3 but not clouded.

27. E721 - Solids Processing Building Electrical Power Plan 1 of 2: Added 120V to flow switch and toggle switch. Moved disconnects away from process pipe.

28. E811 - Admin Building Electrical Grounding Plan: Added two ground connections.

29. E821 - Admin Building Electrical Power Plan: Added clouds for notes 25 and 26 toggle switches. These were in Addendum 3 but not clouded.

30. E821 - Admin Building Electrical Power Plan: Added disconnect for air handling unit.

31. M003 - Mechanical Schedules: Exhaust fan model numbers revised.

32. P701 - Solids Processing Building Plumbing Plan: Modified domestic cold water piping and process water piping for coordination and obstructions.

33. P721 - Solids Processing Building Isometric Riser Diagram: Modified domestic cold water piping and process water piping for coordination and obstructions.

Q1.	Section 33 12 16 2.01 Butterfly Valves - Should the 36" MJ buried butterfly valves in the TABLE be per the KCMO 02641 - WATER VALVES standard for buried butterfly valves for the city?
A1.	**Follow the requirements in project specification 33 12 16 for any discrepancies between project document 33 12 16 and KCMO spec 02641.**
Q2.	Section 33 12 16 2.01 Butterfly Valves - The 4" butterfly valves shown in the TABLE call for a 190 psi leak test in the UV Building. Should these valves be Class 250B to meet the requirement? Do you want it to be an industrial lug butterfly valve instead for the leak requirement? AWWA C504 150B won't go to 190 psi.
A2.	**Yes, valves with design (max) pressure of 190 psi shall be class 250. Section 2.01.C.4.c as well as 2.01.E.1 allow for class 250 valves.**
Q3.	Section 40 70 00 2.17 Differential and Gauge Pressure Transmitters. -Onyx Valve has done these before for the city (as equal), so please confirm they are okay here if we

	follow design criteria and you have time to add them. Distributors/Contractors have asked us to inquire and confirm.
A3.	**Specification section 40 70 00 2.17.M.7 states Red Valve Co. Series 40 or Engineer-approved equal. Onyx Valve would be considered an equal as long as it meets the stated specification requirements. Specifications will not be revised to add specific additional vendors.**
Q4.	Drawing L110 – Overall Tree Preservation And Mitigation Plan, (Sheet 55 of 643), depicts existing trees to be removed along 'Main Road-1.' Per Addendum 03, "All tree removal shall be limited to occur between November 1 and March 31, during bat inactive season." It is presumed that the Owner will not have the Contract approved by council, issued to Contractor, executed by both parties, and issued a Notice To Proceed to the Contractor prior to the March 31 date. Would the Owner allow for and issue the awarded Contractor a limited/preliminary Notice To Proceed exclusively for felling of the designated trees to be removed, prior to the March 31st date allowing for construction to commence the 2nd quarter of 2026?
A4.	**No limited notice to proceed will not be given. City is obtaining temporary access easement for Contractor to access the site from the north/west that doesn't involve tree removal during early construction activity. Alternatively, if tree removal during April-October is necessary, Contractor can obtain a 3rd party bat habitat survey at the time of removal confirming no nesting habitats in the planned tree removal area before proceeding.**
Q5.	Drawing C135A, General Note #4 states, "Contractor shall install 4 settlement plates and 4 surface settlement markers to monitor amount and time rate of consolidation at locations indicated on the applicable drawing. Contractor shall install settlement plates while Owner's geotechnical representative is present." There does not appear to be any drawings that depict or provide the prescribed location of these settlement plates or settlement markers. Please clarify to the prospective Bidders the prescribed location where the settlement plates or settlement markers are to be installed or if they will be required.
A5.	**Drawings C106, C109, C110, C111, and C137A are revised to show general location of settlement plates & markers.**
Q6.	Section 46 42 57-2.04.B - Our valve module is a standardized product that has been custom designed internally to provide the form, fit and function needed. The enclosure, valves and manifold are designed to accommodate the pipe connections, and the internal components were selected based on durability and their specified temperature ranges to be able to handle the cold winters and the hot summer sun. Therefore, we exclude those from standard control panel specifications.
A6.	**Acceptable in reference to the coarse bubble diffusers.**
Q7.	Section 46 42 57-2.04.E - Our valve module comes standard with a hinged door equipped with quarter turn latches. Locking mechanisms are not included.
A7.	**Acceptable in reference to the coarse bubble diffusers.**
Q8.	Section 46 42 57-2.04.G - Our valve module does not contain any power components, therefore, the SCCR depends on the fuses used in the control power transformer upstream of the valve module.
A8.	**Noted for the coarse bubble diffusers.**

Q9.	Section 46 42 57-2.04.J - Regulators are no longer part of Enviromix's standard design due to many failures in the field. Each valve module will be equipped with a throttling valve for firing pressure control instead of a pressure regulator. There is a pressure gauge on the manifold inside the valve module to guide in adjusting the throttling valve.
A9.	**Noted**
Q10.	Section 46 42 57-2.04.K - Please replace Watts F603D with Parker 14F15BB
A10.	**Parker 14F15BB is an acceptable alternative**
Q11.	Section 46 42 57-2.04.L - The Zombie Valve Module (ZVM) is only provided with a pressure switch that will signal a hardwired alarm to SCADA if the pressure in the manifold drops below 30PSI. Valve fail to open alarms are not possible without a main control panel and we are unable to provide valve fail to close alarms since the valves do not have "closed" limit switches. The alarm beacon on top of the ZVM will illuminate when there is a low pressure alarm from the pressure switch.
A11.	**Acceptable**
Q12.	Section 46 42 57-2.06.C - particulate and oil removal filters are integrated into a single filter now.
A12.	**Acceptable**
Q13.	Section 46 42 57-2.06.D.2 - these compressors are factory made machines with very few available options. They are not customizable to project-specific specifications such as Section 46 05 13. Please remove reference to this specification section
A13.	**Exclusion accepted**
Q14.	Section 46 42 57-2.06.E - these compressors are factory made machines with very few available options. They are not customizable to project-specific specifications such as Section 40 67 00. Please remove reference to this specification section.
A14.	**Exclusion accepted**
Q15.	Section 46 42 57-2.06.E.2.c - these compressors are factory made machines with very few available options. They are not customizable to project-specific requirements. The SCCR rating of the compressor is 5 kA.
A15.	**If equipment SCCR rating is below the design stated in the specification section (65kA), Contractor to use the provided SKM model to run fault current studies. If equipment SCCR rating is below the study results fault current, fault-current-mitigating methods (isolating transformer or other means) shall be provided by the Supplier.**
Q16.	Section 46 42 57-2.06.E.2.e - delete differential pressure across fluid filter, differential separator, percent capacity, air filter as these features are not available with our offering.
A16.	**Acceptable**
Q17.	Section 46 42 57-2.06.E.2.g.2 - replace dirty filter warning with general warning
A17.	**Acceptable**

Q18.	Section 46 42 57-2.06.F.1.a.2 - change minimum temperature to 32 degF
A18.	**Minimum room temperature is actually 55°F. Specification updated.**
Q19.	Section 46 42 57-2.06.F.1.b.3 - change capacity at operating target pressure to 63 cfm. A larger compressor is required to ensure uniform mixing at the full design concentration range.
A19.	**Acceptable**
Q20.	Section 46 42 57-2.06.F.1.b.4 - change maximum motor size to 15 HP. A larger compressor is required to ensure uniform mixing at the full design concentration range. The compressor frame size does not change so there is adequate space. concentration range.
A20.	**Acceptable. Change could affect conduit, conductor, and breaker size that contractor is required to install. Contractor to take this into account during bid.**
Q21.	D701 - route compressed air piping from the receiver to each valve module inside the building as long as possible to minimize exposure to freezing temperatures which.
A21.	**noted**
Q22.	In order to confirm Rockwell PlantPax standards are properly applied and to ensure that PlantPax certification will be available upon project completion, vendor recommends that the below items be added to Specification Section 40 60 00, 1.06, C. System Integrator Qualifications: • System Integrator shall possess an active and valid Rockwell Automation PlantPAx System Integrator Badge at the time of bid. • Badge must be traceable and verifiable through the Rockwell Automation PartnerNetwork™ portal. • Badge must correspond to the PlantPAx System Release used for the project (e.g., PlantPAx 5.0+). • System Integrator shall have a minimum of five (5) years of documented experience implementing Rockwell Automation PlantPAx process control systems. • System Integrator shall have completed at least three (3) PlantPAx projects of similar size and complexity within the last five years. Provide project resumes including: 1. Project name and owner 2. Description of scope 3. Quantity and type of controllers (ControlLogix, CompactLogix) 4. HMI platforms 5. I/O counts 6. Process areas served (water, wastewater, etc.) Reference Standards • Rockwell Automation PlantPAx® System Release (latest version at time of bid). • Rockwell Automation Library of Process Objects (latest version at time of bid). • Rockwell Automation Product Compatibility and Download Center (PCDC).
A22.	**Spec 40 60 00 is revised and included in this addendum. Note that experience clauses are not allowed in SRF-funded projects and have been struck from the above request. Refer to the updated specification.**
Q23.	Can we please get clarification on the pipe material and class for the 36" EFFLUENT-1 and EFFLUENT-2 lines shown in the PVC Gravity Pipe Schedule in Section 33 31 11? a. In the schedule, these lines are identified as “DIP/PVC” with a class noted as “150/SDR 26.” Our understanding is that the DIP designation is intended for

	the portions of the lines that are underslab (requiring ductile iron), while the remaining portions can be PVC. b. However, the note above the table calls for C900 piping, while the class is listed as SDR 26. AWWA C900 pipe is not manufactured in SDR 26; it is typically available in DR 14, 18, 21, 25, 32.5, and 41. i. Can you please confirm: 1. Pipe material: Are these lines intended to be a combination of DIP under slab and PVC elsewhere, or a single material throughout? 2. Pipe standard: Is C900 actually required for the PVC portions, or is another standard (e.g., ASTM D3034, ASTM F679, etc.) intended? 3. Pressure/class designation: What is the correct DR/pressure class for the PVC pipe on these lines? c. Once clarified, we can ensure the correct material and class are used in procurement and installation.
A23.	**1. Intent is that Contractor has the option to install lines as either DIP or PVC. Drawings are based on the PVC option.** **2. Pipe shall be AWWA C900 with DR rating of 32.5 if constructed of PVC. Specification revised.** **3. See response 2.**
Q24.	Drawing S217-Influent Pump Station Backfill South Elevation, general excavation note #5 states, "Extents of excavation and backfill shall encompass all structures in this area as shown on S200 series drawings." Note #7 states, "Settlement monitoring is required for fill soils under the valve vault and electrical building. Construction of structure foundations may not commence until duration of settlement monitoring has elapsed." Drawing C135A Civil Details 3, Settlement Monitoring note #3 states, "After fill placement is complete, elevation readings shall be collected on settlement plates and markers for at least an additional 4 weeks after fill placement and until settlement rate is less than 1/10 inch per week to measure time rate of settlement." Per the prescribed excavation layout depicted on drawing S217, the existing soils will be removed including bedrock and shale layers, for the construction of the Wet Well and Coarse Screening Structures. It appears the structural backfill for this excavation could be placed in controlled, compacted, and tested lifts to the bottom of foundation for both the Valve Vault and Electrical Building in-lieu of placing backfill to design subgrade, installing settlement monitoring plates, surveying for 4-weeks, and subsequently excavating the compacted fill/embankment to bottom of foundation elevation. Please clarify to the prospective Bidders if it will be permissible for the Contractor to backfill the Wet Well and Coarse Screening structures excavation in controlled, compacted, and tested lifts to the bottom of foundation for both the Valve Vault and Electrical Building in-lieu of placing backfill to design subgrade, installing settlement monitoring plates, surveying for 4-weeks, and subsequently excavating the compacted fill/embankment to bottom of foundation elevation. This process would be the most economical for the project costs and overall construction duration.
A24.	**Prior to excavation for the IPS wet well and Coarse Screen Structure, filling to finished grade is NOT required. It is permissible to backfill structures as described above to the foundation subgrade for each structure. IPS Electrical Building does NOT need to be on ground improvements. The Valve Vault does need to be on ground improvements.**
Q25.	Specification section 00210-Instructions To Bidders, part 6 states, "Questions received less than ten (10) days prior to the date for opening of Bids may not be answered." Please confirm to the prospective Bidders that the new deadline for questions about the meaning or intent of the Bidding Documents will be 02/14, since the date for opening of Bids has been revised to 02/24.

A25.	**Deadline for questions is extended to Friday 2/13. Questions received after this date may not be answered.**
Q26.	Concerning The Thickened Sludge, Variable Speed, Pumps, SECTION 43 23 57. Normally the electrical contractor provides their control package SECTION 40 60 00. Please confirm if that is the intent on this project.
A26.	**Correct. Motor controllers are provided separately. Motor controllers are not expected to be provided by pump supplier. VFDs and RVSSs are provided by electrical contractor, not by pump supplier. The intent of the manufacturer's rep for start-up services as it is written in section 3.01-A.2 is for the rep to assist the electrical contractor regarding pump controls and be knowledgeable about VFD and RVSS pump control.**
Q27.	1. Will the trace amounts of asbestos joint compound and drywall be required to be removed by an abatement contractor prior to demolition of the admin building? Can you confirm who will be responsible for providing access to the entire structure and will the abatement contractor be responsible for removing contents to access areas? Please confirm if final air will be ran per OSHA, MDNR, EPA regulations for this work? 2. Can you confirm that there will need to be no lead abatement done on the project and that the demolition contractor can handle this assuming that there will be OSHA monitoring confirming that workers are not exposed to the PEL for an 8 hour shift while working? 3. Are there any quantities of universal wastes / HHW that can be released for bidding purposes on removal and disposal of these materials prior to demolition of the structures.
A27.	1. **Abatement shall be conducted by a licensed and competent contractor. Per the Asbestos, Lead-Containing Paint, & Hazardous Materials Survey Report Section 5.1 this is considered unclassified, which still requires adherence to specific OSHA engineering controls including wet methods, HEPA vacuuming, and proper disposal. The City will provide access to the structure. Contractor(s) are responsible for means of access (manlifts, etc) and removing contents that have not been removed prior by the City. The OHSA standards will apply for final air clearances.** 2. **The Asbestos, Lead-Containing Paint, & Hazardous Materials Survey Report is provided for reference only. No confirmation of accuracy or required lead abatement is given. OSHA monitoring of PEL shall be by Contractor as necessary.** 3. **No. Contractor can request a pre-bid walkthrough if needed.**
Q28.	Please provide the prospective Bidders with all as-built information available for the existing Todd Creek WWTP facility that is to be demolished as part of this contract.
A28.	**Please send a request to Shawn Cross at shawn.cross@kcmo.org and a drop box link will be sent where the drawings can be downloaded.**
Q29.	1. Please confirm the documents listed below are only what is due at bid time. If there are additional items needed, please indicate. 2. Please confirm these documents are due within 48 hours of bid opening, and not at time of bid.
A29.	**1. 00410 Construction Bid Form**

	00413- Allowance form **00430 Bid Bond** **Evidence of Competency to Perform- this is based on the 00210- Instruction to Bidder.** **00410.01 Experience reference form** **00410.02 Experience and Reference Summary- Current Project** **00410.03 List of Equipment and Staffing Available for projects.** **00910- Addenda** **00410.04- Equipment Questionnaire.** **00410.05- Instrumentation and Control system Supplier Questionnaire** **00990- CSSRF drop-in specs** **00990.01- Attachment 1 Missouri DBE Requirements.** **2. 00450- Contractor Utilization/Request for Waiver** **00450.01- Letter of Intent to Subcontractor** **00485.05 Affidavit of Training Program** **3. All other documents will be due when the city is ready for intent to contract.**

Bidding Requirements

1. N/A

Contracting Requirements

1. Delete and replace the following section(s):
    a. Delete Document, Section 00010 TABLE OF CONTENTS and replace with the Following Document Section 00010 TABLE OF CONTENTS
    b. Delete Document, Section 00410 CONSTRUCTION BID FORM CONTRACT – ACCEPTANCE OF BID and replace with the Following Document Section 00410 CONSTRUCTION BID FORM CONTRACT – ACCEPTANCE OF BID
2. Add the following section(s):
    a. Document, Section 00410.02 EXPERIENCE REFERENCE FORM - CURRENT PROJECTS
    b. Document, Section 00410.03 LIST OF EQUIPMENT AND STAFFING

Specifications

1. Delete and replace the following section(s):
    a. Delete Document, Section 40 60 00 – PROCESS CONTROL AND INSTRUMENTATION GENERAL REQUIREMENTS and replace with the Following Document Section 40 60 00 – PROCESS CONTROL AND INSTRUMENTATION GENERAL REQUIREMENTS
    b. Delete Document, Section 33 31 11 – GRAVITY PIPING and replace with the Following Document Section 33 31 11 – GRAVITY PIPING

Drawings:

1. Delete and replace the following drawings(s):
    a. Delete Drawing, C106 and Replace with the Following Drawings, C106
    b. Delete Drawing, C109 and Replace with the Following Drawings, C109
    c. Delete Drawing, C110 and Replace with the Following Drawings, C110
    d. Delete Drawing, C111 and Replace with the Following Drawings, C111
    e. Delete Drawing, C137A and Replace with the Following Drawings, C137A
    f. Delete Drawing, C128 and Replace with the Following Drawings, C128
    g. Delete Drawing, C129 and Replace with the Following Drawings, C129
    h. Delete Drawing, C130 and Replace with the Following Drawings, C130
    i. Delete Drawing, C131 and Replace with the Following Drawings, C131
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    k. Delete Drawing, C133 and Replace with the Following Drawings, C133
    l. Delete Drawing, E010 and Replace with the Following Drawings, E010
    m. Delete Drawing, E131 and Replace with the Following Drawings, E131
    n. Delete Drawing, E132 and Replace with the Following Drawings, E132
    o. Delete Drawing, E221 and Replace with the Following Drawings, E221
    p. Delete Drawing, E401 and Replace with the Following Drawings, E401
    q. Delete Drawing, E412 and Replace with the Following Drawings, E412
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    u. Delete Drawing, E611 and Replace with the Following Drawings, E611
    v. Delete Drawing, E621 and Replace with the Following Drawings, E621
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    z. Delete Drawing, E721 and Replace with the Following Drawings, E721
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    bb. Delete Drawing, E811 and Replace with the Following Drawings, E811
    cc. Delete Drawing, E821 and Replace with the Following Drawings, E821
    dd. Delete Drawing, E821 and Replace with the Following Drawings, E821
    ee. Delete Drawing, M003 and Replace with the Following Drawings, M003
    ff. Delete Drawing, P701 and Replace with the Following Drawings, P701
    gg. Delete Drawing, P721 and Replace with the Following Drawings, P721

NOTE: Bidders must acknowledge receipt of this Addendum by listing the number and date, where provided, on the Bid Form - Document 00410.

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Bidder: _____

BID FORM/CONTRACT

Project Number: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrade

1. Bidder, having examined the Bidding Documents, related documents and the Site of the Work, and being familiar with all the conditions affecting the construction of the proposed Work, including Laws and Regulations and the availability of materials and supplies, agrees, if this Bid is selected by CITY, this Bid Form/Contract will become the Contract between Bidder and CITY for Bidder to furnish all labor and materials, equipment and services necessary for the proper completion of the Work in accordance with the Contract Documents, including general construction work at the price(s) stated below, which stated sums include fees and all other charges applicable to materials, appliances, labor and all things subject to and upon which other charges may be levied.
2. Bidder agrees the Contract Documents will comprise the entire agreement between CITY and Bidder. The Contract Documents are identified in the General Conditions and are incorporated into and made part hereof this Bid Form/Contract by reference.
3. Bidder agrees that if this Bid Form/Contract is executed by CITY, Bidder's offer is accepted and this Bid Form/Contract that incorporates all other Contract Documents shall constitute the Contract between the parties. Bidder authorizes the CITY to fill in the Contract Price on this Bid Form/Contract in accordance with Bidder's Bid. Bidder agrees that this Bid Form/Contract may be executed in one or more counterparts, each of which will be deemed an original copy of this Bid Form/Contract and all of which, when taken together, will be deemed to constitute one and the same Bid Form/Contract. This Bid Form/Contract shall be effective upon the execution of counterparts by both parties, notwithstanding that both parties may not sign the same counterpart. The parties' signatures transmitted by facsimile or by other electronic means shall be proof of the execution of this Bid Form/Contract and shall be acceptable in a court of law. A copy of this Bid Form/Contract shall constitute an original and shall be acceptable in a court of law.
4. The Bid Price(s) shall be shown in numeric figures only.

TOTAL BASE BID IN NUMERIC FIGURES	$_____
ALLOWANCE NO. 1 – Unknown Site Conditions	$250,000.00
ALLOWANCE NO. 2 – Admin Building Furnishings	$500,000.00
ALLOWANCE NO. 3 – Evergy Power Buildout	$4,250,000.00
Hydroxy Radical System Equipment	$_____
TOTAL BID IN NUMERIC FIGURES	$_____

5. The undersigned Bidder has given CITY'S Project Manager written notice of all conflicts, errors or discrepancies that it has discovered in the Contract Documents and the written resolution thereof by the Project Manager or by the DESIGN PROFESSIONAL is acceptable to Bidder.
6. The undersigned Bidder agrees that this Bid shall remain subject to selection by CITY, and may not be withdrawn for ninety (90) days after the day Bids are opened.
7. The undersigned Bidder certifies that this Bid contains no modifications, deviations, riders or qualifications.

8. Form(s) 00411 Itemized Prices, contain prices included in the Base Bid, and are incorporated into this Bid. Form(s) must be completed and returned with this Bid.
   a. The itemized prices provided for in this Bid Form shall apply only in the event of a Change Order providing for such increase or decrease in the quantities.
   b. The Contract Price will be subject to adjustment according to final measured, used, or delivered quantities, and the adjustment unit prices in the Bid will apply to such final quantities
9. The undersigned Bidder acknowledges receipt of the following addenda listed by number and date appearing on each addendum:

Addendum Number	Dated	Addendum Number	Dated
(_____)	(_____)	(_____)	(_____)
(_____)	(_____)	(_____)	(_____)
(_____)	(_____)	(_____)	(_____)
(_____)	(_____)	(_____)	(_____)
(_____)	(_____)	(_____)	(_____)
(_____)	(_____)	(_____)	(_____)
(_____)	(_____)	(_____)	(_____)

10. By submitting its bid, Bidder is agreeing to meet or exceed the minimum employment goals of 10% minority and 6.9% women during the term of its contract with the City, or request a waiver of the goals. If a waiver is requested, Bidder must establish good faith efforts towards meeting the goals as set forth in the CREO-KC Instructions for Construction Contracts and the City's Workforce Ordinance. Should Bidder fail to meet or exceed the minimum employment goals or otherwise establish that Bidder is entitled to a waiver under circumstances in which Bidder has previously failed to meet or exceed the goals on one or more occasions with the twenty-four month period immediately preceding the completion of the Work under this Bid Form/Contract, Bidder may be suspended from participating, either as a contractor or subcontractor, on any future contract with the City for a period ranging from thirty days to six months as further specified in the Contract Documents.
11. By submitting its bid, Bidder warrants that if its bid should exceed $300,000.00 and Bidder employs fifty (50) or more people, Bidder has an affirmative action program in place and will maintain the affirmative action program in place for the duration of its contract with the City. Bidder further warrants that it will comply with the affirmative action requirements contained in the General Conditions as incorporated by reference into this Bid Form/Contract.
12. Section 13 through Section 14 constitutes the Affidavit of Intended Utilization required to be submitted by Bidders.
13. By submitting its bid, Bidder is agreeing to the following: (1) Bidder has made by bid opening a good faith effort to meet the DBE goals established for the project; or Bidder will continue to make during the 48 hours after bid opening a good faith effort to meet the DBE goals established for the project; and (2) Bidder will timely submit its **Missouri State Revolving Fund Disadvantaged Business Enterprise Utilization Worksheet (found in Section 00990 Clean Water State Revolving Fund Requirements** for each DBE listed; and (3) Bidder will submit documentation of its good faith efforts to meet the DBE goals when requested by the City or State. Failure to meet these requirements in good faith will result in Bidder forfeiting its bid bond.

14. To the best of Bidder's knowledge, the following are names of certified DBEs with whom Bidder, or Bidder's subcontractors, presently intend to contract with if awarded the Contract on the above project:

A. Name of DBE Firm _____
Address _____
Telephone No. _____
I.R.S. No. _____
Area/Scope of work _____
Subcontract amount _____

B. Name of DBE Firm _____
Address _____
Telephone No. _____
I.R.S. No. _____
Area/Scope of work _____
Subcontract amount _____

C. Name of DBE Firm _____
Address _____
Telephone No. _____
I.R.S. No. _____
Area/Scope of work _____
Subcontract amount _____

D. Name of DBE Firm _____
Address _____
Telephone No. _____
I.R.S. No. _____
Area/Scope of work _____
Subcontract amount _____

E. Name of DBE Firm _____
Address _____
Telephone No. _____
I.R.S. No. _____
Area/Scope of work _____
Subcontract amount _____

F. Name of DBE Firm _____
Address _____
Telephone No. _____
I.R.S. No. _____
Area/Scope of work _____
Subcontract amount _____

(List additional DBEs, if any, on additional pages and attach to this form)

Business Entity Type:

(__) Missouri Corporation
(__) Foreign Corporation
(__) Fictitious Name Registration
(__) Sole Proprietor
(__) Limited Liability Company
(__) Partnership
(__) Joint Venture
(__) Other: (Specify)_____

BIDDER
Legal name & address of Bidder, person firm, partnership, corporation, or association submitting Bid:

_____
Phone No: _____
Cell No: _____
Facsimile No: _____
Bidder's E-Mail: _____

_____
Federal ID. No. _____

I hereby certify that I have authority to execute this document on behalf of Bidder, person, firm, partnership, corporation or association submitting Bid.

By: _____
(Signature)

_____
(Print Name)

Title:_____

Date:_____

(Attach corporate seal if applicable)

NOTARY

Subscribed and sworn to before me this _____ day of _____, 20__.

My Commission Expires: _____ _____

ACCEPTANCE OF BID

CITY, by executing this Bid Form/Contract, hereby accepts Bidder's Bid and this Bid Form/Contract that incorporates all other Contract Documents shall constitute the Contract between the Parties.

CITY shall pay CONTRACTOR for completion of the Work in accordance with the Contract Documents a maximum amount of _____ Dollars, ($ _____). The Contract Price includes:

00411 Itemized Prices, included in the Bid, a copy of which is attached

00413 Allowances, included in the Bid, a copy of which is attached

By executing this Bid Form/Contract, CITY accepts Bidder's offer for the Contract Price stated above and this Bid Form/Contract that incorporates all other Contract Documents shall constitute the Contract between the parties

_____

City of Kansas City, Missouri (OWNER or City)

Approved as to form:

_____

Assistant City Attorney

I hereby certify that there is a balance, otherwise unencumbered, to the credit of the appropriation to which the foregoing expenditure is to be charged, and a cash balance, otherwise unencumbered, in the treasury, to the credit of the fund from which payment is to be made, each sufficient to meet the obligation hereby incurred.

_____

Director of Finance (Date)

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

EXPERIENCE AND REFERENCE SUMMARY – CURRENT PROJECTS

Project/Contract Numbers: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrade

Firm's Legal Name	
Mailing Address	
Contact – Name & E-Mail	
Contact – Phone & Fax	

NO.	PROJECT & LOCATION	CONTRACT AMOUNT/ % COMPLETE	OWNER NAME & ADDRESS CONTACT & PHONE NUMBER	LENGTH, DIAMETER & MATERIAL OF CONSTRUCTION OR DESCRIPTION OF REPAIRS	START DATE
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					

LIST OF EQUIPMENT AND STAFFING AVAILABLE FOR PROJECT

Project/Contract Numbers: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrade

	EQUIPMENT AVAILABLE FOR CONSTRUCTION (OR ATTACH LIST)		STAFFING BREAKDOWN	NUMBER OF EACH CATEGORY
1.		1.	OFFICE STAFF	
2.		2.	SUPERVISORS	
3.		3.	FIELD STAFF – CREW FOREMEN	
4.		4.	FIELD STAFF – OPERATORS (NOT FOREMEN)	
5.		5.	FIELD STAFF – LABORERS (NOT FOREMEN)	
6.		6.		

SECTION 33 31 11 – GRAVITY PIPING

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes all gravity pipe, fittings, and specials.

B. Related Work Specified Elsewhere:

1. Section 31 20 50 - Site Preparation and Earthwork.
2. Section 33 39 00 - Utility Structures.

1.02 REFERENCES:

A. Applicable Standards:

1. ASTM International (ASTM):
   a. C76 – Standard Specification for Reinforced Concrete Culvert, Storm Drain.
   b. D1248 – Polyethylene Plastics Molding and Extrusion Materials.
   c. D1784 – Rigid Poly(Vinyl Chloride) and Chlorinated Poly(Vinyl Chloride) Compounds.
   d. D2241 – Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
   e. D2321- Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
   f. D2412 – Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
   g. D2683 – Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
   h. D2774 – Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
   a. D3035 – Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter.
   i. D3212 – Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
   j. E3261 – Standard Specification for Butt Heat Fusion Polyethylene Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
   k. D3350 – Standard Specification for PE Pipe & Fittings Material.
   l. F412 – Standard Terminology Relating to Plastic Piping Systems.
   m. F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
   n. F714 – Standard Specification for PE Pipe (DR-PR) Based on Outside Diameter.
   o. F1417 – Standard Practice for Installation Acceptance of Plastic Non-pressure Sewer Lines Using Low-Pressure Air.
   p. F1803 – Poly (Vinyl Chloride) (PVC) Closed Profile Gravity Pipe and Fittings Based on Controlled Inside Diameter.
   q. F2026 – Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings.
   r. F2206 – Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene (PE).
   s. F2620 – Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings.
   t. F3124 – Standard Practice for Data Recording the Procedure Used to Produce Heat Butt Fusion Joints in Plastic Piping Systems or Fittings.
   u. F3183 – Standard Practice for Guided Side Bend Evaluation of Polyethylene Pipe Butt Fusion Joint.

v. F3190 - Standard Practice for Heat Fusion Equipment (HFE) Operator Qualification on Polyethylene (PE) and Polyamide (PA) Pipe and Fittings.

2. American Water Works Association (AWWA):
   a. C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. for Water Transmission and Distribution.
   b. C906 – Polyethylene (PE) Pressure Pipe & Tubing, 4-Inch Through 63-Inch for Waterworks.
   c. M23 – PVC Pipe-Design and Installation.
   d. M55 – Manual for the Design and Installation of Polyethylene Pipe in water Applications.
3. Plastic Pipes Institute (PPI):
   a. Handbook of Polyethylene Pipe (latest edition).
   b. MS-3 – HDPE Pipe and Fittings Specification for Buried Potable Water.
   c. TR-3 – Policies and Procedures for Developing Hydrostatic Design Basis (HDB), Pressure Design Basis (PDB), Strength Design Basis (SDB), and minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe.
   d. TR-4 – HDB/SDB/PDB/MRS Listed Materials, PPI Listing of Hydrostatic Design Basis (HDB), Strength Design Basis (SDB), Pressure Design Basis (PDB), and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe.
   e. TR-9 – Recommended Design Factors for Pressure Applications of Thermoplastic Pressure Pipe Materials.
   f. TR-33 – Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe.
   g. TN-42 – Recommended Minimum Training Guidelines for PE Pipe Butt Fusion Joining Operators for Municipal and Industrial Projects.
4. Uni-Bell PVC Pipe Association:
   a. UNI-B-6-98 – Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe.

1.03 SUBMITTALS:

A. Submit as specified in Division 1.
B. Submit the following for acceptance prior to fabrication:
   1. Pipe and joint details.
   2. Special, fitting, and coupling details.
   3. Laying and installation schedule.
   4. Specifications, data sheets, and affidavits of compliance for protective shop coatings and linings.
   5. Manufacturer's design calculations including, but not limited to, wall thickness and deflection under specified live and dead loads.
C. Certificates and Affidavits:
   1. Submit as specified in Division 1.
   2. Furnish the following prior to shipment:
      a. Affidavit of compliance with applicable standard.
      b. Test certificates.
D. Provide Manufacturer's Certification that the material was manufactured and tested in accordance with the specifications.
E. Qualifications:

1. Furnish prior to joint fusion:
   a. Fusion technician qualifications per ASTM F3190 from the pipe supplier for the size and type of fusible pipe being installed.

1.04 QUALITY ASSURANCE:

A. Manufacturer:
   1. Experienced in the design, manufacture, and commercial supply of the specific material.
   2. Experienced in the design, manufacture, and commercial supplying of the specific size of pipe.
   3. Certify to above minimum experience requirements.

1.05 DELIVERY, STORAGE AND HANDLING:

1. Deliver, store, and handle equipment and materials as specified in Division 1 and in accordance with the pipe manufacturer's recommendations.

PART 2 - PRODUCTS

2.01 PIPE REQUIREMENTS:

A. Furnish pipe of materials, joint types, sizes, and strength classes indicated or specified. Higher strengths may be furnished at Contractor's option. Furnish maximum pipe lengths produced by the manufacturer.

B. The pipeline manufacturer shall verify and attest to the fact that their pipe is good at all depths scheduled for installation.
   a. Shop drawings and pipe wall thickness calculations certifying that pipe is good at all depths scheduled for installation shall be submitted to the Engineer for review prior to pipe installation.

C. Pipe shall be designed to withstand all stresses resulting from external loads at depths shown on the Contract Drawings and H-20 live loadings in roadways.

D. Pipe Bedding: As specified.

E. Pipe Color: Pipe interior and exterior shall be green, blue pipe is not acceptable for PVC carrying untreated water.

F. Pipe Marking:
   1. All pipe, fittings and specials shall be marked conforming to the applicable standard specification under which the pipe is manufactured and as otherwise specified.
   2. Mark field location of fittings and specials by station.

G. Pipe Gaskets: All elastomeric gaskets and seals shall be synthetic rubber.

H. Each pipe or fitting shall have plainly and permanently marked on the pipe wall the pipe class and size, date of manufacturer, manufacturer's name or trade mark, and deflection angle for bends.

2.02 DUCTILE IRON PIPE:

A. For ductile iron gravity pipe, refer to Section 33 11 00 - Pressure Pipe.

2.03 PVC GRAVITY PIPE:

A. Design of Pipe: Design shall conform to AWWA C900 and as specified:
   1. External Loading:

GRAVITY PIPING SCHEDULE				
SIZE (in)	LINE	DESCRIPTION	MATERIAL	CLASS
36	EFFL	EFFLUENT-1, EFFLUENT-2	DIP/PVC	150/DR-32.5
36	EFFL	EFFLUENT-3	PVC	DR-32.5
48	INFL	INFLUENT	PVC	DR-32.5
36	SB	SCREEN BYPASS	PVC	DR-32.5

      a. Earth dead load cover at 120 pcf plus AASHTO H-20 live loads.
      b. 5% deflection limit.
      c. Bedding condition as indicated.
   2. Joints:
      a. Compression-type with the elastomeric ring gasket confined in the annular space between the bell end or socket and the spigot end of pipe.
      b. Elastomeric gasket ring joints shall conform to the requirements of ASTM D3212 or ASTM F477. Gaskets shall be neoprene or other synthetic rubber material.
      c. Must be water tight based on high head condition.
      d. Plain end of pipe shall be marked with a reference line to facilitate assembly inspections.
   3. Fittings:
      a. Fittings shall conform to AWWA C110 or AWWA C153
      b. Fittings shall be mechanical joint or push-on-type joint
      c. Fittings shall have pressure rating of not less than that specified for the pipe.
   4. Connections: Furnish any special flexible couplings required for manhole tie-ins or connections to other rigid structures.

B. Inspection and Testing:
   1. Primarily by manufacturer's testing laboratory and quality control personnel.
   2. Perform to avoid, insofar as possible, delivery of defective pipe.
   3. May be witnessed by Owner, Engineer, or approved independent testing laboratory.
      a. Independent testing laboratory, when used, shall be retained by Owner at no expense to Contractor.
      b. Contractor and manufacturer shall cooperate with Owner's inspection and test personnel. Permit unrestricted access, furnish reasonable space and facilities, and provide 5 working days advance notice of test schedule.
   4. Contractor shall provide 3 copies each of certified test reports to Engineer.
      a. Include stiffness and deflection, dimension, and hydrostatic joint tests per ASTM D3034, D3212, F679, F794, and F949.
      b. Furnish prior to delivery.

C. Handling and Delivery:
   1. Do not deliver until tests on representative specimens have been performed.
   2. Use equipment and methods adequate to preserve quality of pipe and to protect joint elements.

2.04 PVC SEWER PIPE:

A. Specified in KC Water Standard Specification Section 02624 – PVC Gravity Sewer Pipe

2.05 REINFORCED CONCRETE PIPE – STORMWATER PIPE (RCP):

A. Specified in KC Water Standard Specifications Section 02630 – Stormwater Pipe and Structures

2.06 GASKETS AND BOLTING MATERIALS:

A. Provide all gaskets, bolts, lubricant, and other accessories required to install pipe, fittings, and specials complete and ready for service.

2.07 TRACER WIRE:

A. Tracer wire shall be provided as indicated.
   1. Minimum AWG 10 solid copper
   2. 30 mils of green PE insulation

B. Tracer wire tape shall be as follows:
   1. 2-inch-wide vinyl plastic electrical tape
   2. 7 mils in thickness

C. Where connections to existing tracer wire are required or where connections to newly installed tracer wire (tees, end of rolls, etc.) are required, tracer wire shall be spliced with:
   1. DryConn Direct Bury Lug Aqua waterproof connector.
   2. Engineer Approved Equal.

2.08 WARNING TAPE:

B. Shall be at 6 inches in width.

C. Shall be green in color.

D. Shall have black lettering stating, “CAUTION BURIED SEWER BELOW.”
   1. Lettering shall be imprinted at 20 to 30-inch intervals.

PART 3 - EXECUTION

3.01 INSTALLATION - GENERAL:

A. Reference Section 33 31 50 - Pipe Installation for installation and testing procedures.

3.02 DUCTILE IRON PIPE INSTALLATION:

A. Install according to Section 33 11 00 - Pressure Pipe and Section 33 31 50 - Pipe Installation.

3.03 PVC SEWER PIPE INSTALLATION:

A. Install according to KC WATER Section 02624 – PVC Gravity Sewer Pipe

3.04 PVC PIPE INSTALLATION:

A. Install according to Section 33 31 50 - Pipe Installation.

3.05 REINFORCED CONCRETE PIPE (RCP) STORMWATER PIPE INSTALLATION:

A. Install according to KC Water Standard Specification Section 0230 – Stormwater Pipe and Structures

B. Prior to constructing new sewers, the Contractor shall physically locate all utilities within ten (10) feet of the proposed sewers. If there is a utility conflict with the proposed sewers, the Contractor shall notify the City/Design Professional and survey the existing service top

elevation and horizontal coordinates. Certified as-built redlines and the utility investigation surveying are the sole responsibility of the Contractor.

C. The Contractor is responsible for determining all conflicted crossings for the proposed storm sewer and submit their service-relocation shop drawings and/or certified sketches for the City/Design Professional's review and approval. (Contractor is also responsible for providing field electronic data such as the location coordinates and spot elevations for the City/Design Professional's use.) It shall be the responsibility of the Contractor to obtain necessary field information for aiding in determining the required minimum length of the existing sanitary or any other services necessary to clear for the construction of proposed sewers.

3.06 TRACER WIRE:

A. Install according to Section 33 31 50 - Pipe Installation.

3.07 WARNING TAPE:

A. Underground marking tape shall be installed at least 18 inches above utility.

END OF SECTION 33 33 11.

DIVISION 40 – PROCESS INTEGRATION

SECTION 40 60 00 – PROCESS CONTROLS AND INSTRUMENTATION – GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:
- A. This Division includes instruments, control devices, control panels, computer hardware and system programming as specified in Sections 40 60 00 – 40 70 00.
- B. Related Work Specified Elsewhere:
  1. Interconnections and control of equipment: All applicable Divisions.

1.03 RELATED REQUIREMENTS:
- A. Division 26: All applicable Sections.

1.04 REFERENCE STANDARDS:
- A. National Fire Protection Association (NFPA):
  1. NFPA 70 – National Electrical Code (NEC).
- B. Other standards as specified in applicable Sections.

1.05 SUBMITTALS:
- A. Submit as specified in Division 01.
- B. Manufacturer with prime responsibility shall assume responsibility for all Compliance Submittals.
- C. Qualifications Submittal:
  1. Submit SI qualifications package with experience, resumes, and certifications for each member of the SI team responsible for the project.
- D. Additional submittals as specified in each applicable Section, this Division.

1.06 QUALITY ASSURANCE:
- A. General:
  1. The Contractor shall provide the services of a single pre-qualified System Integrator (SI), to provide the material, equipment, labor, and services specified in Sections 40 60 00 – 40 70 00. The SI shall be subcontracted and under the direct supervision of the Contractor.
- B. Acceptable System Integrators (SI):
  1. The communication, instrument and control systems may use Equipment of different manufacturers, but the System Integrator Subcontractor shall assume prime responsibility for the complete instrumentation and control system.
  2. No Bidder shall be required to employ any Subcontractor, other person, or organization against whom Bidder has reasonable objection.
  3. The SI shall be one of the following prequalified companies:
     a. R.E. Pedrotti Company, Inc
        (1) 5855 Beverly Ave, Suite A, Mission, KS 66202. Ph: 913.677.3366.
     b. Integrated Controls, Inc.

(1) 15707 Mahaffie St., Olathe, KS 66062. Ph: 913.782.9600.

c. Durkin, Inc.

(1) 2383 Chaffee Dr., St. Louis, MO 63146. Ph: 314.432.2040.

4. If Contractor wishes to utilize a System Integrator not listed, it shall submit qualification documentation for review and approval demonstrating the experience requirements of this article a minimum of two weeks prior to bid opening. As a minimum the following information shall be submitted:
   a. Evidence of sufficient financial resources to perform the required work. This evidence may be in the form of a certified financial report for the latest fiscal year.
   b. Verification of all items listed under the system integrator qualifications paragraph.
   c. Name the key project staff who will be responsible for office engineering and project management; software configuration; field testing, calibration and start-up; and operator instruction and maintenance training. Include an organization chart of key project staff and detail availability of each staff assigned.
   d. Provide resumes of proposed key project staff that demonstrate project experience with the control system products specified for the project.
   e. Provide references for at least five (5) projects where the following tasks were performed by personnel directly employed by the firm as a SI; system engineering and documentation including panel assembly, schematics, and wiring diagrams; software configuration and documentation; field testing, calibration, and start-up; and operating instructions and maintenance training. Project references shall include contact information for owners and consulting engineers.

C. System Integrator Qualifications:
   1. The instrumentation, control and communications system shall be furnished by a System Integrator (SI) who shall assume responsibility for the satisfactory performance of the entire plant control system. Only those SI who can demonstrate that they possess the prerequisite capabilities and experience shall be considered. The System Integrator subcontractor must meet the following minimum criteria:
      a. The SI Company shall have been in business performing SI work on water and wastewater treatment projects, and have control systems technicians with experience with installation, testing, calibrating and startup of industrial control and automation systems.
      b. The SI Company shall demonstrate the number of competent and experienced office staffing, field technicians, and service personnel are available to support this project.
      c. The SI Company shall have specific training and experience with the following:
         (1) Rockwell PlantPAx, FactoryTalk View SE, and associated system architecture.
         (2) Allen-Bradley ControlLogix and CompactLogix Programmable Automation Controllers and associated RSLogix 5000 programming software.
         (3) Ethernet network setup and configuration including managed switch configuration.
         (4) Instrumentation setup and calibration.
      d. The SI shall hold current certifications for the Rockwell software and hardware specified herein. Additional certifications for industrial and enterprise networks as specified in Section 40 66 00 – Process Control Networks.
      e. The SI shall be capable of providing control panels produced in a UL 508 authorized manufacturing facility and listed accordingly.

f. System Integrator shall possess an active and valid Rockwell Automation PlantPAx System Integrator Badge.
   (1) Badge must be traceable and verifiable through the Rockwell Automation PartnerNetwork™ portal.
   (2) Badge must correspond to the PlantPAx System Release used for the project (e.g., PlantPAx 5.0+).
   (3) System Integrator shall have documented experience implementing Rockwell Automation PlantPAx process control systems.
   (4) System Integrator shall have completed PlantPAx projects of similar size and complexity. Provide project resumes, including the following:
      (a) Project name and owner
      (b) Description of scope
      (c) Quantity and type of controllers (ControlLogix, CompactLogix)
      (d) HMI platforms
      (e) I/O counts
      (f) Process areas served (water, wastewater, etc.)
   (5) Reference Standards:
      (a) Rockwell Automation PlantPAx® System Release (latest version at time of bid).
      (b) Rockwell Automation Library of Process Objects (latest version at time of bid).
      (c) Rockwell Automation Product Compatibility and Download Center (PCDC).

1.07 SEQUENCING AND SCHEDULING:
A. Coordinate the installation of Equipment and Materials specified in this Division with construction schedule.

PART 2 - PRODUCTS

2.01 GENERAL:
A. Products as specified in Sections 40 60 00 – 40 70 00.

PART 3 - EXECUTION

3.01 EXAMINATION:
A. Verify site conditions are suitable for installation of equipment and systems specified in this Division.

3.02 INSTALLATION:
A. System Integrator shall be responsible for all cabling terminations at instruments, control panels and devices supplied by the System Integrator.
B. Refer to Section 26 05 19 – Low Voltage Cable for additional cable termination requirements.

3.03 FIELD QUALITY CONTROL:
A. Manufacturer's field services:
   1. As specified in each applicable Section, this Division.
B. Field Testing:

1. General Requirements:
    a. Conform to requirements as specified in Division 01.
    b. Conduct all tests in the presence of Engineer under the supervision of Equipment manufacturer's field engineer.
    c. Notify Engineer two weeks prior to the commencement of all tests.
    d. Include all tests recommended by the Equipment manufacturer unless specifically waived by Engineer.
    e. Include all additional tests recommended by Engineer that he deems necessary because of field conditions, to determine that Equipment and Materials and systems meet requirements of Contract Documents.
    f. Be responsible for all damage to Equipment and Materials due to improper test procedures or test apparatus handling.
2. Test Reports:
    a. Submit test reports as specified in Division 01.
    b. Maintain a written record of all tests showing date, personnel making tests, equipment or material tested, tests performed, and results.

3.04 TRAINING:

A. The System Integrator shall provide formal training for operators, maintenance, and service personnel.
B. A training schedule and log shall be developed. The training schedule shall identify scheduled dates and times for all training sessions specified in this Division. The training log shall identify dates for training and record training session attendees.
C. Training sessions shall be scheduled with the Owner a minimum of two weeks prior to occurrence and a training schedule shall be maintained and communicated to the Owner on a routine basis.
D. Contractor shall make digital video recordings of all on-Site training for training purposes. Any charges for this video recording shall be included.
E. Provide training as specified in each applicable Section, this Division.

END OF SECTION 40 60 00

TREE LINE

ROLL BACK CURB & GUTTER (TYPE CG-2) (TYP)

STRAIGHT CURB (TYPE C-1) AT END OF ROAD

MATCHLINE SEE SHEET C106

ACCESS ROAD 1 (SEE DETAIL ON SHEET C123)

MAIN ROAD 3

CL OF PROPOSED 5' WIDE TRAPEZOIDAL SWALE (SEE DETAIL ON SHEET C134)

ASPHALT PAVEMENT (TYP.) (SEE DETAIL ON SHEET C134)

STAIRS (TYP.) (SEE DETAIL ON SHEET C135)

TYPE 1 CURB INLET (TYP) (SEE DETAIL ON SHEET C135)

RCP-SIZE PER PROFILE (SEE PROFILE ON SHEETS C128-133)

ASPHALT PAVEMENT (TYP.) (SEE DETAIL ON SHEET C134)

SETTLEMENT PLATE / MARKER

FUTURE AGS BASINS
TOW EL: 879
TOF EL: 855
FG: 870

AGS BASINS
TOW EL: 879
TOF EL: 855
FG: 870

FUTURE AGS BASINS
TOW EL: 873
TOF EL: 849
FG: 864

MAIN ROAD 4

MAIN ROAD 5

CL OF PROPOSED 5' WIDE TRAPEZOIDAL SWALE

ASPHALT PAVEMENT (TYP.) (SEE DETAIL ON SHEET C134)

STAIRS (TYP.) (SEE DETAIL ON SHEET C135)

ASPHALT PAVEMENT (TYP.) (SEE DETAIL ON SHEET C134)

SIDEWALK (TYP.) (SEE DETAIL ON SHEET C134)

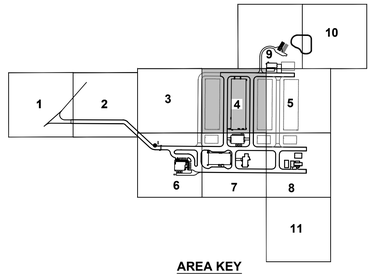
MATCHLINE SEE SHEET C109

MATCHLINE SEE SHEET C105

MATCHLINE SEE SHEET C107

LEGEND

- NEW FENCING
- ASPHALT
- CONCRETE
- GRAVEL ROAD SURFACE
- RIP RAP
- GATE PEDESTAL MOUNTED CARD READER
- CONSTRUCTION LIMITS



AREA KEY

ELEVATION NOTES:
FINISHED FLOOR FOR BUILDINGS
TOP OF CONCRETE FOR NON-BUILDING STRUCTURES
(1) DENOTES STRUCTURE LOCATION POINT

NORTH

0 10' 20' 40'
SCALE IN FEET

NO.	DATE	DRAWN BY:	CHECKED BY:	DESCRIPTION
1	1/29/2026	CRW	JPG	Addendum 5
0	12/19/2025	ODJ	JPG	ISSUED FOR BID

REVISION BLOCK

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

GENERAL SITE AND FENCING PLAN 4

STATE OF MISSOURI · CERVENTE D. SUDDUTH · NUMBER PE-2011015802 · PROFESSIONAL ENGINEER
12/19/2025

FOR WSD USE:

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WELLNER architects
BURNS McDONNELL
9400 WARD PARKWAY
KANSAS CITY, MO 64114
Burns & McDonnell Engineering Co, Inc
816-333-9400
LICENSEE NO. 000165

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ODJ	JPG	12/19/2025	34W	53N 52N	36 01

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698				C106

PROJECT NO. 81000927 SHEET 10 OF 643

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MATCHLINE SEE SHEET C106

MATCHLINE SEE SHEET C108

MATCHLINE SEE SHEET C110

CONCRETE PAVEMENT (TYP.) (SEE DETAIL ON SHEET C134)

CL OF PROPOSED 5' WIDE TRAPEZOIDAL SWALE

FUTURE BLOWER BUILDING FFE: 871

BLOWER BUILDING FFE: 871

FUTURE BLOWER BUILDING FFE: 865

SIDEWALK (TYP.) (SEE DETAIL ON SHEET C129)

MAIN ROAD-1

MAIN ROAD-2

MAIN ROAD-4

MAIN ROAD-5

MAIN ROAD-6

N 1158222.2999
E 2740743.1873

N 1158198.1684
E 2740742.9945

N 1158221.0530
E 2740898.1824

N 1158196.9215
E 2740897.9884

N 1158119.4340
E 2740729.1507

N 1158119.3468
E 2740739.9875

N 1158114.6579
E 2740664.3156

N 1158114.6217
E 2740668.8155

N 1158117.3980
E 2740686.7286

N 1158117.1875
E 2740713.4596

SOLIDS BUILDING FFE: 872

STAIRS (TYP.) (SEE DETAIL ON SHEET C135)

CONCRETE PAVEMENT (TYP.) (SEE DETAIL ON SHEET C134)

N 1158021.2310
E 2740722.9127

N 1158026.9636
E 2740735.4592

N 1158014.0900
E 2740698.3576

N 1158013.3091
E 2740723.3518

N 1158078.1531
E 2740801.7159

SERIES 300 HEADWORKS BUILDING ELEV: 871

PROPOSED BOLLARD (TYP.) (SEE DETAIL, SHEET C134)

N 1158053.1540
E 2740801.5150

SETTLEMENT PLATE / MARKER

TYPE 1 CURB INLET (TYP) (SEE DETAIL ON SHEET C135)

ASPHALT PAVEMENT (TYP.) (SEE DETAIL, SHEET C134)

ASPHALT PAVEMENT (TYP.) (SEE DETAIL, SHEET C134)

RCP-SIZE PER PROFILE (SEE PROFILE ON SHEET C128-133)

FENCE (SEE DETAILS ON SHEET C136) (SEE SPEC SEC 02820)

TREE LINE

CONSTRUCTION LIMITS

PROPERTY LINE

TREE LINE (Typical)

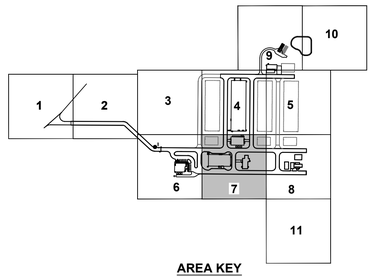
SOUTH LINE, NORTH 10 ACRES, EAST 1/2, SW 1/4, S 31 T N R 21 E AV

FLOOD LINE

FLOOD LINE

LEGEND

- NEW FENCING
- ASPHALT
- CONCRETE
- GRAVEL ROAD SURFACE
- RIP RAP
- GATE PEDESTAL MOUNTED CARD READER
- CONSTRUCTION LIMITS



AREA KEY

ELEVATION NOTES:

FINISHED FLOOR FOR BUILDINGS
TOP OF CONCRETE FOR NON-BUILDING STRUCTURES
(1) DENOTES STRUCTURE LOCATION POINT

NORTH

0 10' 20' 40'
SCALE IN FEET

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14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

GENERAL SITE AND FENCING PLAN 7

STATE OF MISSOURI
CERVENTE D. SUDDUTH
NUMBER PE-2011015802
PROFESSIONAL ENGINEER
12/19/2025

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CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698				C109

PROJECT NO. 81000927

SHEET 13 OF 643

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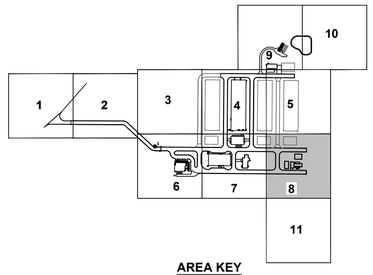
LEGEND

- NEW FENCING
- ASPHALT
- CONCRETE
- GRAVEL ROAD SURFACE
- RIP RAP
- GATE PEDESTAL MOUNTED CARD READER
- CONSTRUCTION LIMITS



AREA KEY

ELEVATION NOTES:
FINISHED FLOOR FOR BUILDINGS
TOP OF CONCRETE FOR NON-BUILDING STRUCTURES
(1) DENOTES STRUCTURE LOCATION POINT

NORTH

0 10' 20' 40'
SCALE IN FEET

NO.	DATE	DRAWN BY:	CHECKED BY:	DESCRIPTION
1	1/29/2026	CRW	JPG	Addendum 5
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STATE OF MISSOURI · CERVENTE D. SUDDUTH · NUMBER PE-2011015802 · PROFESSIONAL ENGINEER
12/19/2025

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TODD CREEK WWTP EXPANSION AND UPGRADE

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GENERAL SITE AND FENCING PLAN 8

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ODJ	JPG	12/19/2025	34W	53N 52N	36 01

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698				C110

PROJECT NO.	SHEET
81000927	14 OF 643

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RACT
00-000-008.000
84.428 Acres±,
treet right of way

/2, NW 1/4,
2N-R34W
nty Deed recorded
o Hunt Midwest
orded as Document
1221, at Page 87,
(Allmon Tract)

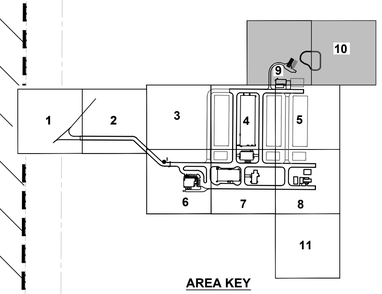
HIP:
OPERTIES, LLC
DRESS:
d Dr, Suite 100
64161-0000
(None Assigned)

TREE LINE
CONSTRUCTION LIMITS
514
515
PROPOSED OUTFALL STRUCTURE (SEE DETAIL SHEET C137)
518
107
115
116
108
INSTALL 12 LOCKABLE CHAIN GATE
CONSTRUCTION LIMITS
DETENTION BASIN
FENCE (SEE DETAILS ON SHEET C136) (SEE SPEC SEC 323113)
TREE LINE (Typical)
CASCADE AERATION TOW EL: 848
FUTURE CASCADE AERATION
EMERGENCY SPILLWAY
TREE LINE (Typical)
513
LIGHT POLE (TYP.)
89
RIP-RAP (7.5'W X 17.25'L) (SEE DETAIL ON SHEET C134)
106
2+00
R70.00'
46
R58.00'
R20.00'
R20.00
3+00
ACCESS ROAD 1
GRAVEL ROAD (TYP.) (SEE DETAIL ON SHEET C123)
91
3+83
45
90
R20.00
R20.00
PROPOSED BOLLARD (TYP.) SEE DETAIL, SHEET C134
44
35
36
12.00"
1+00
ACCESS ROAD 1
SERIES 600 UV DISINFECTION STRUCTURE FFE: 858
535
37
92
48
CONSTRUCTION LIMITS
512
SETTLEMENT PLATE / MARKER
34
33
38
CONCRETE PAVEMENT (TYP.) (SEE DETAIL ON SHEET C134)
FUTURE FILTER BUILDING (BY OTHERS)
32
105
ENCASED DUCT BANK (TYP)
CONSTRUCTION LIMITS
RCP-SIZE PER PROFILE (SEE PROFILE ON SHEETS C128-133)

MATCHLINE SEE SHEET C106
SERIES 600 UV DISINFECTION STRUCTURE FFE: 858
MATCHLINE SEE SHEET C107
MATCHLINE SEE SHEET C107

LEGEND

- NEW FENCING
- CONCRETE
- GRAVEL ROAD SURFACE
- RIP RAP
- CONSTRUCTION LIMITS



AREA KEY

ELEVATION NOTES:
FINISHED FLOOR FOR BUILDINGS TOP OF CONCRETE FOR NON-BUILDING STRUCTURES
(1) DENOTES STRUCTURE LOCATION POINT

NORTH

0 10' 20' 40'
SCALE IN FEET

NO.	DATE	DRAWN BY:	CHECKED BY:	DESCRIPTION
1	1/29/2026	CRW	JPG	Addendum 5
0	12/19/2025	ODJ	JPG	ISSUED FOR BID

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STATE OF MISSOURI
CERVENTE D. SUDDUTH
NUMBER PE-2011015802
PROFESSIONAL ENGINEER
12/19/2025

FOR WSD USE:

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

GENERAL SITE AND FENCING PLAN 9

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CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698				C111

PROJECT NO. 81000927

SHEET 11 OF 643

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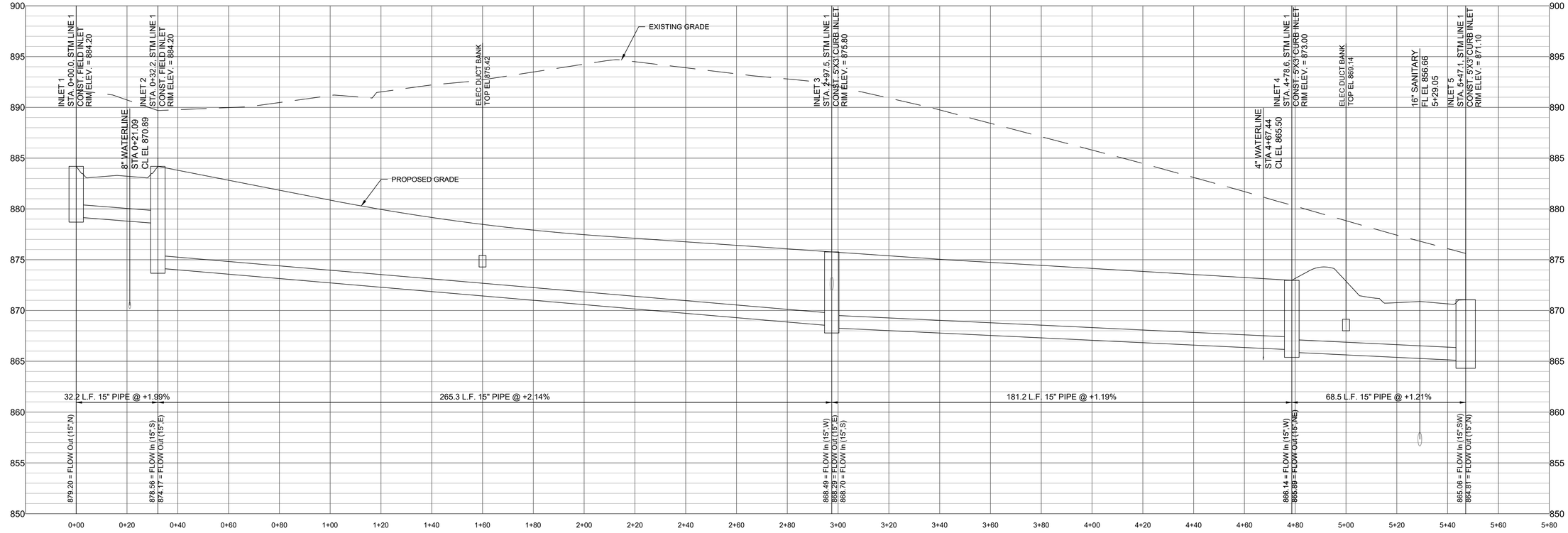
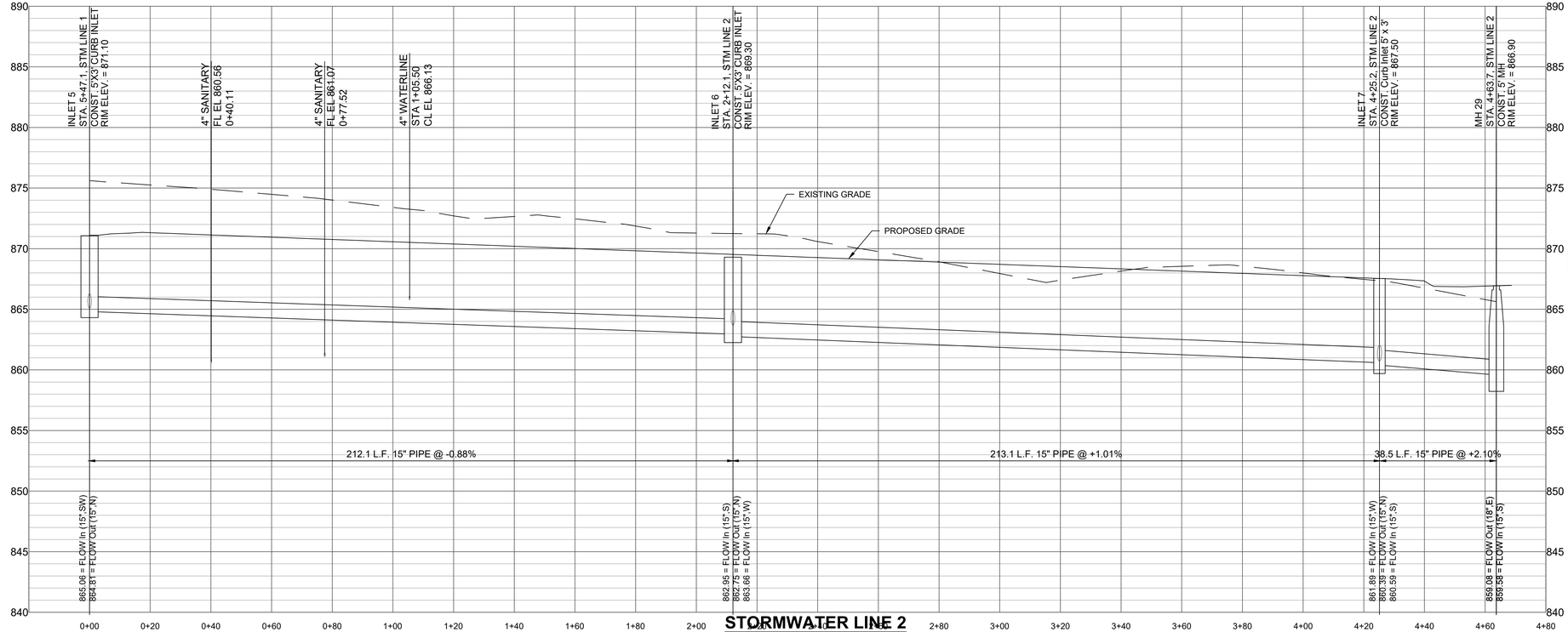


STORMWATER LINE 1



STORMWATER LINE 2

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CIVIL + STRUCTURAL ENGINEERS

WELLNER architects

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KANSAS CITY, MO 64114
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816-333-9400
LICENSEE NO. 000165

KCWATER

NOTE:
1. ALL STORM SEWER PIPE SHALL BE TYPE III RCP OR DUAL/TRIPLE WALL POLYPROPYLENE.

SCALE IN FEET
VERTICAL SCALE IN FEET
0 8'

SCALE IN FEET
HORIZONTAL SCALE IN FEET
0 0 10' 20' 40'

NO.	DATE	DRAWN BY:	CHECKED BY:	DESCRIPTION
1	1/28/2026	CRW	JPG	Addendum 2
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KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

STATE OF MISSOURI
CERVENTE D. SUDDUTH
NUMBER PE-2011015802
PROFESSIONAL ENGINEER
Cerventé D Sudduth
12/19/2025

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STORMWATER PROFILES 1 AND 2

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CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698				C128

PROJECT NO. 81000927
SHEET 32 OF 643

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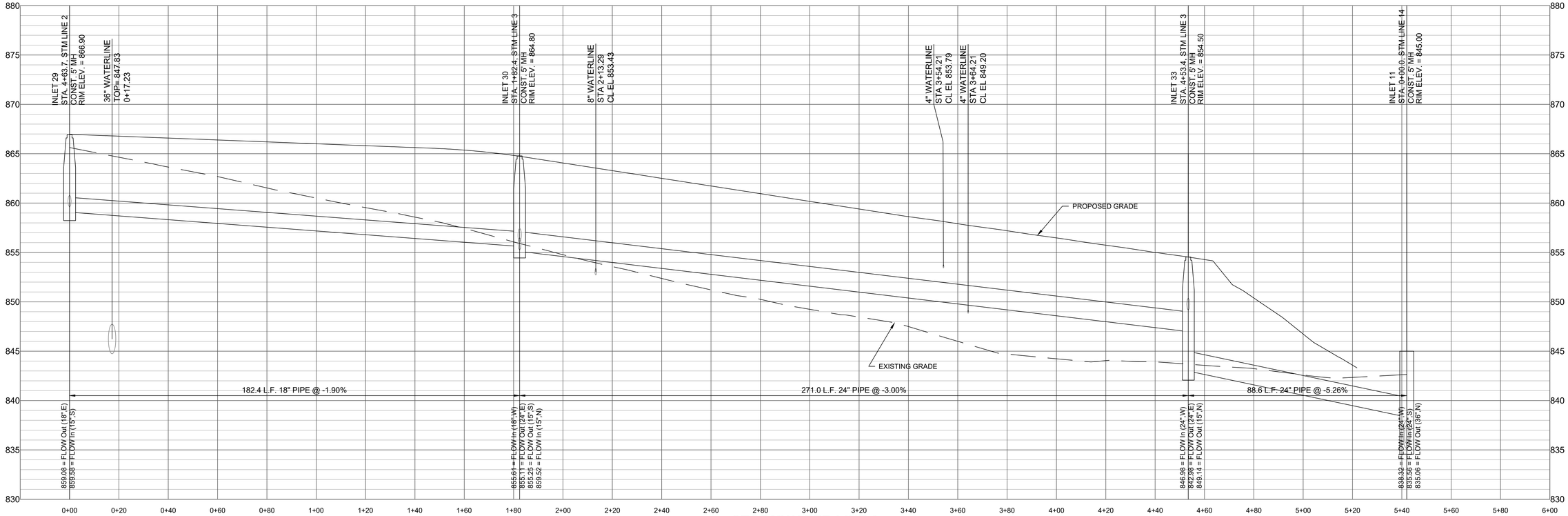

STORMWATER LINE 3

NOTE:
1. ALL STORM SEWER PIPE SHALL BE TYPE III RCP OR DUAL/TRIPLE WALL POLYPROPYLENE.

SCALE IN FEET
VERTICAL SCALE IN FEET
0 4' 8'

SCALE IN FEET
HORIZONTAL SCALE IN FEET
0 10' 20' 40'

NO.	DATE	DRAWN BY:	CHECKED BY:	DESCRIPTION
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0	12/19/2025	ODJ	JPG	ISSUED FOR BID

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TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

STORMWATER PROFILES 3 AND 17

STATE OF MISSOURI
CERVENTE D. SUDDUTH
NUMBER PE-2011015802
PROFESSIONAL ENGINEER
12/19/2025

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BURNS McDONNELL

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ODJ	JPG	12/19/2025	34W	53N 52N	36 01

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698				C129

PROJECT NO.	SHEET 33 OF 643
81000927	

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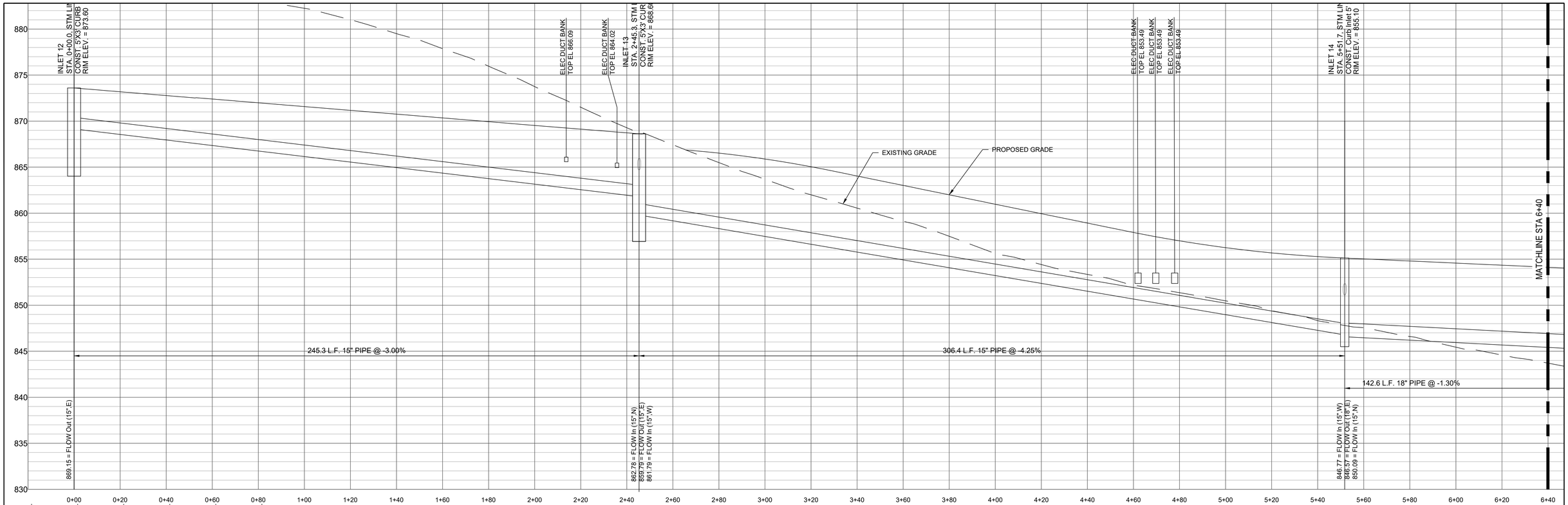
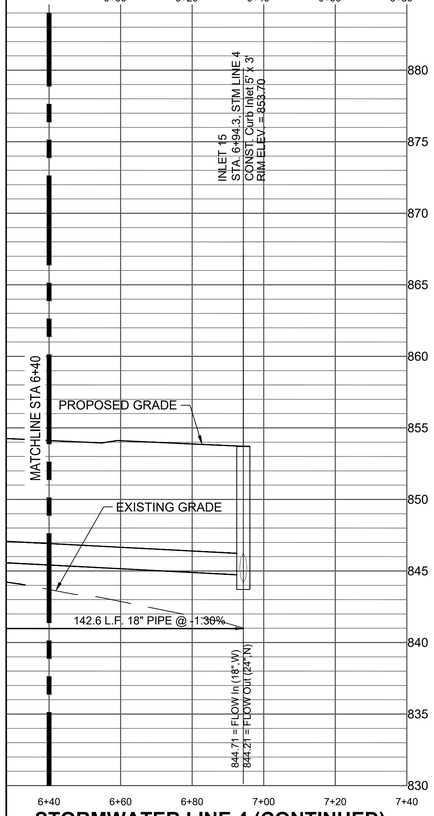


STORMWATER LINE 4



STORMWATER LINE 4 (CONTINUED)

NOTE:
1. ALL STORM SEWER PIPE SHALL BE TYPE III RCP OR DUAL/TRIPLE WALL POLYPROPYLENE.

SCALE IN FEET
VERTICAL SCALE IN FEET
0 4' 8'

SCALE IN FEET
HORIZONTAL SCALE IN FEET
0 10' 20' 40'

NO.	DATE	DRAWN BY:	CHECKED BY:	DESCRIPTION
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0	12/19/2025	ODJ	JPG	ISSUED FOR BID

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KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

STORMWATER PROFILES 4

STATE OF MISSOURI
CERVENTE D. SUDDUTH
NUMBER PE-2011015802
PROFESSIONAL ENGINEER
Cervente D Sudduth
12/19/2025

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ODJ	JPG	12/19/2025	34W	53N 52N	36 01

CONTRACTOR	DATE COMPLETED
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CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698				C130

PROJECT NO. 81000927

SHEET 34 OF 643

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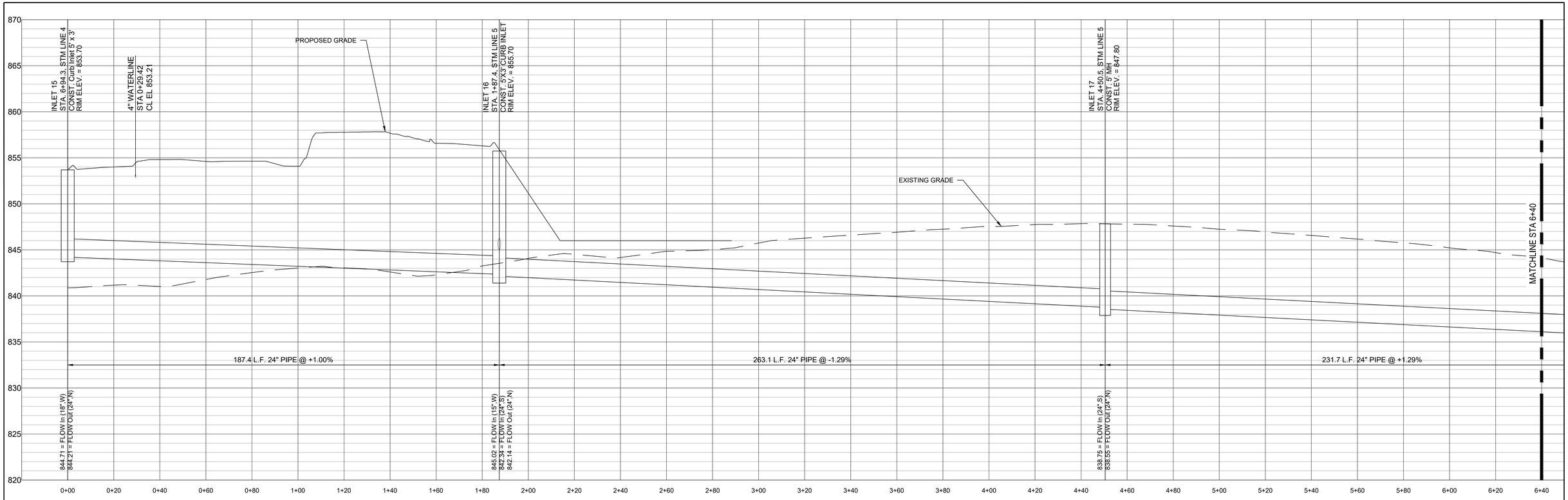
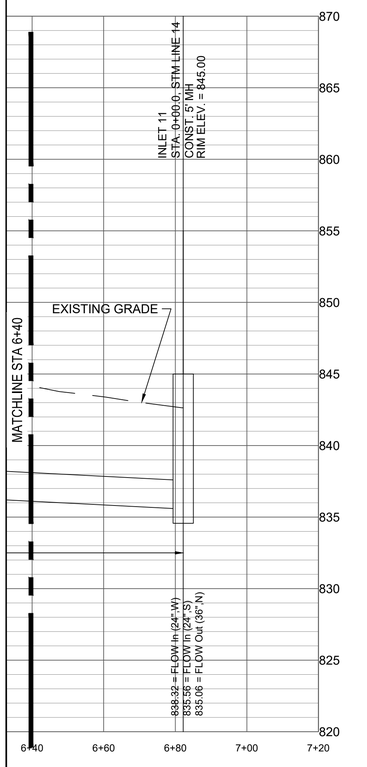


STORMWATER LINE 5



STORMWATER LINE 5 (CONTINUED)

1
NOTE:
1. ALL STORM SEWER PIPE SHALL BE TYPE III RCP OR DUAL/TRIPLE WALL POLYPROPYLENE.

0 4' 8'
SCALE IN FEET
VERTICAL SCALE IN FEET

0 10' 20' 40'
SCALE IN FEET
HORIZONTAL SCALE IN FEET

NO.	DATE	DRAWN BY:	CHECKED BY:	DESCRIPTION
1	1/28/2026	CRW	JPG	Addendum 2
0	12/19/2025	ODJ	JPG	ISSUED FOR BID

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KANSAS CITY, MO 64114
Burns & McDonnell Engineering Co, Inc
816-333-9400
LICENSEE NO. 000165

STATE OF MISSOURI
CERVENTE D. SUDDUTH
NUMBER PE-2011015802
PROFESSIONAL ENGINEER
Cerventé D Sudduth
12/19/2025

FOR WSD USE:

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

STORMWATER PROFILES 5

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ODJ	JPG	12/19/2025	34W	53N 52N	36 01

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698				C131

PROJECT NO. 81000927

SHEET 35 OF 643

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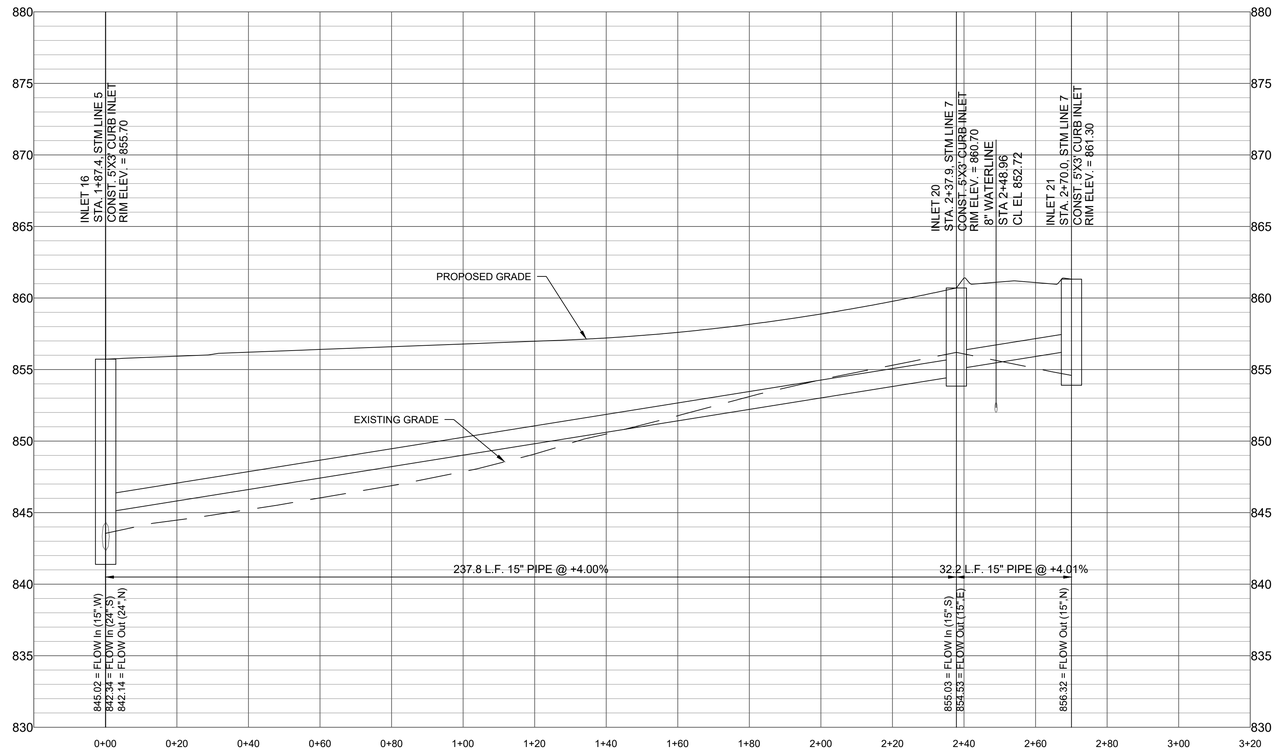
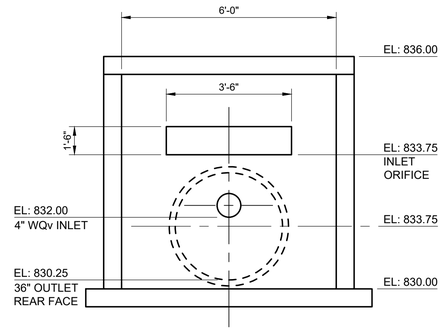
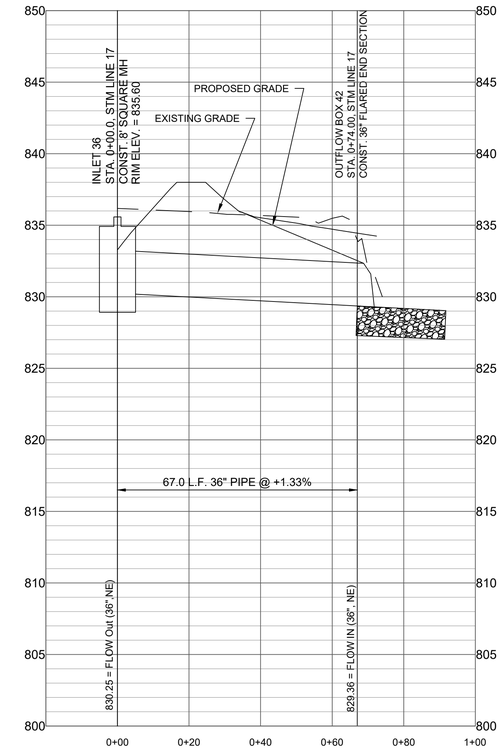


STORMWATER LINE 7

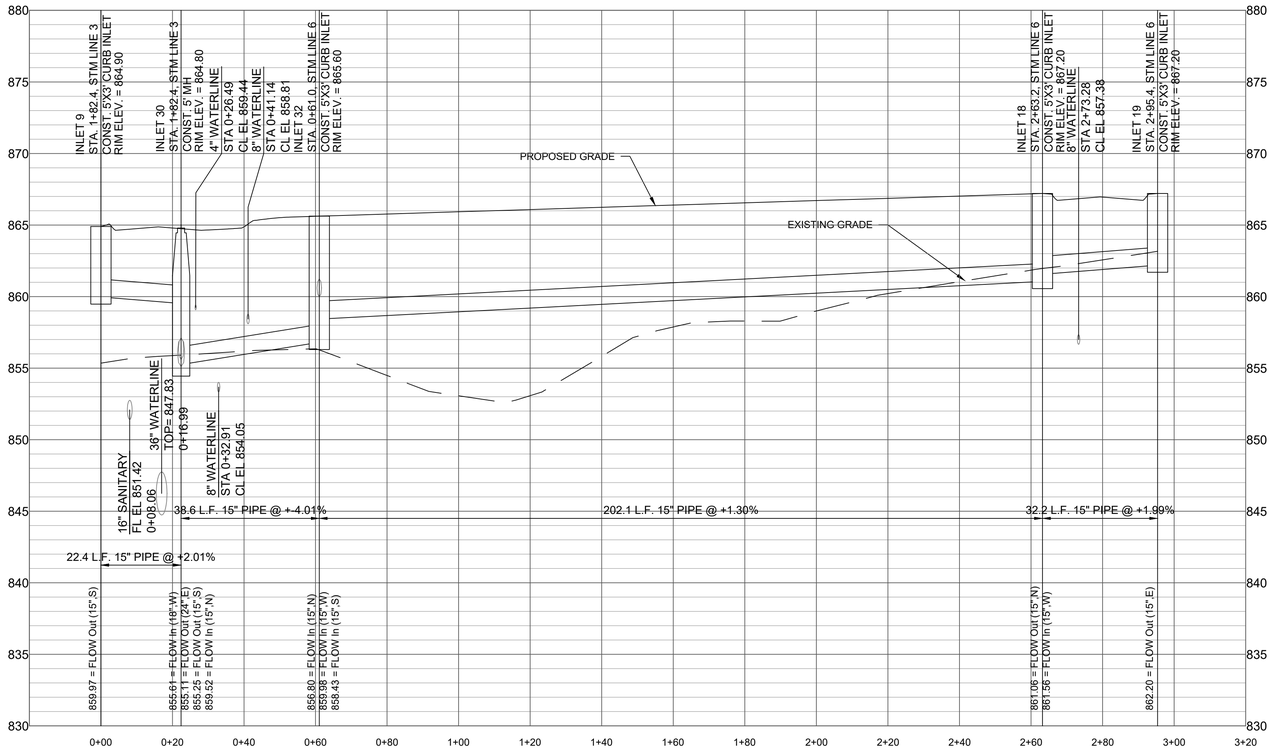


STORMWATER DETENTION OUTFALL

NOTE:
SEE FIELD INLET DETAIL SHEET C132



STORMWATER LINE 17



STORMWATER LINE 6

1
NOTE:
1. ALL STORM SEWER PIPE SHALL BE TYPE III RCP OR DUAL/TRIPLE WALL POLYPROPYLENE.

0 4' 8'
SCALE IN FEET
VERTICAL SCALE IN FEET

0 10' 20' 40'
SCALE IN FEET
HORIZONTAL SCALE IN FEET

NO.	DATE	DRAWN BY:	CHECKED BY:	DESCRIPTION
1	1/28/2026	CRW	JPG	Addendum 2
0	12/19/2025	ODJ	JPG	ISSUED FOR BID

REVISION BLOCK

KCWATER
CUSTOM ENGINEERING
MECHANICAL & ELECTRICAL ENGINEERING
DuBois Consultants
CIVIL + STRUCTURAL ENGINEERING
WELLNER architects
BURNS McDONNELL
9400 WARD PARKWAY
KANSAS CITY, MO 64114
Burns & McDonnell Engineering Co, Inc
816-333-9400
LICENSEE NO. 000165

STATE OF MISSOURI
CERVENTE D. SUDDUTH
NUMBER PE-2011015802
PROFESSIONAL ENGINEER
12/19/2025

FOR WSD USE:

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

STORMWATER PROFILES 6 AND 7

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
ODJ	JPG	12/19/2025	34W	53N 52N	36 01

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698				C132

PROJECT NO. 81000927

SHEET 36 OF 643

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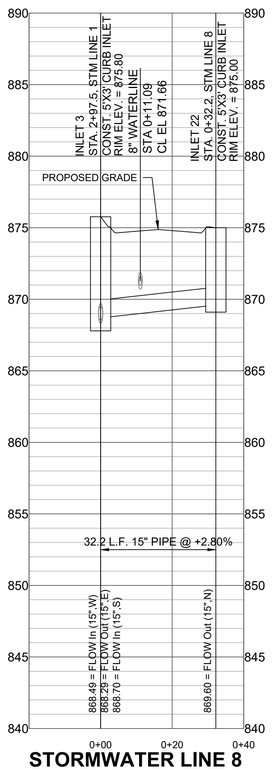
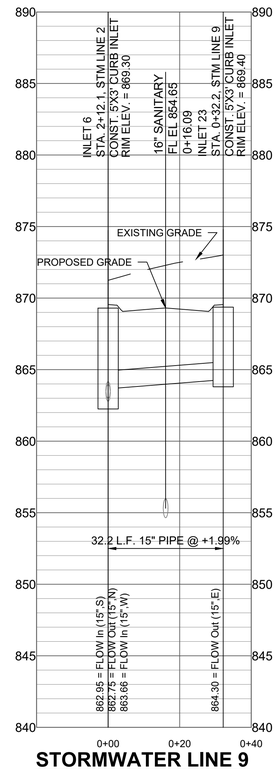
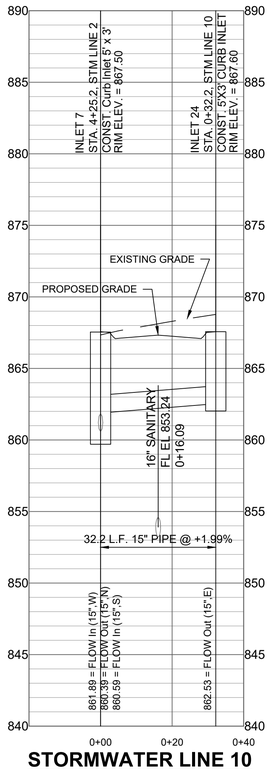


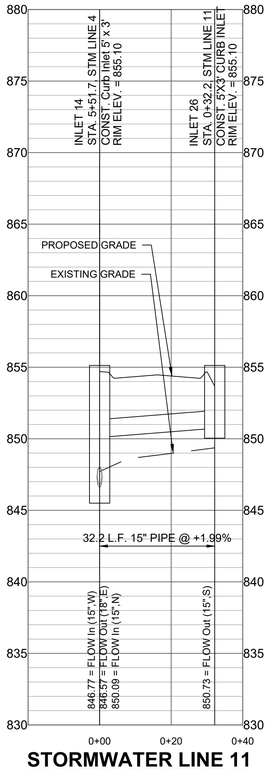
STORMWATER LINE 8



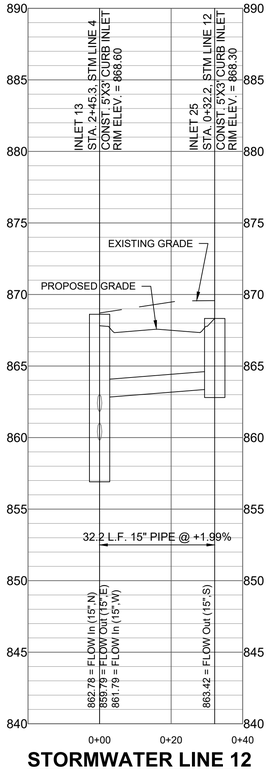
STORMWATER LINE 9



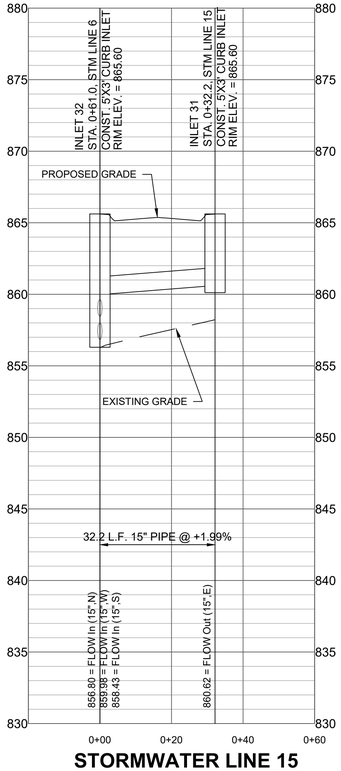
STORMWATER LINE 10



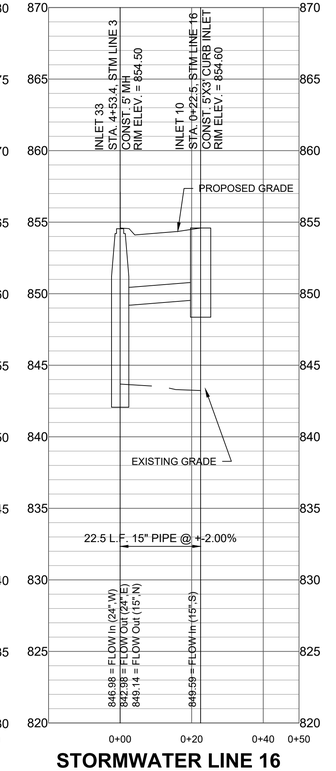
STORMWATER LINE 11



STORMWATER LINE 12



STORMWATER LINE 15



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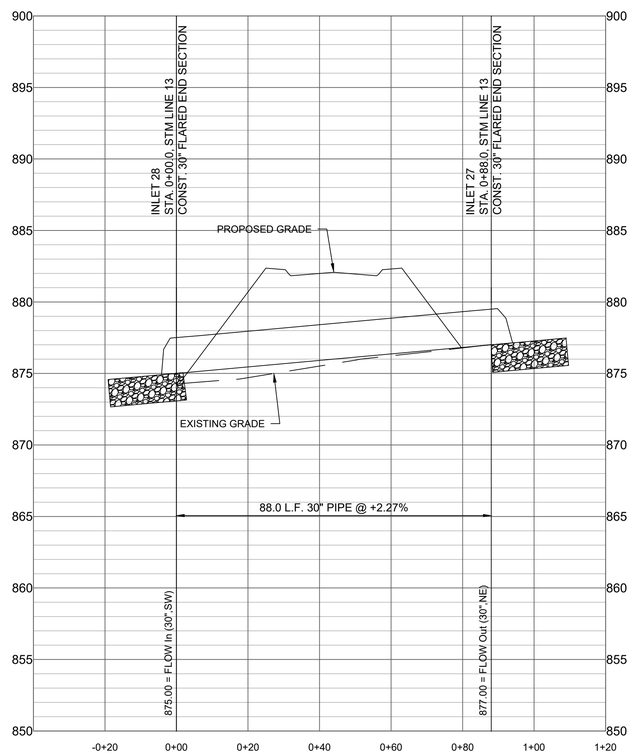
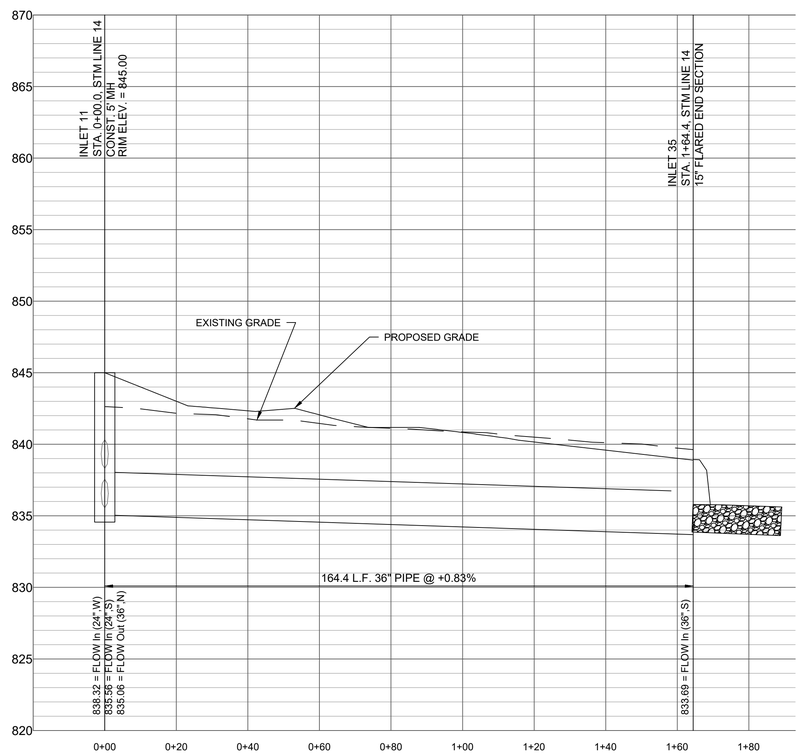


STORMWATER LINE 13



STORMWATER LINE 14

1
NOTE:
1. ALL STORM SEWER PIPE SHALL BE TYPE III RCP OR DUAL/TRIPLE WALL POLYPROPYLENE.

0 4' 8'
SCALE IN FEET
VERTICAL SCALE IN FEET

0 10' 20' 40'
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0	12/19/2025	ODJ	JPG	ISSUED FOR BID

REVISION BLOCK

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

STORMWATER PROFILES 8-14 AND 16-17

STATE OF MISSOURI
CERVENTE D. SUDDUTH
NUMBER PE-2011015802
PROFESSIONAL ENGINEER
12/19/2025

FOR WSD USE:

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
ODJ	JPG	12/19/2025	34W	53N 52N	36 01

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698				C133

PROJECT NO. 81000927

SHEET 37 OF 643

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AREA CONTROL POINTS

AREA 1

CONTROL POINTS			
Point #	Northing	Easting	Description
1	1158331.290	2739501.410	PI
500	1158429.122	2739626.141	CONST LIMIT
501	1158370.642	2739625.838	CONST LIMIT
528	1158266.293	2739499.980	CONST LIMIT
529	1158258.811	2739490.313	CONST LIMIT
530	1158292.268	2739459.926	CONST LIMIT
531	1158429.122	2739600.302	CONST LIMIT

AREA 2

CONTROL POINTS			
Point #	Northing	Easting	Description
2	1158291.634	2740012.722	RADIUS POINT
3	1158328.633	2740012.914	BC
4	1158326.040	2740026.332	MID
5	1158318.753	2740037.892	EC
11	1158328.559	2740027.328	PI
502	1158368.447	2740049.197	CONST LIMIT
523	1158229.573	2740079.229	CONST LIMIT
524	1158204.824	2740054.480	CONST LIMIT
525	1158218.966	2740040.338	CONST LIMIT
526	1158231.341	2740052.713	CONST LIMIT
527	1158263.602	2740019.081	CONST LIMIT

AREA 3

CONTROL POINTS			
Point #	Northing	Easting	Description
503	1158306.386	2740118.631	CONST LIMIT
504	1158325.134	2740135.169	CONST LIMIT
505	1158308.595	2740153.917	CONST LIMIT
506	1158289.847	2740137.378	CONST LIMIT
509	1158702.698	2740487.474	CONST LIMIT

AREA 4

CONTROL POINTS			
Point #	Northing	Easting	Description
20	1158661.496	2740588.609	BRD3
21	1158660.338	2740732.706	BRD4
22	1158658.866	2740915.700	BRD5
43	1158658.384	2740975.699	BACRD1
84	1158623.040	2740769.409	RADIUS POINT
85	1158622.164	2740878.406	RADIUS POINT
86	1158621.569	2740952.404	RADIUS POINT
87	1158690.173	2741001.956	RADIUS POINT
88	1158690.591	2740949.957	RADIUS POINT
93	1158672.637	2740695.805	C-1 CURB
94	1158648.633	2740695.613	C-1 CURB
95	1158623.634	2740695.412	RADIUS POINT
113	1158426.961	2740890.544	SPNT3
114	1158413.618	2740881.270	SPNT3
115	1158259.347	2740848.910	SPNT3
116	1158266.826	2740861.887	SPNT3

AREA 5

CONTROL POINTS			
Point #	Northing	Easting	Description
23	1158656.493	2741210.819	PI
106	1158668.499	2741210.913	C-1 CURB
107	1158644.500	2741210.725	C-1 CURB

AREA 6

CONTROL POINTS			
Point #	Northing	Easting	Description
6	1158184.010	2740237.460	RADIUS POINT
7	1158156.890	2740212.290	BC
8	1158149.623	2740223.802	MID
9	1158147.011	2740237.163	EC
12	1158147.126	2740222.810	PI
13	1158144.518	2740547.454	BRD2
15	1158026.306	2740546.504	BC
16	1158000.057	2740557.131	MID
19	1157989.307	2740546.207	PI
28	1158146.041	2740357.948	BDRWY1
29	1158119.005	2740357.727	BC
30	1158091.733	2740384.645	EC
31	1158118.784	2740384.777	RADIUS POINT
32	1158091.083	2740465.989	BC
33	1158054.084	2740465.693	RADIUS POINT
34	1158080.026	2740492.075	MID
35	1158053.758	2740502.692	EC
36	1158033.780	2740502.515	BC
37	1158002.875	2740519.910	MID
38	1158033.641	2740538.420	RADIUS POINT
39	1158001.985	2740555.363	EC
40	1158099.781	2740365.524	MID
49	1158109.332	2740321.427	RADIUS POINT
50	1158107.816	2740510.158	RADIUS POINT
75	1157968.659	2740493.618	RADIUS POINT
76	1157979.210	2740483.559	RADIUS POINT
77	1157986.394	2740488.617	RADIUS POINT
78	1158026.363	2740539.457	RADIUS POINT
79	1157924.185	2740561.101	RADIUS POINT
80	1158075.369	2740376.977	RADIUS POINT
81	1158073.816	2740468.968	RADIUS POINT
82	1158053.454	2740485.698	RADIUS POINT
83	1158023.012	2740526.588	RADIUS POINT
96	1157969.982	2740387.571	DRIVEWAY EOT
97	1157954.983	2740387.450	DRIVEWAY EOT
98	1157993.394	2740488.673	ADMIN PARKING
99	1157993.523	2740472.576	ADMIN PARKING
100	1158048.553	2740473.020	ADMIN PARKING
101	1158048.454	2740485.658	ADMIN PARKING
102	1158073.855	2740463.968	ADMIN PARKING
103	1158060.595	2740463.861	ADMIN PARKING
104	1158061.255	2740381.864	ADMIN PARKING
105	1158075.329	2740381.977	ADMIN PARKING
110	1158108.749	2740394.053	RADIUS POINT
111	1158115.574	2740382.988	RADIUS POINT
112	1157980.188	2740509.723	RADIUS POINT
507	1158228.411	2740180.396	CONST LIMIT
508	1158225.917	2740490.386	CONST LIMIT
520	1157910.525	2740313.449	CONST LIMIT
521	1158080.525	2740313.449	CONST LIMIT
522	1158098.758	2740210.044	CONST LIMIT

AREA 9

CONTROL POINTS			
Point #	Northing	Easting	Description
44	1158788.522	2740976.745	UV CTR POINT
45	1158788.008	2741040.743	UV RADIUS POINT
46	1158843.675	2741009.165	UV CTR POINT
47	1158843.203	2741073.139	UV CTR POINT
48	1158793.357	2741158.034	UV CTR POINT
89	1158832.382	2741095.792	UV RADIUS POINT
90	1158822.343	2741057.024	UV RADIUS POINT
91	1158809.871	2741134.525	UV RADIUS POINT
92	1158771.518	2741144.892	UV RADIUS POINT
512	1158722.270	2740909.277	CONST LIMIT
513	1158859.958	2740910.237	CONST LIMIT
514	1158974.495	2741193.101	CONST LIMIT

AREA 7

CONTROL POINTS			
Point #	Northing	Easting	Description
14	1158026.009	2740583.503	RADIUS POINT
17	1157989.010	2740583.206	EC
24	1158143.063	2740728.550	ERD4
25	1158142.584	2740788.233	BRD6
26	1158141.593	2740911.544	ERD5
41	1157987.373	2740786.986	ERD6
51	1158107.222	2740584.156	RADIUS POINT
52	1158111.938	2740610.502	RADIUS POINT
53	1158139.779	2740639.365	RADIUS POINT
54	1158139.137	2740719.363	RADIUS POINT
55	1158110.908	2740747.702	RADIUS POINT
56	1158105.882	2740750.937	RADIUS POINT
57	1158180.360	2740691.849	RADIUS POINT
58	1158179.765	2740765.846	RADIUS POINT
59	1158178.889	2740874.843	RADIUS POINT
60	1158178.295	2740948.840	RADIUS POINT
62	1158105.287	2740824.935	RADIUS POINT
70	1158024.074	2740824.282	RADIUS POINT
71	1158024.669	2740750.285	RADIUS POINT
72	1157991.926	2740718.180	RADIUS POINT
73	1157992.568	2740638.183	RADIUS POINT
74	1158020.797	2740609.843	RADIUS POINT
108	1158019.695	2740746.970	RADIUS POINT
109	1158050.807	2740608.703	RADIUS POINT

AREA 8

CONTROL POINTS			
Point #	Northing	Easting	Description
10	1158138.494	2741297.280	PI
18	1157983.283	2741296.031	PI
27	1158140.122	2741094.540	BRD7
42	1157984.912	2741093.292	ERD7
61	1158150.510	2741295.321	C-1 CURB
63	1158103.421	2741057.244	RADIUS POINT
64	1158102.826	2741131.241	RADIUS POINT
65	1158126.516	2741295.133	C-1 CURB
66	1157995.304	2741294.129	C-1 CURB
67	1157971.305	2741293.940	C-1 CURB
68	1158021.613	2741130.589	RADIUS POINT
69	1158022.208	2741056.591	RADIUS POINT
519	1157910.479	2741374.163	CONST LIMIT

AREA 10

CONTROL POINTS			
Point #	Northing	Easting	Description
515	1158974.849	2741294.696	CONST LIMIT
516	1159036.118	2741352.598	CONST LIMIT
517	1159035.872	2741383.216	CONST LIMIT
518	1158974.392	2741382.722	CONST LIMIT

SETTLEMENT POINTS

CONTROL POINTS			
POINT#	NORTHING	EASTING	DESCRIPTION
532	1158472.331	2470882.616	SETTLEMENT POINT
533	1158048.377	2470899.873	SETTLEMENT POINT
534	1158058.256	2471195.432	SETTLEMENT POINT
535	1158762.900	2471068.220	SETTLEMENT POINT

STRUCTURE LOCATIONS

STRUCTURE LOCATION SCHEDULE			
NO	NORTH	EAST	DESCRIPTION
1	1157990.6875	2740374.6820	BC
2	1158034.6859	2740375.0333	BC
3	1158034.6302	2740382.0331	BC
4	1158050.6294	2740382.1608	BC
5	1158050.0546	2740454.1586	BC
6	1158026.0555	2740453.9669	BC
7	1158026.1113	2740446.9669	BC
8	1157990.1126	2740446.6794	BC
9	1158030.6317	2740610.9865	BC
10	1158111.6291	2740611.6381	BC
11	1158110.3821	2740766.6331	BC
12	1158029.3848	2740765.9814	BC
13	1158012.6132	2740848.5906	BC
14	1158119.5521	2740856.6179	BC
15	1158119.3617	2740880.2838	BC
16	1158105.6955	2740880.1739	BC
17	1158105.6204	2740889.5069	BC
18	1158083.7877	2740889.3312	BC
19	1158083.7167	2740898.1643	BC
20	1158061.7174	2740897.9873	BC

STRUCTURE LOCATION SCHEDULE			
NO	NORTH	EAST	DESCRIPTION
21	1158061.8059	2740886.9876	BC
22	1158012.3075	2740886.5894	BC
23	1158177.5348	2740768.3251	BC
24	1158235.0327	2740768.7877	BC
25	1158234.2926	2740860.7843	BC
26	1158176.7947	2740860.3217	BC
27	1158275.0314	2740769.1095	BC
28	1158629.0199	2740771.9574	BC
29	1158628.1913	2740874.9540	BC
30	1158274.2028	2740872.1061	BC
31	1158698.3943	2741017.9928	BC
32	1158718.8936	2741018.1575	BC
33	1158723.0588	2741018.3576	BC
34	1158723.0601	2741018.1910	BC
35	1158755.0578	2741018.6147	BC
36	1158754.4793	2741090.6124	BC
37	1158722.4804	2741090.3449	BC
38	1158718.4560	2741072.6239	BC
39	1158697.9564	2741072.4910	BC
40	1158007.5077	2741143.7225	BC

STRUCTURE LOCATION SCHEDULE			
NO	NORTH	EAST	DESCRIPTION
41	1158059.5061	2741144.1408	BC
42	1158059.2808	2741172.1399	BC
43	1158007.2825	2741171.7216	BC
44	1158011.9157	2741186.2593	BC
45	1158053.9143	2741186.5972	BC
46	1158053.7279	2741209.7631	BC
47	1158011.7293	2741209.4253	BC
48	1158020.8952	2741209.5593	BC
49	1158044.5613	2741209.7272	BC
50	1158044.1084	2741266.0209	BC
51	1158020.4425	2741265.8305	BC
52	1158074.9170	2741214.1274	BC
53	1158110.9158	2741214.4170	BC
54	1158110.5136	2741264.4154	BC
55	1158074.5147	2741264.1258	BC
56	1158105.8859	2740856.5080	BC
57	1158105.9609	2740847.1750	BC
58	1158082.7950	2740846.9886	BC
59	1158082.7776	2740849.1551	BC

STRUCTURE LOCATION SCHEDULE			
NO	NORTH	EAST	DESCRIPTION
60	1158020.5819	2741248.4977	BC
61	1158015.4121	2741248.4561	BC
62	1158015.6575	2741217.9571	BC
63	1158020.8273	2741217.9987	BC
64	1158044.4932	2741218.1891	BC
65	1158054.6595	2741218.2709	BC
66	1158054.4142	2741248.7699	BC
67	1158044.2478	2741248.6881	BC

AREA FENCE AND GATE POINTS

AREA 2

FENCE AND GATE POST POINTS			
POINT #	NORTHING	EASTING	DESCRIPTION
102	1158695.63	2740497.45	FENCE CORNER

AREA 3

FENCE AND GATE POST POINTS			
POINT #	NORTHING	EASTING	DESCRIPTION
103	1158750.26	2740650.99	FENCE CORNER
104	1158714.16	2740674.60	FENCE CORNER
105	1158712.19	2740919.50	FENCE CORNER

AREA 6

FENCE AND GATE POST POINTS			
POINT #	NORTHING	EASTING	DESCRIPTION
100	1158217.61	2740280.33	FENCE CORNER
101	1158215.84	2740500.45	FENCE CORNER
110	1157920.53	2740320.45	FENCE CORNER
111	1158088.92	2740320.45	FENCE CORNER
112	1158096.71	2740279.22	FENCE CORNER
113	1158134.67	2740279.40	FENCE CORNER
114	1158158.67	2740279.60	FENCE CORNER

AREA 8

FENCE AND GATE POST POINTS			
POINT #	NORTHING	EASTING	DESCRIPTION
109	1157920.53	2741358.45	FENCE CORNER

AREA 9

FENCE AND GATE POST POINTS			
POINT #	NORTHING	EASTING	DESCRIPTION
105	1158712.19	2740919.50	FENCE CORNER
106	1158853.21	2740920.20	FENCE CORNER
107	1158965.23	2741196.85	FENCE CORNER

AREA 10

FENCE AND GATE POST POINTS			
POINT #	NORTHING	EASTING	DESCRIPTION
108	1158963.86	2741366.83	FENCE CORNER

NO.	DATE	DRAWN BY:	CHECKED BY:	DESCRIPTION
1	1/29/2026	CRW	JPG	Addendum 5
0	12/19/2025	ODJ	JPG	ISSUED FOR BID

REVISION BLOCK

KCWATER

CUSTOM ENGINEERING
MECHANICAL & ELECTRICAL ENGINEERING

DuBois Consultants
CIVIL • STRUCTURAL ENGINEERING

WELLNER architects

BURNS McDONNELL

9400 WARD PARKWAY
KANSAS CITY, MO 64114
Burns & McDonnell Engineering Co, Inc
816-333-9400
LICENSEE NO. 000165

STATE OF MISSOURI
CERVENTE D. SUDDUTH
NUMBER PE-2011015802
PROFESSIONAL ENGINEER
12/19/2025

FOR WSD USE:

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

SITE-CIVIL COORDINATE TABLES

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
ODJ	JPG	12/19/2025	34W	53N 52N	36 01

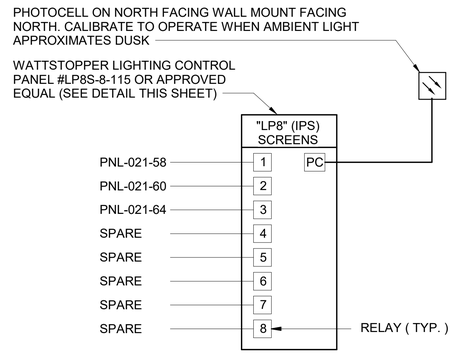
CONTRACTOR: BURNS & MCDONNELL ENGINEERING CO
DATE COMPLETED:

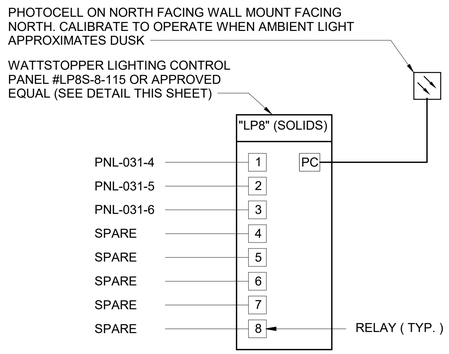
CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698				C137A

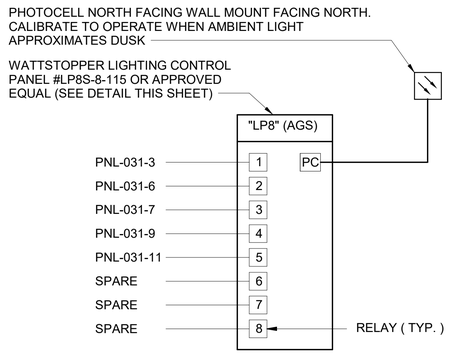
PROJECT NO. 81000927

SHEET 43 OF 643

Saved 02-02-2026 10:36:15 AM by CALVIN.WELLS
PLOT DATE 2/2/2026 10:48:20 AM by CALVIN.WELLS
S:\WORKING PROJECTS\2020 PROJECTS\220004 - TODD CREEK CIVIL\01-REDESIGN\00-CIVIL\09 WORKING\SHEETS\C137A-SITE-CIVIL COORDINATE TABLES-.DWG





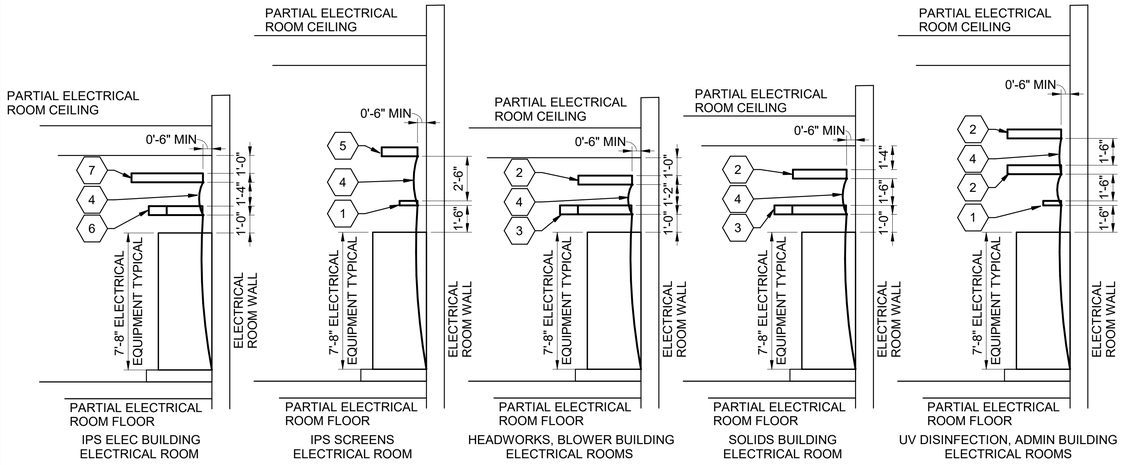


GENERAL NOTES:
1. LIGHTING CONTROL PANEL SHALL PROVIDE WARNING FLASH 2 MINUTES BEFORE LIGHTING TURN OFF.

LIGHTING CONTROL PANEL SCHEDULE (IPS SCREENS AND SOLIDS)		PANEL NO. - LP8
RELAY #	OVERRIDE SWITCH	OPERATIONAL SCHEDULE
1	NO	SET TO RUN DURING NIGHT HOURS WITH PHOTOCELL ON, PHOTOCELL OFF
2	NO	SET TO RUN DURING NIGHT HOURS WITH PHOTOCELL ON, PHOTOCELL OFF
3	NO	SET TO RUN DURING NIGHT HOURS WITH PHOTOCELL ON, PHOTOCELL OFF
4	NO	SPARE
5	NO	SPARE
6	NO	SPARE
7	NO	SPARE
8	NO	SPARE

LIGHTING CONTROL PANEL SCHEDULE (AGS)		PANEL NO. - LP8
RELAY #	OVERRIDE SWITCH	OPERATIONAL SCHEDULE
1	NO	SET TO RUN DURING NIGHT HOURS WITH PHOTOCELL ON, PHOTOCELL OFF
2	NO	SET TO RUN DURING NIGHT HOURS WITH PHOTOCELL ON, PHOTOCELL OFF
3	NO	SET TO RUN DURING NIGHT HOURS WITH PHOTOCELL ON, PHOTOCELL OFF
4	NO	SET TO RUN DURING NIGHT HOURS WITH PHOTOCELL ON, PHOTOCELL OFF
5	NO	SET TO RUN DURING NIGHT HOURS WITH PHOTOCELL ON, PHOTOCELL OFF
6	NO	SPARE
7	NO	SPARE
8	NO	SPARE

TYPICAL EXTERIOR LIGHTING CONTROL DETAILS
NOT TO SCALE



TYPICAL CABLE TRAY AT ELECTRICAL ROOM ELEVATION
NOT TO SCALE

DETAIL KEYED NOTES:

1
1. 12"W x 4"D BASKET CABLE TRAY. IN BASKET CABLE TRAY INSTALL INSTRUMENTATION CABLE: 4 -20 mA CABLE AND CAT6 CABLE.
2. 3'W x 6"D LADDER CABLE TRAY. POWER CONDUCTORS AND CONTROL CABLES.

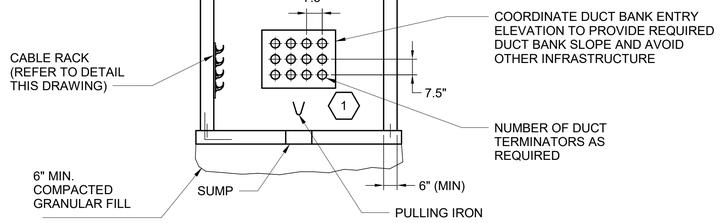
1
3. 4'W x 6"D LADDER CABLE TRAY WITH 12" DIVIDER. IN 12" SECTION INSTALL INSTRUMENTATION CABLE: 4 -20 mA CABLE AND CAT6 CABLE. POWER CONDUCTORS AND CONTROL CABLES IN 3' SECTIONS.

4. BOND CABLE TRAY TO ELECTRICAL ROOM GROUND BAR.
5. 2'W x 6"D LADDER CABLE TRAY. POWER CONDUCTORS AND CONTROL CABLES.

1
6. 3'W x 6"D LADDER CABLE TRAY WITH 12" DIVIDER. IN 12" SECTION INSTALL INSTRUMENTATION CABLE: 4 -20 mA CABLE AND CAT6 CABLE. POWER CONDUCTORS AND CONTROL CABLES IN 2' SECTION.
7. 4'W x 6"D LADDER CABLE TRAY. POWER CONDUCTORS AND CONTROL CABLES.

DETAIL NOTES:

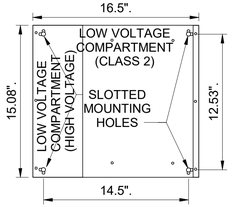
1. COORDINATE TRAY LOCATIONS WITH EQUIPMENT, HVAC, AND LIGHTING TO AVOID INSTALLATION CONFLICTS.
2. REFER TO STRUCTURAL DRAWINGS AND CABLE TRAY SPEC. FOR INSTALLATION REQUIREMENTS FOR CABLE TRAY SYSTEM.
1
3. CABLE TRAY IN CENTERS OF ELECTRICAL ROOMS SHALL BE SIZED TO MATCH TRAYS INSTALLED ALONG WALLS. REFER TO PLANS FOR LAYOUT.



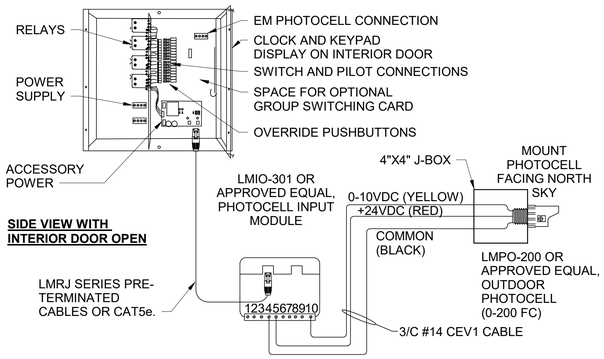
KEYED NOTES:

1 FOR LARGE DUCT BANKS, DUCTS MAY BE NEATLY BUNCHED AT HAND HOLE TO ALLOW PASS THROUGH WITHIN PRECAST OPENING. THIS IS ONLY APPLICABLE FOR HAND HOLES WHEN A SINGLE PRECAST OPENING IS PROVIDED IN LIEU OF INDIVIDUALLY CAST DUCT TERMINATORS.

TYPICAL PRECAST HAND HOLE DETAIL
NOT TO SCALE

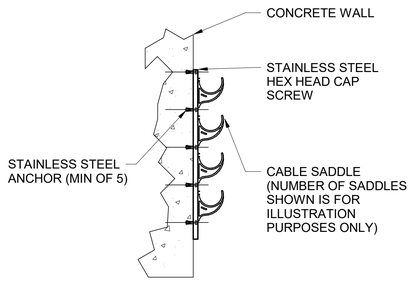


SIDE VIEW



SIDE VIEW WITH INTERIOR DOOR OPEN

TYPICAL EXTERIOR LIGHTING CONTROL PANEL DETAIL FOR AGS, IPS SCREENS AND SOLIDS HANDLING BUILDINGS
NOT TO SCALE



TYPICAL HAND HOLE CABLE RACK DETAIL
NOT TO SCALE

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9400 WARD PARKWAY
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816-333-9400
Licensee No. 000165

NO.	DATE	BY:	CHECKED:	DESCRIPTION
1	01/30/2026	RAL	CKB	ADDENDUM 005
0	12/19/2025	RAL	CKB	ISSUED FOR BID

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

STATE OF MISSOURI · CRAIG KEITH BREWSTER · NUMBER PE-2000150002 · REGISTERED PROFESSIONAL ENGINEER
12-19-2025
CRAIG K. BREWSTER
ELECTRICAL
PE-2000150002

FOR WSD USE:

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

TYPICAL ELECTRICAL DETAILS SHEET 4

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
M.CAYETANO	C.BREWSTER	01/30/2026	34W	-	-

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	-

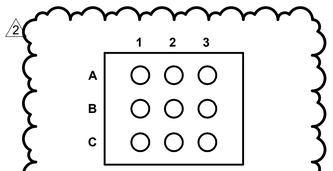
CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	E010

PROJECT NO. 81000927

SHEET 478 OF 643

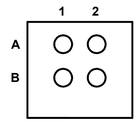
GENERAL NOTES:

1. REFER TO SHEET E001 FOR ELECTRICAL LEGEND.
2. REFER TO ONE-LINES AND PROCESS SHEETS FOR ADDITIONAL INFORMATION.



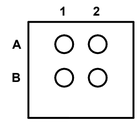
DUCT SCHEDULE "SITE-EDB-001"		
DUCT	DUCT SIZE	CIRCUIT DESCRIPTION
A1	4"	P-ADM-SWB011-01
A2	4"	P-ADM-SWB011-01
A3	4"	P-ADM-SWB011-01
B1	4"	P-ADM-SWB011-01
B2	4"	P-ADM-SWB011-01
B3	4"	SPARE
C1	4"	SPARE
C2	4"	SPARE
C3	4"	SPARE

SECTION A / E116



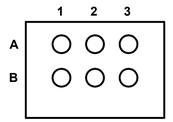
DUCT SCHEDULE "SITE-EDB-002"		
DUCT	DUCT SIZE	CIRCUIT DESCRIPTION
A1	2"	F-SITE-FPP001-01
A2	2"	KC WATER ADMIN FIBER (FUTURE)
B1	2"	SW GATE POWER
B2	2"	SW GATE SPARE

SECTION B / E115



DUCT SCHEDULE "SITE-EDB-003"		
DUCT	DUCT SIZE	CIRCUIT DESCRIPTION
A1	4"	SPARE
A2	2"	F-SPB-FPP001-01
B1	2"	SPARE TO AGS-NER-061
B2	2"	F-UV-FPP001-01

SECTION C / E116



DUCT SCHEDULE "SITE-EDB-004"		
DUCT	DUCT SIZE	CIRCUIT DESCRIPTION
A1	2"	I-UV-FIT301-01A
A2	2"	EFFLUENT 120V POWER
A3	2"	EFFLUENT 208V POWER
B1	2"	EFFLUENT SPARE
B2	2"	SPARE
B3	2"	SPARE

SECTION D / E115

HANDHOLE	HANDHOLE MINIMUM INTERIOR DIMENSIONS (IN.)		
	WIDTH	LENGTH	DEPTH
AGS-HH-001	84	84	84
ADM-HH-001	54	54	66
ADM-HH-002	54	54	66
SPB-HH-001	54	54	72
SITE-HH-001	48	48	66
SITE-HH-002	48	48	66
AGS-HH-002	36	36	60
UV-HH-001	60	60	72
IPS-HH-001	72	72	84
SITE-HH-002A	48	48	66
SITE-HH-002B	54	54	72
SITE-HH-002C	48	48	66
SPB-HH-001A	54	54	72
ADM-HH-001A	54	54	66
IPS-HH-002	72	72	84

1
1

GENERAL NOTES:

1. SIZING IS FOR REFERENCE. CONTRACTOR VERIFY DIMENSIONS PRIOR TO SUBMITTAL.SEE SPECIFICATIONS FOR HANDHOLE SIZING AND ADDITIONAL INFORMATION.

MIN. HANDHOLE DIMENSIONS

KCWATER
CUSTOM ENGINEERING
MECHANICAL & ELECTRICAL ENGINEERING
DuBois Consultants
WELLNER architects
BURNS McDONNELL
9400 WARD PARKWAY
KANSAS CITY, MO 64114
Burns & McDonnell Engineering Co, Inc
816-333-9400
Licensee No. 000165

NO.	DATE	BY:	CHECKED:	DESCRIPTION
2	01/30/2026	RAL	CKB	ADDENDUM 005
1	01/16/2026	RAL	CKB	ADDENDUM #3
0	12/19/2025	RAL	CKB	ISSUED FOR BID

REVISIONS

STATE OF MISSOURI
CRAIG KEITH BREWSTER
NUMBER
PE-2000150002
REGISTERED PROFESSIONAL ENGINEER
12-19-2025

CRAIG K. BREWSTER
ELECTRICAL
PE-2000150002

FOR WSD USE:

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

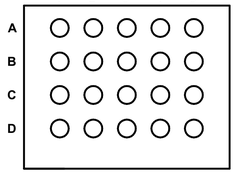
ELECTRICAL DUCT BANK SECTIONS SHEET 1

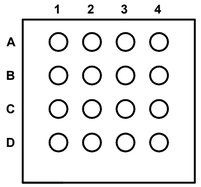
DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
M.CAYETANO	C.BREWSTER	01/30/2026	34W	-	-

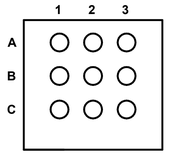
CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	-

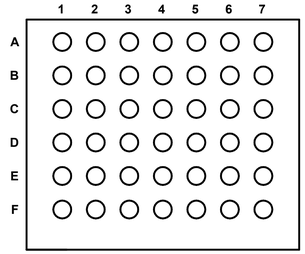
CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	E131

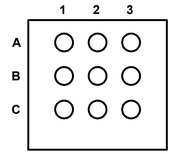
PROJECT NO. 81000927 SHEET 536 OF 643











GENERAL NOTES:

1. REFER TO SHEET E001 FOR ELECTRICAL LEGEND.
2. REFER TO ONE-LINES AND PROCESS SHEETS FOR ADDITIONAL INFORMATION.

DUCT SCHEDULE "UV-EDB-001"

DUCT	DUCT SIZE	CIRCUIT DESCRIPTION
A1	4"	P-ADM-SWB011-01
A2	4"	P-ADM-SWB011-01
A3	4"	P-ADM-SWB011-01
A4	4"	P-ADM-SWB011-01
A5	2"	SPARE
B1	4"	P-ADM-SWB011-01
B2	2"	P-UV-PNL021-54
B3	2"	P-UV-PNL021-60
B4	2"	C-PSEW-LS101-01, 02
B5	2"	SPARE
C1	2"	F-SPB-FPP001-01
C2	2"	F-UV-FPP001-01
C3	2"	C-PSEW-VFD110-03, C-PSEW-VFD120-03
C4	2"	I-PSEW-LIT101-01
C5	4"	SPARE
D1	2"	I-UV-FIT301-01A
D2	2"	EFFLUENT 120V POWER
D3	2"	EFFLUENT 208V POWER
D4	4"	SPARE
D5	4"	SPARE

SECTION E / E115

DUCT SCHEDULE "UV-EDB-002"

DUCT	DUCT SIZE	CIRCUIT DESCRIPTION
A1	4"	P-ADM-SWB011-01
A2	4"	P-ADM-SWB011-01
A3	4"	P-ADM-SWB011-01
A4	4"	P-ADM-SWB011-01
B1	4"	P-ADM-SWB011-01
B2	2"	P-UV-PNL021-54
B3	2"	P-UV-PNL021-60
B4	2"	C-PSEW-LS101-01, 02
C1	2"	F-SPB-FPP001-01
C2	2"	F-UV-FPP001-01
C3	2"	C-PSEW-VFD110-03, C-PSEW-VFD120-03
C4	2"	I-PSEW-LIT101-01
D1	4"	SPARE
D2	4"	SPARE
D3	2"	SPARE
D4	2"	SPARE

SECTION F / E115

DUCT SCHEDULE "UV-EDB-003"

DUCT	DUCT SIZE	CIRCUIT DESCRIPTION
A1	4"	P-ADM-SWB011-01
A2	4"	P-ADM-SWB011-01
A3	4"	P-ADM-SWB011-01
B1	4"	P-ADM-SWB011-01
B2	4"	P-ADM-SWB011-01
B3	4"	SPARE
C1	2"	F-SPB-FPP001-01
C2	2"	F-UV-FPP001-01
C3	4"	SPARE

SECTION F1 / E115, E116

DUCT SCHEDULE "IPS-EDB-001"

DUCT	DUCT SIZE	CIRCUIT DESCRIPTION
A1	1"	C-IPS-VFD110-04
A2	1"	C-IPS-VFD120-04
A3	1"	C-IPS-VFD130-04
A4	1"	C-IPS-VFD140-04
A5	1"	C-IPS-VFD150-04
A6	1"	FUTURE IPS PUMP
A7	2"	SPARE
B1	2"	C-IPS-LS102-01, 02
B2	1"	C-IPS-GATE101-01
B3	1"	C-IPS-GATE001-01
B4	1"	C-IPS-GATE002-01
B5	2"	C-IPS-LS101-01, 02
B6	2"	I-IPS-PIT110-01, I-IPS-PIT120-01, I-IPS-PIT130-01, I-IPS-PIT140-01, I-IPS-PIT150-01
B7	2"	SPARE
C1	1"	FUTURE IPS PUMP INST
C2	1"	FUTURE IPS PUMP INST
C3	1"	FUTURE IPS PUMP INST
C4	1"	FUTURE IPS PUMP INST
C5	1"	FUTURE IPS PUMP INST
C6	1"	FUTURE IPS PUMP INST
C7	4"	SPARE
D1	1"	I-IPS-LIT101A-01
D2	1"	I-IPS-LIT101B-01
D3	1"	I-IPS-GATE101-01
D4	1"	I-IPS-GATE001-01
D5	1"	I-IPS-GATE002-01
D6	4"	SPARE (PUMP STUB-UP)
D7	4"	SPARE
E1	4"	P-IPS-SWB011-03
E2	4"	P-IPS-SWB011-03
E3	4"	P-IPS-SWB011-04
E4	4"	P-IPS-SWB011-04
E5	4"	P-IPS-SWB011-05
E6	4"	P-IPS-SWB011-05
E7	4"	SPARE
F1	4"	P-IPS-SWB011-06
F2	4"	P-IPS-SWB011-06
F3	4"	P-IPS-SWB011-07
F4	4"	P-IPS-SWB011-07
F5	4"	P-IPS-SWB011-08 (FUTURE)
F6	4"	P-IPS-SWB011-08 (FUTURE)
F7	4"	SPARE

SECTION G / E115

DUCT SCHEDULE "IPS-EDB-002"

DUCT	DUCT SIZE	CIRCUIT DESCRIPTION
A1	4"	P-IPS-SWB011-01
A2	4"	SPARE
A3	4"	SPARE
B1	2"	F-IPS-FPP001-03
B2	2"	SPARE
B3	2"	SPARE
C1	2"	SPARE
C2	2"	SPARE
C3	2"	SPARE

SECTION H / E115

NO.	DATE	BY:	CHECKED:	DESCRIPTION
2	01/30/2026	RAL	CKB	ADDENDUM 005
1	01/16/2026	RAL	CKB	ADDENDUM #3
0	12/19/2025	RAL	CKB	ISSUED FOR BID

REVISIONS

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CUSTOM ENGINEERING
MECHANICAL & ELECTRICAL ENGINEERING
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STATE OF MISSOURI
CRAIG KEITH BREWSTER
NUMBER
E-2000150002
REGISTERED PROFESSIONAL ENGINEER

12-19-2025

CRAIG K. BREWSTER
ELECTRICAL
PE-2000150002

FOR WSD USE:

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

ELECTRICAL DUCT BANK SECTIONS SHEET 2

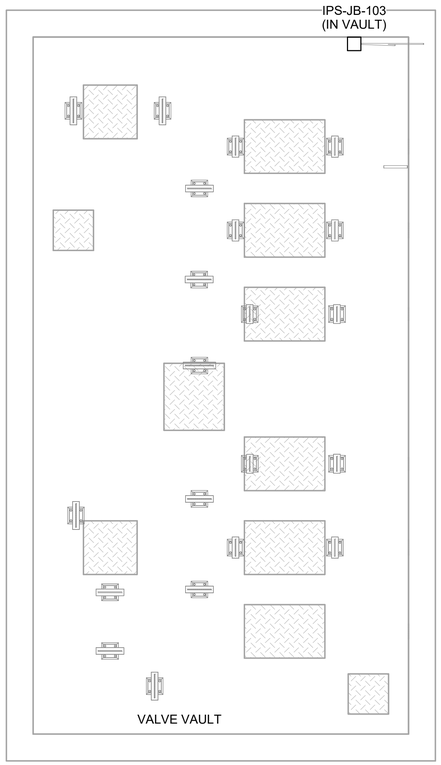
DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
M.CAYETANO	C.BREWSTER	01/30/2026	34W	-	-

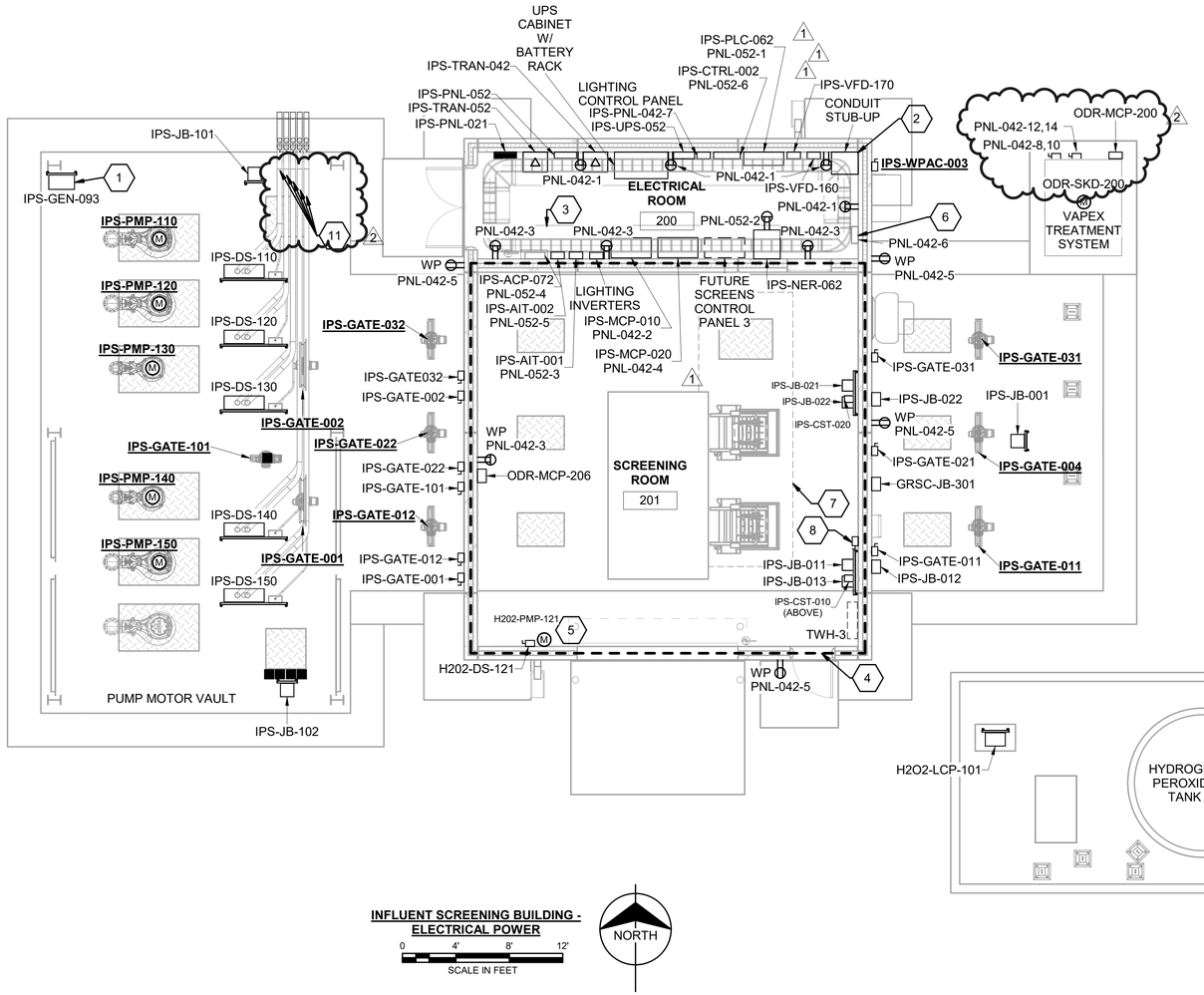
CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	-

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	E132

PROJECT NO. 81000927

SHEET 537 OF 643



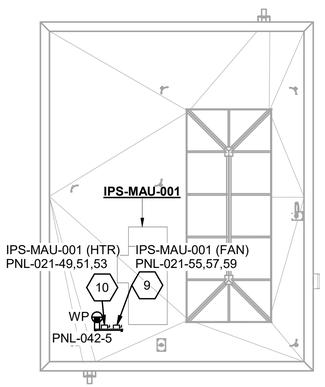


INFLUENT SCREENING BUILDING - ELECTRICAL POWER

0 4' 8' 12'

SCALE IN FEET

NORTH



INFLUENT SCREENING BUILDING ROOF - ELECTRICAL POWER

0 4' 8' 12'

SCALE IN FEET

NORTH

GENERAL NOTES:

1. REFER TO ELECTRICAL LEGEND ON SHEET E001.
2. REFER TO ONE-LINE DIAGRAMS, EQUIPMENT CONNECTION SCHEDULES AND CABLE TAGGING SCHEDULES FOR EQUIPMENT CONNECTIONS FOR CIRCUITING INFORMATION.
3. REFER TO PANEL SCHEDULES ON SHEET TBD.
4. COORDINATE ALL FLOOR-MOUNTED ELECTRICAL EQUIPMENT LOCATIONS AND DIMENSIONS WITH EQUIPMENT PAD DETAILS. REFER TO STRUCTURAL PLANS AND DETAILS FOR STANDARD EQUIPMENT PADS.
5. REFER TO I&C SHEETS FOR TAGGED JUNCTION BOXES HOUSING INSTRUMENTATION.
6. REFER TO SHEET E101 - HAZARDOUS AREA CLASSIFICATION SITE PLAN FOR OUTDOOR CLASSIFIED AREA DESIGNATIONS. PROVIDE ELECTRICAL EQUIPMENT WITH SUITABLE HAZARDOUS RATINGS FOR THESE AREAS.

KEYED NOTES:

1. 600V, 30A, 3P, DISCONNECT SWITCH FOR MONORAIL HOIST. MOUNT TO COLUMN OF STRUCTURE. SEE ONE-LINE DIAGRAM FOR ADDITIONAL INFORMATION.
2. ROUTE DUCTBANK SPARE CONDUITS TO THIS LOCATION AND CAP AND TAG. REFER TO SITE DUCT BANK PLANS AND DUCT BANK SCHEDULES FOR SPARE CONDUIT QUANTITIES AND SIZES.
3. REFER TO CABLE TRAY AT ELECTRICAL ROOM DETAIL SHEET E010 FOR REQUIREMENTS.
4. THIS AREA IS CLASSIFIED CLASS 1 DIVISION 2, GROUP D FROM FLOOR TO CEILING. PROVIDE CLASS 1, DIVISION 2 RATED ELECTRICAL EQUIPMENT INCLUDING, BUT NOT LIMITED TO, LIGHT FIXTURES, DISCONNECT SWITCHES, CONDUIT SEALOFFS, RECEPTACLES, AND LIGHT SWITCHES.
5. 240V, 1Ø, 30A DISCONNECT SWITCH FOR OVER HEAD ROLLING DOOR, 1HP, 208V, 1Ø, 9A.
6. COMPRESSOR MOTOR FOR DOOR OPENING DEVICE, 120V 5A.
7. SKYLIGHT AREA. DO NOT LOCATE ANY ELECTRICAL EQUIPMENT OR ROUTE CONDUITS AND WIRING WITHIN THE AREA OF THE SKYLIGHT.
8. 600V, 200A, 3P DISCONNECT SWITCH FOR WATER HEATER TWH-3.
9. 600V, 30A, 3 PHASE DISCONNECT SWITCH FOR IPS-MAU-001 (FAN).
10. 600V, 100A, 3 PHASE DISCONNECT SWITCH FOR IPS-MAU-001 (HEATER).
11. REFER TO SHEET E011 FOR CONDUIT SUPPORT DETAIL.

NO.	DATE	BY:	CHECKED:	DESCRIPTION
2	01/30/2026	RAL	CKB	ADDENDUM 005
1	01/16/2026	RAL	CKB	ADDENDUM #3
0	12/19/2025	RAL	CKB	ISSUED FOR BID

REVISIONS

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CIVIL • STRUCTURAL ENGINEERING
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KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

STATE OF MISSOURI
CRAIG KEITH BREWSTER
NOTARIAL SEAL
E-2000150002
REGISTERED PROFESSIONAL ENGINEER

Craig K Brewster

12-19-2025

CRAIG K. BREWSTER
ELECTRICAL
PE-2000150002

FOR WSD USE:

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

COARSE SCREENING AND INFLUENT PUMP STATION ELECTRICAL POWER PLAN

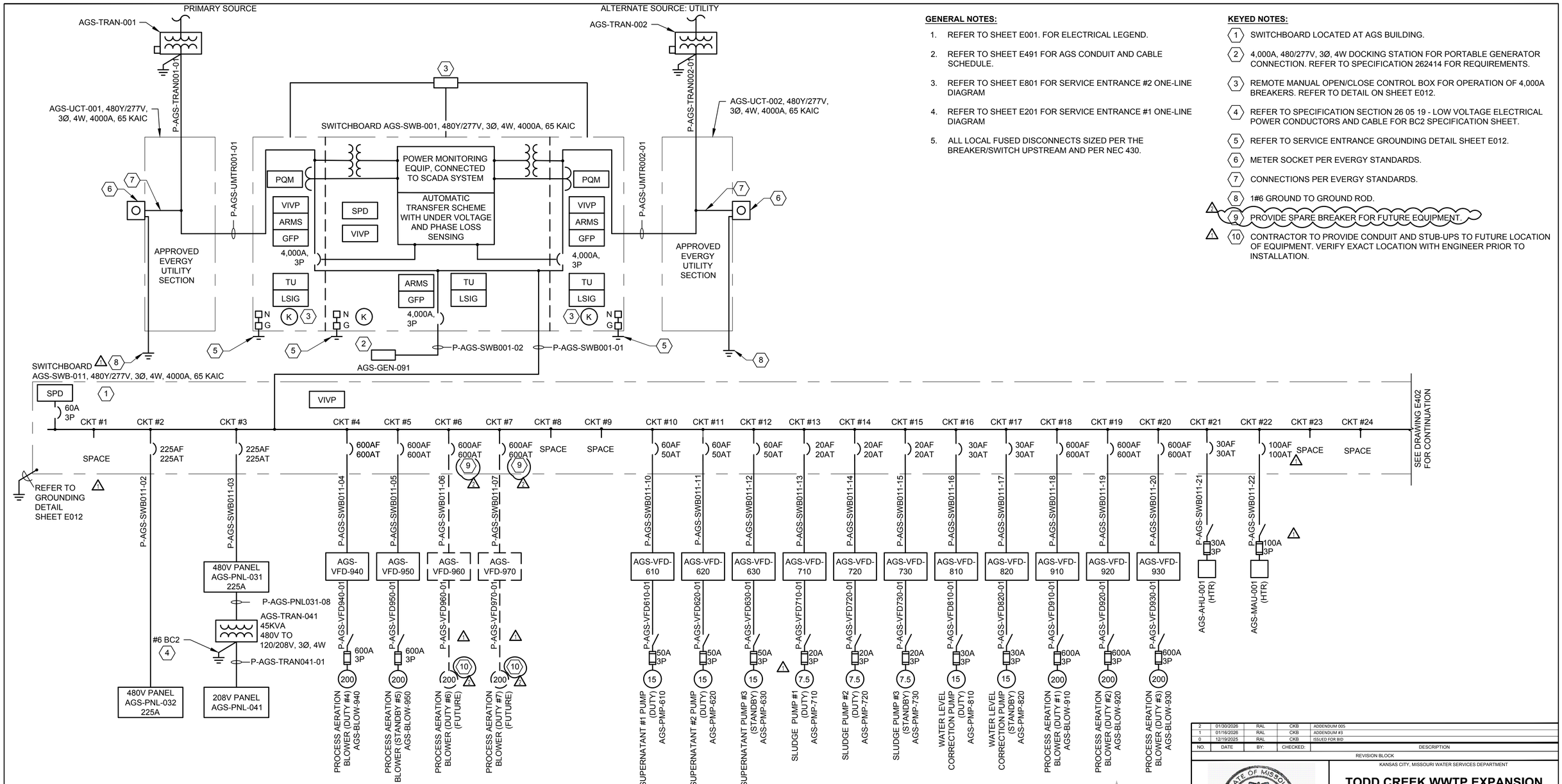
DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
R. LARKEY	C.BREWSTER	01/30/2026	34W		

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	-

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	E221

PROJECT NO. 81000927

SHEET 547 OF 643



GENERAL NOTES:

1. REFER TO SHEET E001. FOR ELECTRICAL LEGEND.
2. REFER TO SHEET E491 FOR AGS CONDUIT AND CABLE SCHEDULE.
3. REFER TO SHEET E801 FOR SERVICE ENTRANCE #2 ONE-LINE DIAGRAM
4. REFER TO SHEET E201 FOR SERVICE ENTRANCE #1 ONE-LINE DIAGRAM
5. ALL LOCAL FUSED DISCONNECTS SIZED PER THE BREAKER/SWITCH UPSTREAM AND PER NEC 430.

KEYED NOTES:

1. SWITCHBOARD LOCATED AT AGS BUILDING.
2. 4,000A, 480/277V, 3Ø, 4W DOCKING STATION FOR PORTABLE GENERATOR CONNECTION. REFER TO SPECIFICATION 262414 FOR REQUIREMENTS.
3. REMOTE MANUAL OPEN/CLOSE CONTROL BOX FOR OPERATION OF 4,000A BREAKERS. REFER TO DETAIL ON SHEET E012.
4. REFER TO SPECIFICATION SECTION 26 05 19 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLE FOR BC2 SPECIFICATION SHEET.
5. REFER TO SERVICE ENTRANCE GROUNDING DETAIL SHEET E012.
6. METER SOCKET PER EVERGY STANDARDS.
7. CONNECTIONS PER EVERGY STANDARDS.
8. 1#6 GROUND TO GROUND ROD.
9. PROVIDE SPARE BREAKER FOR FUTURE EQUIPMENT.
10. CONTRACTOR TO PROVIDE CONDUIT AND STUB-UPS TO FUTURE LOCATION OF EQUIPMENT. VERIFY EXACT LOCATION WITH ENGINEER PRIOR TO INSTALLATION.

AGS ELECTRICAL ONE-LINE DIAGRAM SERVICE #3 SHEET 1 OF 2
NOT TO SCALE

NO.	DATE	BY:	CHECKED:	DESCRIPTION
2	01/30/2026	RAL	CKB	ADDENDUM 005
1	01/16/2026	RAL	CKB	ADDENDUM #3
0	12/19/2025	RAL	CKB	ISSUED FOR BID

REVISION BLOCK

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WELLNER architects
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STATE OF MISSOURI
CRAIG KEITH BREWSTER
NUMBER PE-2000150002
REGISTERED PROFESSIONAL ENGINEER
12-19-2025
CRAIG K. BREWSTER
ELECTRICAL
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FOR WSD USE:

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

AGS ELECTRICAL ONE-LINE DIAGRAM SERVICE #3 SHEET 1 OF 2

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
M.CAYETANO	C.BREWSTER	12/19/2025			

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698				E401

PROJECT NO. 81000927 — SHEET 574 OF 643

Saved 01-29-2026 2:34:26 PM by RJARKEY
PLOT DATE 1/29/2026 4:14:05 PM by RJARKEY
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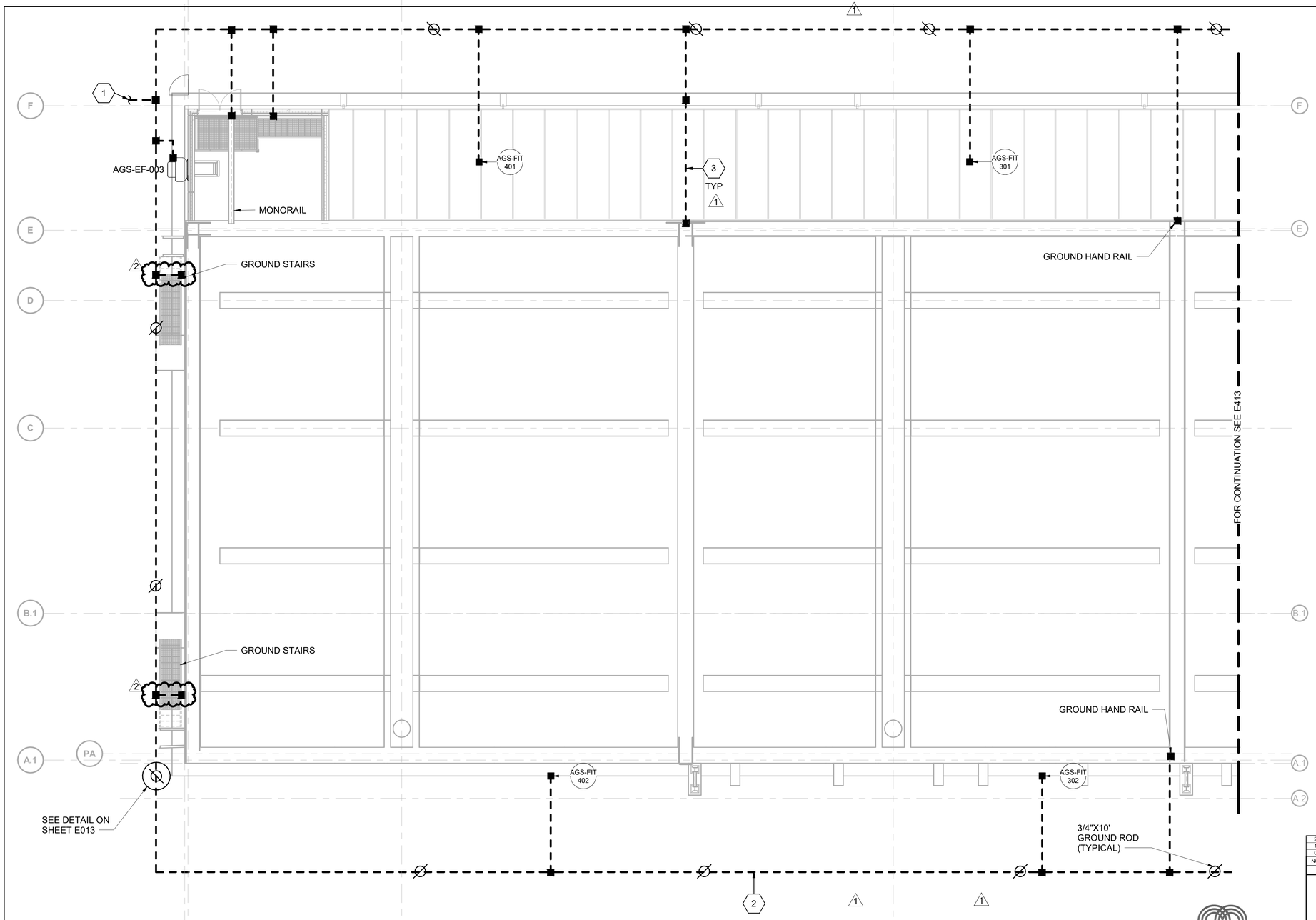

AGS BASIN ELECTRICAL GROUNDING PLAN AREA A

0 4' 8' 16'
SCALE IN FEET

NORTH

GENERAL NOTES:

1. REFER TO ELECTRICAL LEGEND ON SHEET E001.
2. GROUNDING IS SHOWN DIAGRAMMATICALLY. CONTRACTOR SHALL FOLLOW REQUIREMENTS OF SPECIFICATIONS, AND USE BEST JUDGEMENT FOR EXACT ROUTING.
3. PROVIDE LIGHTNING PROTECTION SYSTEM FOR BASINS. REFER TO SPECIFICATION 134600 FOR REQUIREMENTS.

KEYED NOTES:

1. #4/0 SUPPLEMENTAL GROUNDING ELECTRODE BONDING CONDUCTOR TO SITE GROUNDING SYSTEM. SEE SITE PLAN GROUND SYSTEM SHEET E119 FOR CONTINUATION.
2. #4/0 GROUND RING.
3. #6 GROUND TO EQUIPMENT AND STRUCTURES TYPICAL.

KEYPLAN

NO.	DATE	BY:	CHECKED:	DESCRIPTION
2	01/30/2026	RAL	CKB	ADDENDUM 005
1	01/16/2026	RAL	CKB	ADDENDUM #3
0	12/19/2025	RAL	CKB	ISSUED FOR BID

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

STATE OF MISSOURI
CRAIG KEITH BREWSTER
E-2000150002
REGISTERED PROFESSIONAL ENGINEER

Craig Brewster
12-19-2025

CRAIG K. BREWSTER
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FOR WSD USE:

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

AGS BASIN ELECTRICAL GROUNDING PLAN AREA A

KCWATER
CUSTOM ENGINEERING MECHANICAL & ELECTRICAL ENGINEERING
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BURNS McDONNELL

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816-333-9400
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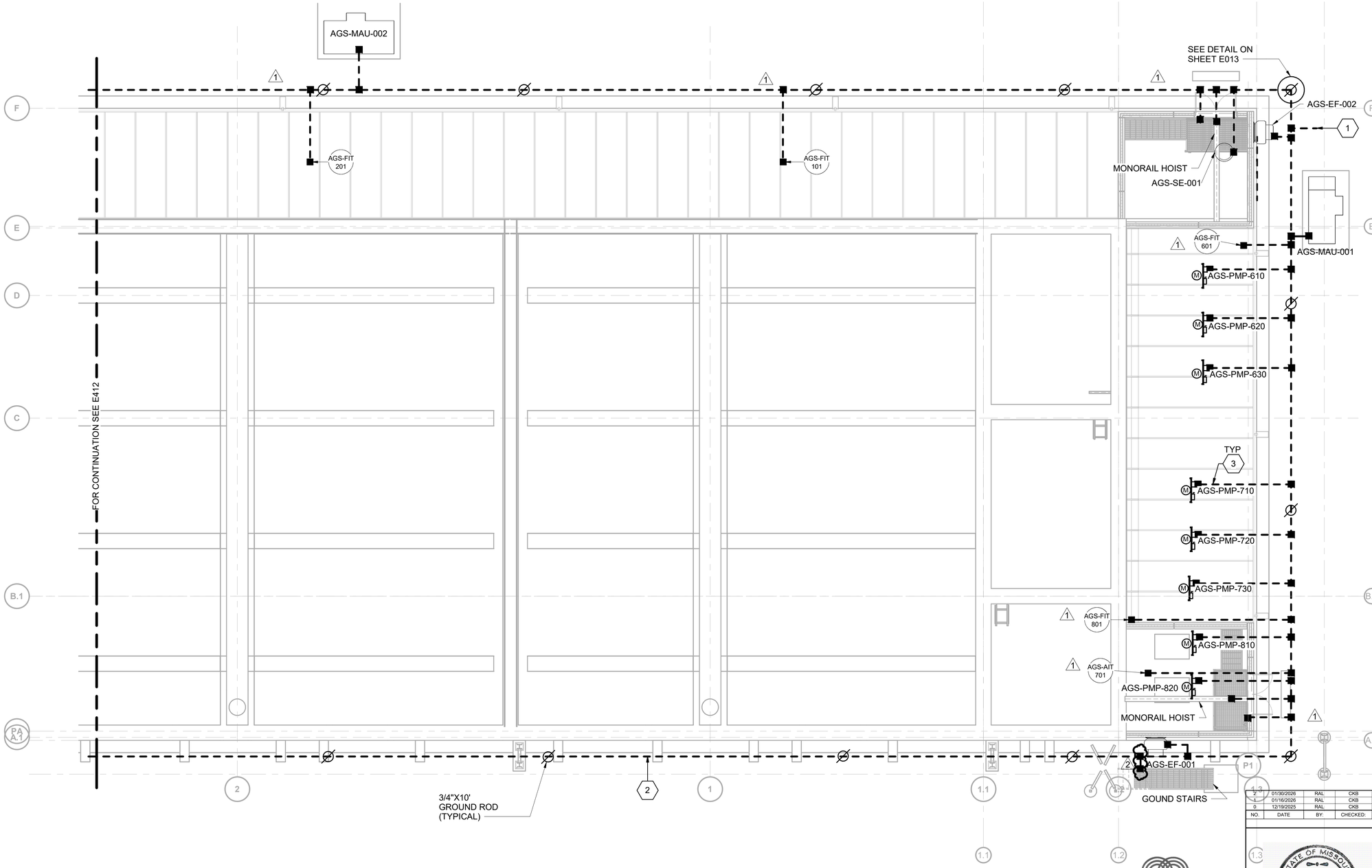
DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
M.CAYETANO	C.BREWSTER	01/30/2026	34W	-	-

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	-

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	E412

PROJECT NO.	SHEET		OF	
81000927		580		643



GENERAL NOTES:

1. REFER TO ELECTRICAL LEGEND ON SHEET E001.
2. GROUNDING IS SHOWN DIAGRAMMATICALLY. CONTRACTOR SHALL FOLLOW REQUIREMENTS OF SPECIFICATIONS, AND USE BEST JUDGEMENT FOR EXACT ROUTING.
3. PROVIDE LIGHTNING PROTECTION SYSTEM FOR BASINS. REFER TO SPECIFICATION 134600 FOR REQUIREMENTS.

KEYED NOTES:

1. #4/0 SUPPLEMENTAL GROUNDING ELECTRODE BONDING CONDUCTOR TO SITE GROUNDING SYSTEM. SEE SITE PLAN GROUND SYSTEM SHEET E119 FOR CONTINUATION.
2. #4/0 GROUND RING.
3. #6 GROUND TO EQUIPMENT AND STRUCTURES TYPICAL.

AGS BASIN ELECTRICAL GROUNDING PLAN AREA B

0 4' 8' 16'
SCALE IN FEET

NORTH

KEYPLAN

NO.	DATE	BY:	CHECKED:	DESCRIPTION
2	01/30/2026	RAL	CKB	ADDENDUM 005
1	01/16/2026	RAL	CKB	ADDENDUM #3
0	12/19/2025	RAL	CKB	ISSUED FOR BID

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

AGS BASIN ELECTRICAL GROUNDING PLAN AREA B

STATE OF MISSOURI
CRAIG KEITH BREWSTER
NUMBER
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REGISTERED PROFESSIONAL ENGINEER

12-19-2025

CRAIG K. BREWSTER
ELECTRICAL
PE-2000150002

FOR WSD USE:

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DuBois Consultants
WELLNER architects

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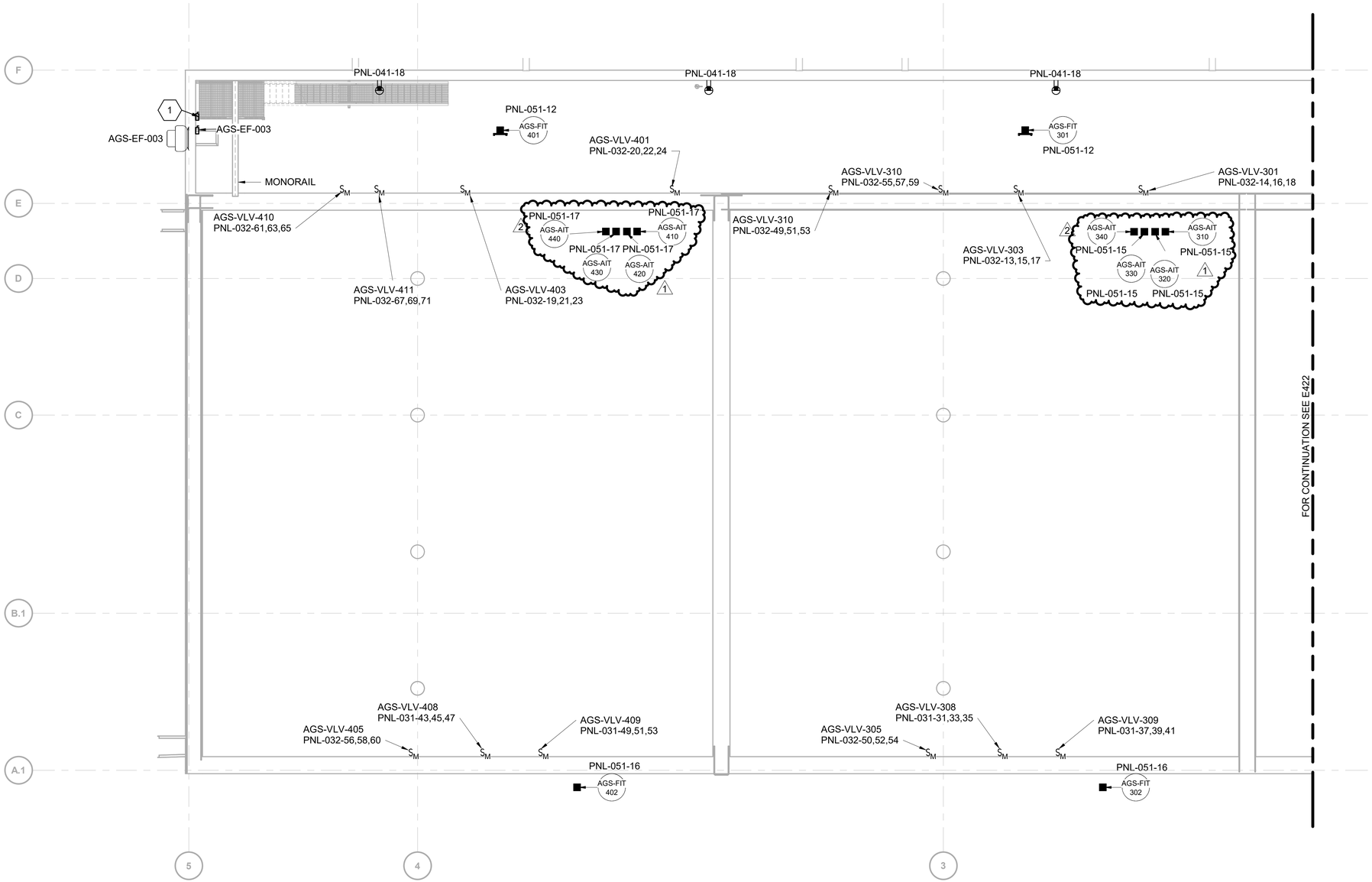
DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
M.CAYETANO	C.BREWSTER	01/30/2026	34W	-	-

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	-

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	E413

PROJECT NO.	SHEET		OF	
81000927		581		643



GENERAL NOTES:

1. REFER TO ELECTRICAL LEGEND ON SHEET E001.
2. REFER TO ONE-LINE DIAGRAMS, EQUIPMENT CONNECTION SCHEDULES AND CABLE TAGGING SCHEDULES FOR EQUIPMENT CONNECTIONS FOR CIRCUITING INFORMATION.
3. REFER TO PANEL SCHEDULES ON SHEET E403 AND E405.

KEYED NOTES:

1. DISCONNECT SWITCH FOR THE MONORAIL HOIST. SEE ONE-LINE DIAGRAM FOR ADDITIONAL INFORMATION.

AGS BASIN ELECTRICAL POWER PLAN AREA A

0 4' 8' 16'
SCALE IN FEET

NORTH

KEYPLAN

NO.	DATE	BY:	CHECKED:	DESCRIPTION
2	01/30/2026	RAL	CKB	ADDENDUM 005
1	01/16/2026	RAL	CKB	ADDENDUM #3
0	12/19/2025	RAL	CKB	ISSUED FOR BID

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

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CRAIG KEITH BREWSTER
NUMBER PE-2000150002
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Craig K. Brewster
12-19-2025

CRAIG K. BREWSTER
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PE-2000150002

FOR WSD USE:

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

AGS BASIN ELECTRICAL POWER PLAN AREA A

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
M.CAYETANO	C.BREWSTER	01/30/2026	34W	-	-

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	-

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	E422

PROJECT NO. 81000927 SHEET 583 OF 643

KCWATER
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WELLNER architects

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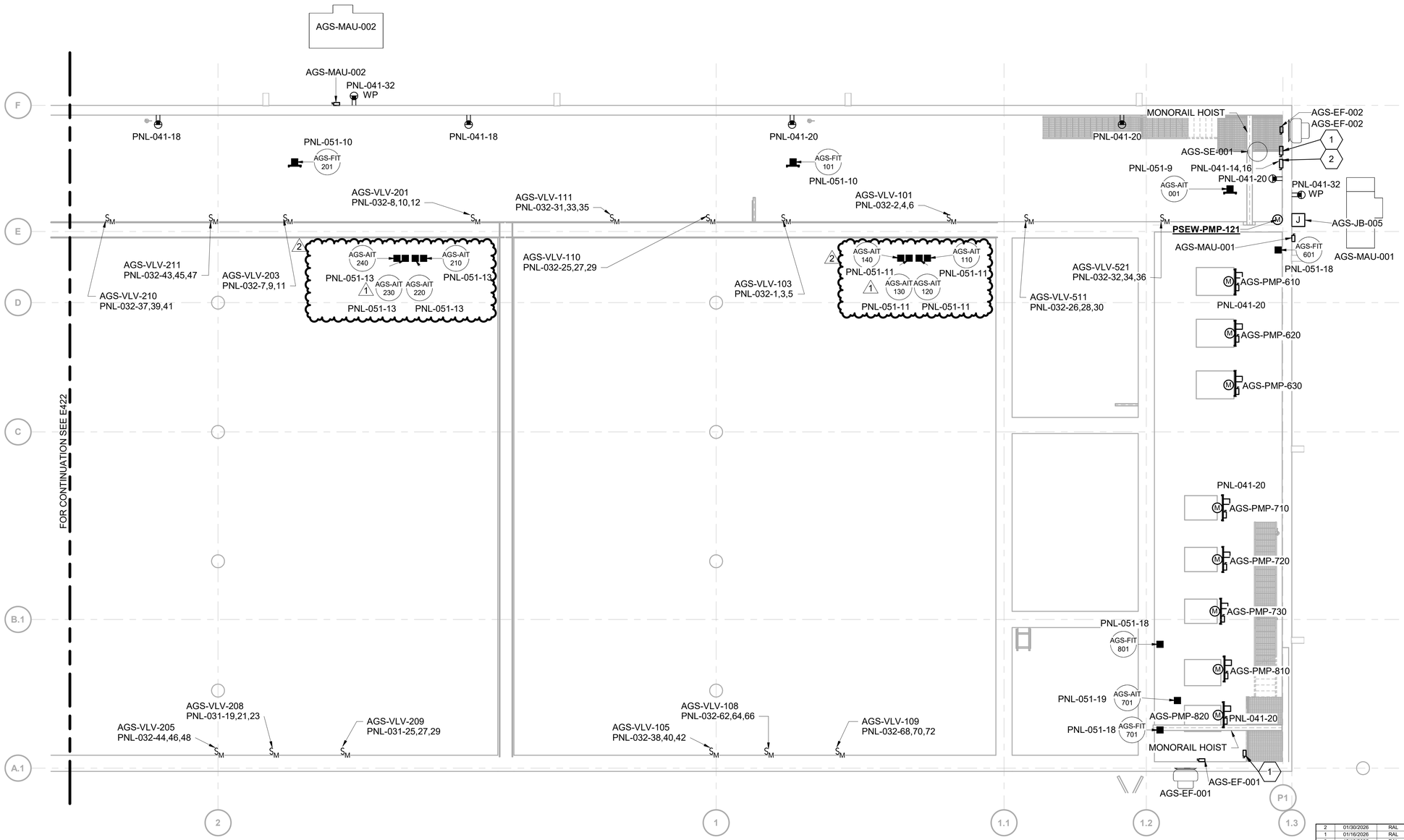

GENERAL NOTES:

1. REFER TO ELECTRICAL LEGEND ON SHEET E001.
2. REFER TO ONE-LINE DIAGRAMS, EQUIPMENT CONNECTION SCHEDULES AND CABLE TAGGING SCHEDULES FOR EQUIPMENT CONNECTIONS FOR CIRCUITING INFORMATION.
3. REFER TO PANEL SCHEDULES ON SHEET E403 AND E405.

KEYED NOTES:

1. DISCONNECT SWITCH FOR THE MONORAIL HOIST. SEE ONE-LINE DIAGRAM FOR ADDITIONAL INFORMATION.
2. 240V, 30A, 1 PHASE, DISCONNECT SWITCH FOR SANITARY SEWAGE PUMP AGS-SE-001.

AGS BASIN ELECTRICAL POWER PLAN AREA B

0 4' 8' 16'

SCALE IN FEET

NORTH

KEYPLAN

NO.	DATE	BY:	CHECKED:	DESCRIPTION
2	01/30/2026	RAL	CKB	ADDENDUM 005
1	01/16/2026	RAL	CKB	ADDENDUM #3
0	12/19/2025	RAL	CKB	ISSUED FOR BID

REVISIONS

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STATE OF MISSOURI
CRAIG KEITH BREWSTER
E-2000150002
REGISTERED PROFESSIONAL ENGINEER

Craig Brewster
12-19-2025

CRAIG K. BREWSTER
ELECTRICAL
PE-2000150002

FOR WSD USE:

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

AGS BASIN ELECTRICAL POWER PLAN AREA B

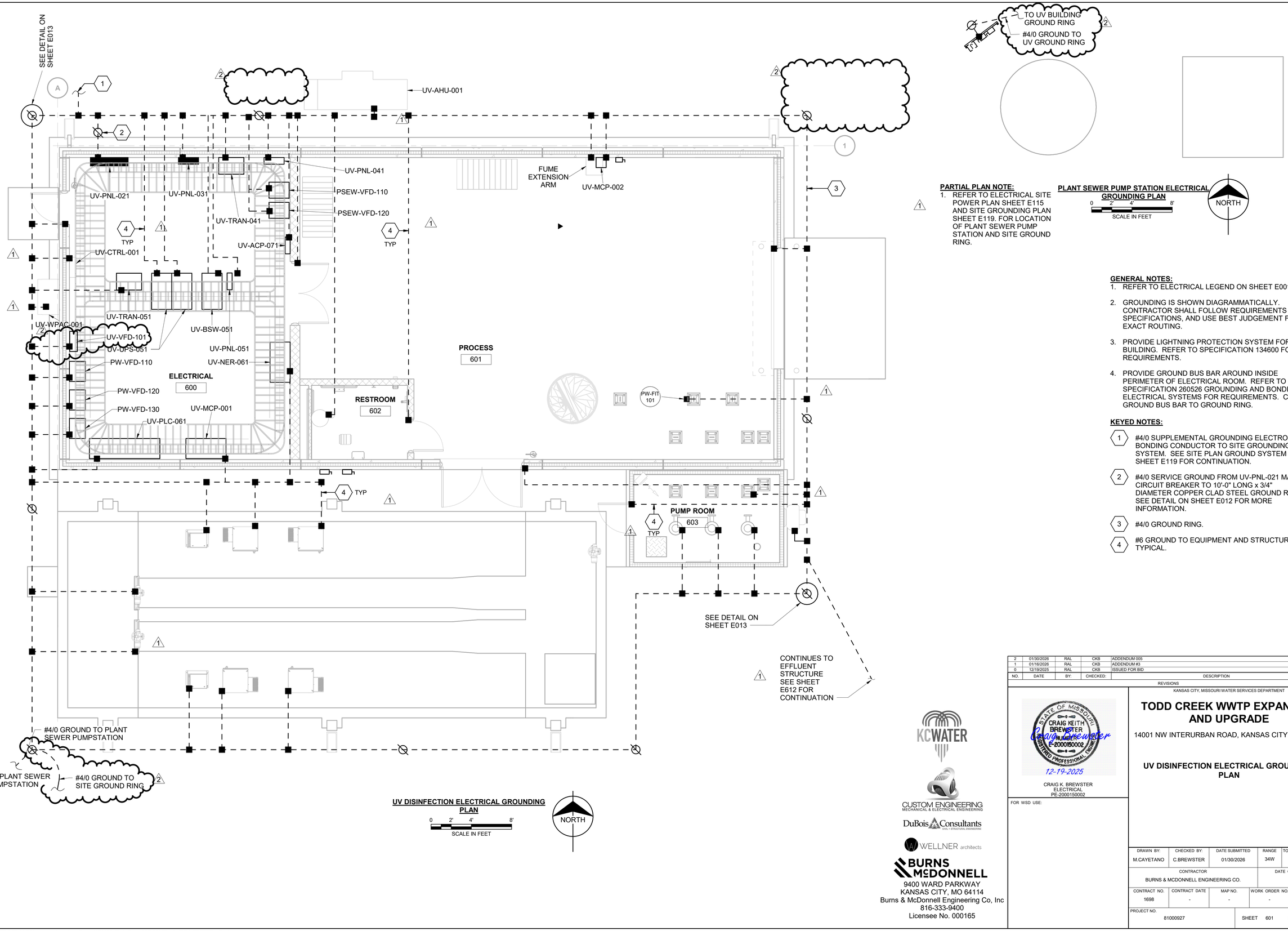
DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
M.CAYETANO	C.BREWSTER	01/30/2026	34W	-	-

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	-

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	E423

PROJECT NO. 81000927

SHEET 584 OF 643



UV DISINFECTION ELECTRICAL GROUNDING PLAN

0 2' 4' 8'

SCALE IN FEET

NORTH

PARTIAL PLAN NOTE:

1. REFER TO ELECTRICAL SITE POWER PLAN SHEET E115 AND SITE GROUNDING PLAN SHEET E119. FOR LOCATION OF PLANT SEWER PUMP STATION AND SITE GROUND RING.

PLANT SEWER PUMP STATION ELECTRICAL GROUNDING PLAN

0 2' 4' 8'

SCALE IN FEET

NORTH

GENERAL NOTES:

1. REFER TO ELECTRICAL LEGEND ON SHEET E001.
2. GROUNDING IS SHOWN DIAGRAMMATICALLY. CONTRACTOR SHALL FOLLOW REQUIREMENTS OF SPECIFICATIONS, AND USE BEST JUDGEMENT FOR EXACT ROUTING.
3. PROVIDE LIGHTNING PROTECTION SYSTEM FOR BUILDING. REFER TO SPECIFICATION 134600 FOR REQUIREMENTS.
4. PROVIDE GROUND BUS BAR AROUND INSIDE PERIMETER OF ELECTRICAL ROOM. REFER TO SPECIFICATION 260526 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS FOR REQUIREMENTS. CONNECT GROUND BUS BAR TO GROUND RING.

KEYED NOTES:

1. #4/0 SUPPLEMENTAL GROUNDING ELECTRODE BONDING CONDUCTOR TO SITE GROUNDING SYSTEM. SEE SITE PLAN GROUND SYSTEM SHEET E119 FOR CONTINUATION.
2. #4/0 SERVICE GROUND FROM UV-PNL-021 MAIN CIRCUIT BREAKER TO 10'-0" LONG x 3/4" DIAMETER COPPER CLAD STEEL GROUND ROD. SEE DETAIL ON SHEET E012 FOR MORE INFORMATION.
3. #4/0 GROUND RING.
4. #6 GROUND TO EQUIPMENT AND STRUCTURES TYPICAL.

NO.	DATE	BY:	CHECKED:	DESCRIPTION
2	01/30/2026	RAL	CKB	ADDENDUM 005
1	01/16/2026	RAL	CKB	ADDENDUM #3
0	12/19/2025	RAL	CKB	ISSUED FOR BID

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

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CRAIG KEITH BREWSTER
E-2000150002
REGISTERED PROFESSIONAL ENGINEER

12-19-2025

CRAIG K. BREWSTER
ELECTRICAL
PE-2000150002

FOR WSD USE:

KCWATER

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WELLNER architects

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TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

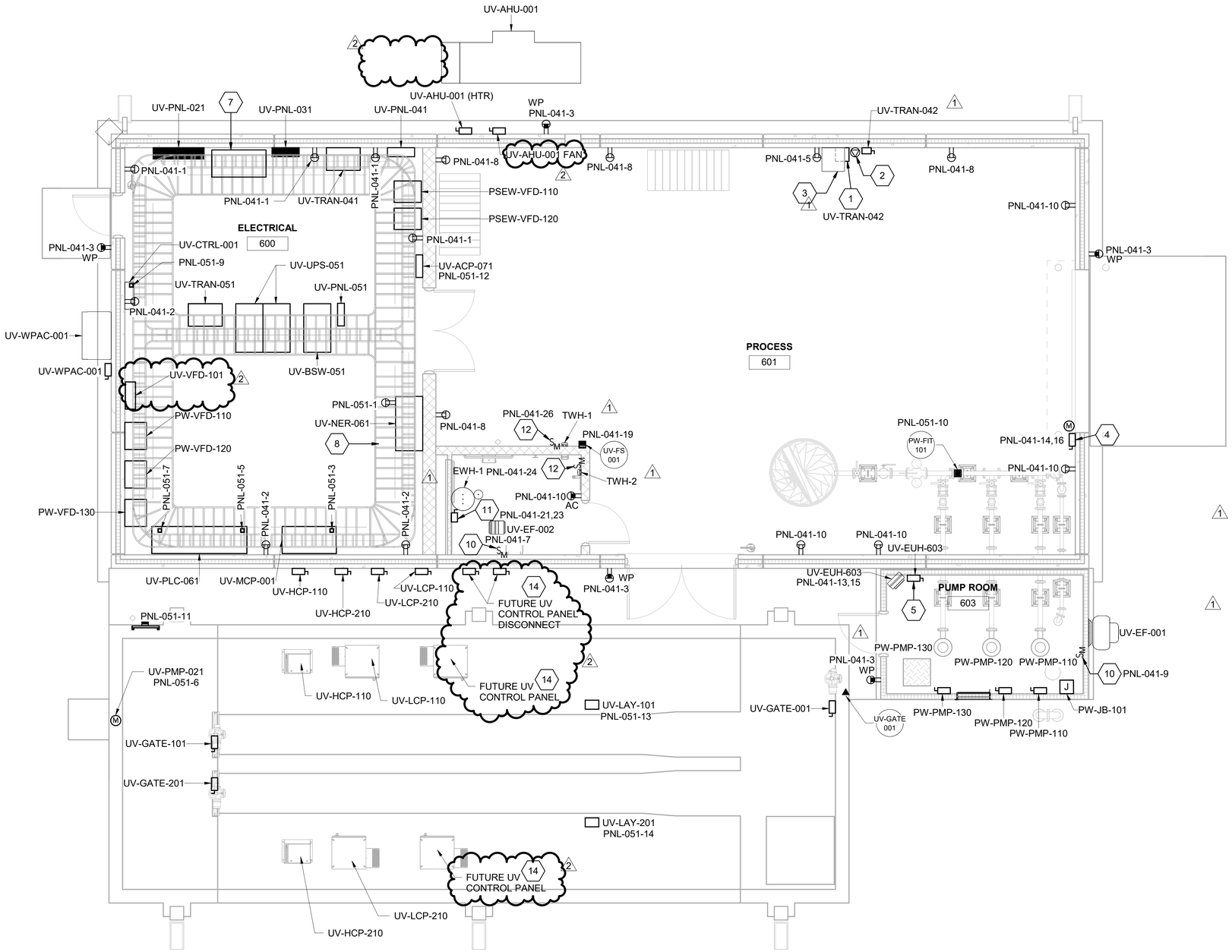
UV DISINFECTION ELECTRICAL GROUNDING PLAN

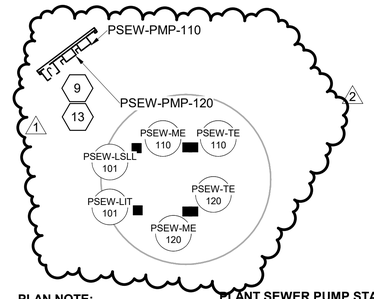
DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
M.CAYETANO	C.BREWSTER	01/30/2026	34W	-	-

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	E611

PROJECT NO.	SHEET	601	OF	643
81000927				





PLAN NOTE:
1. REFER TO ELECTRICAL SITE POWER PLAN SHEET 2 E115 FOR LOCATION.

PLANT SEWER PUMP STATION ELECTRICAL POWER PLAN

0 2' 4' 8'
SCALE IN FEET

NORTH

GENERAL NOTES:
1. REFER TO SHEET E001 FOR ELECTRICAL LEGEND.
2. REFER TO ONE-LINE DIAGRAMS, EQUIPMENT CONNECTION SCHEDULES AND CABLE TAGGING SCHEDULES FOR EQUIPMENT CONNECTIONS FOR CIRCUITING INFORMATION.
3. REFER TO PANEL SCHEDULES ON SHEET E602 AND E603.
4. COORDINATE ALL FLOOR-MOUNTED ELECTRICAL EQUIPMENT LOCATIONS AND DIMENSIONS WITH EQUIPMENT PAD DETAILS. REFER TO STRUCTURAL PLANS AND DETAILS FOR STANDARD EQUIPMENT PADS.
5. REFER TO SHEET E101 - HAZARDOUS AREA CLASSIFICATION SITE PLAN FOR OUTDOOR CLASSIFIED AREA DESIGNATION. PROVIDE ELECTRICAL EQUIPMENT WITH SUITABLE HAZARDOUT RATINGS FOR THESE AREAS.

KEYED NOTES CONT:

10 120V, 20A TOGGLE SWITCH FOR EXHAUST FAN.

11 240V, 2-POLE, 30A DISCONNECT SWITCH FOR WATER HEATER. 2-#6, 1-#10G IN 1"C.

12 120V, 40A TOGGLE SWITCH FOR INSTANT WATER HEATER. 2-#8, 1-#10G IN 3/4" C.

13 PROVIDE UNISTRUT ON CONCRETE PAD. REFER TO STURCTURAL DETAILS FOR CONCRETE PADS. REFER TO DETAIL A ON SET E007 FOR REQUIREMENTS.

14 PROVIDE 2 INCH CONDUIT WITH PULL WIRE FROM DISCONNECT TO FUTURE UV CONTROL PANEL. CAP AND SEAL CONDUIT FOR FUTURE USE

KEYED NOTES:

1 TRANSFORMER FOR WELDING RECEPTACLE.

2 240V WELDING RECEPTACLE. CONTRACTOR SHALL COORDINATE RECEPTACLE CONFIGURATION WITH KC WATER REPRESENTATIVE.

3 WALL MOUNTED WELDING FUME EXTRACTOR, 120V, 2.5A.

4 240V, 1 PHASE, 30A DISCONNECT SWITCH FOR OVERHEAD ROLLING DOOR, 1HP 208V, 1Ø, 9A.

5 240V, 30A, 1 PHASE DISCONNECT SWITCH FOR UV HEATER IN PUMP ROOM.

6 PROVIDE 120V GFCI WP DUPLEX RECEPTACLE ON UNISTURT ADJACENT TO JUNCTION BOX. 2#8, 1#8G, 1"C.

7 ROUTE DUCTBANK SPARE CONDUITS TO THIS LOCATION AND CAP AND TAG. REFER TO SITE DUCT BANK PLANS AND DUCT BANK SCHEDULES FOR SPARE CONDUIT QUANTITIES AND SIZES.

8 REFER TO CABLE TRAY AT ELECTRICAL ROOM DETAIL SHEET E010 FOR REQUIREMENTS.

9 MOUNT PLANT SEWER DISCONNECTS TO UNISTRUIT ON WELL SLAB. REFER TO DETAIL A SHEET E007.

UV DISINFECTION BUILDING ELECTRICAL POWER PLAN

0 2' 4' 8'
SCALE IN FEET

NORTH

NO.	DATE	BY:	CHECKED:	DESCRIPTION
2	01/30/2026	RAL	CKB	ADDENDUM 005
1	01/16/2026	RAL	CKB	ADDENDUM #3
0	12/19/2025	RAL	CKB	ISSUED FOR BID

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

UV DISINFECTION BUILDING ELECTRICAL POWER PLAN

STATE OF MISSOURI
CRAIG KEITH BREWSTER
NUMBER
E-2000150002
REGISTERED PROFESSIONAL ENGINEER
Craig Brewster
12-19-2025

CRAIG K. BREWSTER
ELECTRICAL
PE-2000150002

FOR WSD USE:

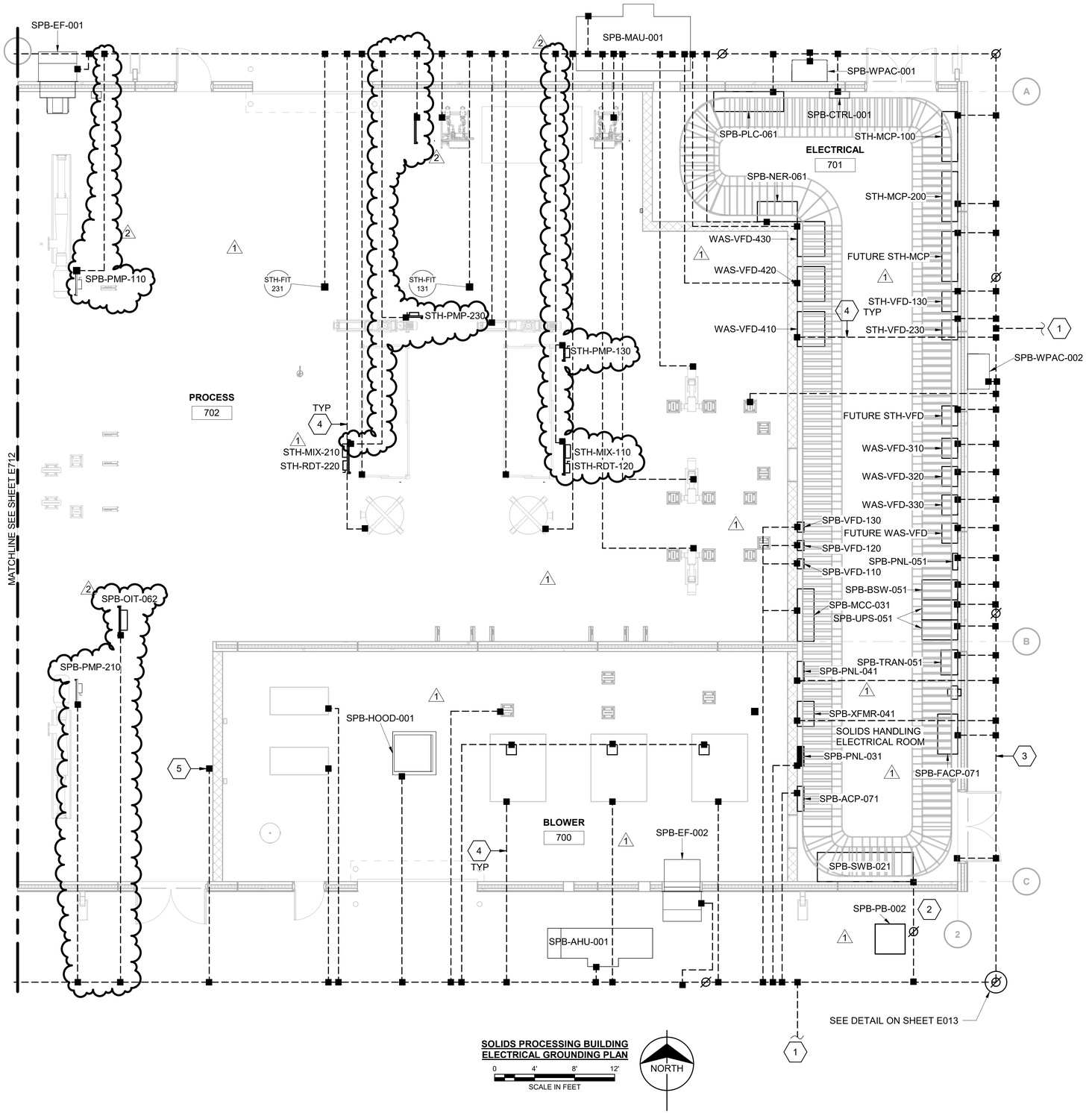
KCWATER
CUSTOM ENGINEERING
MECHANICAL & ELECTRICAL ENGINEERING
DuBois Consultants
WELLNER architects
BURNS McDONNELL
9400 WARD PARKWAY
KANSAS CITY, MO 64114
Burns & McDonnell Engineering Co, Inc
816-333-9400
Licensee No. 000165

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
M.CAYETANO	C.BREWSTER	01/30/2026	34W	-	-

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	E621

PROJECT NO. 81000927 SHEET 603 OF 643



SOLIDS PROCESSING BUILDING ELECTRICAL GROUNDING PLAN

0 4' 8' 12'

SCALE IN FEET

NORTH

GENERAL NOTES:

1. REFER TO ELECTRICAL LEGEND ON SHEET E001.
2. GROUNDING IS SHOWN DIAGRAMMATICALLY. CONTRACTOR SHALL FOLLOW REQUIREMENTS OF SPECIFICATIONS, AND USE BEST JUDGEMENT FOR EXACT ROUTING.
3. PROVIDE LIGHTNING PROTECTION SYSTEM FOR BUILDING. REFER TO SPECIFICATION 134600 FOR REQUIREMENTS.
4. PROVIDE GROUND BUS BAR AROUND INSIDE PERIMETER OF ELECTRICAL ROOM. REFER TO SPECIFICATION 260526 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS FOR REQUIREMENTS. CONNECT GROUND BUS BAR TO GROUND RING.

KEYED NOTES:

1. #4/0 SUPPLEMENTAL GROUNDING ELECTRODE BONDING CONDUCTOR TO SITE GROUND RING. SEE SITE PLAN GROUND SYSTEM SHEET E119 FOR CONTINUATION.
2. #4/0 SERVICE GROUND FROM SPB-SWB-021 MAIN CIRCUIT BREAKER TO 10'-0" LONG x 3/4" DIAMETER COPPER CLAD STEEL GROUND ROD. SEE DETAIL ON SHEET E012 FOR MORE INFORMATION.
3. #4/0 GROUND RING.
4. #6 GROUND TO EQUIPMENT AND STRUCTURES TYPICAL.
5. BOND WATER SERVICE ENTRANCE METAL PIPE.

NO.	DATE	BY:	CHECKED:	DESCRIPTION
2	01/30/2026	RAL	CKB	ADDENDUM 005
1	01/16/2026	RAL	CKB	ADDENDUM #3
0	12/19/2025	RAL	CKB	ISSUED FOR BID

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

STATE OF MISSOURI
CRAIG KEITH BREWSTER
E-2000150002
REGISTERED PROFESSIONAL ENGINEER

Craig Brewster

12-19-2025

CRAIG K. BREWSTER
ELECTRICAL
PE-2000150002

FOR WSD USE:

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

SOLIDS PROCESSING BUILDING ELECTRICAL GROUNDING PLAN 1 OF 2

KCWATER

CUSTOM ENGINEERING
MECHANICAL & ELECTRICAL ENGINEERING

DuBois Consultants
CIVIL + STRUCTURAL ENGINEERING

WELLNER architects

BURNS McDONNELL
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816-333-9400
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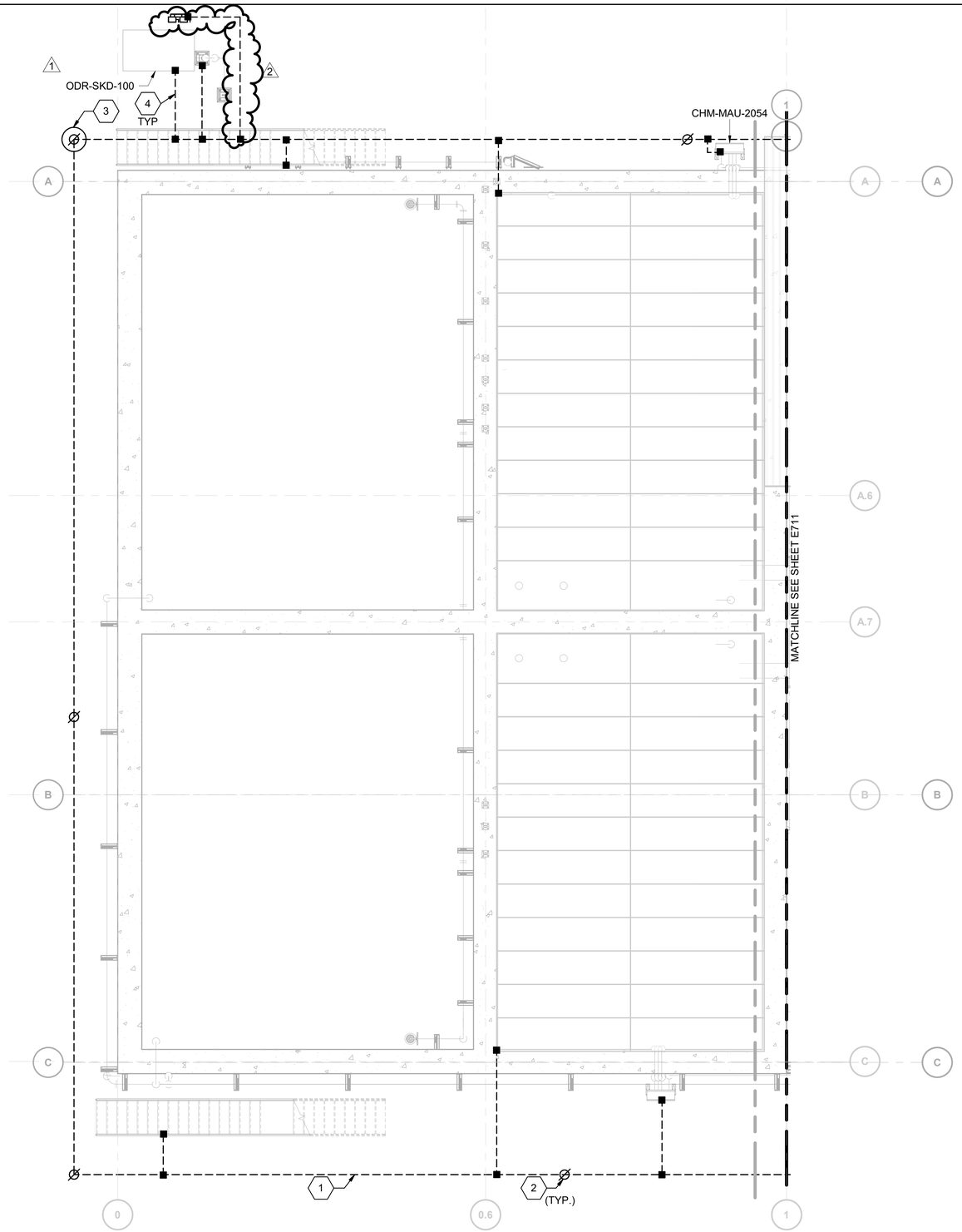
DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
M.CAYETANO	C.BREWSTER	01/30/2026	34W	-	-

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	E711

PROJECT NO. 81000927

SHEET 614 OF 643



SOLIDS PROCESSING BUILDING ELECTRICAL GROUNDING PLAN

0 4' 8' 12'

SCALE IN FEET

NORTH

GENERAL NOTES:

1. REFER TO ELECTRICAL LEGEND ON SHEET E001.
2. GROUNDING IS SHOWN DIAGRAMMATICALLY. CONTRACTOR SHALL FOLLOW REQUIREMENTS OF SPECIFICATIONS, AND USE BEST JUDGEMENT FOR EXACT ROUTING.
3. PROVIDE LIGHTNING PROTECTION SYSTEM FOR BUILDING. REFER TO SPECIFICATION 134600 FOR REQUIREMENTS.

KEYED NOTES:

1. #4/0 GROUND RING.
2. GROUND ROD.
3. GROUND TEST WELL.
4. #6 GROUND TO EQUIPMENT AND STRUCTURES. TYPICAL.

NO.	DATE	BY:	CHECKED:	DESCRIPTION
2	01/30/2026	RAL	CKB	ADDENDUM 005
1	01/16/2026	RAL	CKB	ADDENDUM #3
0	12/19/2025	RAL	CKB	ISSUED FOR BID

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STATE OF MISSOURI
CRAIG KEITH BREWSTER
Number
PE-2000150002
REGISTERED PROFESSIONAL ENGINEER

Craig K. Brewster
12-19-2025

CRAIG K. BREWSTER
ELECTRICAL
PE-2000150002

FOR WSD USE:

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

SOLIDS PROCESSING BUILDING ELECTRICAL GROUNDING PLAN 2 OF 2

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
M.CAYETANO	C.BREWSTER	01/30/2026	34W	-	-

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	E712

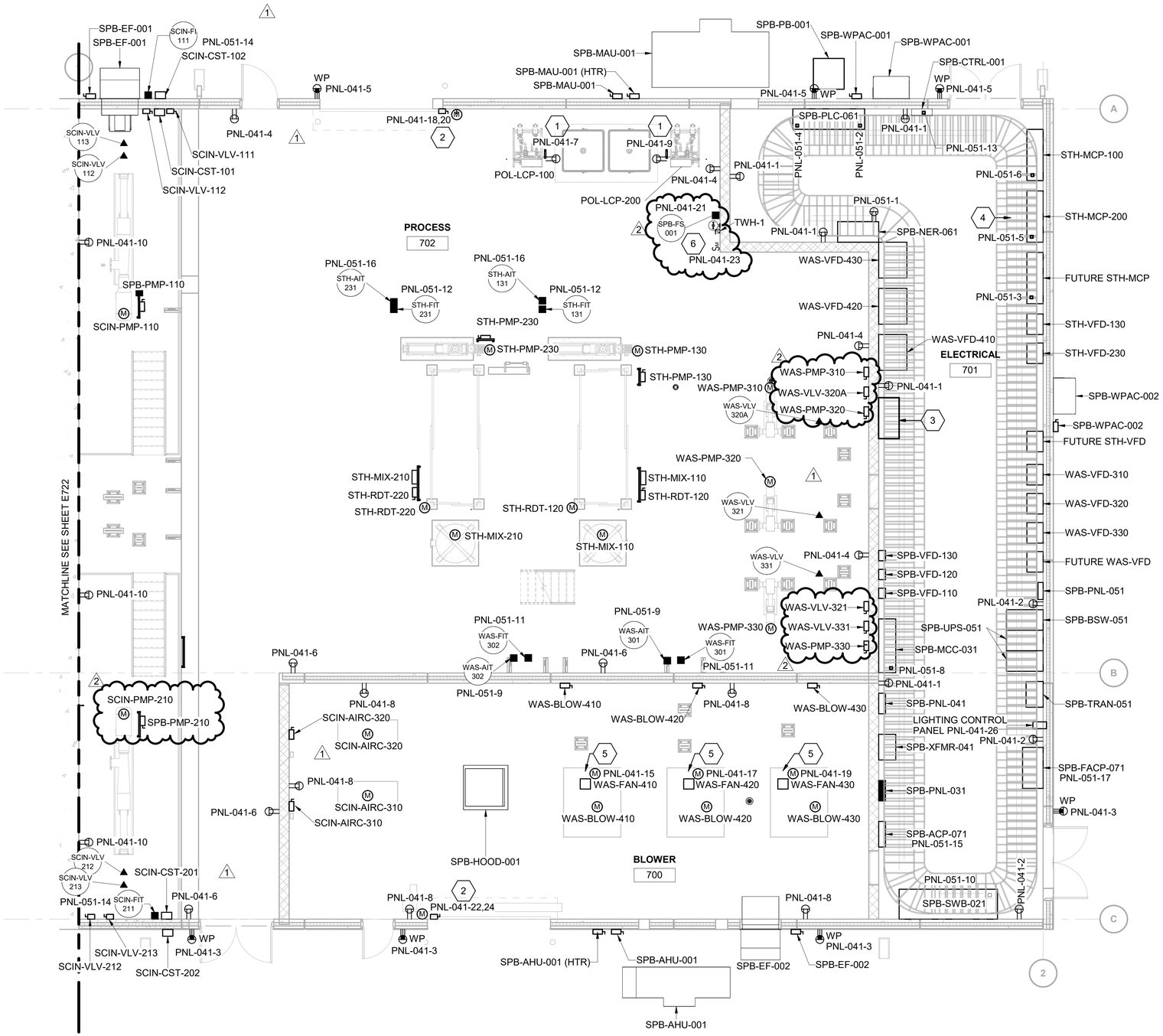
PROJECT NO.	SHEET		OF	
81000927	615		643	

GENERAL NOTES:

1. REFER TO SHEET E001 FOR ELECTRICAL LEGEND.
2. REFER TO ONE-LINE DIAGRAMS, EQUIPMENT CONNECTION SCHEDULES AND CABLE TAGGING SCHEDULES FOR EQUIPMENT CONNECTIONS FOR CIRCUITING INFORMATION.
3. REFER TO PANEL SCHEDULES ON SHEET E704.
4. COORDINATE ALL FLOOR-MOUNTED ELECTRICAL EQUIPMENT LOCATIONS AND DIMENSIONS WITH EQUIPMENT PAD DETAILS. REFER TO STRUCTURAL PLANS AND DETAILS FOR STANDARD EQUIPMENT PADS.

KEYED NOTES:

1. COORDINATE RECEPTACLE IN ACCESSIBLE LOCATION WITH POLYMER TOTE MIXER LOCATION.
2. 240V, 1 PHASE, 30A DISCONNECT SWITCH FOR OVERHEAD ROLLING DOOR, 1HP, 208V 1Ø, 9A.
3. ROUTE DUCTBANK SPARE CONDUITS TO THIS LOCATION AND CAP AND TAG. REFER TO SITE DUCT BANK PLANS AND DUCT BANK SCHEDULES FOR SPARE CONDUIT QUANTITIES AND SIZES.
4. REFER TO CABLE TRAY AT ELECTRICAL ROOM DETAIL SHEET E010 FOR REQUIREMENTS.
5. 120V, 20A, MOTOR RATED TOGGLE SWITCH. COORDINATE LOCATION WITH FAN INSTALLER.
6. 120V, 40A TOGGLE SWITCH FOR INSTANT WATER HEATER. 2-#8, 1-#10G IN 3/4"C



SOLIDS PROCESSING BUILDING ELECTRICAL POWER PLAN 1 OF 2

0 4' 8' 12'

SCALE IN FEET

NORTH

NO.	DATE	BY:	CHECKED:	DESCRIPTION
2	01/30/2026	RAL	CKB	ADDENDUM 005
1	01/16/2026	RAL	CKB	ADDENDUM #3
0	12/19/2025	RAL	CKB	ISSUED FOR BID

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

SOLIDS PROCESSING BUILDING ELECTRICAL POWER PLAN 1 OF 2

STATE OF MISSOURI — CRAIG KEITH BREWSTER — NUMBER E-2000150002 — REGISTERED PROFESSIONAL ENGINEER

Craig K. Brewster

12-19-2025

CRAIG K. BREWSTER
ELECTRICAL
PE-2000150002

FOR WSD USE:

KCWATER

CUSTOM ENGINEERING
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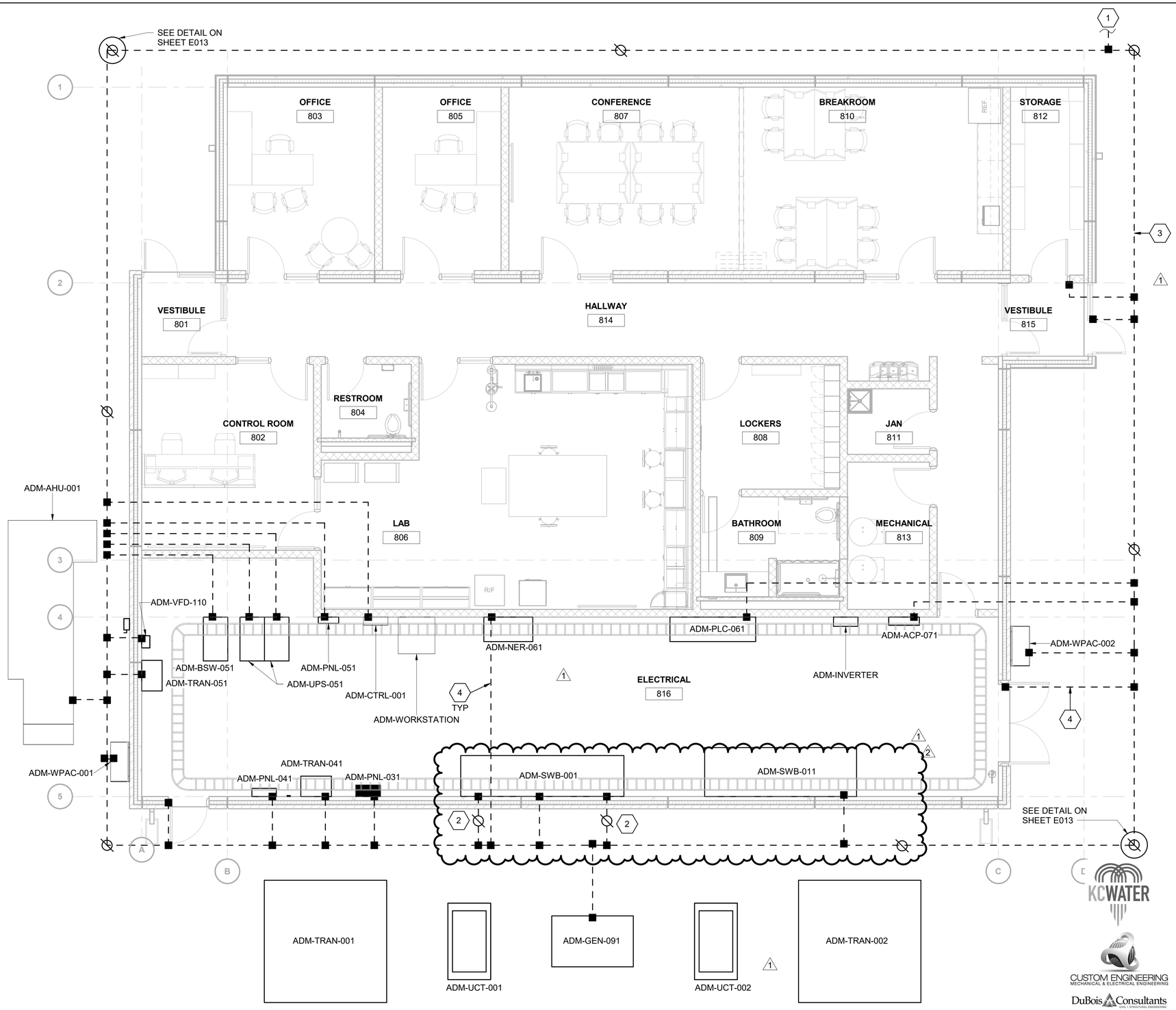
M.CAYETANO	C.BREWSTER	01/30/2026	34W	-	-

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	E721

PROJECT NO. 81000927

SHEET 616 OF 643



ADMINISTRATION BUILDING ELECTRICAL GROUNDING PLAN

0 2' 4' 8'

SCALE IN FEET

NORTH

GENERAL NOTES:

1. REFER TO ELECTRICAL LEGEND ON SHEET E001.
2. GROUNDING IS SHOWN DIAGRAMMATICALLY. CONTRACTOR SHALL FOLLOW REQUIREMENTS OF SPECIFICATIONS, AND USE BEST JUDGEMENT FOR EXACT ROUTING.
3. PROVIDE LIGHTNING PROTECTION SYSTEM FOR BUILDING. REFER TO SPECIFICATION 134600 FOR REQUIREMENTS.
4. PROVIDE GROUND BUS BAR AROUND INSIDE PERIMETER OF ELECTRICAL ROOM. REFER TO SPECIFICATION 260526 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS FOR REQUIREMENTS. CONNECT GROUND BUS BAR TO GROUND RING.

KEYED NOTES:

1. #4/0 SUPPLEMENTAL GROUNDING ELECTRODE BONDING CONDUCTOR TO THE SITE STRUCTURE GROUND RING. SEE SITE PLAN GROUND SYSTEM SHEET E119 FOR CONTINUATION.
2. #4/0 SERVICE GROUND FROM ADM-SWB-001, 011 MAIN CIRCUIT BREAKER TO 10'-0" LONG x 3/4" DIAMETER COPPER CLAD STEEL GROUND ROD. SEE DETAIL ON SHEET E012 FOR MORE INFORMATION.
3. #4/0 GROUND RING.
4. #6 GROUND TO STRUCTURE AND EQUIPMENT TYPICAL.

NO.	DATE	BY:	CHECKED:	DESCRIPTION
2	01/30/2026	RAL	CKB	ADDENDUM 005
1	01/16/2026	RAL	CKB	ADDENDUM #3
0	12/19/2025	RAL	CKB	ISSUED FOR BID

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

ADMIN BUILDING ELECTRICAL GROUNDING PLAN

STATE OF MISSOURI CRAIG KEITH BREWSTER E-2000150002 REGISTERED PROFESSIONAL ENGINEER

Craig K. Brewster

12-19-2025

CRAIG K. BREWSTER
ELECTRICAL
PE-2000150002

FOR WSD USE:

KCWATER

CUSTOM ENGINEERING
MECHANICAL & ELECTRICAL ENGINEERING

DuBois Consultants
CIVIL + STRUCTURAL ENGINEERING

WELLNER architects

BURNS McDONNELL
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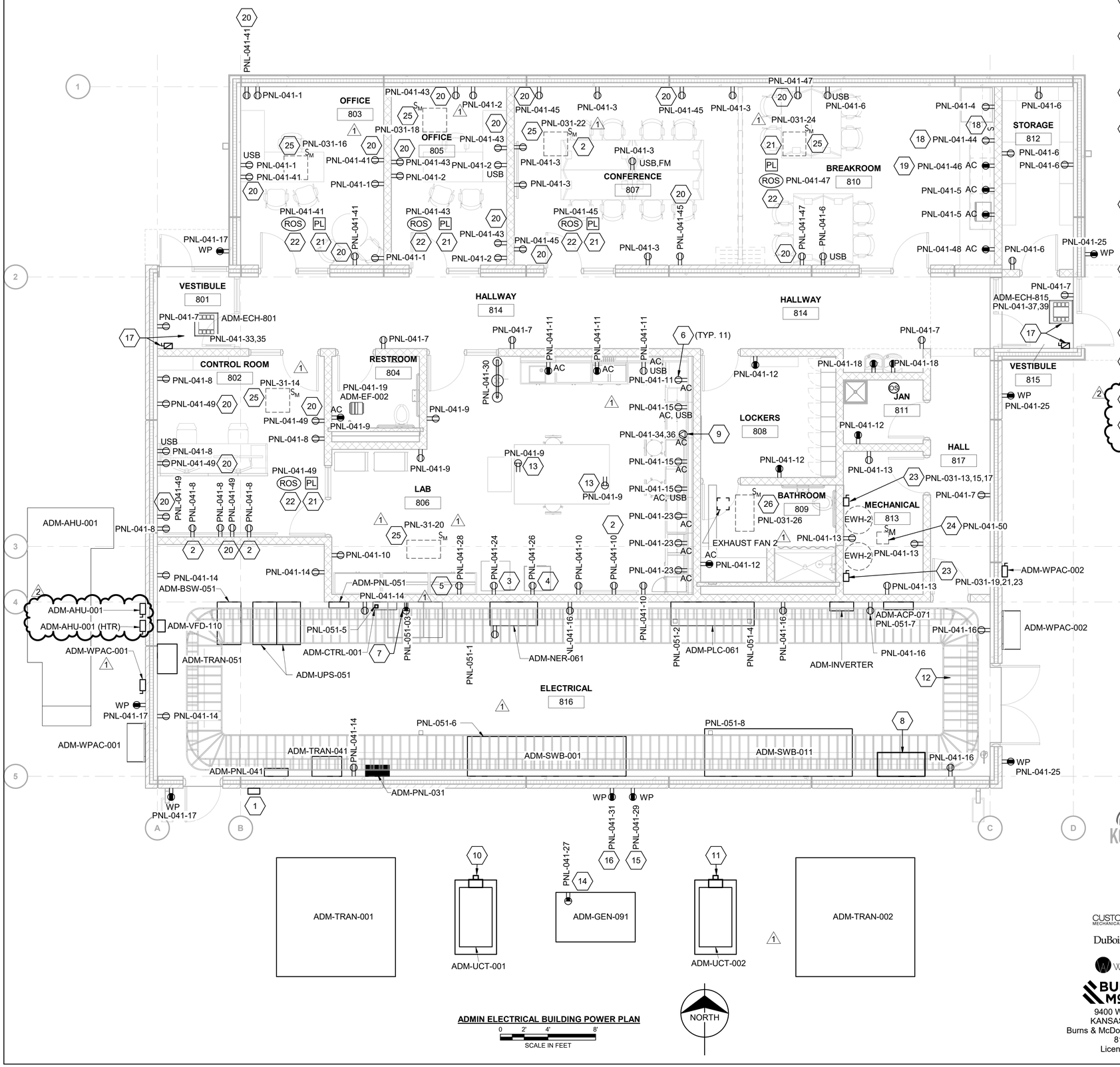
DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
M.CAYETANO	C.BREWSTER	01/30/2026	34W	-	-

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	E811

PROJECT NO.	SHEET		OF	
81000927	629		643	



KEYED NOTES CONT.:

17. 240V, 30A, 1 PHASE DISCONNECT SWITCH FOR ADMINISTRATION UNIT HEATER IN VESTIBULE.
18. DEDICATED 20A RECEPTACLE FOR GARBAGE DISPOSAL. COORDINATE LOCATION WITH COUNTER INSTALLER. PROVIDE 120V SWITCH ABOVE COUNTER FOR ON/OFF CONTROL.
19. DEDICATED 20A RECEPTACLE FOR TRASH COMPACTOR COORDINATE LOCATION WITH COMPACTOR AND COUNTER INSTALLER.
20. STANDARD RECEPTACLE WITH 2021 IECC 'C405.11' CODE REQUIRED AUTOMATIC CONTROL PROVIDED VIA INTERCONNECTION WITH nLIGHT PLUG LOAD CONTROL POWER PACK AND nLIGHT OCCUPANCY SENSOR. SEE NOTES 21 & 22 BELOW.
21. nLIGHT PLUG LOAD CONTROL POWER PACK, 'nPP20 PL' TO PROVIDE AUTOMATIC CONTROL TO RECEPTACLES TAGGED WITH KEY NOTE 20 AND DESIGNATED WITH THE SAME CIRCUIT NUMBER AS THIS DEVICE. INSTALL ABOVE T-BAR CEILING.
22. nLIGHT OCCUPANCY SENSOR, 'nCM 9 RJB' TO PROVIDE AUTOMATIC CONTROL OF RECEPTACLES TAGGED WITH KEY NOTE 20 VIA, INTERCONNECTION WITH nLIGHT PLUG LOAD CONTROL POWER PACK. CEILING MOUNTED.
23. 600V, 3 PHASE, 30A DISCONNECT SWITCH FOR WATER HEATER EWH-2
24. 120V, 20A MOTORIZED TOGGLE SWITCH FOR CIRCULATION PUMP MOUNTED ABOVE CEILING.
25. 277V, 15A MOTORIZED TOGGLE SWITCH FOR VAV BOX MOUNTED ABOVE CEILING.
26. 277V, 30A MOTORIZED TOGGLE SWITCH FOR VAV BOX MOUNTED ABOVE CEILING.

GENERAL NOTES:

1. REFER TO ELECTRICAL LEGEND ON SHEET E001.
2. REFER TO ONE-LINE DIAGRAMS, EQUIPMENT CONNECTION SCHEDULES AND CABLE TAGGING SCHEDULES FOR EQUIPMENT CONNECTIONS FOR CIRCUITING INFORMATION.
3. REFER TO PANEL SCHEDULES ON SHEET E803.
4. COORDINATE ALL FLOOR-MOUNTED ELECTRICAL EQUIPMENT LOCATIONS AND DIMENSIONS WITH EQUIPMENT PAD DETAILS. REFER TO STRUCTURAL PLANS AND DETAILS FOR STANDARD EQUIPMENT PADS.
5. PERIMETER WALL AND HALLWAY 814 NORTH WALL OF BUILDING IS PRECAST CONCRETE. FACTORY PRECAST OPENINGS FOR ALL RECEPTACLES AND OTHER DEVICE LOCATIONS. FACTORY CAST IN 1-INCH CONDUIT FROM RECEPTACLES AND DEVICES TO TOP OF WALL.
6. CONDUIT ROUTES IN LAB 806 AND WALLWAY 814 SHALL BE APPROVED BY ARCHITECT PRIOR TO INSTALLATION.

KEYED NOTES:

1. REMOTE MANUAL OPEN/CLOSE CONTROL BOX FOR OPERATION 4,000A BREAKERS IN ADM-SWB-001. REFER TO DETAIL ON SHEET E012.
2. MOUNT RECEPTACLE AT APPROXIMATELY 84" FOR WALL MOUNTED TV. COORDINATE WITH TV LOCATION.
3. DEDICATED 20A RECEPTACLE FOR LAB REFRIGERATOR. COORDINATE WITH REFRIGERATOR LOCATION PER OWNER.
4. DEDICATED 20A RECEPTACLE FOR LAB FREEZER. COORDINATE WITH FREEZER LOCATION PER OWNER.
5. DEDICATED 20A RECEPTACLE FOR LAB ICE BIN. COORDINATE WITH ICE BIN LOCATION PER OWNER.
6. ALL LAB COUNTER DUPLEX RECEPTACLES SHALL BE MOUNTED IN THE CHASE AT THE BACK OF THE CASEWORK UNDERNEATH THE ARCHITECTURAL REAGENT SHELF. COORDINATE WITH DATA LOCATIONS AND ARCHITECTURAL MILLWORK.
7. HVAC COMPUTER WORK STATION.
8. ROUTE DUCTBANK SPARE CONDUITS TO THIS LOCATION AND CAP AND TAG. REFER TO SITE DUCT BANK PLANS AND DUCT BANK SCHEDULES FOR SPARE CONDUIT QUANTITIES AND SIZES.
9. DEDICATED 208V, 20A, 1PH RECEPTACLE FOR LAB OVEN. COORDINATE WITH OVEN LOCATION PER OWNER.
10. PROVIDE UTILITY APPROVED METER SOCKET AND CT CABINET PER EVERGY STANDARDS.
11. PROVIDE UTILITY APPROVED METER SOCKET AND CT CABINET PER EVERGY STANDARDS.
12. REFER TO CABLE TRAY AT ELECTRICAL ROOM DETAIL SHEET E010 FOR REQUIREMENTS.
13. SURFACE MOUNT RECEPTACLE ON SIDE OF LAB TABLE. JUST BELOW COUNTER TOP. COORDINATE WITH LAB TABLE MILLWORK AND LOCATION.
14. PROVIDE 120V GFCI DUPLEX RECEPTACLE FOR INTERNAL HEATER AND LIGHT. 2-#12, 1#12 G IN 3/4"C.
15. PROVIDE 120V GFCI WP DUPLEX RECEPTACLE FOR BATTERY CHARGER. 2-#12, 1-#12 G IN 3/4"C.
16. PROVIDE 120V,30A, L5-30 GFCI WP DUPLEX RECEPTACLE FOR BLOCK HEATER. 2-#10, 1-#10 G IN 3/4"C.

NO.	DATE	BY:	CHECKED:	DESCRIPTION
2	01/30/2026	RAL	CKB	ADDENDUM 005
1	01/16/2026	RAL	CKB	ADDENDUM #3
0	12/19/2025	RAL	CKB	ISSUED FOR BID

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

STATE OF MISSOURI · CRAIG KEITH BREWSTER · NUMBER PE-2000150002 · REGISTERED PROFESSIONAL ENGINEER

12-19-2025

CRAIG K. BREWSTER
ELECTRICAL
PE-2000150002

FOR WSD USE:

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

ADMIN BUILDING ELECTRICAL POWER PLAN

KCWATER

CUSTOM ENGINEERING
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DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
M.CAYETANO	C.BREWSTER	01/30/2026	34W	-	-

CONTRACTOR: BURNS & MCDONNELL ENGINEERING CO. — DATE COMPLETED:

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	E821

PROJECT NO. 81000927 — SHEET 630 OF 643

FAN (EF) SCHEDULE

TAG	SERVES	MFR	MODEL	DUTY	ALT (FT)	AIR TEMP (°F)	FLOW (CFM)	DEV PRESS (INWC)	TYPE	IMPELLER TYPE	IMPELLER MATL	HOUSING TYPE	HOUSING MATL	DUCT/ SLEEVE* (IN)	DAMPER	SPEED* (RPM)	BRAKE HP *	BRAKE HP MAX	DRIVE	MOTOR* SIZE	MOTOR* TYPE	MOTOR* SPEED (RPM)	MOTOR* VOLT (V)	MOTOR* PH (φ)	MOTOR* FLA (A)	OP WT* (LBS)	DETAIL DRAW	PLAN DRAW	SPEC	OPTIONS
ADM-EF-001	RESTROOMS	LOREN COOK	SQN-D-90SQN17DH (VF)	EXHAUST	1,005	70.0	183	0.19	INLINE	BACKWARD	AL	SPUN	GS	12x12	GRAVITY	1500	0.04	0.06	DIRECT	1/8 HP	ECM	1725	120	1	1.9	58	M004	M801	23 34 23	4,7
ADM-EF-002	RESTROOMS	LOREN COOK	SQN-D-70SQN17DM (VF)	EXHAUST	1,005	70.0	50	0.19	INLINE	BACKWARD	AL	SPUN	GS	10x10	GRAVITY	1332	0.01	0.02	DIRECT	1/20 HP	ECM	1725	120	1	-	41	M004	M801	23 34 23	6,7
AGS-EF-001	402-PUMP	LOREN COOK	ACWHP-210WH6B	EXHAUST	1,005	70.0	3,380	0.30	CENTRIFUGAL	BACKWARD	AL	SPUN	AL	24x24	MOTORIZED	846	0.51	1.51	BELT	3/4 HP	XPROOF	1725	460	3	1.6	150	M005	M403	23 34 23	1,2,3,10,11
AGS-EF-002	403-PIPE GALLERY	LOREN COOK	ACWHP-245WH9B	EXHAUST	1,005	70.0	6,030	0.24	CENTRIFUGAL	BACKWARD	AL	SPUN	AL	24x24	MOTORIZED	898	1.20	1.20	BELT	2 HP	XPROOF	1725	460	3	3.4	206	M005	M403	23 34 23	1,2,3,10,11
AGS-EF-003	403-PIPE GALLERY	LOREN COOK	ACWHP-245WH9B	EXHAUST	1,005	70.0	6,030	0.24	CENTRIFUGAL	BACKWARD	AL	SPUN	AL	24x24	MOTORIZED	898	1.20	1.20	BELT	2 HP	XPROOF	1725	460	3	3.4	206	M005	M402	23 34 23	1,2,3,10,11
AGS-EF-004	401-BLOWER	LOREN COOK	AWD-36A11DA	EXHAUST	1,005	70.0	19,150	0.24	PROPELLER	-	AL	SPUN	STEEL	54.5x54.5	MOTORIZED	581	0.26	0.26	DIRECT	1 HP	XPROOF	1140	460	3	1.6	403	M005	M401	23 34 23	1,2,3,4,8,9
IPS-EF-001	202-SCREEN	LOREN COOK	ACWB-210W5B	EXHAUST	1,005	70.0	3,078	0.14	CENTRIFUGAL	BACKWARD	AL	SPUN	AL	24x24	MOTORIZED	581	0.26	0.26	BELT	1/2 HP	XPROOF	1725	460	3	1.1	145	M005	M202	23 34 23	1,2,3,10,11
GRSC-EF-001	302-STAIR	LOREN COOK	ACEB-210C6B	EXHAUST	1,005	70.0	3,300	0.26	CENTRIFUGAL	BACKWARD	AL	SPUN	AL	24x24	MOTORIZED	668	0.41	0.75	BELT	3/4 HP	XPROOF	1725	460	3	1.6	124	M005	M301	23 34 23	1,2,3,10,11
GRSC-EF-002	301-PROCESSING	LOREN COOK	ACEB-225W9B	EXHAUST	1,005	70.0	6,720	0.16	CENTRIFUGAL	BACKWARD	AL	SPUN	AL	24x24	MOTORIZED	916	1.42	2.00	BELT	2 HP	XPROOF	1725	460	3	3.4	175	M005	M301	23 34 23	1,2,3,10,11
GRSC-EF-003	303-SCREENING	LOREN COOK	ACWB-225W9B	EXHAUST	1,005	70.0	6,720	0.16	CENTRIFUGAL	BACKWARD	AL	SPUN	AL	24x24	MOTORIZED	916	1.42	2.00	BELT	2 HP	XPROOF	1725	460	3	3.4	175	M005	M302	23 34 23	1,2,3,10,11
SPB-EF-001	702-PROCESS	LOREN COOK	AWD-36A11DA	EXHAUST	1,005	70.0	9,600	0.25	PROPELLER	-	AL	SPUN	STEEL	42.5x42.5	MOTORIZED	1020	0.97	0.75	DIRECT	1-1/2 HP	XPROOF	1140	460	3	3.0	343	M005	M701	23 34 23	1,2,3,9,10,11
SPB-EF-002	700-BLOWER	LOREN COOK	AWD-36A11DA	EXHAUST	1,005	70.0	9,620	0.25	PROPELLER	-	AL	SPUN	STEEL	42.5x42.5	MOTORIZED	1022	0.98	1.00	DIRECT	1-1/2 HP	XPROOF	1140	460	3	3.0	343	M005	M701	23 34 23	1,2,3,4,8,9,11
UV-EF-001	603-PUMP	LOREN COOK	ACWB-C6	EXHAUST	1,005	70.0	1,185	0.25	CENTRIFUGAL	BACKWARD	AL	SPUN	AL	12x12	MOTORIZED	1211	0.16	0.25	DIRECT	1/2 HP	ECM	1725	120	1	5.8	35	M005	M601	23 34 23	1,2,3
UV-EF-002	602-RESTROOM	LOREN COOK	SQN-D-70SQN17DM (VF)	EXHAUST	1,005	70.0	50	0.12	INLINE	BACKWARD	AL	SPUN	GS	10x10	GRAVITY	1332	0.01	0.02	DIRECT	1/20 HP	ECM	1725	120	1	-	41	M004	M601	23 34 23	5,6,7

NOTES:
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OPTION 1: PROVIDE ALL ALUMINUM CONSTRUCTION WITH STAINLESS STEEL HARDWARE AND VFD-RATED SEVERE-DUTY MOTOR. VENTURA AND DRIVE PLATE FOR PROPELLER FANS MAY BE STEEL WITH BAKED EPOXY POWDER COATING.
OPTION 2: PROVIDE AMCA LEVEL-A SPARK-RESISTANT CONSTRUCTION.
OPTION 3: PROVIDE ALUMINUM BIRD SCREEN.
OPTION 4: PROVIDE ALUMINUM BACKDRAFT DAMPER.
OPTION 5: PROVIDE POLYETHYLENE INTAKE GRILL.
OPTION 6: PROVIDE ALUMINUM WALL VENT WITH BACKDRAFT DAMPER.
OPTION 7: PROVIDE ELECTRONIC SPEED CONTROLLER.
OPTION 8: PROVIDE OSHA INTAKE SAFETY CAGE.
OPTION 9: ALUMINUM DISCHARGE HOOD.
OPTION 10: FURNISH VFD FOR INSTALLATION BY ELECTRICAL CONTRACTOR. COORDINATE VFD SELECTION AND INSTALLATION WITH MECHANICAL INSTRUMENTATION CONTRACTOR.
OPTION 11: PROVIDE EQUIPMENT WITH SAIL SWITCH IN DUCTWORK, HONEYWELL MODEL S688A1007 5-INCH SAIL SWITCH. INSTALL PER MANUFACTURER'S INSTRUCTIONS. COORDINATE WITH INSTRUMENTATION AND CONTROLS TO PROVIDE FLOW DETECTION FOR SYSTEMS.

DAMPER (FSD, DMPR) SCHEDULE

TAG	SERVES	MFR	MODEL	DUTY	TYPE	FLOW (CFM)	FRAME QTY	FRAME WIDTH (IN)	FRAME HEIGHT (IN)	FRAME DEPTH (IN)	FRAME THICK (GA)	FRAME MATL	BLADE STYLE	BLADE WIDTH (IN)	BLADE MATL	BLADE LINKAGE	SEALS EDGE	SEALS JAMB	FACE AREA (SQFT)	FACE VEL (FPM) *	FACE VEL (FPM) MAX	FRICTION (INWC) *	FRICTION (INWC) MAX	PRESS (INWC) *	PRESS (INWC) MAX	TEMP RATING (°F)	FIRE RATING (HR)	UL555S LEAKAGE CLASS	DETAIL DRAW	PLAN DRAW	SPEC
AGS-FSD-001	AGS-MAU-001	RUSKIN	FSD37SS	DYNAMIC	FIRE/SMOKE	3,375	1	20.00	22.00	5.00	16	SS-316	TRIPLE-V	6.00	SS-316	PARALLEL	SILICONE	SS COMP	3.1	1,105	2,000	0.083	0.100	1.9	4	450	1-1/2	1	M004	M403	23 33 00
AGS-FSD-002	AGS-MAU-002	RUSKIN	FSD37SS	DYNAMIC	FIRE/SMOKE	12,060	1	48.00	24.00	5.00	16	SS-316	TRIPLE-V	6.00	SS-316	PARALLEL	SILICONE	SS COMP	8.0	1,508	2,000	0.070	0.100	2.7	4	450	1-1/2	1	M004	M403	23 33 00
AGS-FSD-003	AGS-EF-001	RUSKIN	FSD37SS	DYNAMIC	FIRE/SMOKE	3,380	1	24.00	24.00	5.00	16	SS-316	TRIPLE-V	6.00	SS-316	PARALLEL	SILICONE	SS COMP	4.0	845	2,000	0.049	0.075	0.5	4	450	1-1/2	1	M004	M403	23 33 00
AGS-FSD-004	AGS-EF-002	RUSKIN	FSD37SS	DYNAMIC	FIRE/SMOKE	6,030	1	24.00	24.00	5.00	16	SS-316	TRIPLE-V	6.00	SS-316	PARALLEL	SILICONE	SS COMP	4.0	1,508	2,000	0.155	0.200	1.1	4	450	1-1/2	1	M004	M403	23 33 00
AGS-FSD-005	AGS-EF-003	RUSKIN	FSD37SS	DYNAMIC	FIRE/SMOKE	6,030	1	24.00	24.00	5.00	16	SS-316	TRIPLE-V	6.00	SS-316	PARALLEL	SILICONE	SS COMP	4.0	1,508	2,000	0.155	0.200	1.1	4	450	1-1/2	1	M004	M402	23 33 00
GRSC-FSD-001	GRSC-MAU-001	RUSKIN	FSD37SS	DYNAMIC	FIRE/SMOKE	469	1	14.00	24.00	5.00	16	SS-316	TRIPLE-V	6.00	SS-316	PARALLEL	SILICONE	SS COMP	2.3	201	2,000	0.003	0.025	2.6	4	450	1-1/2	1	M004	M301	23 33 00
GRSC-FSD-002	GRSC-MAU-002	RUSKIN	FSD37SS	DYNAMIC	FIRE/SMOKE	10,570	1	32.00	32.00	5.00	16	SS-316	TRIPLE-V	6.00	SS-316	PARALLEL	SILICONE	SS COMP	7.1	1,486	2,000	0.150	0.200	4.0	4	450	1-1/2	1	M004	M301	23 33 00
GRSC-FSD-003	GRSC-EF-001	RUSKIN	FSD37SS	DYNAMIC	FIRE/SMOKE	3,300	1	24.00	24.00	5.00	16	SS-316	TRIPLE-V	6.00	SS-316	PARALLEL	SILICONE	SS COMP	4.0	825	2,000	0.046	0.075	0.6	4	450	1-1/2	1	M004	M301	23 33 00
GRSC-FSD-004	GRSC-EF-002	RUSKIN	FSD37SS	DYNAMIC	FIRE/SMOKE	6,720	1	24.00	24.00	5.00	16	SS-316	TRIPLE-V	6.00	SS-316	PARALLEL	SILICONE	SS COMP	4.0	1,680	2,000	0.192	0.200	2.1	4	450	1-1/2	1	M004	M301	23 33 00
GRSC-FSD-005	GRSC-EF-003	RUSKIN	FSD37SS	DYNAMIC	FIRE/SMOKE	6,720	1	24.00	24.00	5.00	16	SS-316	TRIPLE-V	6.00	SS-316	PARALLEL	SILICONE	SS COMP	4.0	1,680	2,000	0.192	0.200	2.1	4	450	1-1/2	1	M004	M302	23 33 00
GRSC-FSD-006	GRSC-MAU-001	RUSKIN	FSD37SS	DYNAMIC	FIRE/SMOKE	578	1	18.00	14.00	5.00	16	SS-316	TRIPLE-V	6.00	SS-316	PARALLEL	SILICONE	SS COMP	1.8	330	2,000	0.007	0.025	2.6	4	450	1-1/2	1	M004	M301	23 33 00
SPB-DMPR-001	SPB-HOOD-001	RUSKIN	CD51	INTAKE	CONTROL	9,620	1	48.00	48.00	5.00	0.125"	AL	EXTRUDED	6.00	AL	OPPOSED	VINYL	SS COMP	16.0	601	2,000	-	-	-	2	250	-	-		M701	23 33 00
SPB-FSD-001	SPB-MAU-001	RUSKIN	FSD37SS	DYNAMIC	FIRE/SMOKE	9,600	1	30.00	30.00	5.00	16	SS-316	TRIPLE-V	6.00	SS-316	PARALLEL	SILICONE	SS COMP	6.3	1,536	2,000	0.160	0.200	3.6	4	450	1-1/2	1	M004	M701	23 33 00
SPB-FSD-002	SPB-EF-001	RUSKIN	FSD37SS	DYNAMIC	FIRE/SMOKE	9,600	1	42.50	42.50	5.00	16	SS-316	TRIPLE-V	6.00	SS-316	PARALLEL	SILICONE	SS COMP	12.5	765	2,000	0.018	0.050	0.9	4	450	1-1/2	1	M004	M701	23 33 00

NOTES:
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9400 WARD PARKWAY
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Burns & McDonnell Engineering Co, Inc
816-333-9400
Licensee No. 000165

NO.	DATE	BY:	CHECKED:	DESCRIPTION
1	01/30/2026	TDP	JRW	ADDENDUM 005
0	12/19/2025	TDP	JRW	ISSUED FOR BID

REVISIONS

JEREMY R. WALKER
MECHANICAL
PE-2022003792

FOR WSD USE:

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

MECHANICAL SCHEDULES

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
T. PARKER	M. HUBERT	01/30/2026	34W	-	-

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	M003

PROJECT NO. 81000927

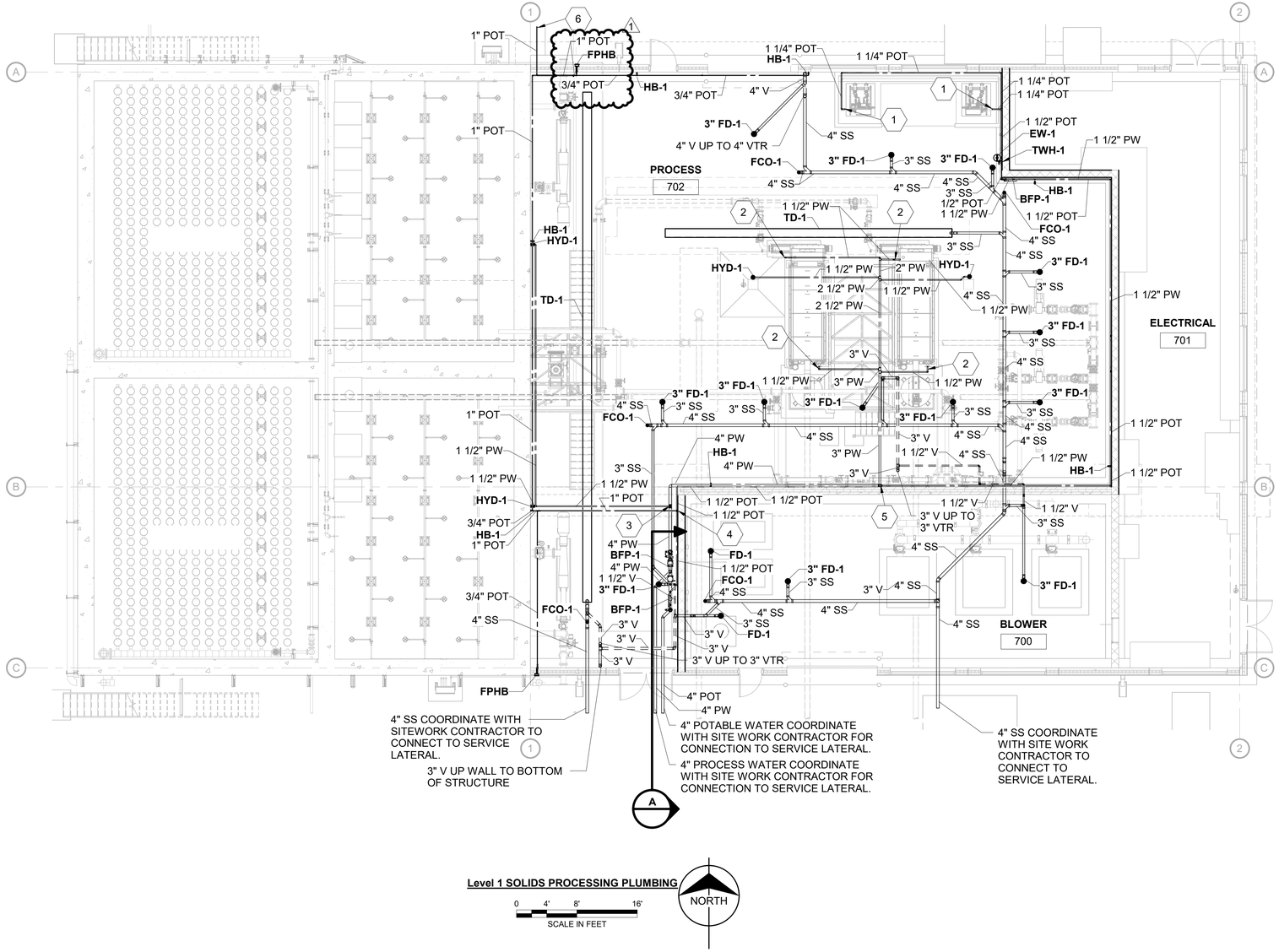
SHEET 403 OF 643

PLAN NOTES

1. ALL PROCESS WATER SHALL RUN ALONG BOTTOM OF STRUCTURE UNLESS OTHERWISE NOTED.
2. PROVIDE SHUT-OFF VALVES, UNIONS AND ALL OTHER REQUIRED ACCESSORIES FOR CONNECTION TO EQUIPMENT AND HOSE BIBS.
3. ALL PIPING BELOW STRUCTURES SHALL BE ENCASED PER STRUCTURAL DETAILS. REFERENCE SHEET S006. ENCASEMENT SHALL EXTEND 4 FEET BEYOND THE EDGE OF FOOTING.

KEY NOTES

1. PROVIDE 1 1/4" PW TO POLYMER FEED SKID.
2. PROVIDE 1 1/2" PW DOWN TO ROTARY DRUM THICKENER.
3. 1 1/2" PW UP TO BOTTOM OF STRUCTURE.
4. 1" POT UP TO BOTTOM OF STRUCTURE.
5. 3" PW UP TO BOTTOM OF STRUCTURE.
6. 1" POT BELOW FROST LINE TO ODOR CONTROL UNIT. COORDINATE ROUTING WITH SITE WORK CONTRACTOR.

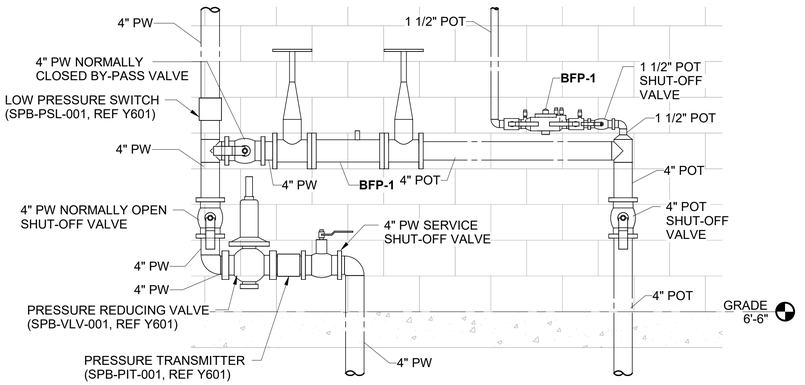


Level 1 SOLIDS PROCESSING PLUMBING

0 4' 8' 16'

SCALE IN FEET

NORTH



SECTION

WATER SERVICE SECTION

0 1' 2' 3'

SCALE IN FEET

NO.	DATE	BY:	CHECKED:	DESCRIPTION
1	01/30/2026	LT	JRW	ADDENDUM 005
0	12/19/2025	LT	JRW	ISSUED FOR BID

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

SOLIDS PROCESSING BUILDING PLUMBING PLAN

STATE OF MISSOURI — JEREMY RYAN WALKER — NUMBER PE-2022003792 — PROFESSIONAL ENGINEER

01/30/2026

JEREMY R. WALKER
MECHANICAL
PE-2022003792

FOR WSD USE:

KCWATER

CUSTOM ENGINEERING
MECHANICAL & ELECTRICAL ENGINEERING

DuBois Consultants
CIVIL + STRUCTURAL ENGINEERING

WELLNER architects

BURNS McDONNELL
9400 WARD PARKWAY
KANSAS CITY, MO 64114
Burns & McDonnell Engineering Co, Inc
816-333-9400
Licensee No. 000165

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
L. TATUM	M. HUBERT	01/30/2026	34W	-	-

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

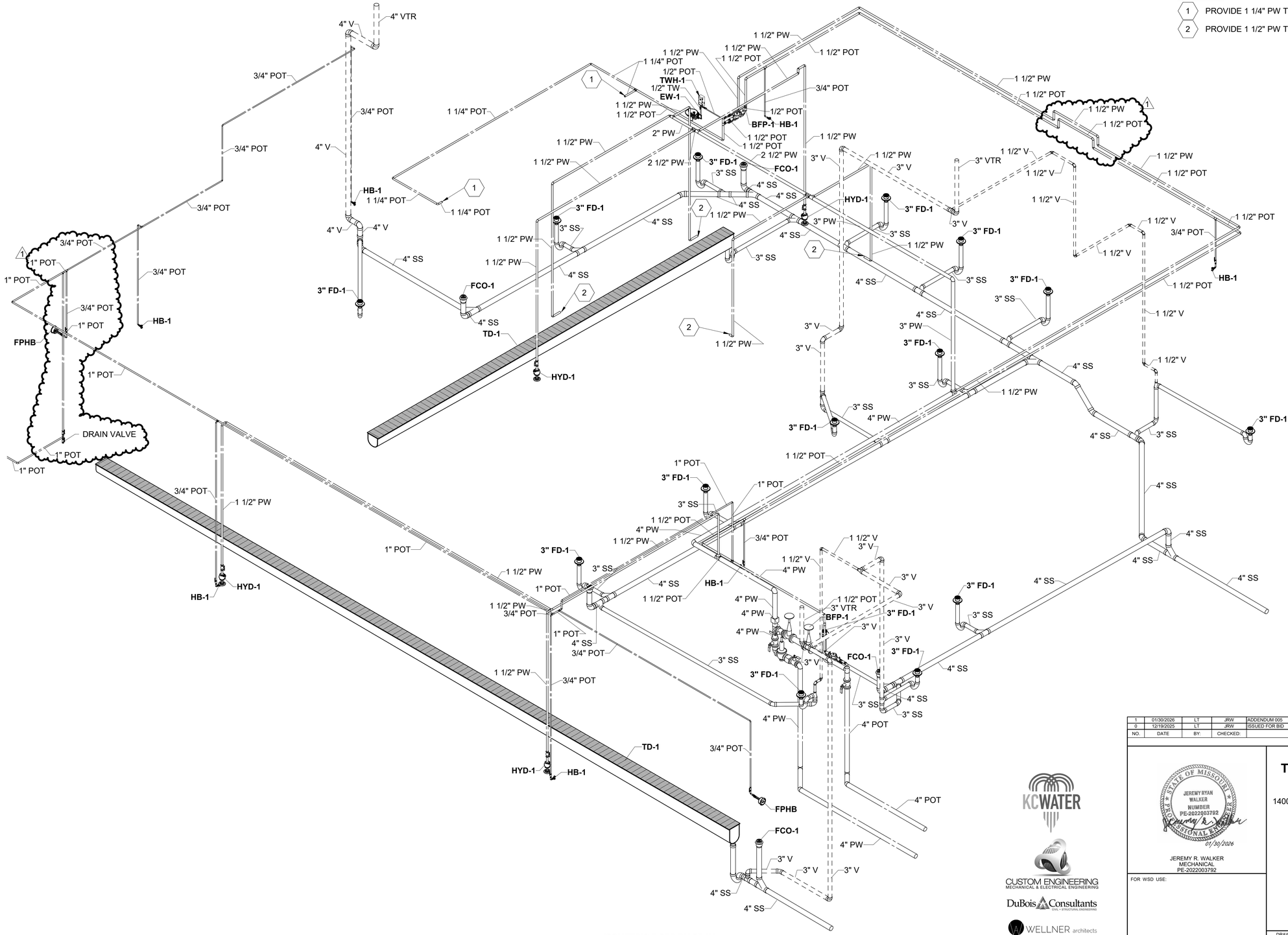
CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	P701

PROJECT NO. 81000927

SHEET 468 OF 643

KEY NOTES

1. PROVIDE 1 1/4" PW TO POLYMER FEED SKID.
2. PROVIDE 1 1/2" PW TO ROTARY DRUM THICKENER.



ISOMETRIC RISER DIAGRAM
NOT TO SCALE

NO.	DATE	BY:	CHECKED:	DESCRIPTION
1	01/30/2026	LT	JRW	ADDENDUM 005
0	12/19/2025	LT	JRW	ISSUED FOR BID

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

SOLIDS PROCESSING BUILDING ISOMETRIC RISER DIAGRAM

STATE OF MISSOURI — JEREMY RYAN WALKER — NUMBER PE-2022003792 — PROFESSIONAL ENGINEER
01/30/2026

JEREMY R. WALKER
MECHANICAL
PE-2022003792

FOR WSD USE:

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Licensee No. 000165

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
L. TATUM	M. HUBERT	01/30/2026	34W	-	-

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	P721

PROJECT NO. 81000927 — SHEET 469 OF 643

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

ADDENDUM NUMBER 006

Project/Contract Number: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrade

ISSUE DATE: **February 19, 2026**

Bidders are hereby notified that the Bidding and Contract Documents for the above project, for which Bids are to be received on **February 24, 2026**, are amended as follows:

Information to Bidders The following is provided to Bidders for information only:

Specification Changes:

1. 00005 Construction Certification Page – Architectural
    a. *Added section 07 13 00 and 07 14 16*

2. 03 15 50 – Vapor Retarder
    a. *Section 2.01-B.4.*
        i. *Delete:* Solids Handling Building
        ii. *Replace with:* Solids Handling Building and Solids Handling Basin

3. 07 13 00 – Sheet Applied Waterproofing
    a. *Add specification section*

4. 07 14 16 – Cold Fluid-Applied Waterproofing
    a. *Add specification section*

5. 07 16 00 – Bituminous Dampproofing
    a. *Section 1.02-A.1*
        i. Delete: Coal Tar-Epoxy dampproofing for all below grade exterior walls except those containing potable water. Refer to structural drawings.
        ii. Replace with:

            B. Coal Tar-Epoxy dampproofing for all below grade exterior walls with occupiable spaces, non-liquid-containing structures (vaults, manholes, etc..) and structures with interior protective coatings, including the following locations:
                1. AGS Basin – Pipe Gallery and Pump Room
                2. Solids Handling Building – Foundation, Pipe Trench and Sludge Holding Tanks
            C. Where below grade walls and slabs are exposed to groundwater, a waterproofing system, in lieu of dampproofing, shall be provided per Section 07 14 16 Cold Fluid-Applied Waterproofing and Section 07 13 00 Sheet Applied Waterproofing.
            D. Not to be used in areas in contact with potable water.

b. *Insert Section 3.01 - Examination and Renumber Sections 3.02 through 3.04:*

3.01 EXAMINATION:

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
B. Surface Condition: Before applying dampproofing materials, examine substrate conditions.
C. Proceed with installation once unsatisfactory conditions have been corrected.

c. *Insert 3.02-C and renumber Sections D through H:*

C. Formed Concrete Surfaces: Remove fins and projections. Fill voids, form-tie holes, and other defects greater than 1/4 inch (6 mm) in depth.

6. 09 90 00 – Protective Coatings
   a. *Section 2.04-F.1.b*
      i. Delete: Reference: Architectural and Process Drawings
      ii. Replace with: Reference: Process Drawings

   b. *Section 2.04-G*
      i. Delete: Item: Interior Chemical Containment Area: Polymer
      ii. *Replace with:* Item: Interior Chemical Containment Area: Polymer Concrete Containment

   c. *Section 2.04-G.1.b*
      i. *Delete:* Location: As indicated on drawings…
      ii. *Replace with:*
         b. Reference: Process Drawings
         c. Location: Polymer containment structure inside the Solids Handling Building; exposed concrete including curbing, floor, tank pads, sumps, and top of curb wall.

   d. *Section 2*.04-H
      i. *Delete*: Item: Influent Wet Well, Diversion Structure, Covered Sludge Holding Tank.
      ii. *Replace with*: Headworks Channels.

   e. *Section 2*.04-H.1.b
      i. *Delete*: Location: As indicated on drawings including the interior face of concrete wall, concrete floor, and top of concrete wall.
      ii. *Replace with*:
         b. Reference: Structural Drawings
         c. Location: All interior concrete channel surfaces exposed to wastewater.

   f. *Add Section 2.04-L*

L. Item: Influent Wet Well/Pump Station, Coarse Screening Structure, covered Thickened Sludge Holding Tanks. Concrete Immersion: Raw sewage and Ozone gas
   1. Provide the following Tnemec system or approved Sherwin Williams or Carboline equal meeting the design criteria listed below:
      a. Coating System:
         (1) Surface Preparation: Allow new cast-in-place concrete to cure a minimum of 28 days at 75°F (24°C). Verify concrete dryness and prepare concrete surfaces in accordance with NACE No. 6/SSPC-SP13 Joint Surface Preparation Standards and ICRI Technical Guidelines. Moisture vapor transmission should not exceed three lbs. per 1,000 sq. ft. in a 24-hour period. Relative humidity should not exceed 80%. Abrasive blast, shot-blast or mechanically abrade concrete surfaces to remove laitance, curing compounds, hardeners, sealers and other contaminants and to provide a minimum ICRI-CSP 5 or greater surface profile. Large cracks, voids and other surface imperfections should be filled with a recommended filler or surfacer.
         (2) Primer: Series 251SC @ 4.0-12.0 mils D.F.T.
         (3) Base Coat: Series 252SC Chembloc MCK System w/fiberglass mat reinforcement per manufacturer's direction @ 60.0 - 80.0 mils.
         (4) Saturant Coat: Series 252SC Chembloc @ 8.0-20.0 mils.
         (5) Top Coat: Series 252SC Chembloc @ 4.0-12.0 mils. System Total D.F.T. of 76.0-124.0 mils minimum.
      b. Location: All interior exposed concrete including face of concrete channel wall, concrete floor, concrete ceiling, and top of concrete wall.

7. 32 31 13 – Chain Link Fence and Gates
   a. *Section 2.02-C*
      i. *Delete:* Fence Fabric Height: 7-feet
      ii. *Replace with:*
         C. Total Fence Height: 9-feet
            1. Fence Fabric Height: 8-feet.
            2. Height of Barbed Wire: 1-foot.

   b. *Section 2.*04-A
      i. *Delete:* No. 9-gate, 2-inch diamond mesh chain-link fabric with PVC coated.
      ii. *Replace with:* No. 8-gage (9-gage core) 1-inch diamond mesh chain-link fabric with PVC coating.

   c. *Section 2.04*
      i. *Add:*
         E. Color: ASTM F934-Black

   d. *Add Section 2.06*

2.06 BARBED WIRE:
   A. 12-1/2 Gauge 4 point Class 3
   B. Number of Strands: 3
   C. Barbed Wire Height: 12-inches (Quantity 3 strands above fence fabric)
      1. Angled at 30 degree to 45 degree angle above horizon away from the facility.
      2. Vertical on sliding cantilevered gate.

Drawings Changes

1. A003 – Added callouts for high-temp waterproofing and nailer base to details 01, 02, 05, 06.
2. A410 – Showed extents of dampproofing
3. A600 – Rotated building viewport to correct orientation
4. A603 – Removed TPO roofing membrane callout and adjusted roof sloping for elimination of gutter
5. A701 – Corrected scale
6. A730 – Showed extents of dampproofing
7. C136 – Revised fence and gate details to 8’ high, added barbed wire, added mow strip detail
8. D703 – Added callout for chemical containment coating
9. D707 – Added callout for chemical containment coating
10. D404 – Added clarification on blower piping type
11. D413 – Added clarification on blower piping type
12. D414 – Added clarification on blower piping and insulation.
13. D415 – Added clarification on blower piping and insulation.
14. D416 – Added clarification on blower piping type
15. E202 – Revised circuit callouts
16. E291 – Revised circuit callouts
17. E612 – Added keyed notes
18. M002 - Revised GRSC-MAU-002 air unit schedule. Added option 3 note to provide spark resistant supply fan constructed in accordance with AMCA 99 for Type A or Type B spark resistance. Revised AIC ratings.
19. S202 – Added note 9 clarifying waterproofing
20. S207 – Added callouts clarifying waterproofing extents
21. S208 – Added vapor retarder callout and modified sections clarifying waterproofing and vapor retarder
22. S304 – Added keyed note 1 clarifying coatings
23. S308 – Added keyed note 1 clarifying coatings
24. S309 – Added keyed note 1 clarifying coatings
25. S702 – Revised grade beam extension (eliminated approximately 10’ of duplicated grade beam)

26. S703 – Revised grade beam extension (eliminated approximately 10’ of duplicated grade beam)
27. S704 – Revised grade beam extension (eliminated approximately 10’ of duplicated grade beam)
28. S707 – Revised grade beam extension (eliminated approximately 10’ of duplicated grade beam)
29. S709 – Revised grade beam extension (eliminated approximately 10’ of duplicated grade beam)

Q1.	Drawing No. M002 “Air Unit Schedule” Option 3 states: “Provide spark-resistant supply fans constructed in accordance with AMCA 99 for Type-A or Type-B compliance with motor circuit using methods and materials consistent with NEC Class-1 Group-D Division-2 Hazardous Locations.” Please confirm that Single Inlet Single Width Fans with motors and bearings out of the airstream and aluminum impeller and ring about the opening through which the shaft passes are required. Under this interpretation it would be assumed that standard Double Width Double Inlet Fans with aluminum wheel and cone and bearings/motors in the airstream are not acceptable.
A1.	**Fans shall be fabricated in accordance with Air Moving and Control Association (AMCA) Type A or Type B spark resistant construction where serving hazardous location per NFPA 820 9.2.3 per Note 3 on equipment schedule. It is the responsibility of the fan manufacturer to show that fan is fabricated as specified. This shall be indicated on equipment cut sheets. Drawing M002 revised.**
Q2.	In specification 41 22 00 - 2.02 - B - 4 - a It mentions that the pendant needs to be suspended from a cable reel on the trolley hoist. Usually, the pendant that hangs from the hoist does not hang from a cable reel unless there are multiple levels in which the operator will need to pull the pendant down like a curtain. Is this what KCMO wants?
A2.	**The hoist controls are intended to be used on multiple levels. The AGS has a platform at grade and the lower level where the equipment is located. The Influent PS will need to have access to controls to remove the motors at the bottom of the wet well. Another alternative that is acceptable in lieu of a cable reel is a torque reel/balancer.**
Q3.	In addendum No. 2 MBE and WBE goals were added. Can you please clarify which certifying agency will be used to determine MBE/WBE acceptance? Section 00990 referenced notes the state of Missouri MRCC directory however this is DBE only. Are we to utilize the KCMO MBE / WBE approved DBE list?
A3.	**MDNR is the certifying agency to determine MBE/WBE acceptance. We have approval from MDNR to use KCMO’s MBE/WBE as the DBE directories to fulfill the DBE requirements.**
Q4.	What is the width of the mow strip for the site fencing. Reference detail on Sheet C136
A4.	**Mow strip is nominally 12” wide. Detail added to revision 1 of C136 for clarity.**
Q5.	In specification 32 31 13 it calls the fence to be 7' in height however fence detail on C136 shows a 6' fence. Can you please verify the height wanted?

A5.	**As stated in amendment 4, fence shall be nominally 8' high with an additional 3 strand barbed wire approximately 12" high for a total height of 9'. Cantilevered entry gate shall be nominally 8' high with post height of 9'-6", fabric height of 7', and 3-strand barbed wire atop. Fence details are revised on sheet C136 and specification 32 31 13 is revised.**
Q6.	Does KC Water intend to spec/use any crystalline waterproofing and or antimicrobial admixtures for waterproofing the new underground structures such as the AGS Basin, Wet Wells, and Headworks?
A6.	**Specification 03 30 00 – Concrete did not include any admixtures for antimicrobial or waterproofing in the concrete for this project for these structures.**
Q7.	Regarding the pre-engineered canopy at the UV disinfection facility, the listed manufacturer Austin Mohawk cannot provide a product that exactly demonstrates what is being asked for in the specification section 10 73 16. In addition to that their canopy is not designed to have a TPO roof membrane system on top of it as is depicted on sheet A603. It is weather resistant without a TPO membrane roof. Austin Mohawk only provides an embossed deck pan that is designed to be exposed to the open air. Please confirm that this will be acceptable. If it is not, then please provide additional design information including cut sections to direct us in a path where real pricing can be obtained.
A7.	**This is acceptable. The note for a TPO roof membrane is removed from sheet A603 to reflect no TPO roofing necessary for the pre-engineered canopy.**
Q8.	The coiling door specification (08 33 23) lists explosion proof operators at listed locations. Will these be required?
A8.	**Overhead doors and operators will need to be explosion proof in Class I Div II building and are noted on the door schedules.**
Q9.	Please confirm if the lab equipment will be procured from the base bid or part of the furniture allowance.
A9.	**This is part of the furniture allowance**
Q10.	Are the interior 8" CMU walls at the admin building supposed to be filled with grout or perlite insulation?
A10.	**The CMU will need to be grouted per Structural drawings and specifications and the remaining cells will need to be filled with Perlite for sound transmission purposes.**
Q11.	The orientation of the UV building with true north is not square on sheet A603.
A11.	**It appears you are referring to the north arrow on A600 which is incorrectly pointing 'up' on the sheet. Viewport on sheet A600 is now rotated to show correct building orientation on revised drawing. The UV building is square. The building should be laid out on site per civil. Any slight rotation should be ignored.**
Q12.	Please review and confirm scale for the AGS basin in the architectural sheets (A410).
A12.	**Drawing is 3/64 scale. Drawing scale is corrected and sheet A410 is revised. Drawings shall not be scaled off of for accuracy. Please refer to dimensions.**

Q13.	Please review and confirm scale for the solids handling building in the architectural sheets (A701).
A13.	**Drawing is 1/8 scale. Drawing scale is corrected and sheet A701 is revised. Drawings shall not be scaled off of for accuracy. Please refer to dimensions.**
Q14.	Section 07 16 00 says to provide coal tar-epoxy dampproofing for all below grade exterior walls excepting those which contain potable water. However, the only place that show it being required in the drawings is on sheet A440 at the AGS basin and on sheet D202 at the influent pump station. Please confirm where this applies and if any structures besides the IPS and AGS basin will get dampproofing below grade.
A14.	**Dampproofing applies to all below-grade exterior walls with occupiable spaces, non-liquid-containing structures (such as vaults, manholes, etc…) and structures with interior protective coatings. Specification 07 16 00 is revised for location clarity. At the Influent Pump Station and Coarse Screen Channels, waterproofing is required since structures are partially below the water table. Specifications 07 13 00 – Sheet Applied Waterproofing and 07 14 16 – Cold Fluid Applied Waterproofing are added. Drawings A410, A730, S202, S207, S208, S304, S308, and S309 are revised to provide dampproofing and waterproofing clarity.**
Q15.	Regarding section 07 16 00, will all below grade walls get the dampproofing at the AGS basin or will it only be on the pipe gallery / utility corridor walls as shown in the drawings?
A15.	**Only the below-grade exterior walls that open to the pump room and pipe gallery (mainly the south and east walls with wraparound on the pump room west wall and pipe gallery north wall). Dampproofing should be extended slightly beyond to Basin 4 north wall and WLC tank west wall to prevent vapor migration through the concrete to the pump room or pipe gallery. Drawing A410 is revised to show dampproofing extents.**
Q16.	Regarding section 09 90 00 there are several coating systems listed that do not show up in the drawing sheets. a. 2.04 G - please confirm the room(s) that will receive the interior chemical containment coating. b. 2.04 H - please confirm the structures that will receive the concrete immersion raw sewage coating. Is it only the influent wet well, diversion structure, and covered sludge holding tank? Please advise. c. 2.04 I - will this resinous flooring system only be required at the Administration building? Please confirm. d. 2.04 K - what part of the project will receive this exterior secondary chemical containment coating? Please confirm.
A16.	**a. The interior chemical containment coating is located at the polymer feed chemical area in the Solids Processing Building. Reference drawing D701 for location. Drawings D703 and D707 are revised to call out chemical containment coating. Section 09 90 00-2.04-G revised to call out specific location.** **b. Tnemec G435 Perma-Glaze raw sewage coating shall be applied to the Influent Wet Well/Pump Station, Coarse Screening Structure, Covered Sludge Holding**

	Tanks, and Headworks influent screening channels and Headworks effluent channels. Specification section 2.04-H is revised to state this. **c. Yes** **d. The sodium hydroxide chemical containment area as shown on D205. Section 09 90 00-2.04-K revised to call out specific location.**
Q17.	Please provide the prospective Bidders with all as-built information available for the existing Todd Creek WWTP facility that is to be demolished as part of this contract.
A17.	**These are provided upon request for any contractors that wish to see the drawings.**
Q18.	Please clarify to the prospective Bidders who will be responsible for any required dewatering, sludge, or solids handling as part of the closure and demolition of the existing Todd Creek WWTP facility that is to be demolished as part of this contract.
A18.	**KCW on-call sludge contract would handle any cleaning/hauling. Contractor will need to coordinate with KCW and Engineer after lagoon closure plan is finalized and accepted by MDNR.**
Q19.	Are there any known or stipulated bid quantities of dewatering, sludge, or solids handling that is to be included as part of the Bidders base bid proposal as part of the closure and demolition of the existing Todd Creek WWTP facility that is to be demolished as part of this contract?
A19.	**No**
Q20.	Specification section 31 66 12 specifies 'cast-in-place ground improvement elements (CGEs)' and requires the Contractor to secure the services of a Professional Engineer licensed in Missouri to design CGEs and the load transfer platform (LTP) "delegated design." The geotechnical investigation report also references rammed aggregate piers (RAP). If the Contractor is responsible to provide an Engineered system, will there be consideration for alternative methods other than cast-in-place ground improvement elements (CGEs)? Based on the preliminary geotechnical investigation and provided soils data, aggregate piers may be viable option for ground improvements to satisfy the performance requirements at a more economical cost to the overall project.
A20.	**RAP is excluded due to poor past experiences and site characteristics at the discretion of the design Geotechnical Engineer.**
Q21.	Currently, there are no plan sheets, specification, geotechnical information that list, depict, or detail what structures are to receive the ground improvement elements, cast-in-place, rammed aggregate piers, or otherwise. Please provide the prospective Bidders with further clarification defining what specific structures are to receive the ground improvement elements, cast-in-place, rammed aggregate piers, or otherwise.
A21.	**Drawing D158 shows the requested information. Per addendum 006 answer 24, the IPS Electrical Building does NOT need to be on ground improvements.**
Q22.	Spec 3410 section 2.10 does not provide the thin brick manufacturer or the type/color of brick desired. Please specify the thin brick desired.
A22.	**Basis of design shown in public and private renderings is to be Sioux City Brick Fine Art Smooth Modular and will need to be approved by owner. Provide a full range of colors to be approved by owner/Architect.**

Q23.	Elevations say precast is to be panel with integral color. I cannot find a description of what color is desired in the spec. Please provide the desired color of the precast.
A23.	**Basis of design shown in public and private renderings is to be Sandstone and will need to be approved by owner. Provide a full range of Buff colors to be approved by owner/Architect.**
Q24.	We are not seeing drawing sheets Y407, Y704, Y706, or D116 included in Addendum 3 as instructed in a previous response. Please advise.
A24.	**These were included in Addendum 002.**
Q25.	Section 01 43 39 references mock-up requirements; however, the contract documents do not clearly define whether **in-place mock-ups** or **stand-alone mock-ups** are required. Please confirm the intended requirement. If **stand-alone mock-ups** are required, the Architect/Engineer must provide drawings and specifications defining the required size, scope, materials, and level of detail. Without this information, the mock-up requirements cannot be accurately priced or scheduled, and any additional scope, cost, or time impacts resulting from clarification will require adjustment to the Contract.
A25.	**Stand-alone mock-ups are required. Mockup drawing will be forthcoming.**
Q26.	The specifications reference BIM requirements under Section 01 34 00; however, the extent of the General Contractor's responsibilities is not clearly defined. Please clarify the GC's scope with respect to BIM. Specifically, confirm whether the GC is required to coordinate with an existing BIM model and/or record as-built information provided by the Owner/Engineer, or if the GC is responsible for developing and maintaining a complete BIM design model.
A26.	**BIM model will be developed by the Engineer/Designer. Contractor is to retain and provide any necessary BIM information from construction record documents to the Engineer/Designer at the level of detail stated in Section 01340 – Project BIM Coordination.**
Q27.	Who is responsible for the sludge holding cell closure plan?
A27.	**KCW's engineer of record will handle sludge holding cell closure plan with MDNR**

Bidding Requirements:

1. N/A

Contracting Requirements:

1. Delete and replace the following section(s):
    a. Delete Document, Section 00005 CONSTRUCTION CERTIFICATION PAGE and replace with the Following Document Section 00005 CONSTRUCTION CERTIFICATION PAGE

Specifications:

1. Delete and replace the following section(s):

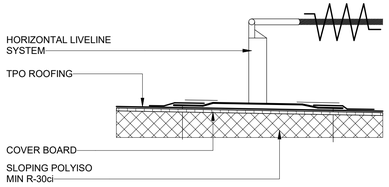
    a. Delete Document, Section 03 15 50 – VAPOR RETARDER and replace with the Following Document Section 03 15 50 – VAPOR RETARDER
    b. Delete Document, Section 07 13 00 – SHEET APPLIED WATERPROOFING and replace with the Following Document Section 07 13 00 – SHEET APPLIED WATERPROOFING
    c. Delete Document, Section 07 14 16 – COLD FLUID-APPLIED WATERPROOFING and replace with the Following Document Section 07 14 16 – COLD FLUID-APPLIED WATERPROOFING
    d. Delete Document, Section 07 16 00 – BITUMINOUS DAMPPROOFING and replace with the Following Document Section 07 16 00 – BITUMINOUS DAMPPROOFING
    e. Delete Document, Section 09 90 00 – PROTECTIVE COATINGS and replace with the Following Document Section 09 90 00 – PROTECTIVE COATINGS
    f. Delete Document, Section 32 31 13 – CHAIN LINK FENCE AND GATES and replace with the Following Document Section 32 31 13 – CHAIN LINK FENCE AND GATES

Drawings:

1. Delete and replace the following drawings(s):
    a. Delete Drawing, A003 and Replace with the Following Drawings, A003
    b. Delete Drawing, A410 and Replace with the Following Drawings, A410
    c. Delete Drawing, A600 and Replace with the Following Drawings, A600
    d. Delete Drawing, A603and Replace with the Following Drawings, A603
    e. Delete Drawing, A701 and Replace with the Following Drawings, A701
    f. Delete Drawing, A730 and Replace with the Following Drawings, A730
    g. Delete Drawing, C136 and Replace with the Following Drawings, C136
    h. Delete Drawing, D703 and Replace with the Following Drawings, D703
    i. Delete Drawing, D707 and Replace with the Following Drawings, D707
    j. Delete Drawing, D404 and Replace with the Following Drawings, D404
    k. Delete Drawing, D413 and Replace with the Following Drawings, D413
    l. Delete Drawing, D414 and Replace with the Following Drawings, D414
    m. Delete Drawing, D415 and Replace with the Following Drawings, D415
    n. Delete Drawing, D416 and Replace with the Following Drawings, D416
    o. Delete Drawing, E202 and Replace with the Following Drawings, E202
    p. Delete Drawing, E291 and Replace with the Following Drawings, E291
    q. Delete Drawing, E612 and Replace with the Following Drawings, E612
    r. Delete Drawing, M002 and Replace with the Following Drawings, M002
    s. Delete Drawing, S202 and Replace with the Following Drawings, S202
    t. Delete Drawing, S207 and Replace with the Following Drawings, S207
    u. Delete Drawing, S208 and Replace with the Following Drawings, S208
    v. Delete Drawing, S304 and Replace with the Following Drawings, S304
    w. Delete Drawing, S308 and Replace with the Following Drawings, S308
    x. Delete Drawing, S309 and Replace with the Following Drawings, S309
    y. Delete Drawing, S702 and Replace with the Following Drawings, S702
    z. Delete Drawing, S703 and Replace with the Following Drawings, S703
    aa. Delete Drawing, S704 and Replace with the Following Drawings, S704
    bb. Delete Drawing, S707 and Replace with the Following Drawings, S707

cc. Delete Drawing, S709 and Replace with the Following Drawings, S709

NOTE: Bidders must acknowledge receipt of this Addendum by listing the number and date, where provided, on the Bid Form - Document 00410.



SECTION 14
FALL PROTECTION SYSTEM
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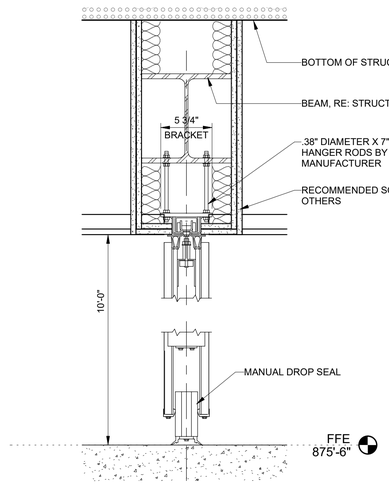
NOT TO SCALE
SCALE IN FEET



SECTION 13
OPERABLE
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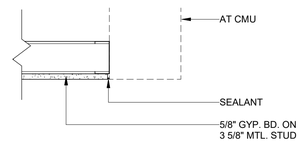
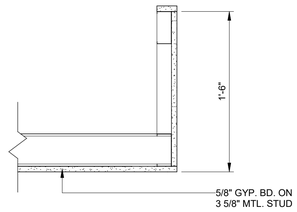
SCALE IN FEET



SECTION 04 A810
INTERIOR CLG. SOFFIT AT CMU
0 16" 32" 64'
NOT TO SCALE
SCALE IN FEET



SECTION 03 A810
INTERIOR CEILING SOFFIT
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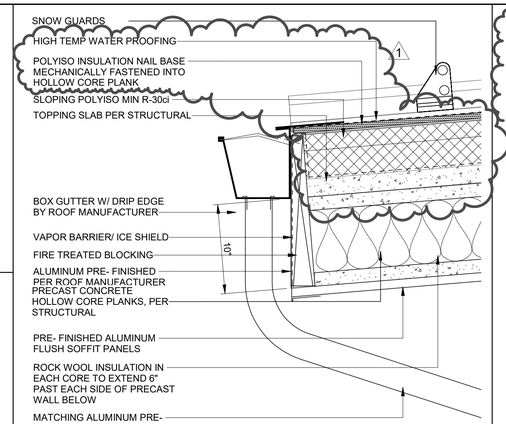
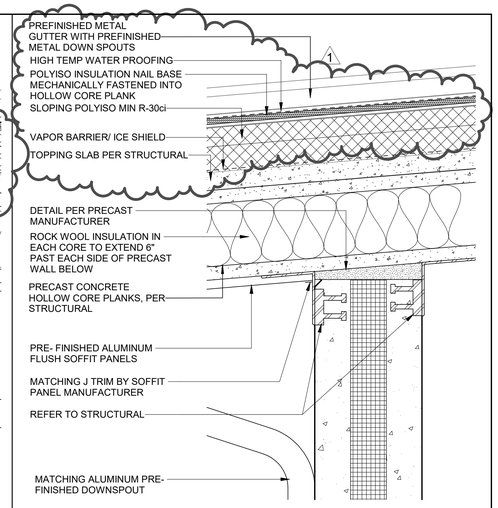


DETAIL 02 A830
SLOPING ROOF GUTTER
0 0 1€1/2' 32' 1' €1 1/2'
SCALE IN FEET



DETAIL 01 A830
SLOPING ROOF @ PRECAST
0 0 1€1/2' 32' 1' €1 1/2'
SCALE IN FEET

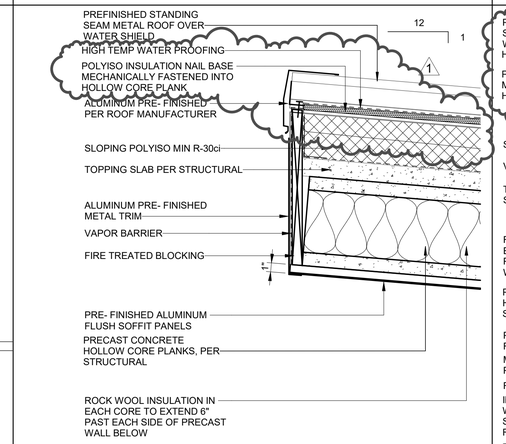
HEAD- FIBERGLASS FRAME AT PRECAST (08161.3)

SECTION 09
EXTERIOR DOOR HEAD
0 16" 32" 64'
NOT TO SCALE
SCALE IN FEET

JAMB- FIBERGLASS FRAME AT PRECAST (08161.3)

SECTION 08
EXTERIOR DOOR JAMB
0 16" 32" 64'
NOT TO SCALE
SCALE IN FEET

SECTION 07 A840
CANOPY DETAIL
0 16" 32" 64'
NOT TO SCALE
SCALE IN FEET



DETAIL 06 A830
SLOPING ROOF EAVE
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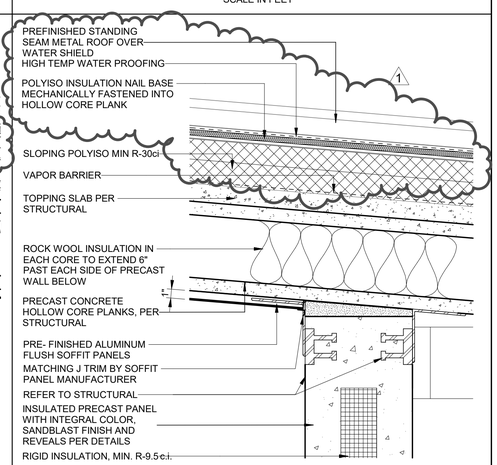
SCALE IN FEET



DETAIL 05 A830
SLOPING ROOF @ PRECAST 2
0 0 1€1/2' 32' 1' €1 1/2'
SCALE IN FEET

FIBERGLASS FRAME AT CMU (08161.3)

SECTION 12
INTERIOR DOOR HEAD
0 16" 32" 64'
NOT TO SCALE
SCALE IN FEET

FIBERGLASS FRAME (08161.3)

SECTION 11
INTERIOR DOOR JAMB
0 16" 32" 64'
NOT TO SCALE
SCALE IN FEET

SECTION 10
O.H. COILING DOOR HEAD/JAMB
0 16" 32" 64'
NOT TO SCALE
SCALE IN FEET

NO.	DATE	BY:	CHECKED:	DESCRIPTION
0	12/19/25	JB	BK	ISSUED FOR BID
1	02/05/26	JB	BK	ADDENDUM 6

REVISIONS

STATE OF MISSOURI
JASON SCOTT BARKER
NUMBER A-2005001198
REGISTERED ARCHITECT

JASON SCOTT BARKER
ARCHITECTURAL
A-2005001198

FOR WSD USE:

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

TYPICAL DETAILS

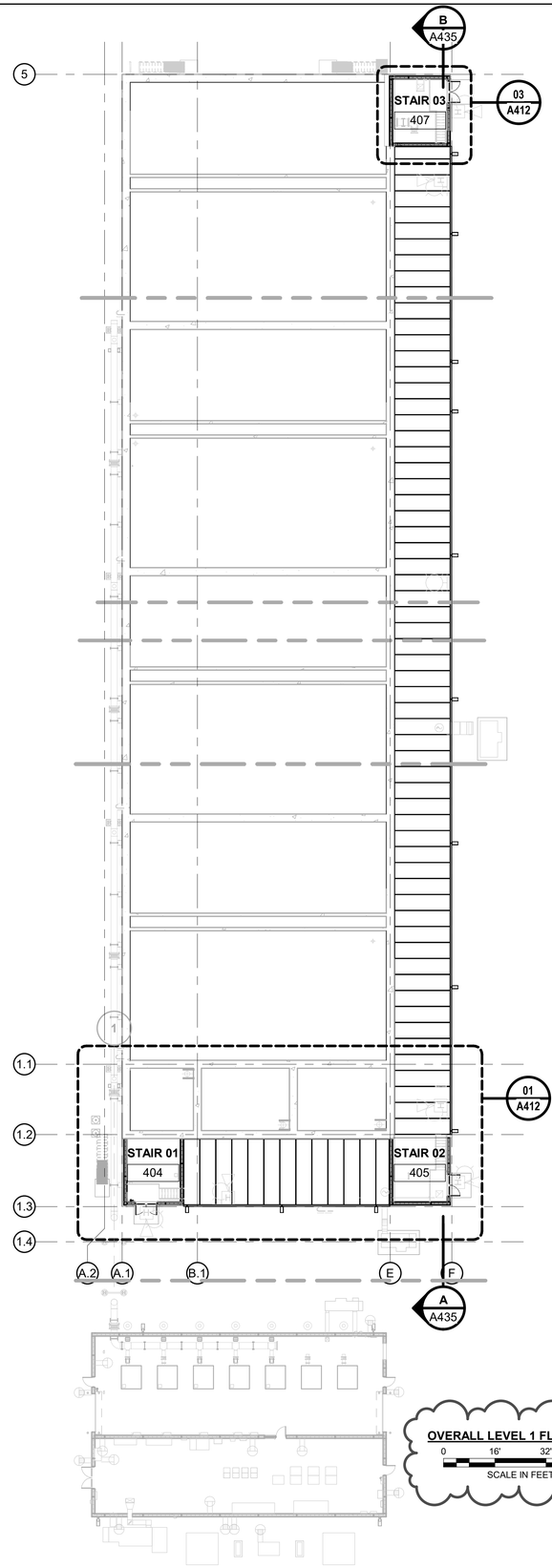
KCWATER
CUSTOM ENGINEERING MECHANICAL & ELECTRICAL ENGINEERING
DuBois Consultants CIVIL + STRUCTURAL ENGINEERING
WELLNER architects
BURNS McDONNELL
9400 WARD PARKWAY
KANSAS CITY, MO 64114
Burns & McDonnell Engineering Co, Inc
816-333-9400
Licensee No. 000165

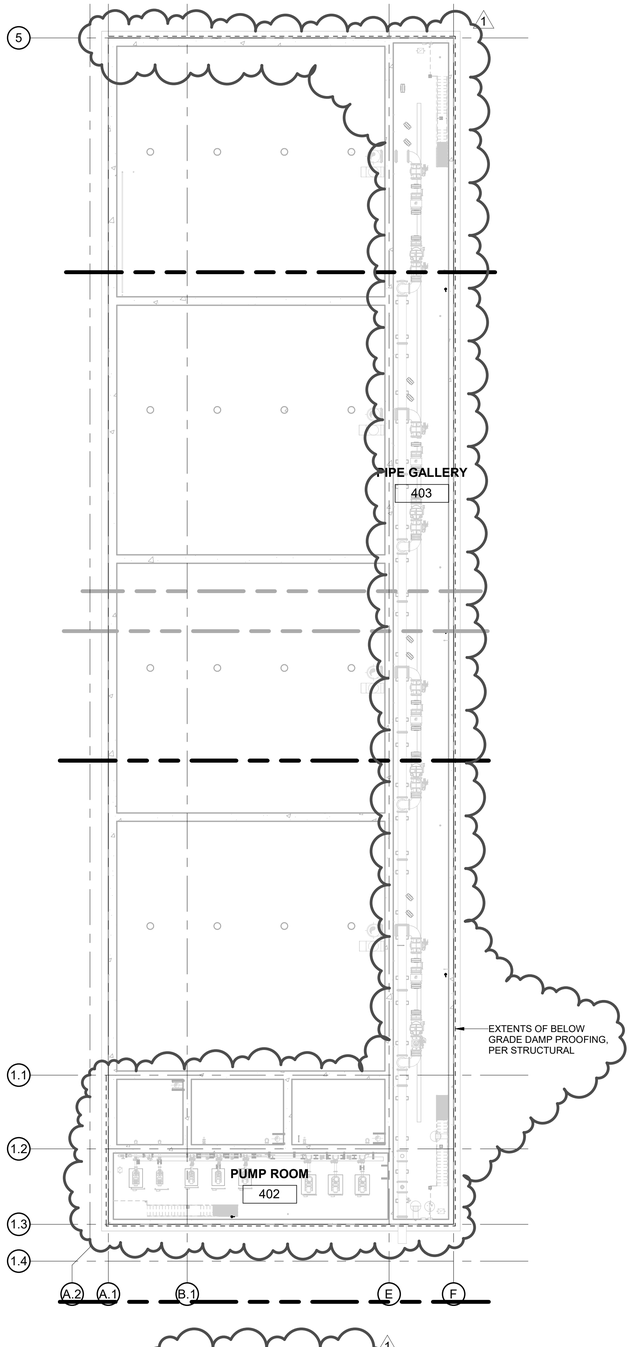
DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
BK	JB		34W	53N	36

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	A003

PROJECT NO. 81000927 SHEET 61 OF 643





OVERALL SUB LEVEL FLOOR PLAN

0 16' 32' 48'

SCALE IN FEET

OVERALL LEVEL 1 FLOOR PLAN

0 16' 32' 48'

SCALE IN FEET

NORTH

NO.	DATE	BY:	CHECKED:	REVISIONS
0	12/19/25	JB	BK	ISSUED FOR BID
1	02/05/26	JB	BK	ADDENDUM 6

KCWATER

CUSTOM ENGINEERING
MECHANICAL & ELECTRICAL ENGINEERING

DuBois Consultants
CIVIL • STRUCTURAL ENGINEERING

WELLNER architects

BURNS McDONNELL
9400 WARD PARKWAY
KANSAS CITY, MO 64114
Burns & McDonnell Engineering Co, Inc
816-333-9400
Licensee No. 000165

STATE OF MISSOURI
JASON SCOTT BARKER
NUMBER A-2005001198
REGISTERED ARCHITECT

JASON SCOTT BARKER
ARCHITECTURAL
A-2005001198

FOR WSD USE:

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

AGS BASIN OVERALL FLOOR PLAN

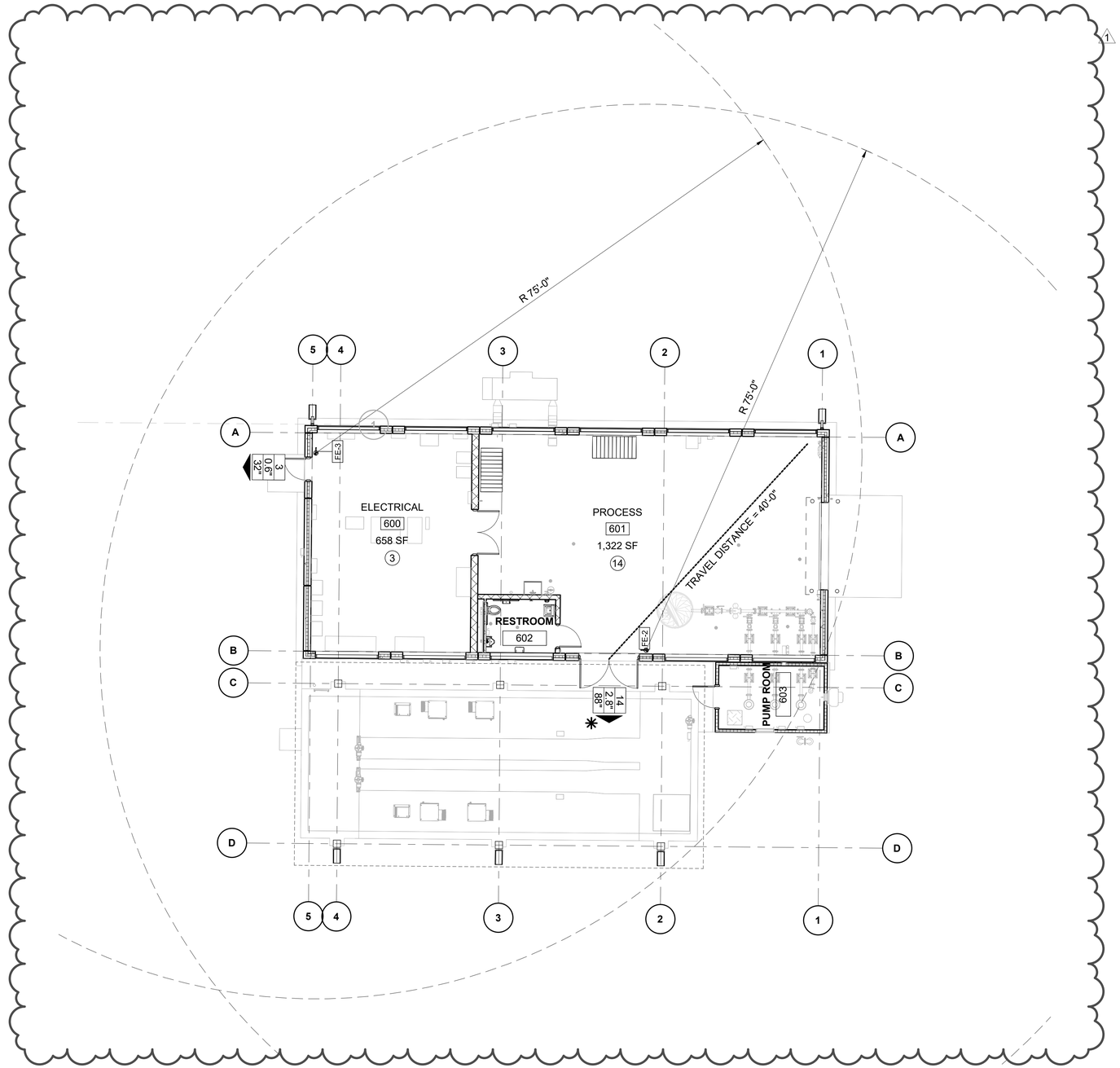
DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
BK	JB		34W	53N	36

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	A410

PROJECT NO. 81000927

SHEET 100 OF 643



CODE PLAN

0 4' 8' 16'

SCALE IN FEET

NORTH

UV DISINFECTION CODE INFORMATION

APPLICABLE CODE:
PLATTE COUNTY MISSOURI AS AMENDED
- 2018 INTERNATIONAL BUILDING CODE
- 2018 INTERNATIONAL MECHANICAL CODE
- 2018 UNIFORM PLUMBING CODE
- 2018 INTERNATIONAL ENERGY CONSERVATION CODE
- 2017 NATIONAL ELECTRICAL CODE
- PLATTE COUNTY ZONING ORDINANCE (ADAPTED 1990)

OCCUPANCY CLASSIFICATION: (SECTION 302):
GROUP S-2, STORAGE

CONSTRUCTION TYPE (TABLE 601):
IIB (NON COMBUSTIBLE MATERIALS)

ALLOWABLE HEIGHT (TABLE 504.3 & 504.4):
ALLOWABLE BUILDING HEIGHT: (GROUP S-2, NON-SPRINKLED) 3 STORIES, 55 FEET
ACTUAL BUILDING HEIGHT: 1 STORY, 22 FEET

ALLOWABLE AREA: (TABLE 506.2):
ALLOWABLE BUILDING AREA (GROUP S-2, NON-SPRINKLED) 26,000 SQ. FT.
ACTUAL BUILDING AREA: 3,792 SQ. FT.

FIRE EXTINGUISHERS (SECTION 906)
REQUIRED IN GENERAL AREAS AND IN EVERY MECHANICAL / ELECTRICAL ROOM
EXTINGUISHER SIZE (MINIMUM) 2A:20B:C
MIN. DISTANCE TO EXTINGUISHER: 75 FEET
MAX. AREA OF COVERAGE: 11,250 SF

EXITING

EXIT WIDTH - OTHER THAN STAIRS (SECTION 1005.3.2)	60 PEOPLE PER FOOT (0.2" PER PERSON)
EXIT ACCESS MAXIMUM TRAVEL DISTANCE (TABLE 1017.2) (TO AN EXTERIOR DOOR OR STAIR ENCLOSURE)	
OCCUPANCY S-2 AREAS:	300 FEET
MAXIMUM COMMON PATH OF TRAVEL (TO A CHOICE OF TWO EXITS - TABLE 1006.2.1)	
OCCUPANCY OF >30 - S-2 AREAS:	75 FEET
OCCUPANCY OF <30 - S-2 AREAS:	100 FEET
2ND EXIT REQUIRED (TABLE 1006.2.1)	
GROUP F-1 AREAS:	>49 PEOPLE IN SPACE
EXIT SEPARATION (1007.1.1):	>1/2 DIAGONAL OF THE SPACE
DEAD END CORRIDOR MAX. LENGTH:	20 FEET
OCCUPANT LOADS (TABLE 1004.1.2)	
INDUSTRIAL AREAS	100 GROSS SF PER PERSON
MECHANICAL/EQUIPMENT	300 GROSS SF PER PERSON

R-VALUES (TABLE C402.1.3 & C402.1.4)
WALLS R-9.5ci (U-0.104)
ROOF R-30ci (U-0.032)

CODE LEGEND

- DESIGNATED EXIT
- DESIGNATED EXIT TO GRADE
- 0 — # OF OCCUPANTS
- 0" — EXIT WIDTH REQUIRED (INCHES)
- 0" — EXIT WIDTH AVAILABLE (INCHES)
- (2) OCCUPANT LOAD
- FE-1 FIRE EXTINGUISHER (SEMIRECESSED CABINET)
- 1 HR RATED
- 2 HR RATED
- MAX TRAVEL DISTANCE
- FIRE EXTINGUISHER RADIUS - 75FT
- FE-2 FIRE EXTINGUISHER (SURFACE CABINET)
- FE-3 FIRE EXTINGUISHER (CLEAN AGENT, SURFACE CABINET)

NO.	DATE	BY:	CHECKED:	DESCRIPTION
0	12/19/25	JB	BK	ISSUED FOR BID
1	02/05/26	JB	BK	ADDENDUM 6

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

STATE OF MISSOURI
JASON SCOTT BARKER
NUMBER A-2005001198
REGISTERED ARCHITECT

JASON SCOTT BARKER
ARCHITECTURAL
A-2005001198

FOR WSD USE:

KCWATER

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MECHANICAL & ELECTRICAL ENGINEERING

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CIVIL + STRUCTURAL ENGINEERING

WELLNER architects

BURNS McDONNELL
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KANSAS CITY, MO 64114
Burns & McDonnell Engineering Co, Inc
816-333-9400
Licensee No. 000165

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

UV DISINFECTION CODE INFORMATION AND PLAN

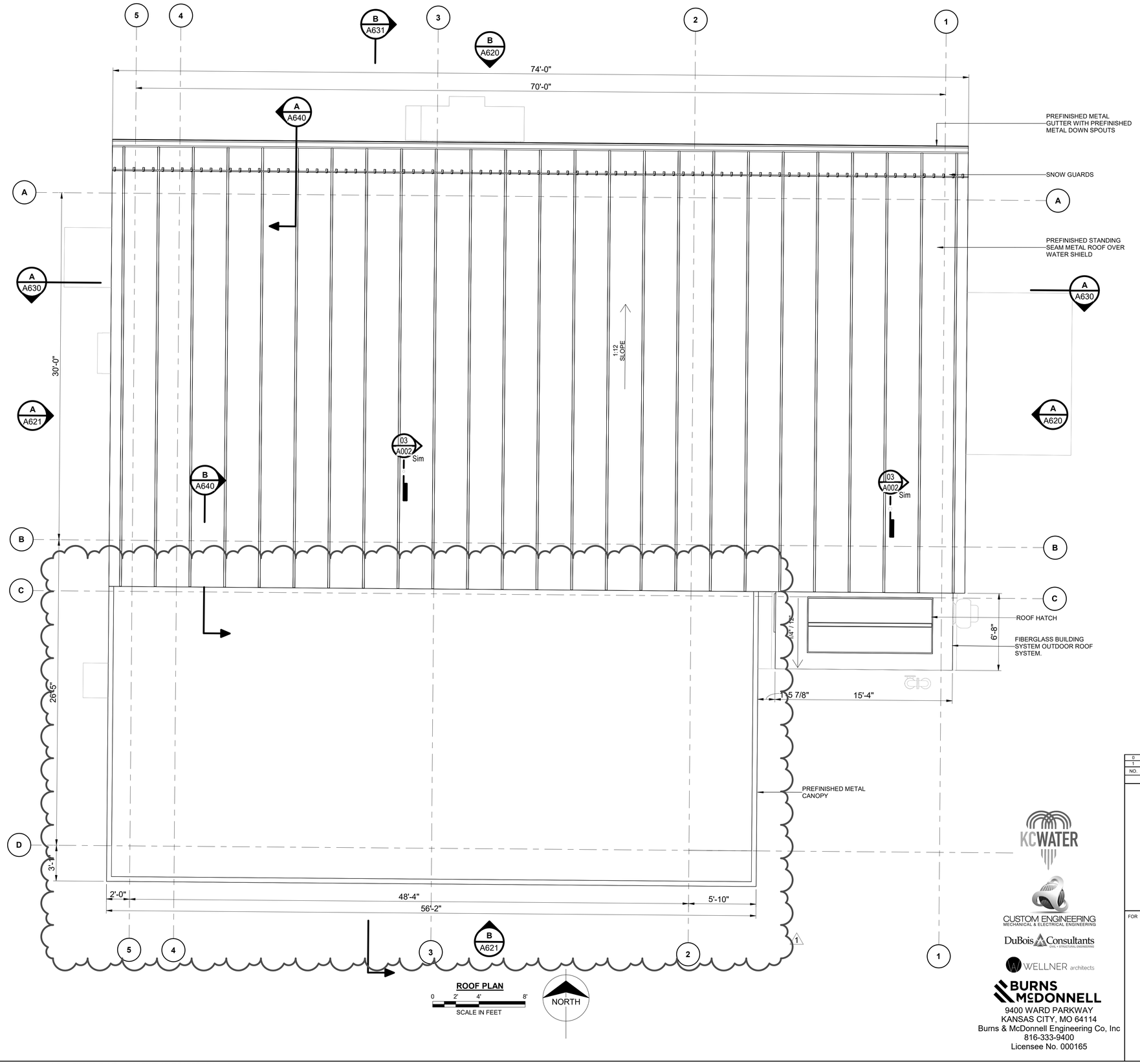
DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
BK	JB		34W	53N	36

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	A600

PROJECT NO. 81000927

SHEET 118 OF 643



NO.	DATE	BY:	CHECKED:	DESCRIPTION
0	12/19/25	JB	BK	ISSUED FOR BID
1	02/05/26	JB	BK	ADDENDUM 6

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

STATE OF MISSOURI
JASON SCOTT BARKER
NUMBER A-2005001198
REGISTERED ARCHITECT

JASON SCOTT BARKER
ARCHITECTURAL
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WELLNER architects

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Licensee No. 000165

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

UV DISINFECTION ROOF PLAN

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
BK	JB		34W	53N	36

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

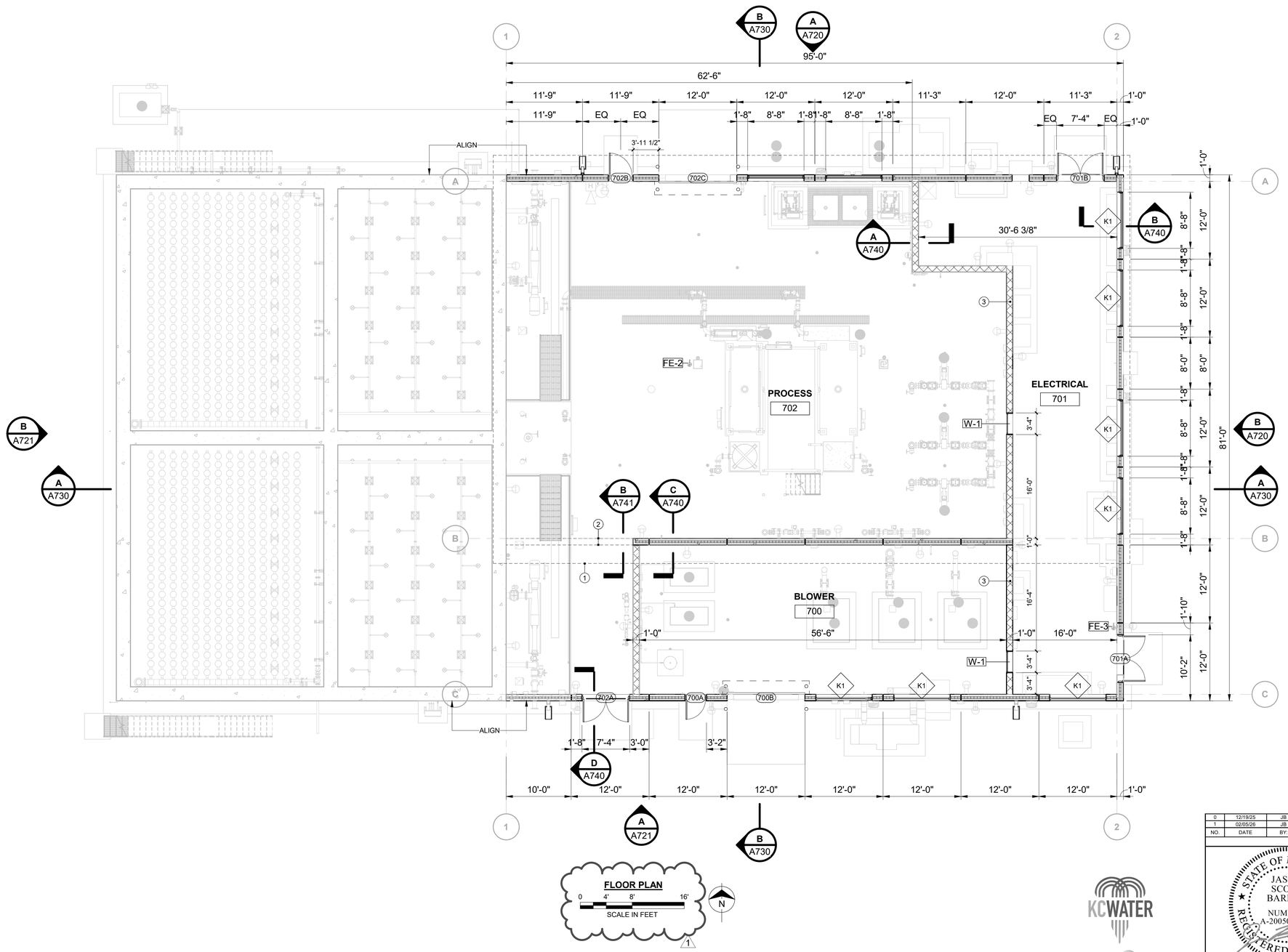
CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	A603

PROJECT NO. 81000927

SHEET 121 OF 643

PLAN NOTES

1 LINE OF CANOPY ABOVE
2 LINE OF SOFFIT ABOVE
3 12" CMU, FULLY FILL WITH PERLITE INSULATION.



NO.	DATE	BY:	CHECKED:	DESCRIPTION
0	12/19/25	JB	BK	ISSUED FOR BID
1	02/05/26	JB	BK	ADDENDUM 6

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

SOLIDS HANDLING FLOOR PLAN

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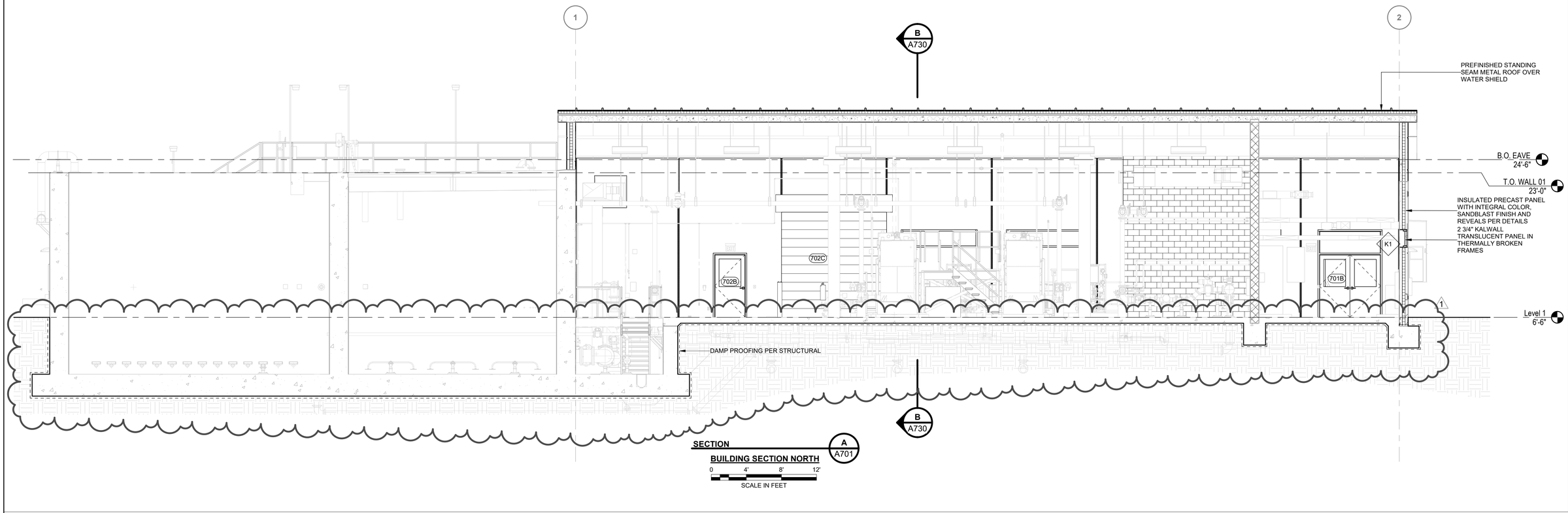
FOR WSD USE:

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
BK	JB		34W	53N	36

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	A701

PROJECT NO. 81000927

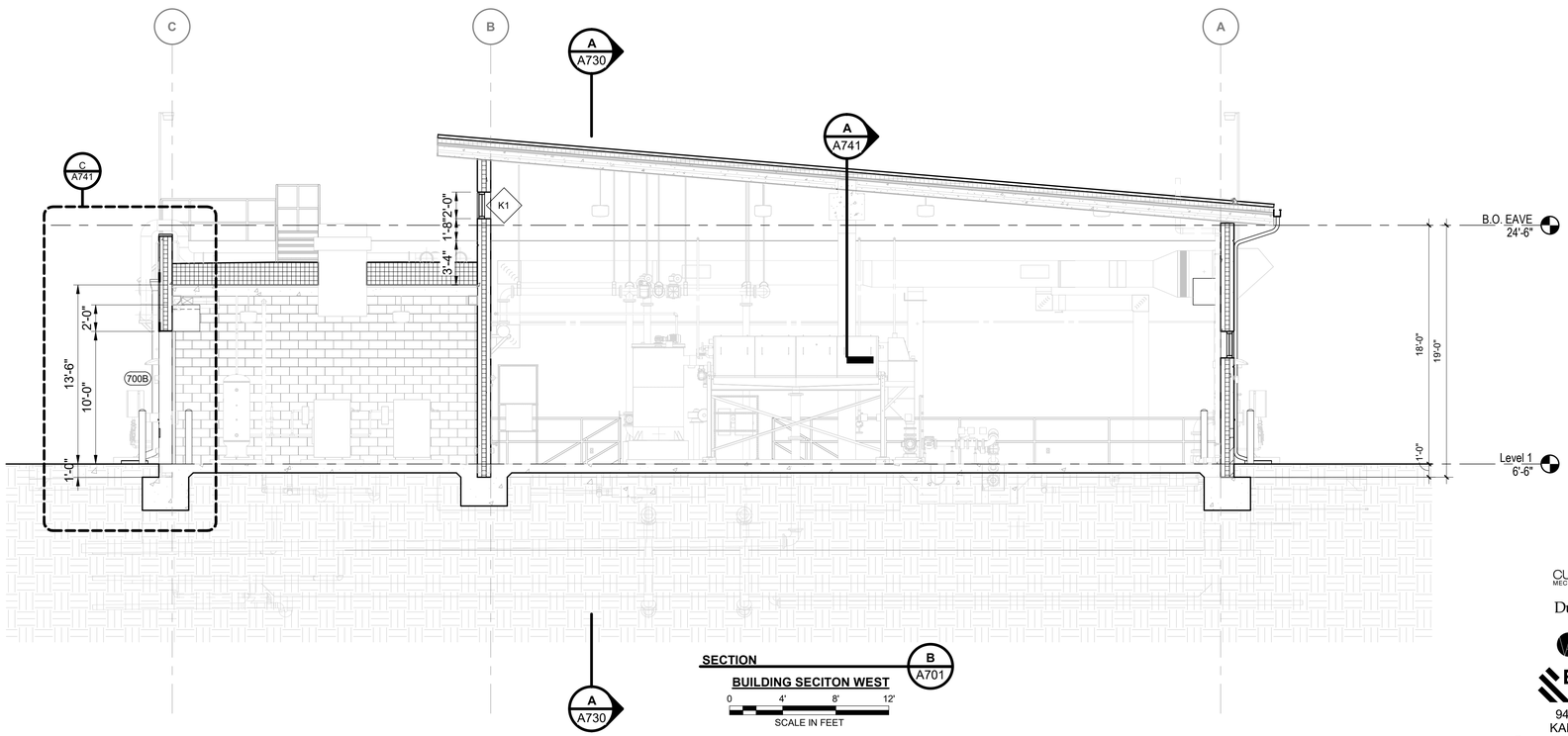


SECTION A / A701

BUILDING SECTION NORTH

0 4' 8' 12'

SCALE IN FEET



SECTION B / A701

BUILDING SECITON WEST

0 4' 8' 12'

SCALE IN FEET

NO.	DATE	BY:	CHECKED:	DESCRIPTION
0	12/19/25	JB	BK	ISSUED FOR BID
1	02/05/26	JB	BK	ADDENDUM 6

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WELLNER architects

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STATE OF MISSOURI
JASON SCOTT BARKER
NUMBER A-2005001198
REGISTERED ARCHITECT

JASON SCOTT BARKER
ARCHITECTURAL
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FOR WSD USE:

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TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

SOLIDS HANDLING BUILDING SECTIONS

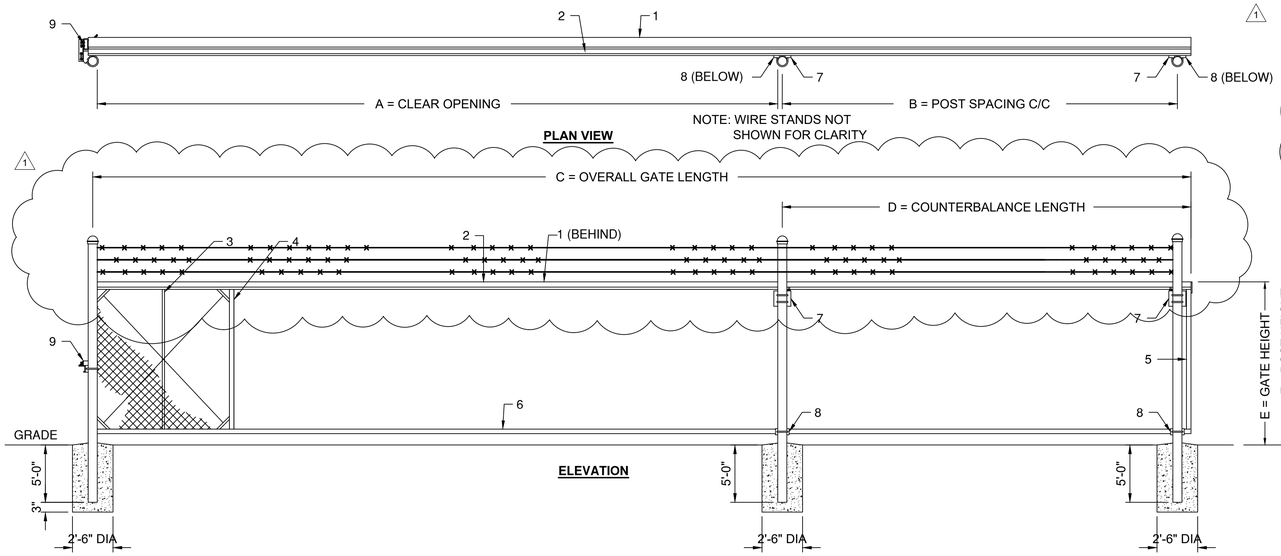
DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
BK	JB		34W	53N	36

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	A730

PROJECT NO. 81000927

SHEET OF 643



AUTOMATIC CANTILEVER CHAIN LINK MAIN ROAD ACCESS GATE (A)

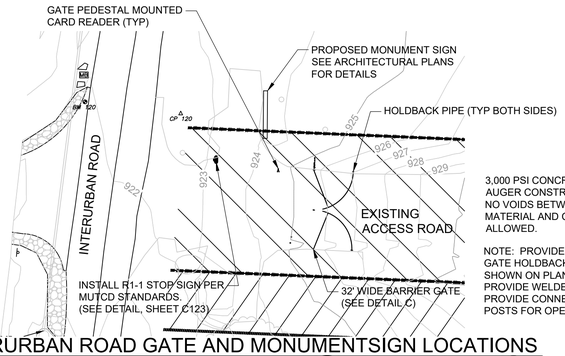
NOT TO SCALE

CRITICAL DIMENSION CHART			
MARK	DESCRIPTION	ROAD 1, ROAD4 (FEET)	DIM.
A	CLEAR OPENING	28	24
B	COUNTERBALANCE POST SPACING C/C	13	35
C	OVERALL GATE LENGTH	41	
D	COUNTERBALANCE LENGTH	14	12
E	NOMINAL GATE HEIGHT	8	8
F	POST HEIGHT (W/ BARB ARMS)	9	9
G	FABRIC HEIGHT	8	8

HEAVY DUTY CANTILEVER SLIDE GATE		
BILL OF MATERIALS		
MARK	DESCRIPTION	NOTES:
1	TOP PRIMARY MEMBER	
2	STANDARD TRACK	
3	1" x 2" ALUM. TUBE	CENTERED BETWEEN 2x2'S
4	2" x 2" ALUM. TUBE	
5	STANDARD PRIMARY	TYP. AT ENDS OF GATE FRAME
6	2" x 5" ALUM. TUBE	
7	HANGER ASSEMBLY	2 REQUIRED
8	BOTTOM GUIDE ASSEMBLY	2 REQUIRED
9	CATCH ASSEMBLY	1 REQUIRED

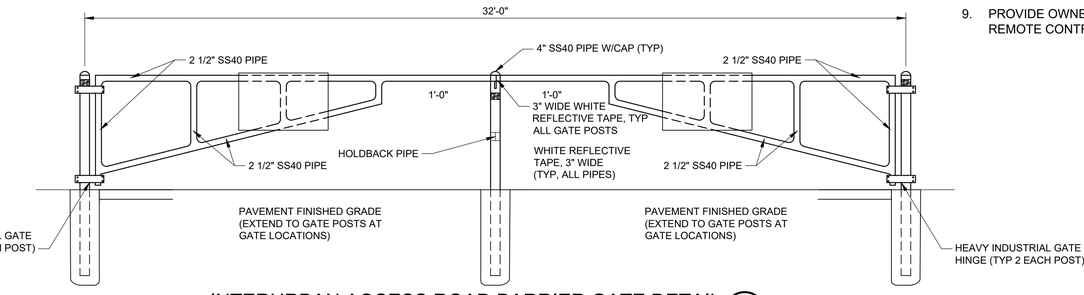
CATILEVER GATE NOTES:

1. ALL FITTINGS STANDARDLY PROVIDED FOR 4" O.D. POSTS.
2. FENCE GATES, DETAILS AND FIGURES ARE BASED ON "TYMETAL CORPORATION" GATES AND SHOULD BE CONFIRMED WITH THE MANUFACTURER PRIOR TO START OF WORK.
3. AUTOMATED OPERATING DEVICE SHALL BE COMPATIBLE WITH EXISTING FACILITY EQUIPMENT AND SHALL BE INSTALLED PER MANUFACTURER'S DESIGN AND RECOMMENDATIONS.
4. AUTOMATIC OPERATING DEVICE DESIGN AND INSTALLATION SHALL BE COORDINATED WITH GATE MANUFACTURER'S DESIGN AND INTALLATION.
5. GATE EQUIPMENT SHALL CONFORM TO ASTM F1184.
6. GATE CONSTRUCTION:
   A. CONSTRUCT WITH FITTING OR BY WELDING.
   B. PROVIDE RIGID, WATERPROOF JOINTS.
   C. ASSURE RIGHT, NON-SAGGING, NON-TWIST GATE.
   D. COAT WELDS WITH RUST PREVENTATIVE PAINT, COLOR TO MATCH GATE MATERIAL.
7. ELECTRIC GATE OPERATOR TO BE INSTALLED IN ACCORDANCE WITH 2017 NEC. AND MANUFACTURER'S RECOMMENDATIONS. OPERATOR SHALL BE 208 VOLT, 1-PHASE. OPERATOR SHALL BE RATED TO OPERATE GATE WEIGHT. MOTOR STARTER AND OVERLOADS AND CONTROL SHALL BE PROVIDED BY GATE SUPPLIER IN NEMA 4X ENCLOSURE. EXTERIOR CONTROL WIRING BY CONTRACTOR.
8. OPERATOR SHALL BE PAD MOUNTED. PAN AND ANCHORAGE BY CONTRACTOR.
9. PROVIDE OWNER WITH 10 HANDHELD GATE ACCESS REMOTE CONTROL UNITS.



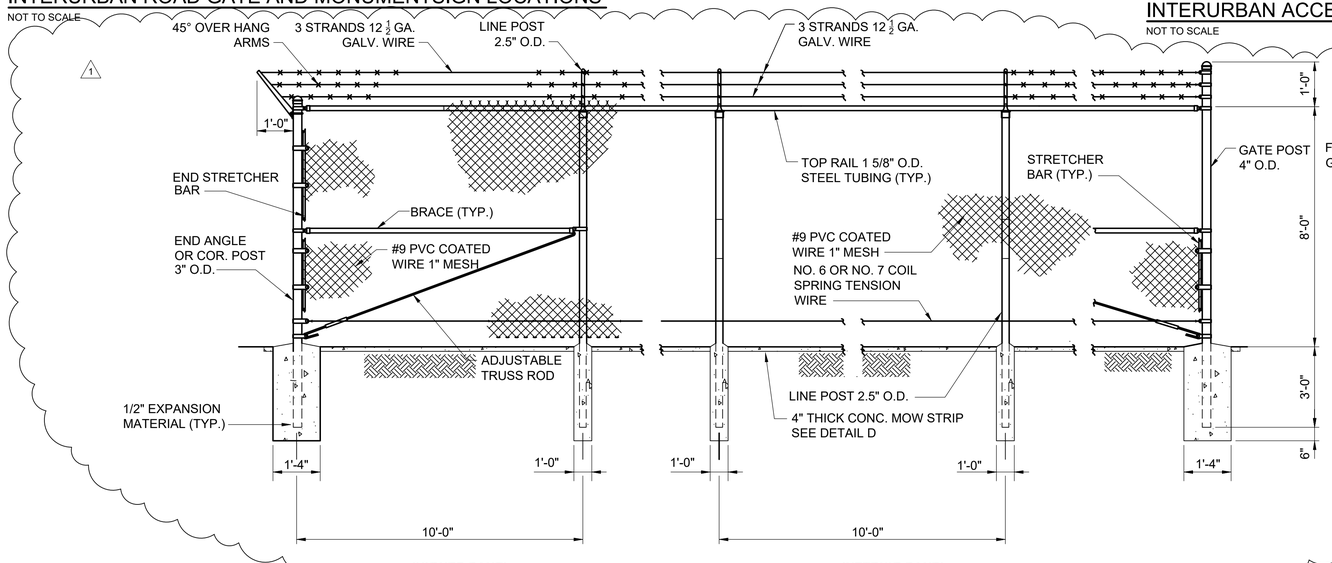
INTERURBAN ROAD GATE AND MONUMENTSIGN LOCATIONS

NOT TO SCALE



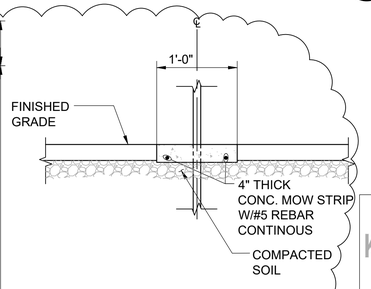
INTERURBAN ACCESS ROAD BARRIER GATE DETAIL (C)

NOT TO SCALE



8' CHAIN LINK FENCE (B)

NOT TO SCALE



MOW STRIP DETAIL (D)

NOT TO SCALE

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NO.	DATE	DRAWN BY:	CHECKED BY:	DESCRIPTION
1	02/06/2026	ODJ	JPG	ADDENDUM 7
0	12/19/2025	ODJ	JPG	ISSUED FOR BID

REVISION BLOCK

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

CIVIL DETAILS 4

STATE OF MISSOURI · CERVENTE D. SUDDUTH · NUMBER PE-2011015802 · PROFESSIONAL ENGINEER
12/19/2025

FOR WSD USE:

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
ODJ	JPG	12/19/2025	34W	53N 52N	36 01

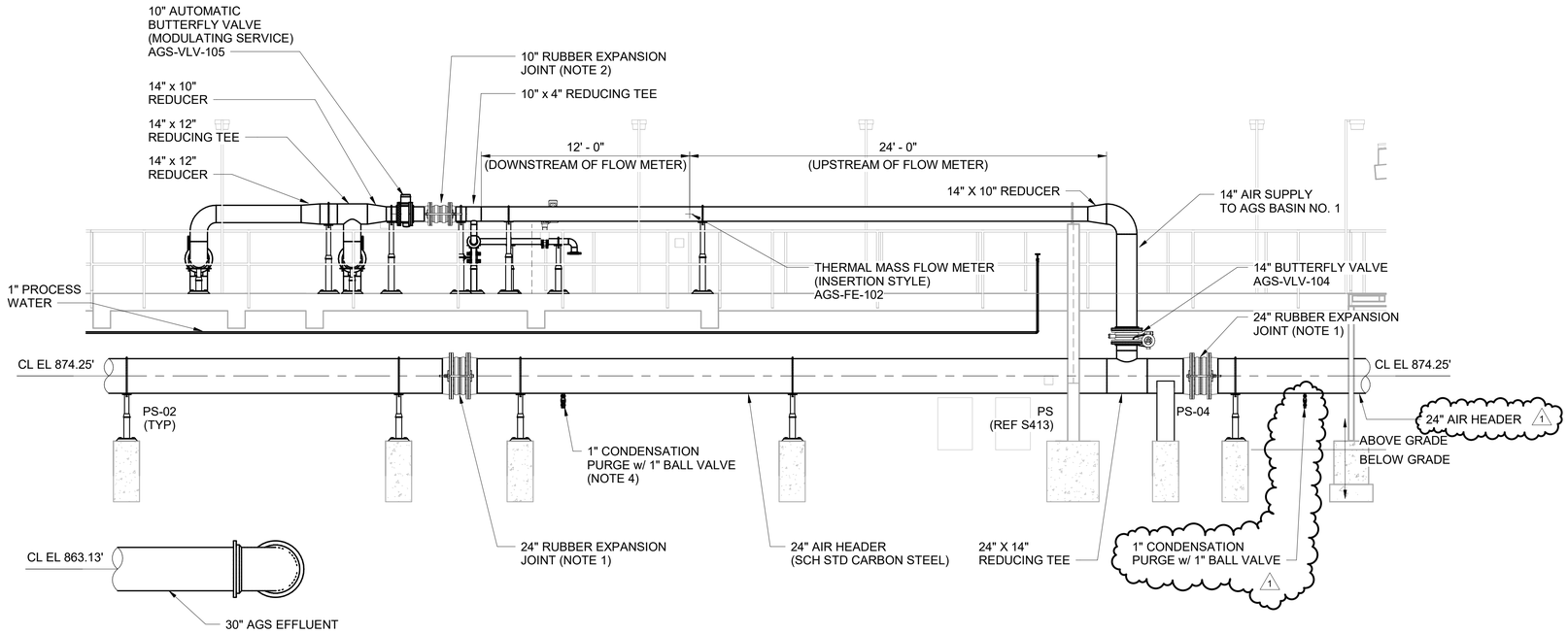
CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO	

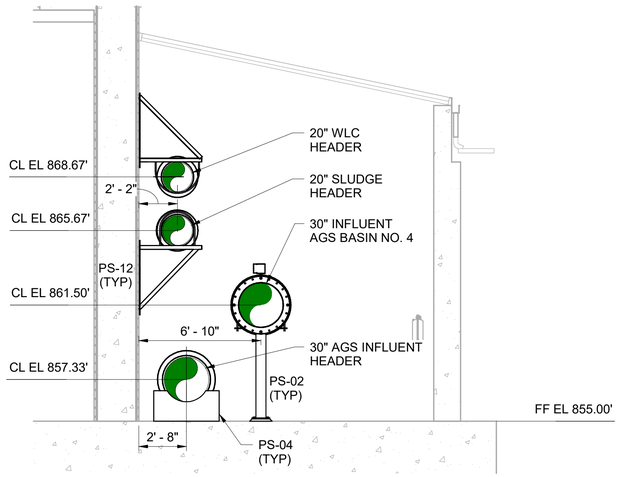
CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698				C136

PROJECT NO. 81000927

SHEET 41 OF 643

Saved 02-05-2026 4:37:34 PM by DAVID
PLOT DATE 2/5/2026 4:38:00 PM by DAVID
S:\WORKING PROJECTS\2020 PROJECTS\J20004 - TODD CREEK CIVIL\01-REDESIGN\00-CIVIL\09 WORKING\SHEETS\C136-CIVIL DETAILS 4.DWG





SECTION B D401

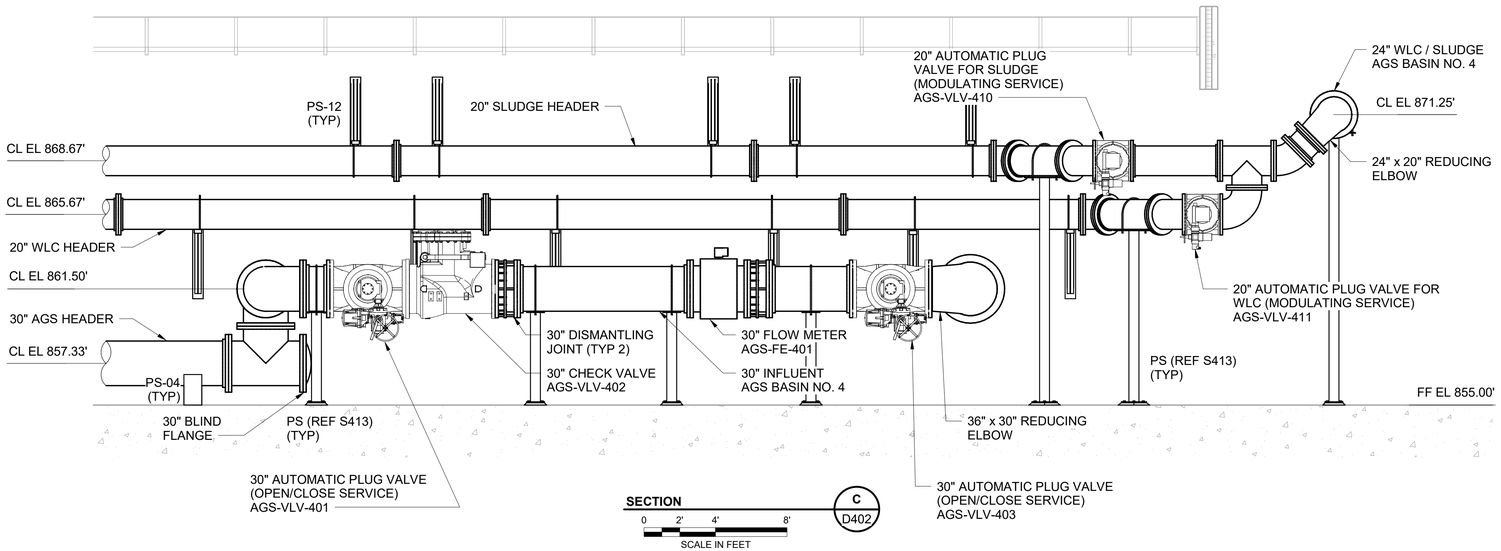
0 2' 4' 8'

SCALE IN FEET

SECTION A D401

0 2' 4' 8'

SCALE IN FEET



SECTION C D402

0 2' 4' 8'

SCALE IN FEET

NOTES:

1. RUBBER EXPANSION JOINT SHALL BE PROCO STYLE 242 DOUBLE SPHERE TYPE, OR ENGINEER APPROVED EQUAL, AND PROVIDED WITH CONTROL UNIT AND MINIMUM TWO (2) LIMIT RODS. EXPANSION JOINT SHALL BE PROVIDED WITH EPDM TUBE / COVER, AND 316L STAINLESS STEEL RETAINING / CONTROL UNIT, FLANGE, AND BOLTS. EXPANSION JOINT SHALL BE RATED FOR 300 DEGREES FAHRENHEIT IN BLOWER AIR SERVICE.
2. ABOVE GRADE CARBON STEEL AIR PIPING SHALL BE COATED PER SPECIFICATION 09 99 00 PROTECTIVE COATINGS.
3. VALVES AND FLOW METER COMPONENTS SHOWN ARE SHOWN IN SECTION C FOR AGS BASIN NO. 4 ONLY. AGS BASINS NO. 1, NO. 2, AND NO. 3 HAVE SAME QUANTITY, TYPE, AND SIZE OF VALVES. REFER TO P&ID DRAWINGS FOR QUANTITY AND TAGGING.
4. CONDENSATION PURGE CONNECTION AND BALL VALVE SHALL BE INSTALLED UPSTREAM OF EACH SUBSEQUENT RUBBER EXPANSION JOINT.

NO.	DATE	BY:	CHECKED:	DESCRIPTION
1	2/13/26	PEW	ALW	ADDENDUM 6
0	12/19/25	PEW	ALW	ISSUED FOR BID

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

AGS SECTIONS SHEET 1

STATE OF MISSOURI PAUL E. WARD NUMBER PE-2016017691 PROFESSIONAL ENGINEER

PAUL E. WARD
PROCESS
PE-2016017691

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WELLNER architects
BURNS McDONNELL
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816-333-9400
Licensee No. 000165

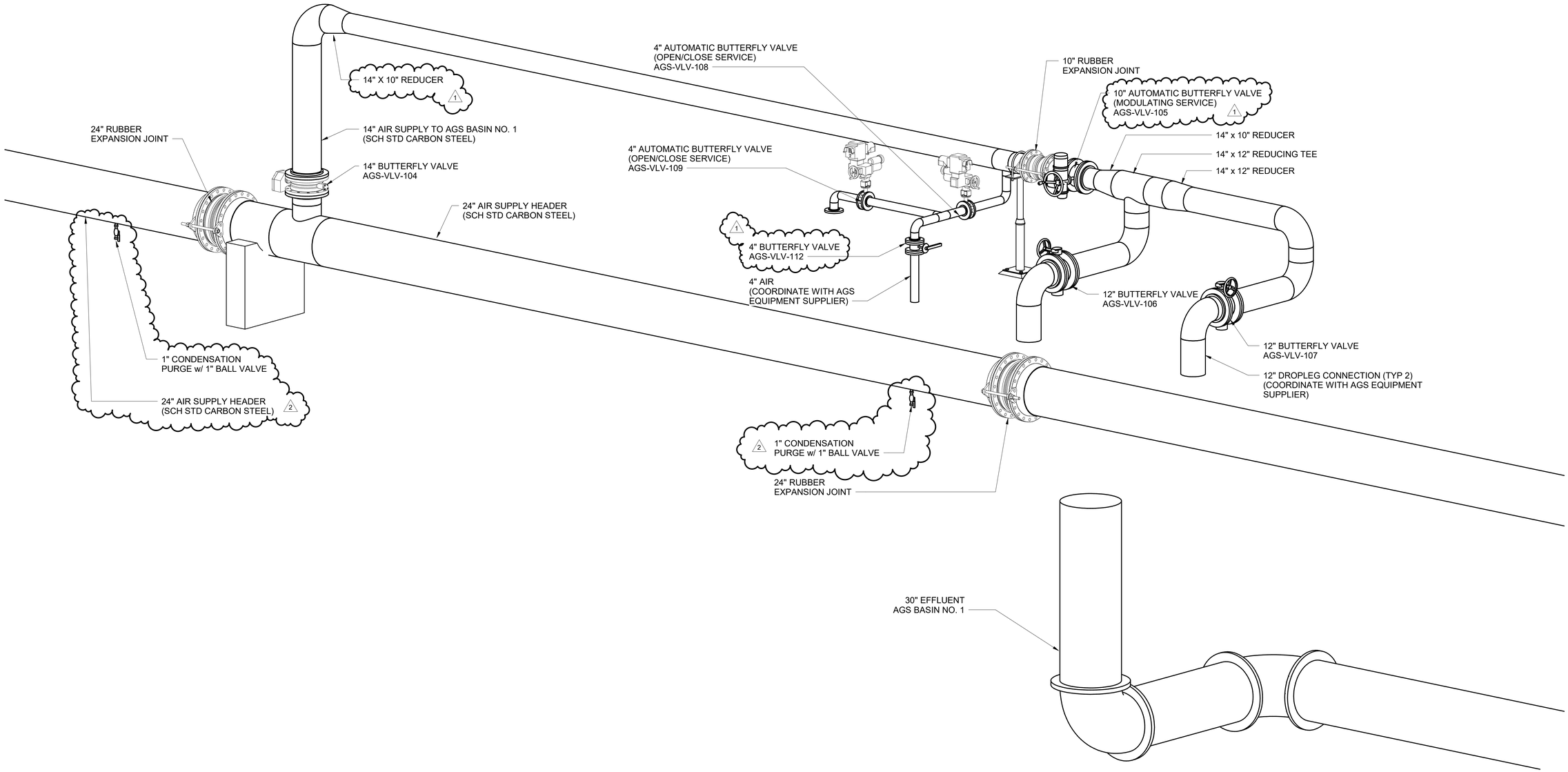
DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
C. JENSEN	A. WADDOUPS	2/13/26	34W	53N	36

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	D404

PROJECT NO. 81000927

SHEET 374 OF 643



AGS AIR SUPPLY AND EFFLUENT ISO

0 1' 2' 4'

SCALE IN FEET

NO.	DATE	BY:	CHECKED:	DESCRIPTION
2	2/13/26	PEW	ALW	ADDENDUM 6
1	1/16/26	PEW	ALW	ADDENDUM 3
0	12/19/25	PEW	ALW	ISSUED FOR BID

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Licensee No. 000165

STATE OF MISSOURI
PAUL E. WARD
NUMBER PE-2016017691
PROFESSIONAL ENGINEER

PAUL E. WARD
PROCESS
PE-2016017691

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TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

AGS ISO DIAGRAM SHEET 3

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
C. JENSEN	A. WADDOUPS	2/13/26	34W	53N	36

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

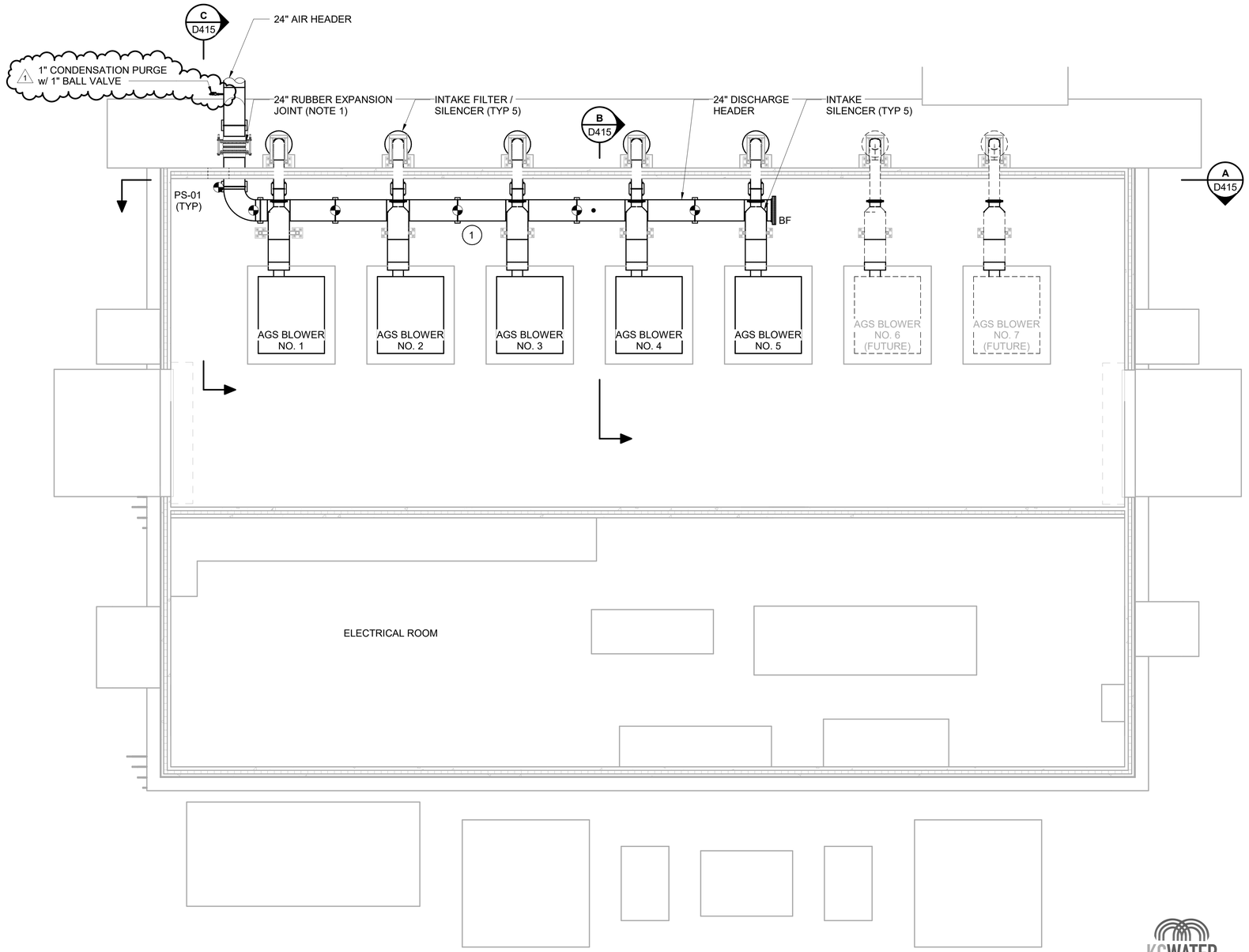
CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	D413

PROJECT NO. 81000927

SHEET 381 OF 643

KEYED NOTE:

(1) SEE KEYED NOTE ON D202 FOR PI THAT IS SHOWN HERE PER P&ID Y408.



NOTES:

1. RUBBER EXPANSION JOINT SHALL BE PROCO STYLE 242 DOUBLE SPHERE TYPE, OR ENGINEER APPROVED EQUAL, AND PROVIDED WITH CONTROL UNIT AND MINIMUM TWO (2) LIMIT RODS. EXPANSION JOINT SHALL BE PROVIDED WITH EPDM TUBE / COVER, AND 316L STAINLESS STEEL RETAINING / CONTROL UNIT, FLANGE, AND BOLTS. EXPANSION JOINT SHALL BE RATED FOR 300 DEGREES FAHRENHEIT IN BLOWER AIR SERVICE.
2. INDOOR AIR PIPING SHALL BE INSULATED WITH 1.5" THICK FOAMGLAS INSULATION. REFER TO SECTION 22 07 19.
3. AGS BLOWERS NO. 6 AND NO. 7 ARE SHOWN FOR REFERENCE ONLY. BLOWERS NO. 6 AND NO. 7, INCLUDING ASSOCIATED SUPPORTS AND EQUIPMENT PADS, WILL BE INSTALLED IN THE FUTURE AND SHALL NOT BE PART OF PROJECT.

BLOWER BUILDING FF

0 4' 8' 12'

SCALE IN FEET

NORTH

NO.	DATE	BY:	CHECKED:	DESCRIPTION
1	2/13/26	PEW	ALW	ADDENDUM 6
0	12/19/25	PEW	ALW	ISSUED FOR BID

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

STATE OF MISSOURI
PAUL E. WARD
NUMBER PE-2016017691
PROFESSIONAL ENGINEER

PAUL E. WARD
PROCESS
PE-2016017691

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TODD CREEK WWTP EXPANSION AND UPGRADE

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BLOWER BUILDING FLOOR PLAN

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WELLNER architects
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Burns & McDonnell Engineering Co, Inc
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Licensee No. 000165

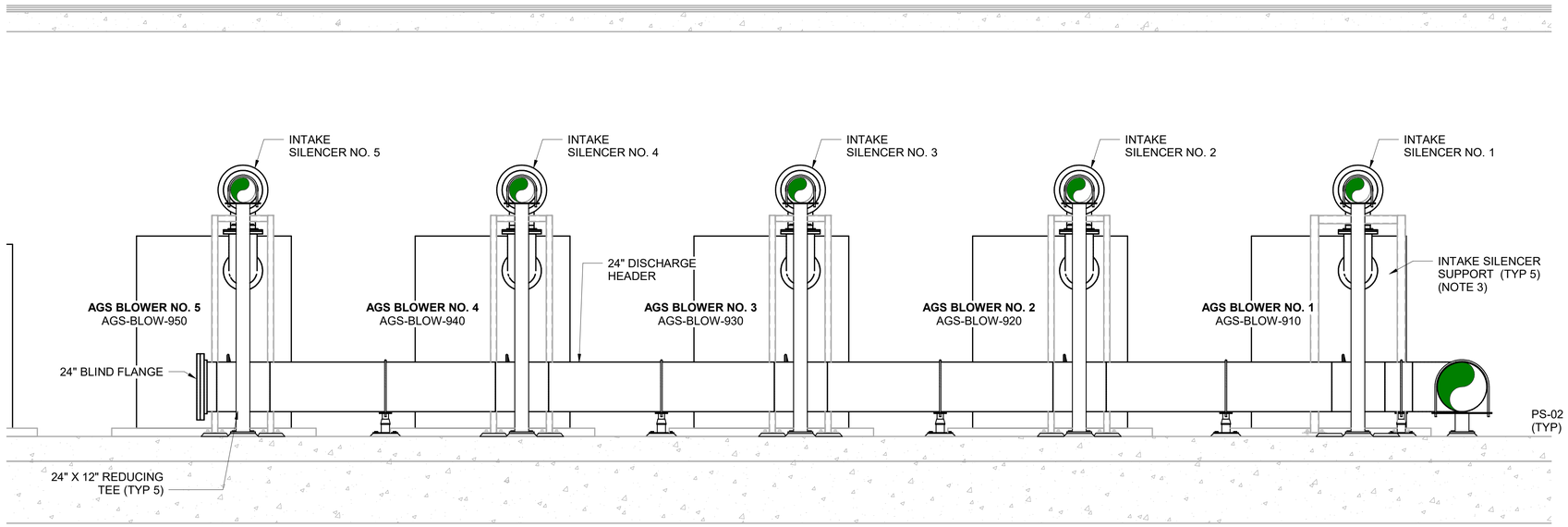
DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
C. JENSEN	A. WADDOUPS	2/13/26	34W	53N	36

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	D414

PROJECT NO. 81000927

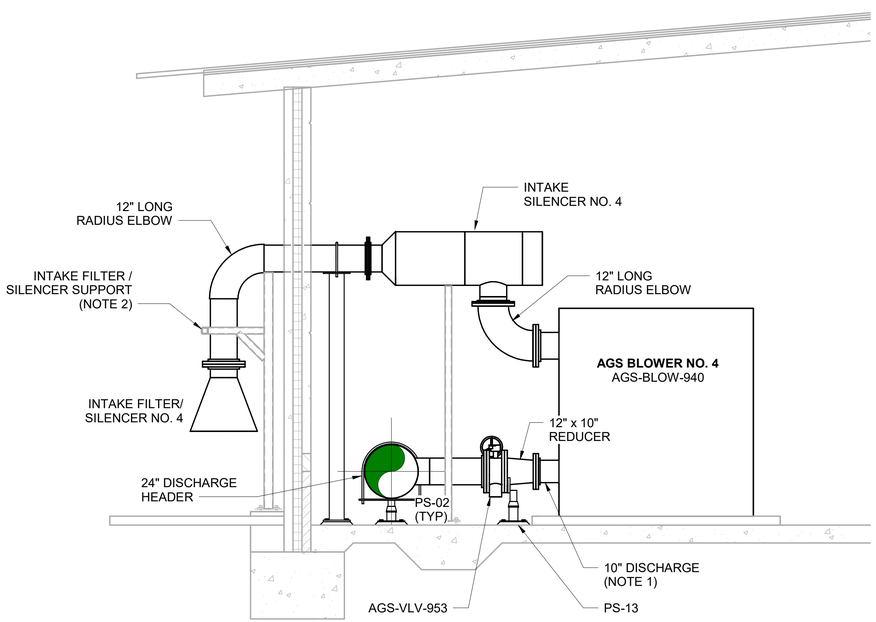
SHEET 382 OF 643



SECTION A D414

0 2' 4' 6'

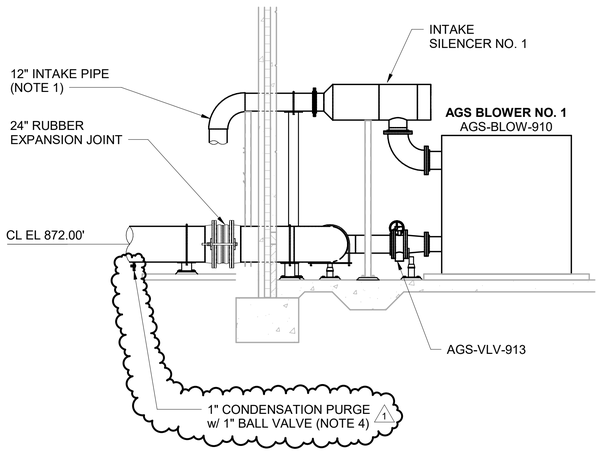
SCALE IN FEET



SECTION B D414

0 2' 4' 6'

SCALE IN FEET



SECTION C D414

0 2' 4' 8'

SCALE IN FEET

NOTES:

1. INTAKE FILTER / SILENCER ASSEMBLY NOT SHOWN FOR CLARITY.
2. BLOWER INTAKE PIPE SHALL BE PROVIDED WITH WELDED SUPPORT TABS TO ALLOW PROPER SUPPORT (REFER TO PS-10 AND PS-11 FOR WELDED TAB DETAIL). REFER TO STRUCTURAL FOR DETAILS ON ADDITIONAL PIPE SUPPORT ASSEMBLY.
3. SUPPORT ASSEMBLY SHALL PROVIDE SUPPORT FOR INTAKE SILENCER AND DISCHARGE PIPE BELOW. REFER TO STRUCTURAL DRAWINGS FOR ADDITIONAL DETAILS. COORDINATE WITH BLOWER MANUFACTURER AND INTAKE SILENCER MANUFACTURER TO DETERMINE FINAL SUPPORT LOCATION AND CONNECTION.
4. 1-INCH CONDENSATION PURGE LINE SHALL BE WELDED TO 24-INCH AIR HEADER PIPING. LINE SHALL BE ROUTED TO GRADE AND PROTECTED FROM IMPACT. LINE SHALL BE PROVIDED WITH BALL VALVE AND DISCHARGE DOWNWARDS.

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WELLNER architects

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NO.	DATE	BY:	CHECKED:	DESCRIPTION
1	2/13/26	PEW	ALW	ADDENDUM 6
0	12/19/25	PEW	ALW	ISSUED FOR BID

REVISIONS

STATE OF MISSOURI
PAUL E. WARD
NUMBER PE-2016017691
PROFESSIONAL ENGINEER

PAUL E. WARD
PROCESS
PE-2016017691

FOR WSD USE:

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

BLOWER BUILDING SECTIONS AND DETAILS

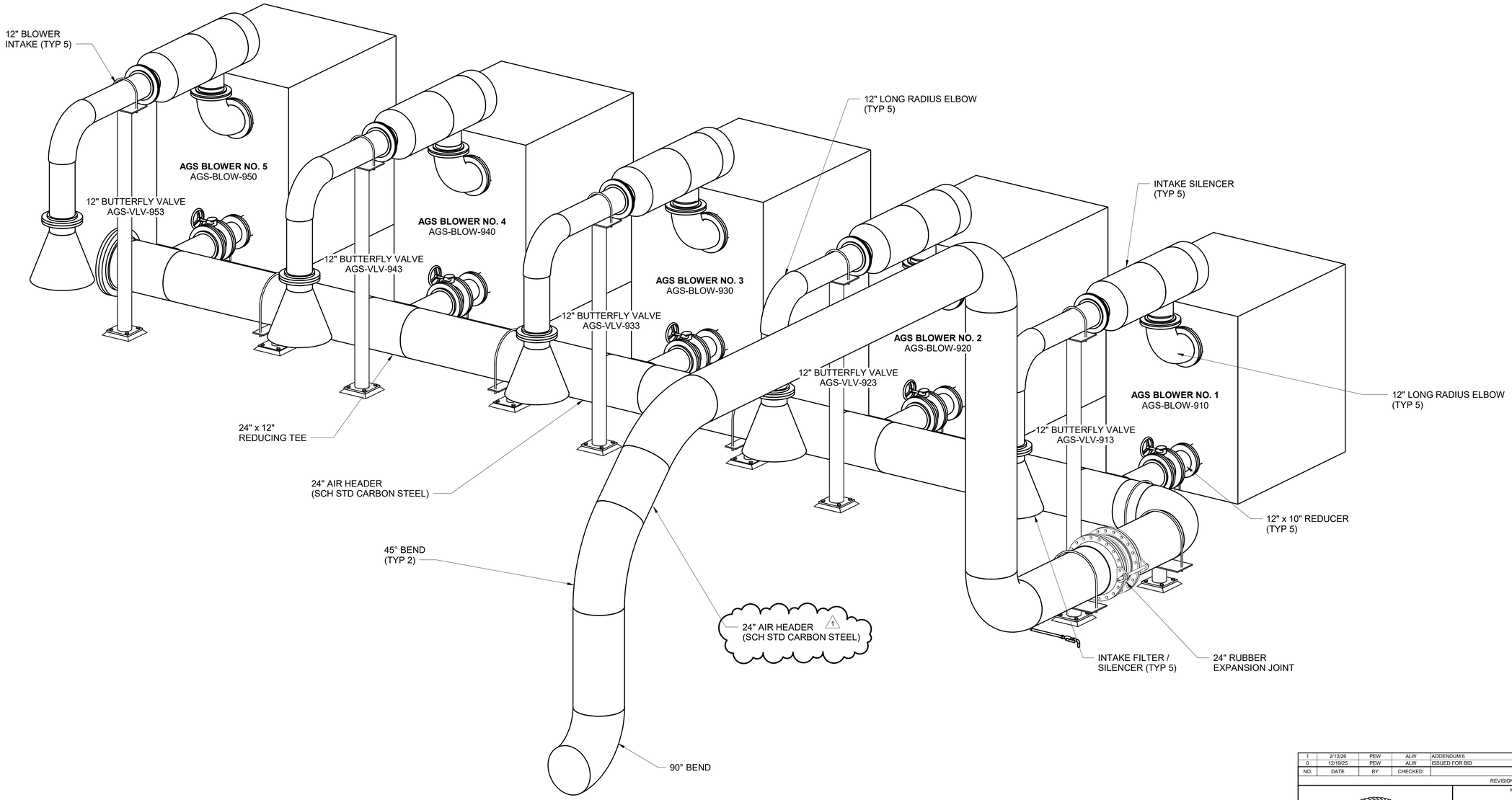
DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
C. JENSEN	A. WADDOUPS	2/13/26	34W	53N	36

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	D415

PROJECT NO. 81000927

SHEET 383 OF 643



NO.	DATE	BY:	CHECKED:	DESCRIPTION
1	2/13/26	PEW	ALW	ADDENDUM 6
0	12/19/25	PEW	ALW	ISSUED FOR BID

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

STATE OF MISSOURI
PAUL E. WARD
NUMBER PE-2016017691
PROFESSIONAL ENGINEER

PAUL E. WARD
PROCESS
PE-2016017691

FOR WSD USE:

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

BLOWER BUILDING ISO DIAGRAM

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
C. JENSEN	A. WADDOUPS	2/13/26	34W	53N	36

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	D416

PROJECT NO. 81000927

SHEET 384 OF 643

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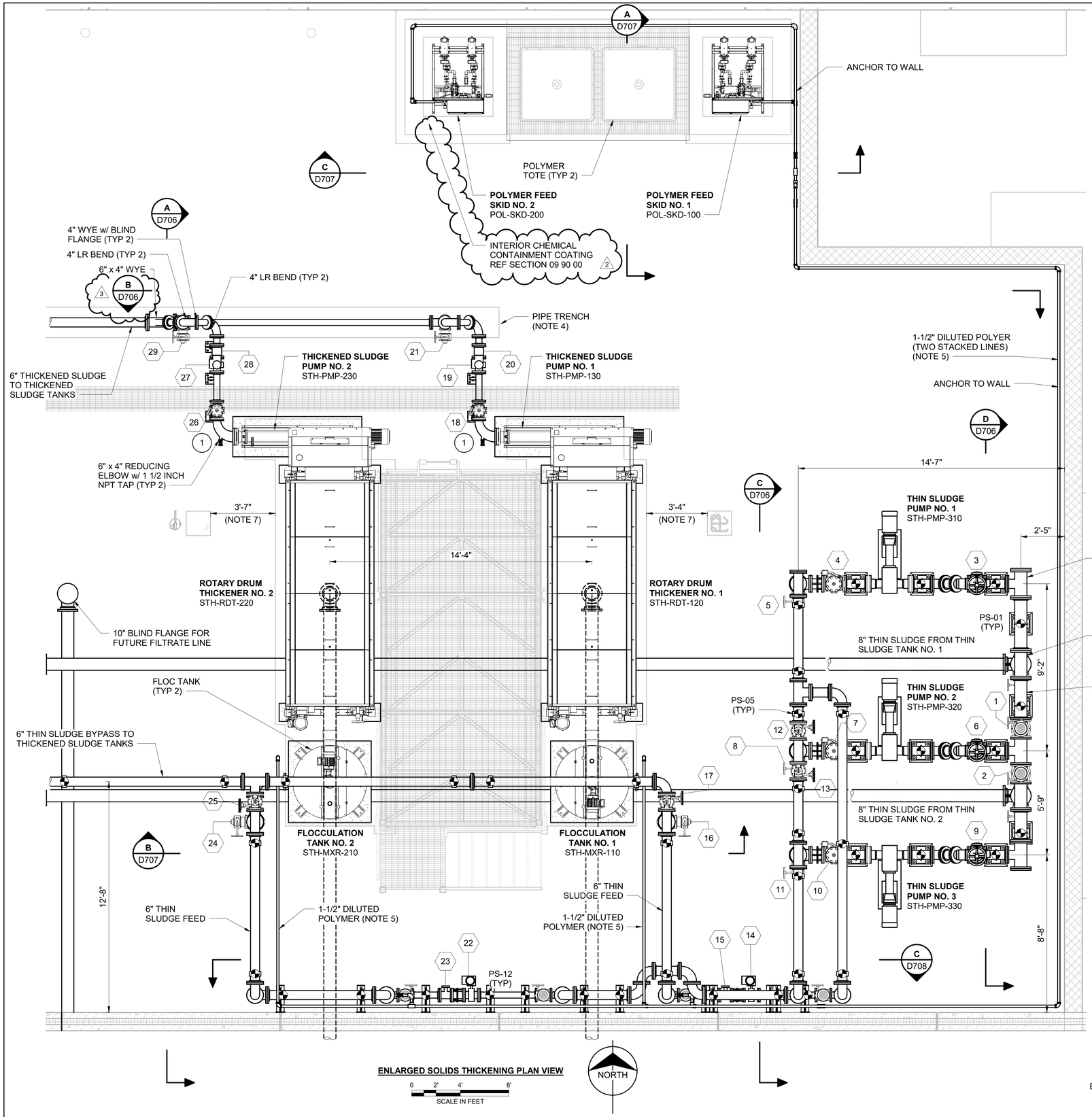

ENLARGED SOLIDS THICKENING PLAN VIEW

0 2' 4' 8'
SCALE IN FEET

NORTH

GENERAL NOTES:

1. PIPING WITHIN FOUR FEET OF FINISHED FLOOR SHALL BE SUPPORTED WITH SADDLE TYPE SUPPORT, UNLESS OTHERWISE SPECIFIED. SEE PS-1.
2. ALL PIPE SUPPORTS AT A MINIMUM, SHALL FOLLOW MSS-SP 69, UNLESS SPECIFIED ELSEWHERE.
3. ELEVATED AIR PIPING SHALL BE SUPPORTED WITH CLEVIS HANGER PIPE SUPPORT, UNLESS OTHERWISE SPECIFIED.
4. PIPE TRENCH GRATING NOT SHOWN FOR CLARITY. CONTRACTOR SHALL PROVIDE REMOVABLE GRATING IN SEGMENTS THAT ALLOW REMOVAL OF GRATING AROUND PIPE PENTRATIONS WITHOUT PIPE DISASSEMBLY.
5. CONTRACTOR SHALL FIELD ROUTE PVC DILUTED POLYMER FEED PIPING TO POLYMER INJECTION RING ASSEMBLY LOCATED UPSTREAM OF FLOCCULATION TANKS. REFER TO D706. CONTRACTOR SHALL PROVIDE TUBING AND MANIFOLD AS REQUIRED TO TRANSITION FROM 1-1/2" DILUTED POLYMER PIPING TO FOUR (4) TUBING CONNECTIONS ON POLYMER INJECTION RING. INSTALLATION SHALL BE COORDINATED WITH ROTARY DRUM THICKENER MANUFACTURER. PROCESS WATER PIPING SHOWN ON PLUMBING DRAWINGS.
6. CONTRACTOR SHALL FIELD ROUTE PROCESS WATER PROCESS WATER TO WASH CONNECTIONS AT THE ROTARY DRUM THICKENERS PER MANUFACTURER REQUIREMENTS.
7. DIMENSION SHOWN BETWEEN ROTARY DRUM THICKENER AND STRUCTURAL COLUMN IS APPROXIMATE. DIMENSION SHALL BE MINIMUM 3'-0". CONTRACTOR SHALL COORDINATE WITH DESIGN ENGINEER AS NEEDED IF SUPPLIED EQUIPMENT DOES NOT PERMIT THE MINIMUM DIMENSION TO BE MAINTAINED BASED ON LAYOUT SHOWN.
8. CONTRACTOR SHALL FIELD ROUTE PROCESS WATER (NON-POTABLE WATER) PIPE TO THE POLYMER FEED DILUTION WATER CONNECTION POINTS. REFER TO D707. FINAL SIZE OF PROCESS WATER PIPE FACILITING DILUTION TO EACH SKID SHALL BE COORDINATED WITH SELECTED POLYMER FEED MANUFACTURER.

KEYED NOTE:

(1) SEE KEYED NOTE ON D202 FOR PI THAT IS SHOWN HERE PER P&ID Y702 AND Y703.

VALVE KEY:

1. 8" PLUG VALVE WAS-VLV-303
2. 8" PLUG VALVE WAS-VLV-304
3. 6" AUTOMATIC PLUG VALVE (OPEN/CLOSE SERVICE) WAS-VLV-311
4. 6" CHECK VALVE WAS-VLV-312
5. 6" PLUG VALVE WAS-VLV-313
6. 6" AUTOMATIC PLUG VALVE (OPEN/CLOSE SERVICE) WAS-VLV-321
7. 6" CHECK VALVE WAS-VLV-322
8. 6" PLUG VALVE WAS-VLV-323
9. 6" AUTOMATIC PLUG VALVE (OPEN/CLOSE SERVICE) WAS-VLV-331
10. 6" CHECK VALVE WAS-VLV-332
11. 6" PLUG VALVE WAS-VLV-333
12. 6" PLUG VALVE WAS-VLV-305
13. 6" PLUG VALVE WAS-VLV-306
14. 4" FLOW METER WAS-FE-301
15. 4" TOTAL SOLIDS METER WAS-AE-301
16. 6" PLUG VALVE STH-VLV-101 (1)
17. 6" PLUG VALVE WAS-VLV-307
18. 4" CHECK VALVE STH-VLV-131
19. 4" FLOW METER STH-FE-131
20. 4" TOTAL SOLIDS METER STH-AE-131
21. 4" PLUG VALVE (FULL PORT) STH-VLV-132
22. 4" FLOW METER WAS-FE-302
23. 4" TOTAL SOLIDS METER WAS-AE-302
24. 6" PLUG VALVE STH-VLV-201 (1)
25. 6" PLUG VALVE WAS-VLV-308
26. 4" CHECK VALVE STH-VLV-231
27. 4" FLOW METER STH-AE-231
28. 4" TOTAL SOLIDS METER STH-AE-231
29. 4" PLUG VALVE (FULL PORT) STH-VLV-232 (1)

NO.	DATE	BY:	CHECKED:	DESCRIPTION
REVISIONS				
3	2/17/26	PEW	ALW	ADDENDUM 7
2	2/10/26	PEW	ALW	ADDENDUM 6
1	1/16/26	PEW	ALW	ADDENDUM 3
0	12/19/25	PEW	ALW	ISSUED FOR BID

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

STATE OF MISSOURI · PAUL E. WARD · NUMBER PE-2016017691 · PROFESSIONAL ENGINEER

PAUL E. WARD
PROCESS
PE-2016017691

FOR WSD USE:

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

ENLARGED SLUDGE THICKENING PLAN

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
C. JENSEN	A. WADDOUPS	2/17/26	34W	53N	36

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	D703

PROJECT NO. 81000927 SHEET 391 OF 643

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WELLNER architects
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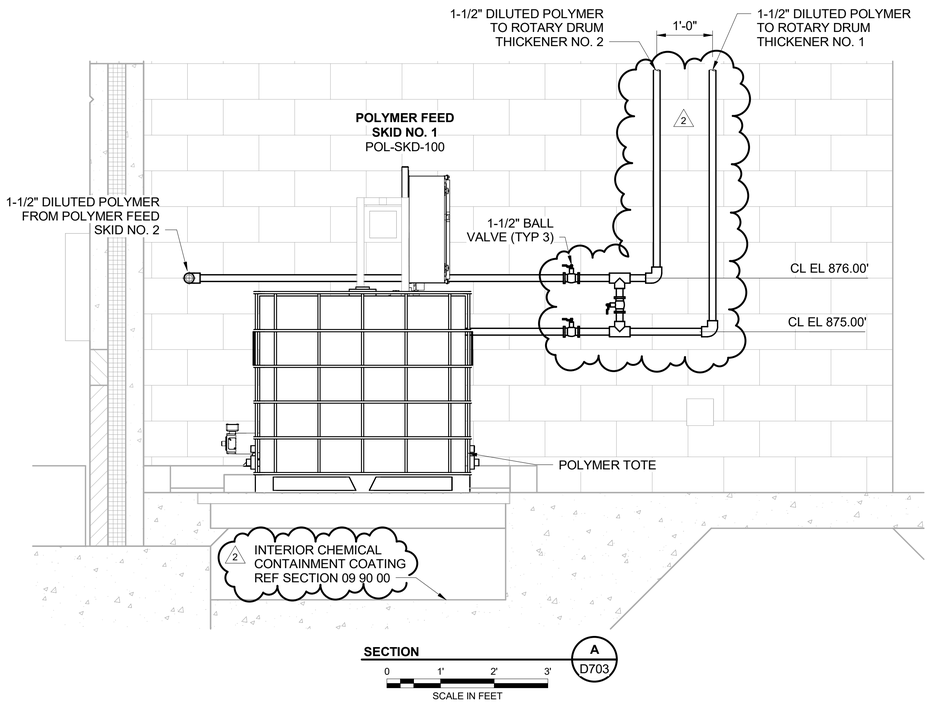

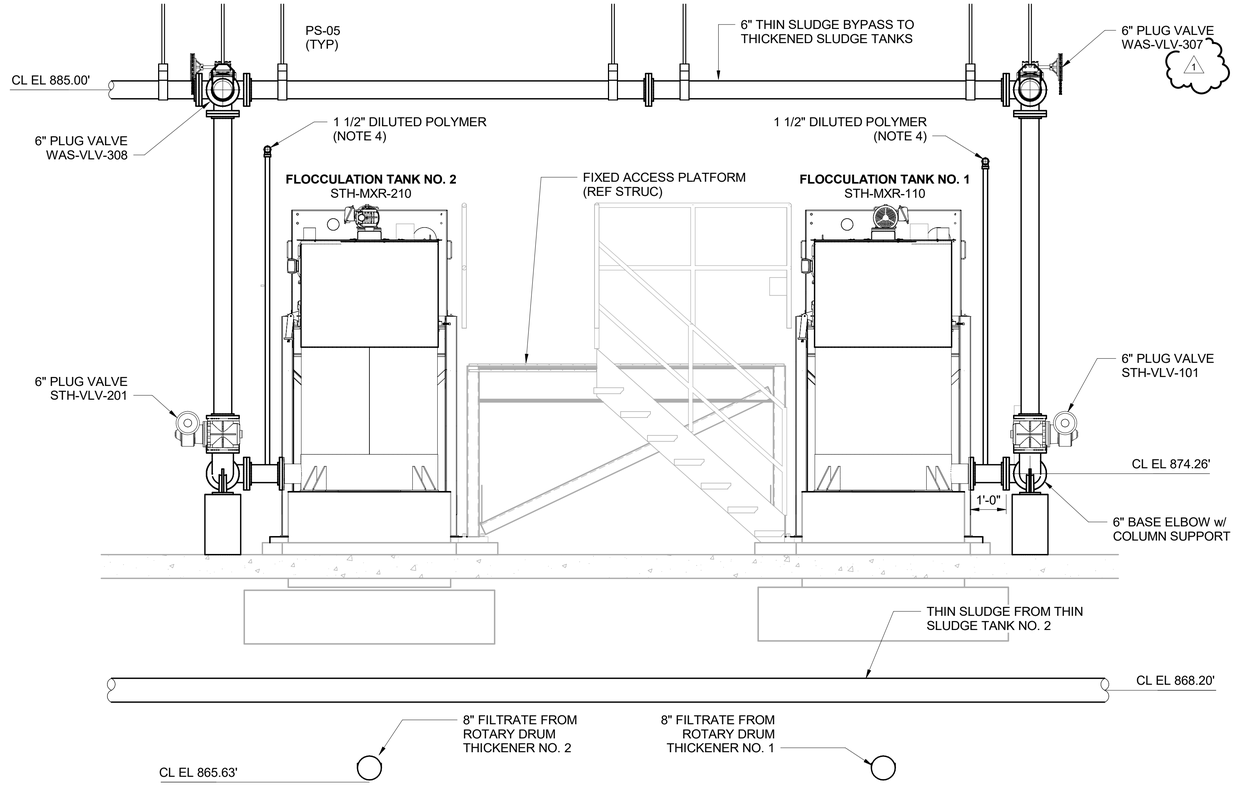

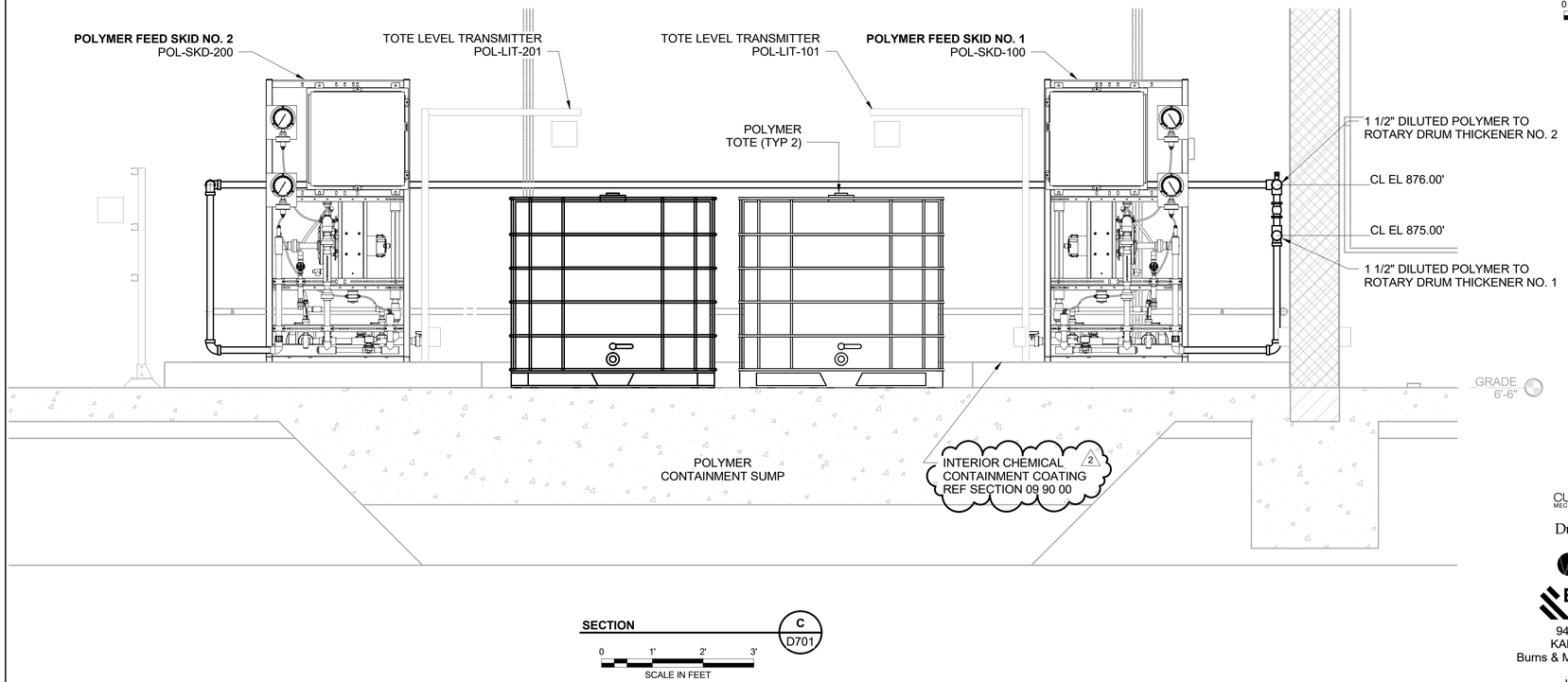

GENERAL NOTES:

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2. ALL PIPE SUPPORTS AT A MINIMUM, SHALL FOLLOW MSS-SP 69, UNLESS SPECIFIED ELSEWHERE.
3. ELEVATED AIR PIPING SHALL BE SUPPORTED WITH CLEVIS HANGER PIPE SUPPORT, UNLESS OTHERWISE SPECIFIED.
4. CONTRACTOR SHALL FIELD ROUTE PVC DILUTED POLYMER FEED PIPING TO POLYMER INJECTION RING ASSEMBLY. CONTRACTOR SHALL PROVIDE TUBING AND MANIFOLD AS REQUIRED TO TRANSITION FROM 1-1/2" DILUTED POLYMER PIPING TO FOUR (4) TUBING CONNECTIONS ON POLYMER INJECTION RING. INSTALLATION SHALL BE COORDINATED WITH ROTARY DRUM THICKENER MANUFACTURER.

NO.	DATE	BY:	CHECKED:	DESCRIPTION
2	2/10/26	PEW	ALW	ADDENDUM 6
1	1/16/26	PEW	ALW	ADDENDUM 3
0	12/19/25	PEW	ALW	ISSUED FOR BID

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

STATE OF MISSOURI
PAUL E. WARD
NUMBER PE-2016017691
PROFESSIONAL ENGINEER

PAUL E. WARD
PROCESS
PE-2016017691

FOR WSD USE:

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TODD CREEK WWTP EXPANSION AND UPGRADE

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SOLIDS PROCESSING BUILDING SECTIONS AND DETAILS SHEET 2

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
C. JENSEN	A. WADDOUPS	2/10/26	34W	53N	36

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	D707

PROJECT NO. 81000927

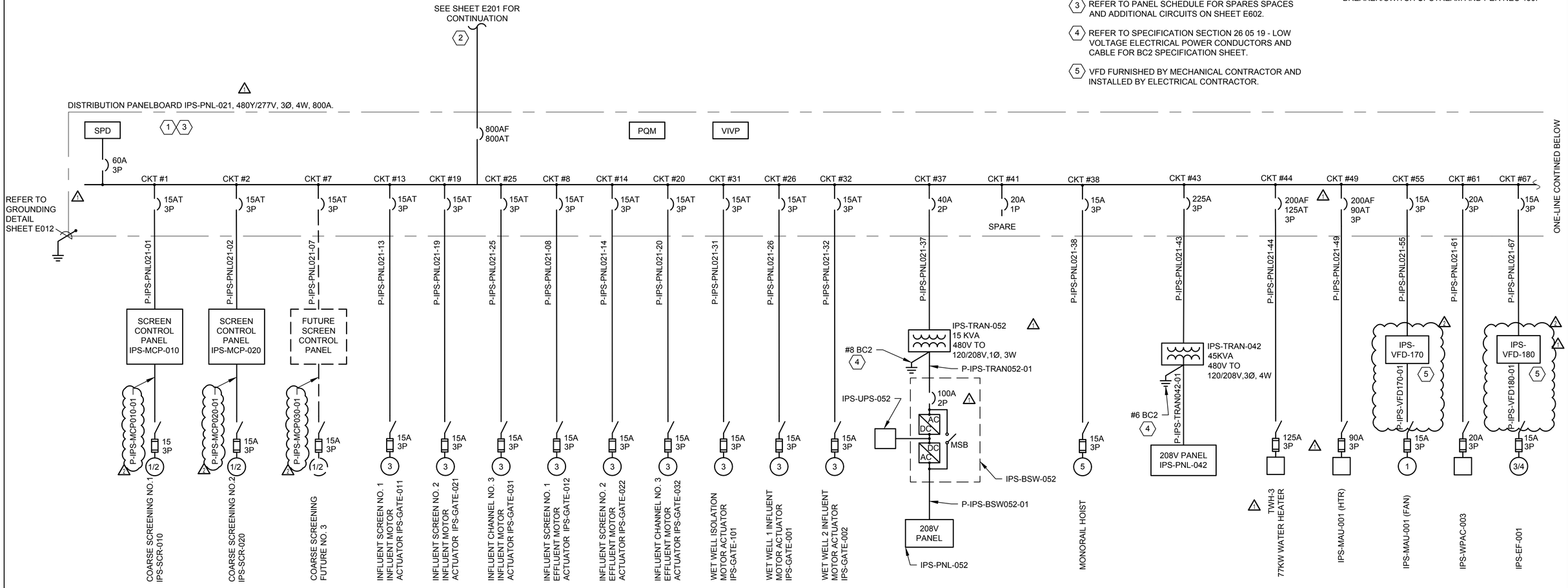
SHEET 395 OF 643

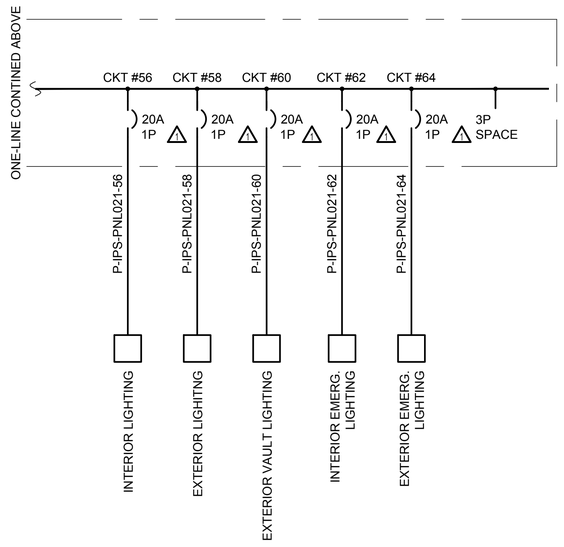
KEYED NOTES:

1. MCC AND PANEL LOCATED AT GRIT SCREENS BUILDING.
2. REFER TO SHEET E201 FOR INFLUENT SCREENING SERVICE ENTRANCE ONE-LINE DIAGRAM.
3. REFER TO PANEL SCHEDULE FOR SPARES SPACES AND ADDITIONAL CIRCUITS ON SHEET E602.
4. REFER TO SPECIFICATION SECTION 26 05 19 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLE FOR BC2 SPECIFICATION SHEET.
5. VFD FURNISHED BY MECHANICAL CONTRACTOR AND INSTALLED BY ELECTRICAL CONTRACTOR.

GENERAL NOTES:

1. REFER TO SHEET E001 FOR ELECTRICAL LEGEND.
2. REFER TO SHEET E291 FOR GRIT SCREENS CONDUIT AND CABLE SCHEDULE.
3. ALL LOCAL FUSED DISCONNECTS SIZED PER THE BREAKER/SWITCH UPSTREAM AND PER NEC 430.





COARSE SCREENS BUILDING ELECTRICAL ONE-LINE DIAGRAM
NOT TO SCALE

NO.	DATE	BY:	CHECKED:	DESCRIPTION
2	02/09/2026	RAL	CKB	ADDENDUM 006
1	01/16/2026	RAL	CKB	ADDENDUM #3
0	12/19/2025	RAL	CKB	ISSUED FOR BID

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KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 63164
COARSE SCREENING BUILDING
ELECTRICAL ONE-LINE DIAGRAM

STATE OF MISSOURI — CRAIG KEITH BREWSTER — NUMBER PE-2000150002 — REGISTERED PROFESSIONAL ENGINEER

12-19-2025
CRAIG K. BREWSTER
ELECTRICAL
PE-2000150002

FOR WSD USE:

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CUSTOM ENGINEERING MECHANICAL & ELECTRICAL ENGINEERING
DuBois Consultants CIVIL & STRUCTURAL ENGINEERING
WELLNER architects
BURNS McDONNELL
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KANSAS CITY, MO 64114
Burns & McDonnell Engineering Co, Inc
816-333-9400
LICENSEE NO. 000165

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
R. LARKEY	C.BREWSTER	12/19/2025			

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698				E202

PROJECT NO. 81000927 — SHEET 542 OF 643

Saved 02-09-2026 11:01:20 AM by RLARKEY
PLOT DATE 2/9/2026 2:51:31 PM by RLARKEY
C:\USERS\RLARKEY\DOCAC\DOCS\BURNS & MCDONNELL\1125460_TODDCREEKFP\PROJECT FILES\200 - INFLUENT PUMPINGIE202 - COARSE SCREENING BUILDING ELECTRICAL ONE-LINE DIAGRAM.DWG

TODD CREEK WATER/WASTEWATER TREATMENT PLANT - INFLUENT PUMP STATION CONDUIT AND CABLE SCHEDULE

REV. NO.	CONDUIT							CABLE						
	NO.	#SET	SIZE	TYPE	ROUTE	FROM	TO	NO.	TYPE	#	SIZE	GND	FROM	TO
	C20001	10	4"	40PVC	BG	IPS-TRAN-001	IPS-UCT-001	P-IPS-TRAN001-01	SE3	4-1/C	#500		IPS-TRAN-001	IPS-UCT-001
	C20002	10	4"	40PVC	BG	IPS-UCT-001	IPS-SWB-001	P-IPS-UMTR001-01	SE3	4-1/C	#500		IPS-UCT-001	IPS-SWB-001
	C20003	10	4"	40PVC	BG	IPS-TRAN-002	IPS-UCT-002	P-IPS-TRAN002-01	SE3	4-1/C	#500		IPS-TRAN-002	IPS-UCT-002
	C20004	10	4"	40PVC	BG	IPS-UCT-002	IPS-SWB-001	P-IPS-UMTR002-01	SE3	4-1/C	#500		IPS-UCT-002	IPS-SWB-001
	C20005	10	6"	RAL	TRAY	IPS-SWB-001	IPS-SWB-011	P-IPS-SWB001-01	SE3	4-1/C	#500	#500	IPS-SWB-001	IPS-SWB-011
	C20006	10	4"	40PVC	BG	IPS-SWB-001	IPS-GEN-091	P-IPS-SWB001-02	SE3	4-1/C	#500	#500	IPS-SWB-001	IPS-GEN-091
	C20007	1	4"	RAL/PVC	AG/BG	IPS-SWB-011	IPS-PNL-021	P-IPS-SWB011-01	SE3	4-1/C	#300	#1/0	IPS-SWB-011	IPS-PNL-021
	C20008	1	6"	RAL	TRAY	IPS-SWB-011	IPS-PNL-031	P-IPS-SWB011-02	SE2	4-1/C	#250	#4	IPS-SWB-011	IPS-PNL-031
	C20009	2	6"	RAL	TRAY	IPS-SWB-011	IPS-VFD-110	P-IPS-SWB011-03	SEV5	3/C	#4/0	(3)#4+#1	IPS-SWB-011	IPS-VFD-110
	C20010	2	4"	RAL/PVC	AG/BG	IPS-VFD-110	IPS-DS-110	P-IPS-VFD110-01	SEV5	3/C	#4/0	(3)#4+#1	IPS-VFD-110	IPS-DS-110
	C20011	2	6"	RAL	TRAY	IPS-SWB-011	IPS-VFD-120	P-IPS-SWB011-04	SEV5	3/C	#4/0	(3)#4+#1	IPS-SWB-011	IPS-VFD-120
	C20012	2	4"	RAL/PVC	AG/BG	IPS-VFD-120	IPS-DS-120	P-IPS-VFD120-01	SEV5	3/C	#4/0	(3)#4+#1	IPS-VFD-120	IPS-DS-120
	C20013	2	6"	RAL	TRAY	IPS-SWB-011	IPS-VFD-130	P-IPS-SWB011-05	SEV5	3/C	#4/0	(3)#4+#1	IPS-SWB-011	IPS-VFD-130
	C20014	2	4"	RAL/PVC	AG/BG	IPS-VFD-130	IPS-DS-130	P-IPS-VFD130-01	SEV5	3/C	#4/0	(3)#4+#1	IPS-VFD-130	IPS-DS-130
	C20015	2	6"	RAL	TRAY	IPS-SWB-011	IPS-VFD-140	P-IPS-SWB011-06	SEV5	3/C	#4/0	(3)#4+#1	IPS-SWB-011	IPS-VFD-140
	C20016	2	4"	RAL/PVC	AG/BG	IPS-VFD-140	IPS-DS-140	P-IPS-VFD140-01	SEV5	3/C	#4/0	(3)#4+#1	IPS-VFD-140	IPS-DS-140
	C20017	2	6"	RAL	TRAY	IPS-SWB-011	IPS-VFD-150	P-IPS-SWB011-07	SEV5	3/C	#4/0	(3)#4+#1	IPS-SWB-011	IPS-VFD-150
	C20018	2	4"	RAL/PVC	AG/BG	IPS-VFD-150	IPS-DS-150	P-IPS-VFD150-01	SEV5	3/C	#4/0	(3)#4+#1	IPS-VFD-150	IPS-DS-150
	C20019	2	6"	RAL	TRAY	IPS-SWB-011	IPS-VFD-160	P-IPS-SWB011-08					IPS-SWB-011	IPS-VFD-160
	C20020	2	4"	RAL/PVC	AG/BG	IPS-VFD-160 (FTR)	IPS-DS-160 (FTR)	P-IPS-VFD160-01					IPS-VFD-160 (FTR)	IPS-DS-160 (FTR)
	C20021	1	6"	RAL	TRAY	IPS-SWB-011	IPS-TRAN-051	P-IPS-SWB011-10	SE2	2-1/C	#8	#10	IPS-SWB-011	IPS-TRAN-051
	C20022	1	1"	RAL	AG	IPS-TRAN-051	IPS-BSW-051	P-IPS-TRAN051-01	SE2	3-1/C	#4	#8	IPS-TRAN-051	IPS-BSW-051
	C20023	1	1"	RAL	AG	IPS-BSW-051	IPS-PNL-051	P-IPS-BSW051-01	SE2	3-1/C	#6	#8	IPS-BSW-051	IPS-PNL-051
	C20024	1	3/4"	RAL	AG	IPS-SWB-011	IPS-WPAC-001	P-IPS-SWB011-13	SE2	3-1/C	#10	#10	IPS-SWB-011	IPS-WPAC-001
	C20025	1	3/4"	RAL	AG	IPS-SWB-011	IPS-WPAC-002	P-IPS-SWB011-14	SE2	3-1/C	#10	#10	IPS-SWB-011	IPS-WPAC-002
2	C20026	1	1"	RAL	AG	IPS-PNL-021	IPS-MCP-010	P-IPS-PNL021-01	SEV1	3/C	#10	#10	IPS-PNL-021	IPS-MCP-010
	C20027	1	1"	RAL	AG	IPS-MCP-010	IPS-SCR-010	P-IPS-MCP010-01	SEV1	3/C	#10	#10	IPS-MCP-010	IPS-SCR-010
	C20028	1	1"	RAL	AG	IPS-PNL-021	IPS-MCP-020	P-IPS-PNL021-02	SEV1	3/C	#10	#10	IPS-PNL-021	IPS-MCP-020
	C20028	1	1"	RAL	AG	IPS-MCP-020	IPS-SCR-020	P-IPS-MCP020-01	SEV1	3/C	#10	#10	IPS-MCP-020	IPS-SCR-020
	C20029	1	1"	RAL	AG	IPS-PNL-021	IPS-MCP-030 (FTR)	P-IPS-PNL021-07					IPS-PNL-021	IPS-MCP-030 (FTR)
	C20029	1	1"	RAL	AG	IPS-MCP-030 (FTR)	IPS-SCR-030 (FTR)	P-IPS-MCP030-01					IPS-MCP-030 (FTR)	IPS-SCR-030 (FTR)
	C20030	1	1"	RAL	AG	IPS-PNL-021	IPS-GATE-011	P-IPS-PNL021-13	SEV1	3/C	#10	#10	IPS-PNL-021	IPS-GATE-011
	C20031	1	1"	RAL	AG	IPS-PNL-021	IPS-GATE-021	P-IPS-PNL021-19	SEV1	3/C	#10	#10	IPS-PNL-021	IPS-GATE-021
	C20032	1	1"	RAL	AG	IPS-PNL-021	IPS-GATE-031	P-IPS-PNL021-25	SEV1	3/C	#10	#10	IPS-PNL-021	IPS-GATE-031
	C20033	1	1"	RAL	AG	IPS-PNL-021	IPS-GATE-012	P-IPS-PNL021-08	SEV1	3/C	#10	#10	IPS-PNL-021	IPS-GATE-012
	C20034	1	1"	RAL	AG	IPS-PNL-021	IPS-GATE-022	P-IPS-PNL021-14	SEV1	3/C	#10	#10	IPS-PNL-021	IPS-GATE-022
	C20035	1	1"	RAL	AG	IPS-PNL-021	IPS-GATE-032	P-IPS-PNL021-20	SEV1	3/C	#10	#10	IPS-PNL-021	IPS-GATE-032
	C20036	1	1"	RAL	AG	IPS-PNL-021	IPS-GATE-101	P-IPS-PNL021-31	SEV1	3/C	#10	#10	IPS-PNL-021	IPS-GATE-101
	C20037	1	1"	RAL	AG	IPS-PNL-021	IPS-GATE-001	P-IPS-PNL021-26	SEV1	3/C	#10	#10	IPS-PNL-021	IPS-GATE-001
	C20038	1	1"	RAL	AG	IPS-PNL-021	IPS-GATE-002	P-IPS-PNL021-32	SEV1	3/C	#10	#10	IPS-PNL-021	IPS-GATE-002
	C20039	1	1"	RAL/PVC	TRAY	IPS-PNL-021	IPS-TRAN-052	P-IPS-PNL021-37	SEV1	2/C	#8	#10	IPS-PNL-021	IPS-TRAN-052
	C20040	1	1"	RAL	AG	IPS-TRAN-052	IPS-BSW-052	P-IPS-TRAN052-01	SE2	3-1/C	#4	#8	IPS-TRAN-052	IPS-BSW-052
	C20041	1	1"	RAL	AG	IPS-BSW-052	IPS-PNL-052	P-IPS-BSW052-01	SE2	3-1/C	#4	#8	IPS-BSW-052	IPS-PNL-052
	C20042	1	1"	RAL	AG	IPS-PNL-021	MONORAIL HOIST	P-IPS-PNL021-38	SEV1	3/C	#10	#10	IPS-PNL-021	MONORAIL HOIST
	C20043	1	1 1/2"	RAL	AG	IPS-PNL-021	IPS-TRAN-042	P-IPS-PNL021-43	SE2	3-1/C	#4	#8	IPS-PNL-021	IPS-TRAN-042
	C20044	1	2"	RAL	AG	IPS-TRAN-042	IPS-PNL-042	P-IPS-TRAN042-01	SE2	4-1/C	#1/0	#6	IPS-TRAN-042	IPS-PNL-042
2	C20045	1	2 1/2"	RAL	AG	IPS-PNL-021	IPS-MAU-001(HTR)	P-IPS-PNL021-49	SE2	3-1/C	#3/0	#6	IPS-PNL-021	IPS-MAU-001(HTR)
	C20046	1	1"	RAL	AG	IPS-PNL-021	IPS-VFD-170	P-IPS-PNL021-55	SE2	3-1/C	#10	#10	IPS-PNL-021	IPS-VFD-170
	C20046	1	1"	RAL	AG	IPS-VFD-170	IPS-MAU-001(FAN)	P-IPS-VFD170-01	SE2	3-1/C	#10	#10	IPS-VFD-170	IPS-MAU-001(FAN)
2	C20047	1	3/4"	RAL	AG	IPS-PNL-021	IPS-WAC-003	P-IPS-PNL021-61	SE2	3-1/C	#10	#10	IPS-PNL-021	IPS-WAC-003
	C20048	1	1"	RAL	AG	IPS-PNL-021	IPS-VFD-180	P-IPS-PNL021-67	SE2	3-1/C	#10	#10	IPS-PNL-021	IPS-VFD-180
	C20049	1	1"	RAL	AG	IPS-VFD-180	IPS-EF-001	P-IPS-VFD180-01	SE2	3-1/C	#10	#10	IPS-VFD-180	IPS-EF-001
	C20050	1	1"	RAL	AG	IPS-PNL-021	INTERIOR LTG	P-IPS-PNL021-56	SEV1	2-1/C	#10	#10	IPS-PNL-021	INTERIOR LTG
	C20051	1	1"	RAL	AG	IPS-PNL-021	EXT. LTG	P-IPS-PNL021-58	SEV1	2-1/C	#10	#10	IPS-PNL-021	EXT. LTG
	C20052	1	1"	RAL	AG	IPS-PNL-021	EXT. VAULT LTG	P-IPS-PNL021-60	SEV1	2-1/C	#10	#10	IPS-PNL-021	EXT. VAULT LTG
	C20053	1	1"	RAL	AG	IPS-PNL-021	INT EMERG. LTG	P-IPS-PNL021-62	SEV1	2-1/C	#10	#10	IPS-PNL-021	INT EMERG. LTG
	C20054	1	1"	RAL	AG	IPS-PNL-021	EXT EMERG. LTG	P-IPS-PNL021-64	SEV1	2-1/C	#10	#10	IPS-PNL-021	EXT EMERG. LTG
	C20055	1	1 1/2"	RAL	AG	IPS-PNL-021	PWH-3 WATER HTR	P-IPS-PNL021-44	SEV1	3-1/C	#1	#6	IPS-PNL-021	PWH-3 WATER HTR
	C20056	1	1 1/2"	RAL	AG	IPS-PNL-031	IPS-TRAN-041	P-IPS-PNL031-08	SE2	3-1/C	#4	#8	IPS-PNL-031	IPS-TRAN-041
	C20057	1	2"	RAL	AG	IPS-TRAN-041	IPS-PNL-041	P-IPS-TRAN041-01	SE2	4-1/C	#1/0	#6	IPS-TRAN-041	IPS-PNL-041

GENERAL NOTES:

1. REFER TO SHEET E001 FOR ELECTRICAL LEGEND.
2. REFER TO SHEET E201 AND E202 FOR ONE-LINE DIAGRAMS.
3. COORDINATE ALL ELECTRICAL CONNECTIONS FOR PROCESS EQUIPMENT WITH P&ID "Y" SHEETS.

NO.	DATE	BY:	CHECKED:	DESCRIPTION
2	02/09/2026	RAL	CKB	ADDENDUM 006
1	01/16/2026	RAL	CKB	ADDENDUM #3
0	12/19/2025	RAL	CKB	ISSUED FOR BID

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

INFLUENT PUMP STATION ELECTRICAL BUILDING CABLE TAG SCHEDULE SHEET 1

STATE OF MISSOURI — CRAIG KEITH BREWSTER — PE-2000150002 — REGISTERED PROFESSIONAL ENGINEER

12-19-2025

CRAIG K. BREWSTER
ELECTRICAL
PE-2000150002

FOR WSD USE:

KCWATER

CUSTOM ENGINEERING
MECHANICAL & ELECTRICAL ENGINEERING

DuBois Consultants
CIVIL + STRUCTURAL ENGINEERING

WELLNER architects

BURNS McDONNELL
9400 WARD PARKWAY
KANSAS CITY, MO 64114
Burns & McDonnell Engineering Co, Inc
816-333-9400
Licensee No. 000165

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
M.CAYETANO	C.BREWSTER	02/09/2026	34W	-	-

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	-

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	E291

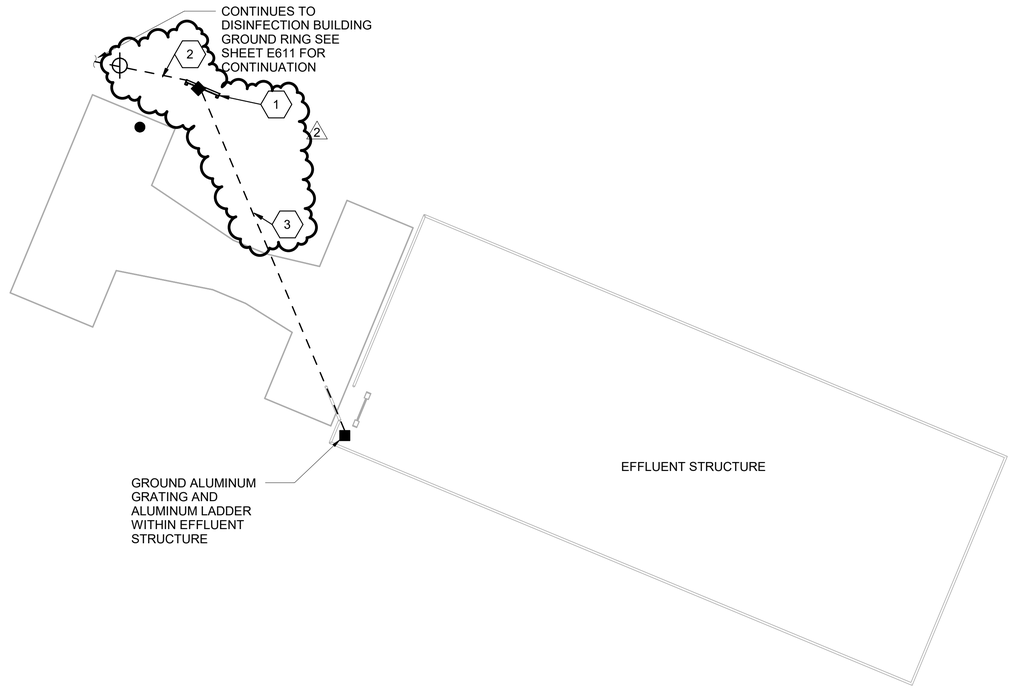
PROJECT NO. 81000927 — SHEET 555 OF 643

GENERAL NOTES:

1. REFER TO ELECTRICAL LEGEND ON SHEET E001.
2. GROUNDING IS SHOWN DIAGRAMMATICALLY. CONTRACTOR SHALL FOLLOW REQUIREMENTS OF SPECIFICATIONS, AND USE MEANS AND METHODS FOR EXACT ROUTING.

KEYED NOTES:

1. PROVIDE UNISTUT ON CONCRETE PAD. REFER TO STRUCTURAL DETAILS FOR CONCRETE PADS.
2. #4/0 GROUND TO SITE GROUND RING.
3. #6 GROUND TO EQUIPMENT AND STRUCTURE.



UV DISINFECTION BUILDING EFFLUENT STRUCTURE ELECTRICAL GROUNDING

0 2' 4' 8'

SCALE IN FEET

NORTH

1

NO.	DATE	BY:	CHECKED:	DESCRIPTION
2	02/09/2026	RAL	CKB	ADDENDUM 006
1	01/16/2026	RAL	CKB	ADDENDUM #3
0	12/19/2025	RAL	CKB	ISSUED FOR BID

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

STATE OF MISSOURI
CRAIG KEITH BREWSTER
NUMBER
E-2000150002
REGISTERED PROFESSIONAL ENGINEER

Craig Brewster
12-19-2025

CRAIG K. BREWSTER
ELECTRICAL
PE-2000150002

FOR WSD USE:

KCWATER

CUSTOM ENGINEERING
MECHANICAL & ELECTRICAL ENGINEERING

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Licensee No. 000165

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

EFFLUENT STRUCTURE ELECTRICAL GROUNDING PLAN

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
M.CAYETANO	C.BREWSTER	02/09/2026	34W	-	-

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	E612

PROJECT NO. 81000927

SHEET 602 OF 643

AIR UNIT (AHU, MAU, WPAC) SCHEDULE

SYSTEM								DX COOLING COIL, R-410A								CONDENSING UNIT				ELECTRIC HEATING COIL					
								COOL (MBH)			FLOW	ENTER TEMP		LEAVE TEMP						HEAT			AIR		
TAG	SERVES	MFR	MODEL*	TYPE	ALT (FT)	EXT PRESS (INWC)	MIN OA (CFM)	NOMINAL TONS*	MIN TOTAL	MIN SENS	(CFM)	DB (°F)	WB (°F)	DB (°F)	WB (°F)	TAG	OUTDOOR TEMP (°F)	MIN IEER	MIN COP	NOMINAL KW*	MIN MBH	MIN KW	FLOW (CFM)	ENTER (°F)	LEAVE (°F)
ADM-AHU-001	ADMIN OFFICES	ENGINEERED AIR	FWXH164/K/O	VAV PACKAGE HEAT PUMP	1,005	0.80	730	9.0	99.6	71.4	2,910	80.0	66.3	56.2	54.7	INTEGRAL	105.0	-	-	14.0	46.3	14.0	1,875	-2.1	56.4
ADM-WPAC-001	816-ELECTRICAL	BARD	W30AB-C06	WALL-MOUNTED AIR CONDITIONER	1,005	0.21	0	2.5	21.2	19.9	607	85.0	63.4	54.7	51.2	INTEGRAL	105.0	11.0	-	6.0	8.2	2.4	607	55.0	67.4
ADM-WPAC-002	816-ELECTRICAL	BARD	W30AB-C06	WALL-MOUNTED AIR CONDITIONER	1,005	0.21	0	2.5	21.2	19.9	607	85.0	63.4	54.7	51.2	INTEGRAL	105.0	11.0	-	6.0	8.2	2.4	607	55.0	67.4
AGS-AHU-001	401-BLOWER	ENGINEERED AIR	LM1/K/O	HEATING-ONLY AIR HANDLING UNIT	1,005	0.24	0	-	-	-	-	-	-	-	-	-	-	-	-	15.0	48.8	14.3	1,286	55.0	90.0
AGS-AHU-002	400-ELECTRICAL	ENGINEERED AIR	FWX113/K/O	PACKAGE AIR CONDITIONER	1,005	0.34	0	12.7	132.9	128.5	3917	85.0	62.7	54.7	50.6	-	105.0	11.0	-	18.0	25.8	7.6	3,917	55.0	61.1
AGS-MAU-001	402-PUMP	ENGINEERED AIR	LM4/K/O	MAKEUP-AIR UNIT	1,005	0.16	3,375	-	-	-	-	-	-	-	-	-	-	-	-	89.0	241.5	70.8	3,375	-2.1	63.9
AGS-MAU-002	403-PIPE GALLERY	ENGINEERED AIR	LM13/K/O	MAKEUP-AIR UNIT	1,005	0.16	12,060	-	-	-	-	-	-	-	-	-	-	-	-	242.0	854.6	250.5	12,060	-2.1	63.2
IPS-MAU-001	201-SCREENING	ENGINEERED AIR	LM4/K/O	MAKEUP-AIR UNIT	1,005	0.16	3,078	-	-	-	-	-	-	-	-	-	-	-	-	64.0	299.0	91.0	3,078	-2.1	63.9
GRSC-MAU-001	302-STAIRS	ENGINEERED AIR	LM3/K/O	MAKEUP-AIR UNIT	1,005		1,900	-	-	-	-	-	-	-	-	-	-	-	-	60.0	194.8	57.1	2,890	-2.1	60.2
GRSC-MAU-002	301-PROCESSING, 303-SCREENING	ENGINEERED AIR	LM10/K/O	MAKEUP-AIR UNIT	1,005	0.12	10,570	-	-	-	-	-	-	-	-	-	-	-	-	260.0	1,042.1	305.4	10,570	-2.1	88.9
GRSC-WPAC-001	300-ELECTRICAL	BARD	W48AC-C09	WALL-MOUNTED AIR CONDITIONER	1,005	-	0	4.0	33.9	32.0	975	85.0	63.3	54.7	51.1	INTEGRAL	105.0	11.0	-	9.0	14.4	4.2	976	55.0	68.6
IPS-WPAC-001	200-ELECTRICAL	BARD	W60AC-C09	WALL-MOUNTED AIR CONDITIONER	1,005	-	0	5.0	43.0	41.2	1,255	85.0	63.0	54.7	51.0	INTEGRAL	105.0	11.0	-	9.0	12.7	3.7	1,255	55.0	64.4
IPS-WPAC-002	200-ELECTRICAL	BARD	W60AC-C09	WALL-MOUNTED AIR CONDITIONER	1,005	-	0	5.0	43.0	41.2	1,255	85.0	63.0	54.7	51.0	INTEGRAL	105.0	11.0	-	9.0	12.7	3.7	1,255	55.0	64.4
IPS-WPAC-003	201-ELECTRICAL	BARD	W36AC-C09	WALL-MOUNTED AIR CONDITIONER	1,005	-	35	3.0	35.8	24.5	1,200	85.0	63.0	54.7	51.0	INTEGRAL	105.0	11.0	-	9.0	12.7	3.7	1,255	55.0	64.4
SPB-AHU-001	700-BLOWER	ENGINEERED AIR	LM1/K/O	HEATING-ONLY AIR HANDLING UNIT	1,005	0.27	0	-	-	-	-	-	-	-	-	-	-	-	-	5.0	15.4	4.5	405	55.0	90.0
SPB-MAU-001	702-PROCESS	ENGINEERED AIR	LM10/K/O	MAKEUP-AIR UNIT	1,005	0.42	9,600	-	-	-	-	-	-	-	-	-	-	-	-	242.0	660.8	193.7	9,600	-2.1	61.5
SPB-WPAC-001	701-ELECTRICAL	BARD	W48AC-C09	WALL-MOUNTED AIR CONDITIONER	1,005	0.06	0	4.0	36.3	34.1	1,040	85.0	63.3	54.7	51.0	INTEGRAL	105.0	11.0	-	9.0	15.2	4.4	1,040	55.0	68.5
SPB-WPAC-002	701-ELECTRICAL	BARD	W48AC-C09	WALL-MOUNTED AIR CONDITIONER	1,005	0.06	0	4.0	36.3	34.1	1,040	85.0	63.3	54.7	51.0	INTEGRAL	105.0	11.0	-	9.0	15.2	4.4	1,040	55.0	68.5
UV-AHU-001	601-PROCESS	ENGINEERED AIR	LM1/K/O	HEATING-ONLY AIR HANDLING UNIT	1,005	0.08	257	-	-	-	-	-	-	-	-	-	-	-	-	15.0	44.8	13.1	900	38.8	84.4
UV-WPAC-001	600-ELECTRICAL	BARD	W42AC-C09	WALL-MOUNTED AIR CONDITIONER	1,005	0.15	0	3.5	28.2	26.0	791	85.0	63.7	54.7	51.3	INTEGRAL	105.0	11.0	-	6.0	14.9	4.4	780	55.0	72.4

NOTES:
* VALUE BASED UPON CURRENTLY SELECTED DESIGN BASIS EQUIPMENT. CONTRACTOR IS RESPONSIBLE FOR DESIGN CHANGES ASSOCIATED WITH SUBSTITUTIONS AND THEIR COSTS, EVEN THOSE BORNE BY OTHER TRADES.
# COORDINATE WITH ELECTRICAL CONTRACTOR, WHERE CURRENT-LIMITING FUSE IS REQUIRED TO ACHIEVE SHORT-CIRCUIT CURRENT RATING.

AIR UNIT (AHU, MAU, WPAC) SCHEDULE (CONTINUED)

	FILTERS			ELECTRICAL						ENCLOSURE					
TAG	THICK (IN)	TYPE	MERV	DUTY	VOLT (V)	PH (φ)	MCA* (A)	MOCP* (A)	SCCR # (KA)	MATL	FINISH	OP WT* (LBS)	PLAN DRAW	SPEC SECTION	OPTIONS
ADM-AHU-001	2 + 2	ACTIVATED-CARBON PANEL + PLEATED	7	FAN VFD	460	3	6	15	5	AL OR SS-316	MILL	-	M801	23 74 13	1,4,5,7,10,11,14,15
				AC/HEAT	460	3	50	60	6						
ADM-WPAC-001	2	PLEATED	7	SINGLE	460	3	12	15	3	AL OR SS-316	MILL	350	M801	23 81 13	1,4,8,10,12,16
ADM-WPAC-002	2	PLEATED	7	SINGLE	460	3	12	15	3	AL OR SS-316	MILL	350	M801	23 81 13	1,4,8,10,12,16
AGS-AHU-001	2	PLEATED	7	FAN VFD	460	3	2	15	5	AL OR SS-316	MILL	2,400	M401	23 74 13	1,4,5,7,10
				HEAT	460	3	27	30	3						
AGS-AHU-002	2	PLEATED	7	SINGLE	460	3	26.8	30	4	AL OR SS-316	MILL	5,550	M401	23 74 13	1,4,7,10
AGS-MAU-001	-	-	7	FAN VFD	460	3	2.6	15	25	AL OR SS-316	MILL	2,275	M403	23 74 33	1,2,3,4,5,6,14
				HEAT	460	3	90	100	20						
AGS-MAU-002	-	-	7	FAN VFD	460	3	6	15	29	AL OR SS-316	MILL	4,200	M403	23 74 33	1,2,3,4,5,6,14
				HEAT	460	3	317	350	29						
IPS-MAU-001	-	-	7	FAN VFD	460	3	3	15	25	AL OR SS-316	MILL	2,275	M202	23 74 33	1,2,3,4,5,6,14
				HEAT	460	3	82	90	10						
GRSC-MAU-001	-	-	7	FAN VFD	460	3	3	15	23	AL OR SS-316	MILL	1,875	M301	23 74 33	1,2,4,5,6,14
				HEAT	460	3	73.9	80	3						
GRSC-MAU-002	-	-	7	FAN VFD	460	3	6	15	39	AL OR SS-316	MILL	3,475	M301	23 74 33	1,2,3,4,5,6,14
				HEAT	460	3	386.3	400	31						
GRSC-WPAC-001	2	PLEATED	7	SINGLE	460	3	17	20	8	AL OR SS-316	MILL	539	M301	23 81 13	1,4,8,10,12,16
IPS-WPAC-001	2	PLEATED	7	SINGLE	460	3	18	20	8	AL OR SS-316	MILL	505	M201	23 81 13	1,4,8,10,12,13,16
IPS-WPAC-002	2	PLEATED	7	SINGLE	460	3	18	20	8	AL OR SS-316	MILL	505	M201	23 81 13	1,4,8,10,12,13,16
IPS-WPAC-003	2	PLEATED	7	SINGLE	460	3	17	20	8	AL OR SS-316	MILL	505	M202	23 81 13	1,4,8,10,12,13,16
SPB-AHU-001	2	PLEATED	7	FAN VFD	460	3	3	15	8	AL OR SS-316	MILL	2,300	M701	23 74 13	1,4,5,7,10
				HEAT	460	3	9	15	2						
SPB-MAU-001	-	-	7	FAN VFD	460	3	6	15	35	AL OR SS-316	MILL	3,475	M701	23 74 33	1,2,3,4,5,6,14
				HEAT	460	3	246.5	250	26						
SPB-WPAC-001	2	PLEATED	7	SINGLE	460	3	17	20	3	AL OR SS-316	MILL	495	M701	23 81 13	1,4,8,10,12,16
SPB-WPAC-002	2	PLEATED	7	SINGLE	460	3	17	20	3	AL OR SS-316	MILL	495	M701	23 81 13	1,4,8,10,12,16
UV-AHU-001	2	PLEATED	7	FAN VFD	460	3	3	15	11	AL OR SS-316	MILL	1,750	M601	23 74 13	1,4,5,7,10
				HEAT	460	3	24	25	10						
UV-WPAC-001	2	PLEATED	7	SINGLE	460	3	17	20	10	AL OR SS-316	MILL	490	M601	23 81 13	1,4,8,10,12,16

OPTION 1: PROVIDE ALL STAINLESS STEEL OR ALUMINUM CONSTRUCTION WITH STAINLESS STEEL HARDWARE, VFD-RATED SEVERE-DUTY FAN MOTORS AND NEMA-4X OR BETTER ELECTRICAL ENCLOSURES.
OPTION 2: PROVIDE EQUIPMENT WITH SAIL SWITCH IN DUCTWORK, HONEYWELL MODEL S688A1007 5-INCH SAIL SWITCH. INSTALL PER MANUFACTURER'S INSTRUCTIONS. COORDINATE WITH INSTRUMENTATION AND CONTROLS TO PROVIDE FLOW DETECTION FOR SYSTEMS.
OPTION 3: PROVIDE SPARK-RESISTANT SUPPLY FANS CONSTRUCTED IN ACCORDANCE WITH AMCA 99 FOR TYPE-A OR TYPE-B COMPLIANCE WITH MOTOR CIRCUIT USING METHODS AND MATERIALS CONSISTENT WITH NEC CLASS-I GROUP-D DIVISION-2 HAZARDOUS LOCATIONS.
OPTION 4: PROVIDE ELECTRIC-RESISTANCE HEATER COIL WITH AIR-FLOW SWITCH, HIGH-TEMPERATURE TRIP, AND ALL OTHER SAFETIES REQUIRED FOR UL LISTING AND SAFE OPERATION.
OPTION 5: PROVIDE VFD RATED SUPPLY MOTORS.
OPTION 6: PROVIDE 100% OUTDOOR AIR UNIT.
OPTION 7: PROVIDE OUTDOOR/RETURN-AIR MIXING BOX WITH LOW-LEAKAGE OUTDOOR-AIR DAMPER, RETURN-AIR DAMPER, AND BAROMETRIC RELIEF-AIR DAMPER.
OPTION 8: PROVIDE MANUAL MINIMUM OUTDOOR-AIR DAMPER.
OPTION 9: PROVIDE AIR ECONOMIZER WITH RETURN-AIR DAMPER. MANUFACTURER'S ECONOMIZER CONTROLLER NOT REQUIRED AS ECONOMIZER AND RETURN-AIR DAMPER WILL BE CONTROLLED BY DDC TO MAINTAIN ROOM PRESSURIZATION.
OPTION 10: EXTERNAL PRESSURE RATINGS SHALL BE BASED UPON FILTER PRESSURE DROP AT DOUBLE ITS INITIAL VALUE.
OPTION 11: PROVIDE REFILLABLE ACTIVATED-CARBON PANEL RATED FOR THE AIR VELOCITY ENCOUNTERED AT SUPPLY FAN'S MAXIMUM AIR FLOW RATING. PROVIDE PLEATED AIR FILTER AFTER ACTIVATED-CARBON PANEL.
OPTION 12: PROVIDE 2-INCH FLANGE RETURN GRILLE.
OPTION 13: PROVIDE 2-INCH FLANGE SUPPLY GRILLE.
OPTION 14: FURNISH VFD FOR INSTALLATION BY ELECTRICAL CONTRACTOR. COORDINATE VFD SELECTION AND INSTALLATION WITH MECHANICAL INSTRUMENTATION CONTRACTOR.
OPTION 15: PROVIDE SYSTEM WITH FULL OUTDOOR AIR ECONOMIZER.
OPTION 16: PROVIDE UNIT WITH A MINIMUM SEER2 RATING OF 13.4 OR THAT MEETS THE MINIMUM PERFORMANCE REQUIREMENTS REQUIRED IN 2021 IECC 403.3.2.

NO.	DATE	BY:	CHECKED:	DESCRIPTION
2	02/09/2026	TDP	JRW	ADDENDUM 006
1	01/16/2026	TDP	JRW	ADDENDUM #3
0	12/19/2025	TDP	JRW	ISSUED FOR BID

REVISIONS

KCWATER
CUSTOM ENGINEERING MECHANICAL & ELECTRICAL ENGINEERING
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Licensee No. 000165

STATE OF MISSOURI — JEREMY RYAN WALKER — NUMBER PE-2022003792 — PROFESSIONAL ENGINEER
12/19/2025
JEREMY R. WALKER
MECHANICAL
PE-2022003792

FOR WSD USE:

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

MECHANICAL SCHEDULES

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
T. PARKER	M. HUBERT	02/09/2026	34W	-	-

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

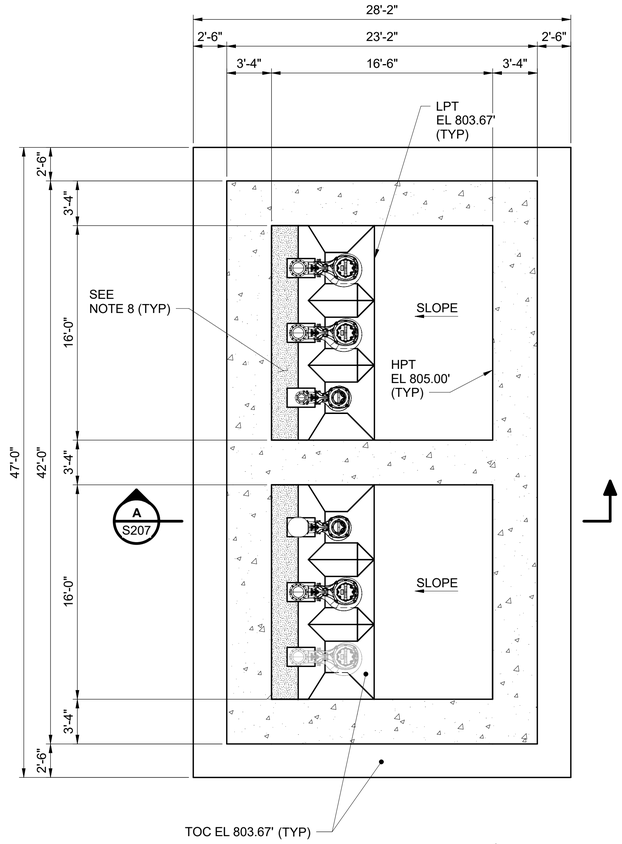
CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	M002

PROJECT NO. 81000927

SHEET 402 OF 643

INFLUENT PUMP STATION COARSE SCREEN STRUCTURE AND WET WELL NOTES:

1. SEE DRAWING S002 FOR STRUCTURAL GENERAL NOTES.
2. SEE DRAWING S003 THROUGH S014 FOR STANDARD DETAILS.
3. SEE ARCHITECTURAL, CIVIL, ELECTRICAL, MECHANICAL, AND PROCESS DRAWINGS FOR MISCELLANEOUS STEEL, CONCRETE, ANCHORS AND OPENINGS NOT INDICATED ON STRUCTURAL DRAWINGS.
4. DESIGN LOADS (IBC 2018) SEE S002 AND BELOW:
   A. DEAD LOADS:
      1. WEIGHT OF MATERIALS OF CONSTRUCTION.
      2. COLLATERAL DEAD LOAD (TOP SLAB) = 30 PSF.
   B. SNOW LOADS:
      1. FLAT ROOF SNOW LOAD = 22 PSF.
   C. FLUID LOADS: SEE DRAWING S002.
   D. SOIL LOADS: SEE DRAWING S002.
5. DO NOT BACKFILL STRUCTURE UNTIL TOP SLAB IS IN PLACE AND HAS REACHED DESIGN STRENGTH.
6. TIGHTNESS TESTING OF LIQUID CONTAINMENT STRUCTURE: PERFORM IN ACCORDANCE WITH SPECIFICATION 03 30 00.
7. CONCRETE FILL. COORDINATE WITH PUMP MANUFACTURER FOR REQUIRED SHAPING AROUND PUMPS.
8. SEE DRAWING S217 AND S218 FOR EXCAVATION, SUBGRADE, AND BACKFILL REQUIREMENTS.
9. WATERPROOFING SYSTEM REQUIRED AROUND COARSE SCREENING AND WET WELL STRUCTURE. SEE SECTIONS S207 AND S208 FOR EXTENTS OF WATERPROOFING. SEE SPECIFICATION SECTION 07 13 00 AND 07 14 16 FOR REQUIREMENTS. (1)

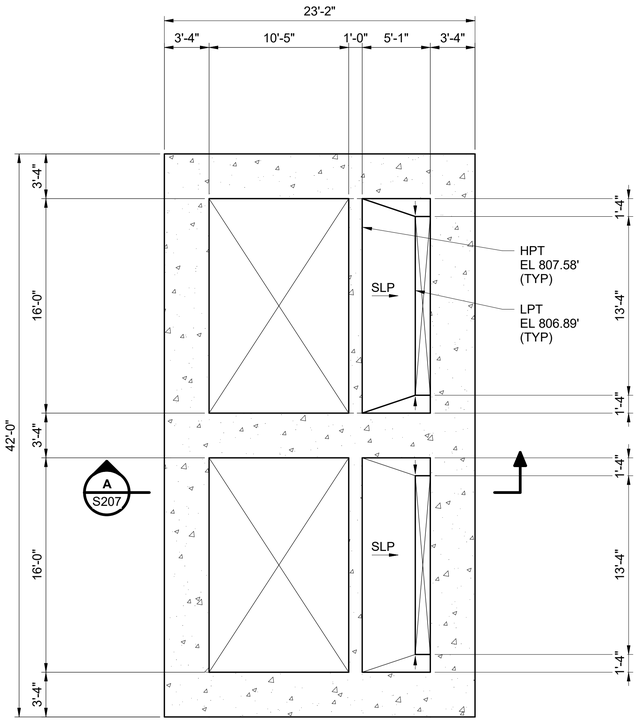


PLAN @ EL 805.00'

0 4' 8' 12'

SCALE IN FEET

NORTH



PLAN @ EL 807.92'

0 4' 8' 12'

SCALE IN FEET

NORTH

NO.	DATE	BY:	CHECKED:	DESCRIPTION
1	2/13/2026	JT	AMH	ISSUED PER ADDENDUM #006
0	12/19/2025	JT	AMH	ISSUED FOR BID

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

INFLUENT PUMP STATION COARSE SCREENING AND WET WELL PLANS

STATE OF MISSOURI JOHN TSOUFLIAS PE2015001427 PROFESSIONAL ENGINEER

JOHN TSOUFLIAS
STRUCTURAL
LICENSE NO. 2015001427

FOR WSD USE:

KCWATER

CUSTOM ENGINEERING
MECHANICAL & ELECTRICAL ENGINEERING

DuBois Consultants
CIVIL • STRUCTURAL ENGINEERING

WELLNER architects

BURNS McDONNELL
9400 WARD PARKWAY
KANSAS CITY, MO 64114
Burns & McDonnell Engineering Co, Inc
816-333-9400
Licensee No. 000165

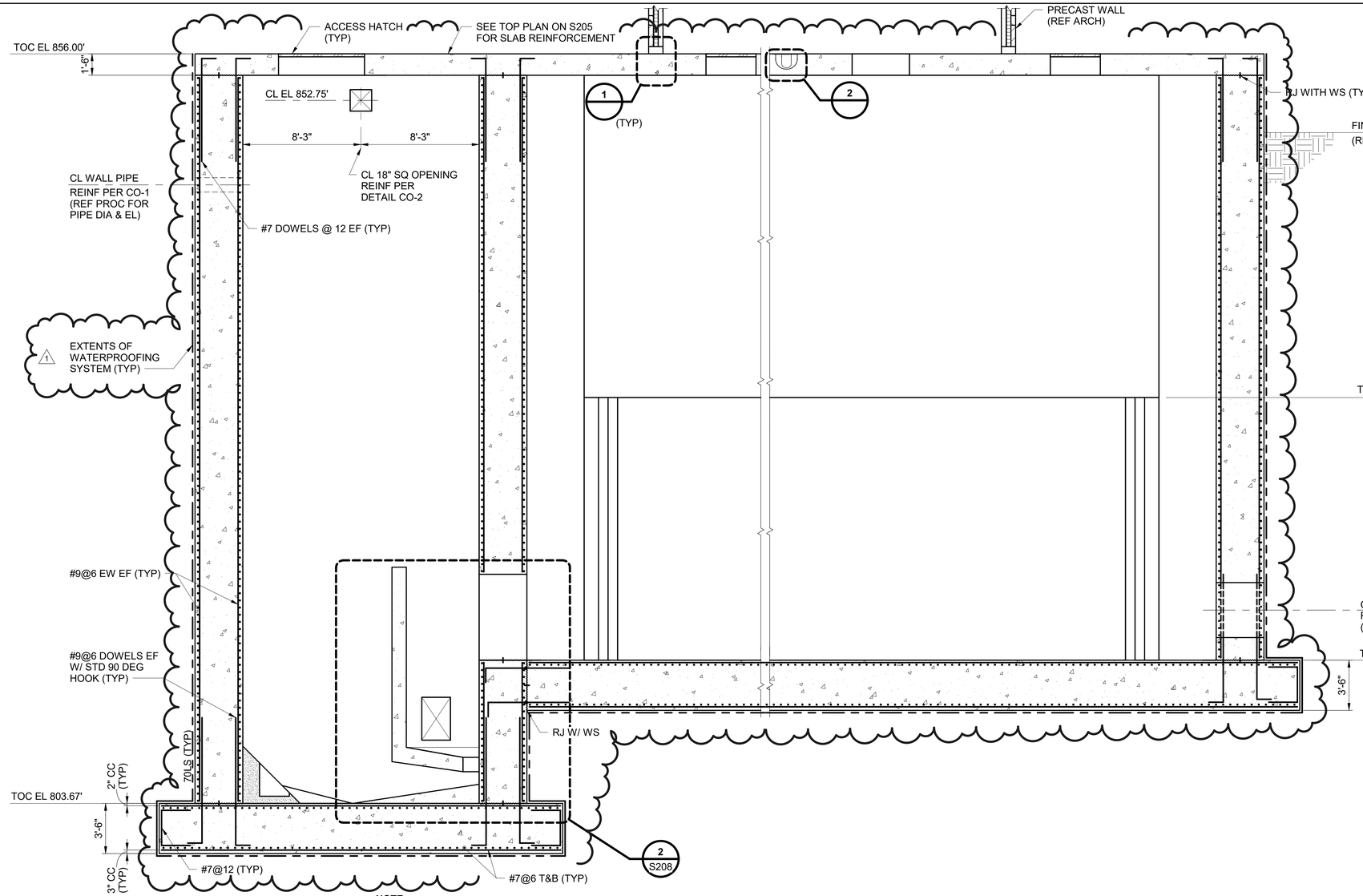
DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
B. BAIR	A. HOLMES	2/13/2026	34W		

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	S202

PROJECT NO. 81000927

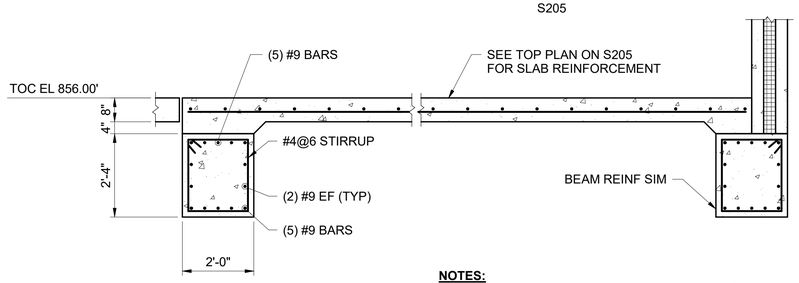
SHEET 170 OF 643



NOTE:

1. MONORAIL STRUCTURE NOT SHOWN FOR CLARITY.
2. SEE DRAWING S204 FOR REQUIRED WALL CORNER BARS.

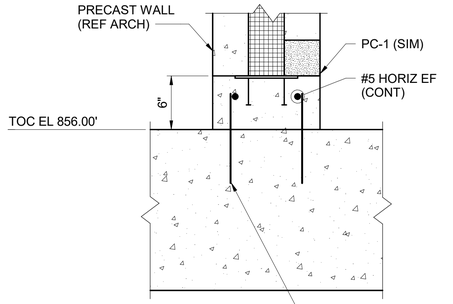
SECTION A
0 2' 4' 8'
SCALE IN FEET
S202
S203
S204
S205



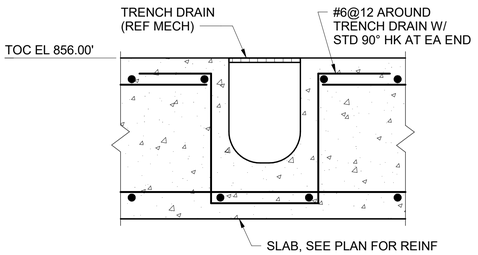
NOTES:

1. SEE STANDARD BEAM DETAILS ON DRAWING S013.

SECTION D
0 1' 2' 4'
SCALE IN FEET
S205



DETAIL 1
0 1/2' 1' 1 1/2'
SCALE IN FEET



DETAIL 2
0 1/2' 1' 1 1/2'
SCALE IN FEET

NO.	DATE	BY:	CHECKED:	DESCRIPTION
1	2/13/2026	JT	AMH	ISSUED PER ADDENDUM #006
0	12/19/2025	JT	AMH	ISSUED FOR BID

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

INFLUENT PUMP STATION COARSE SCREENING AND WET WELL SECTION

STATE OF MISSOURI
JOHN TSOUFLIAS
PE2015001427
PROFESSIONAL ENGINEER

JOHN TSOUFLIAS
STRUCTURAL
LICENSE NO. 2015001427

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WELLNER architects
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Licensee No. 000165

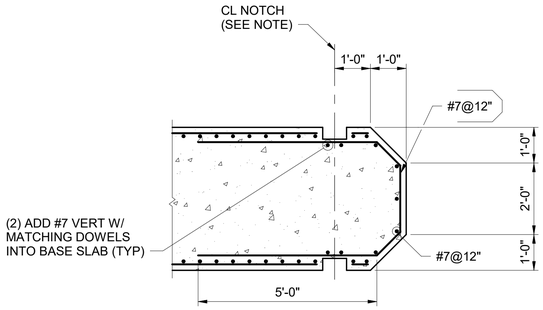
DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
B. BAIR	A. HOLMES	2/13/2026	34W		

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	S207

PROJECT NO. 81000927

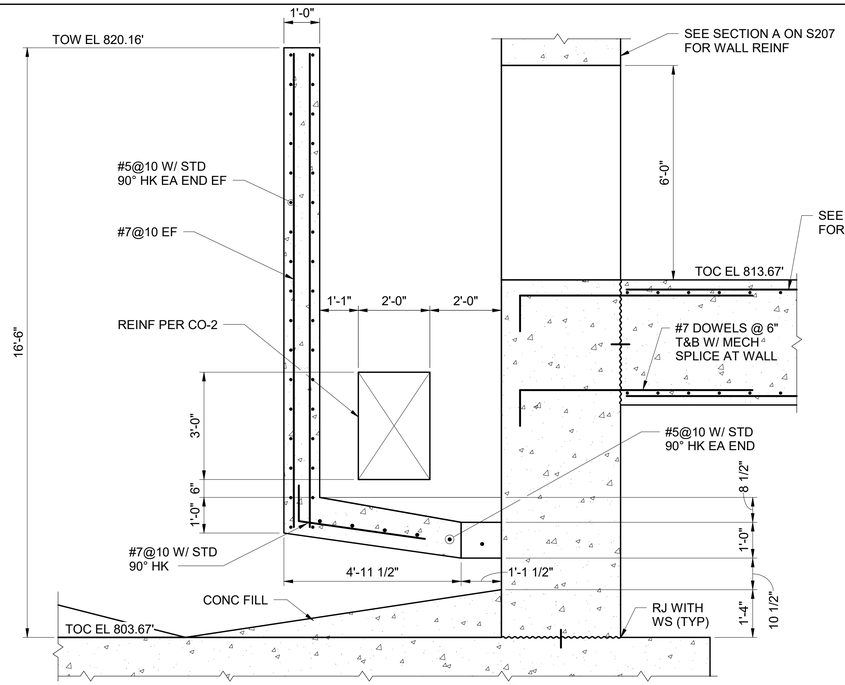
SHEET 175 OF 643



NOTE:
COORDINATE GATE LOCATION WITH PROCESS DRAWINGS. COORDINATE GATE INSTALLATION REQUIREMENTS WITH SELECTED GATE MANUFACTURER.

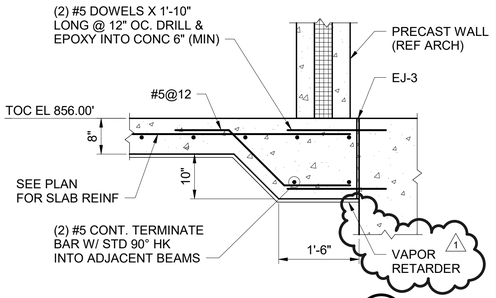
DETAIL 1 S203

0 1' 2' 4'
SCALE IN FEET



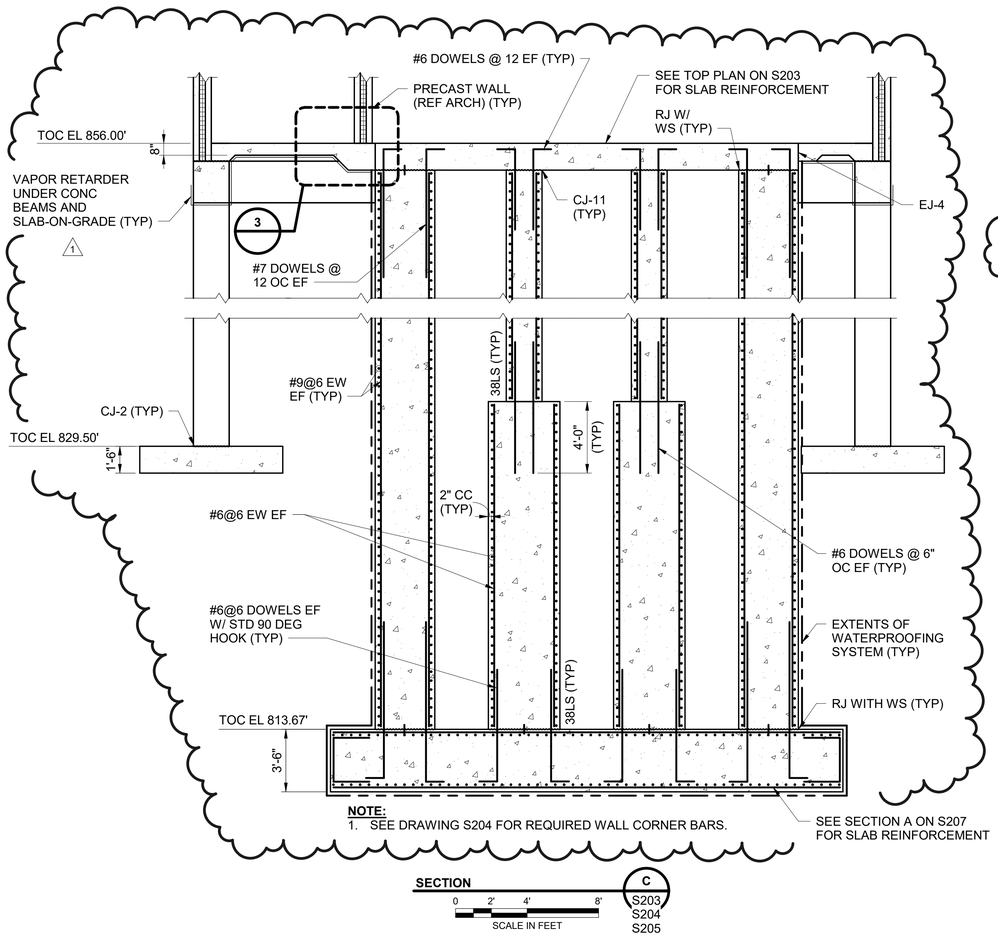
DETAIL 2 S207

0 1' 2' 4'
SCALE IN FEET



DETAIL 3

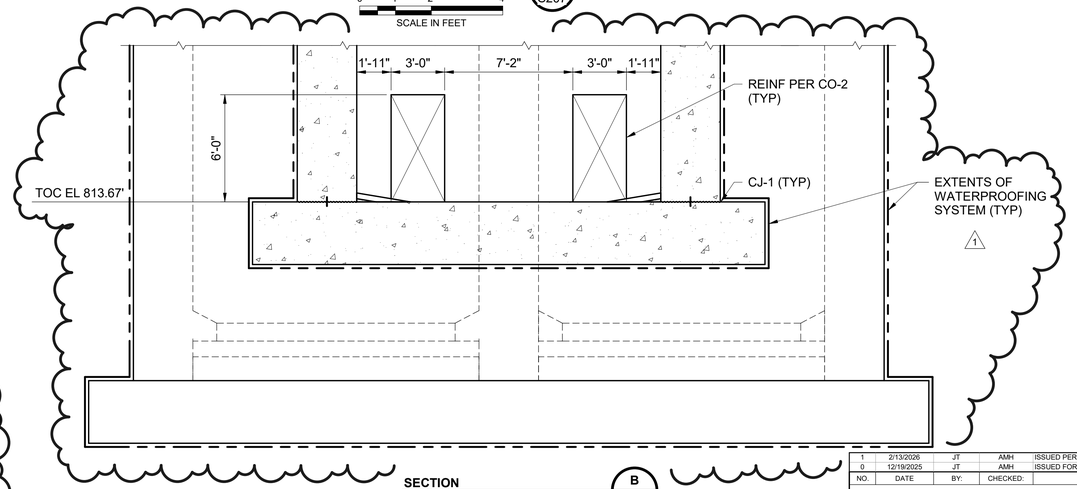
0 1' 2' 3'
SCALE IN FEET



NOTE:
1. SEE DRAWING S204 FOR REQUIRED WALL CORNER BARS.

SECTION C S203 S204 S205

0 2' 4' 8'
SCALE IN FEET



SECTION B S203

0 2' 4' 8'
SCALE IN FEET

NO.	DATE	BY:	CHECKED:	DESCRIPTION
1	2/13/2026	JT	AMH	ISSUED PER ADDENDUM #006
0	12/19/2025	JT	AMH	ISSUED FOR BID

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KANSAS CITY, MO 64114
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816-333-9400
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STATE OF MISSOURI
JOHN TSOUFLIAS
PE2015001427
PROFESSIONAL ENGINEER

JOHN TSOUFLIAS
STRUCTURAL
LICENSE NO. 2015001427

FOR WSD USE:

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

INFLUENT PUMP STATION
COARSE SCREENING AND WET WELL
SECTIONS

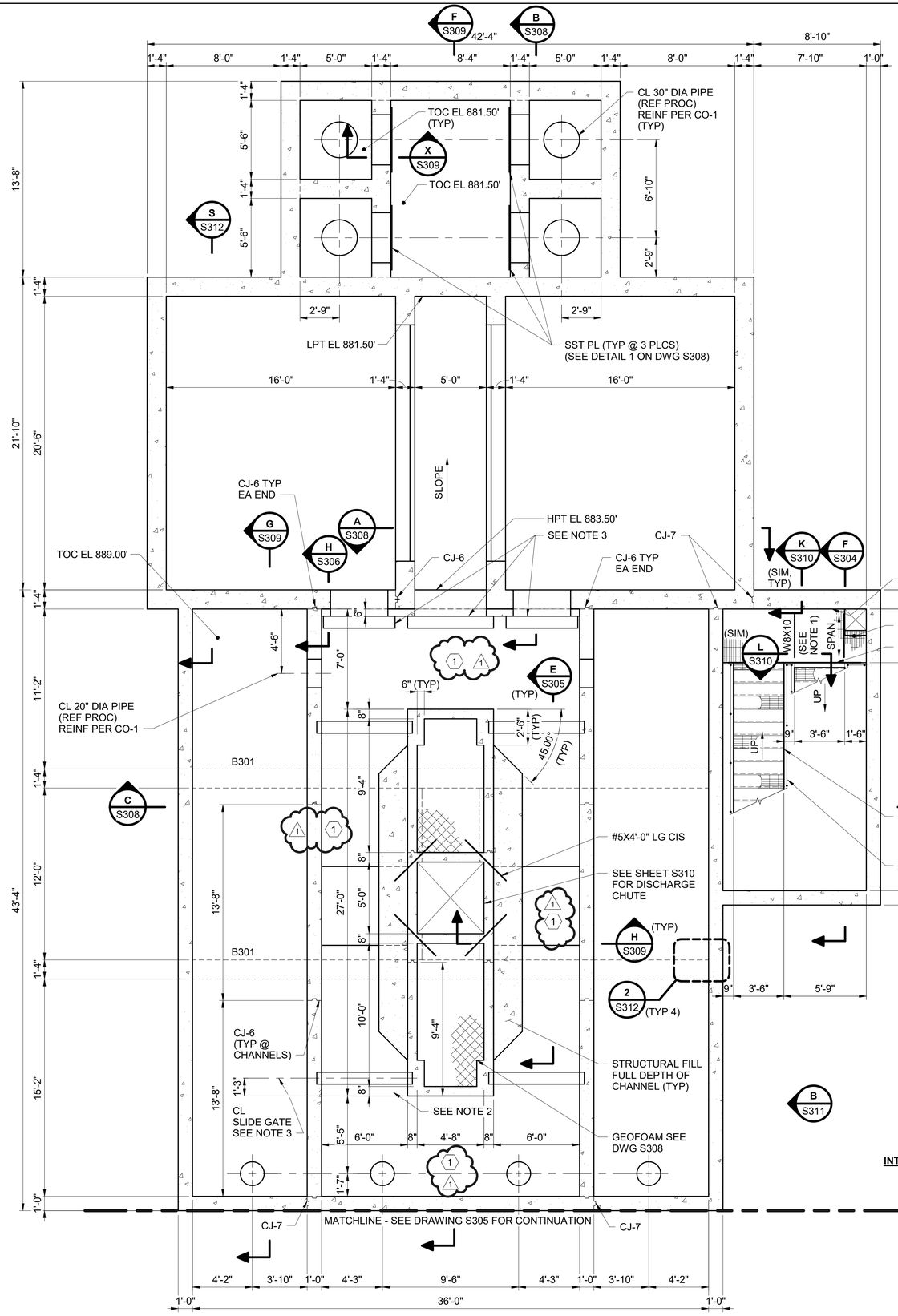
DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
B. BAIR	A. HOLMES	2/13/2026	34W		

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	S208

PROJECT NO. 81000927

SHEET 176 OF 643

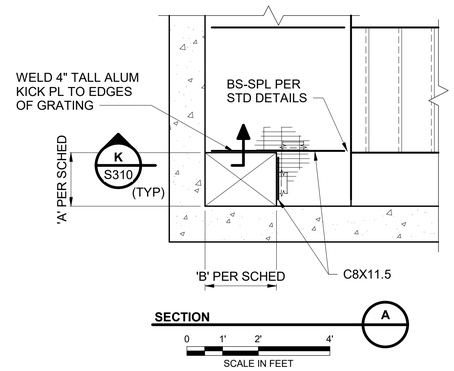


INTERMEDIATE PLAN AREA A @ EL 889.00'

0 2' 4' 8'

SCALE IN FEET

NORTH



SECTION A

0 1' 2' 4'

SCALE IN FEET

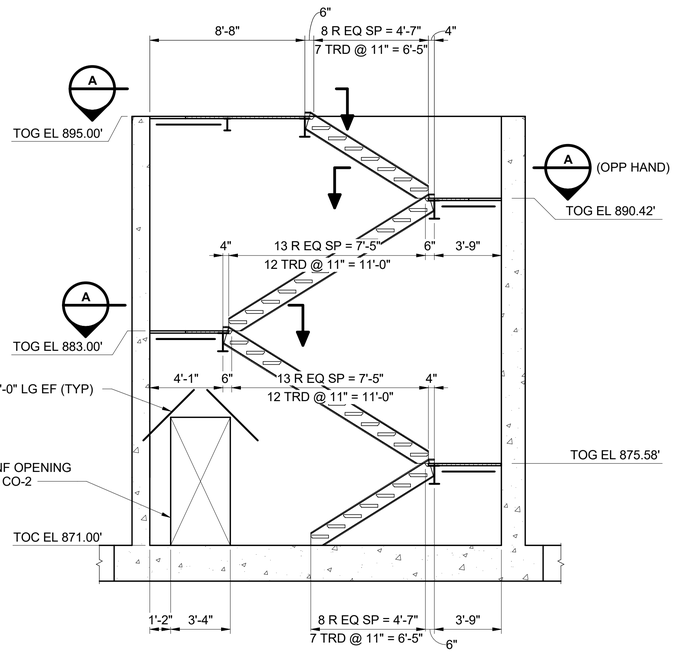
GRATING PENETRATION SCHEDULE		
PLATFORM LANDING ELEV	DIMENSION 'A'	DIMENSION 'B'
895.00'	1'-6"	2'-0"
890.42'	1'-6"	1'-10"
883.00'	1'-6"	2'-0"

DRAWING NOTE:

1. SECTION SIZES AND GRATING SPAN SHOWN ARE TYPICAL AT THE INTERMEDIATE STAIR LANDINGS.
2. FUTURE WALL PIPE SHOWN WHERE INDICATED. INSTALL CO-1 REINFORCING AROUND OPENING LOCATION, BUT DO NOT BLOCK OUT OPENING.
3. SEE TYPICAL SLIDE GATE REINFORCEMENT DETAIL ON DRAWING S312. DETAIL IS APPLICABLE AT SLAB AND WALLS. TYPICAL SIX SLIDE GATE LOCATIONS.
4. BXXX - REFER TO BEAM SCHEDULE ON DRAWING S316.

KEYED NOTE:

1 APPLY PROTECTIVE COATING TO WALLS AND SLAB OF CHANNEL. SEE SPECIFICATION SECTION 09 90 00 FOR PROTECTIVE COATING.



NOTE:

1. SUPPORTS AND RAILINGS NOT SHOWN FOR CLARITY.
2. REFERENCE STANDARD DETAILS FOR TYPICAL STAIR CONNECTION DETAILS. BEAM TO BEAM CONNECTIONS SHALL BE TYPE BS-SPL.

SECTION F S302 S304 S306

0 2' 4' 8'

SCALE IN FEET

NO.	DATE	BY:	CHECKED:	DESCRIPTION
1	2/13/2026	JT	AMH	ISSUED PER ADDENDUM #006
0	12/19/2025	JT	AMH	ISSUED FOR BID

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

HEADWORKS
INTERMEDIATE PLAN AREA A @ EL 889.00' AND SECTION

STATE OF MISSOURI JOHN TSOUFLIAS PE2015001427 PROFESSIONAL ENGINEER

JOHN TSOUFLIAS
STRUCTURAL
LICENSE NO. 2015001427

FOR WSD USE:

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CUSTOM ENGINEERING
MECHANICAL & ELECTRICAL ENGINEERING

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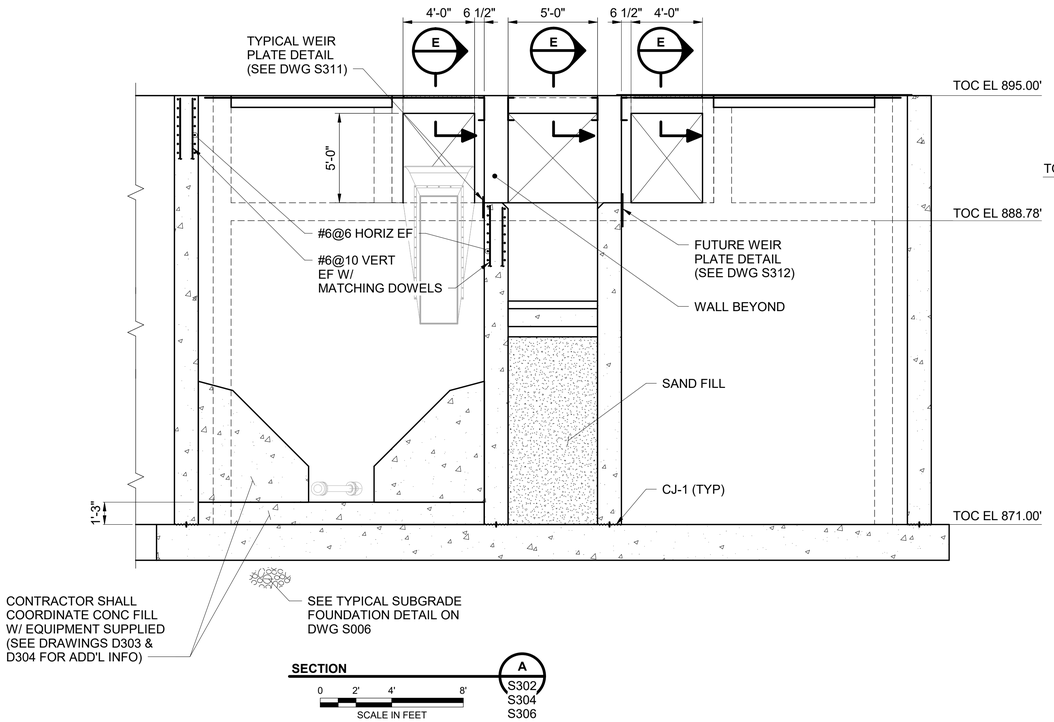
DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
B. BAIR	A. HOLMES	2/13/2026	34W		

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

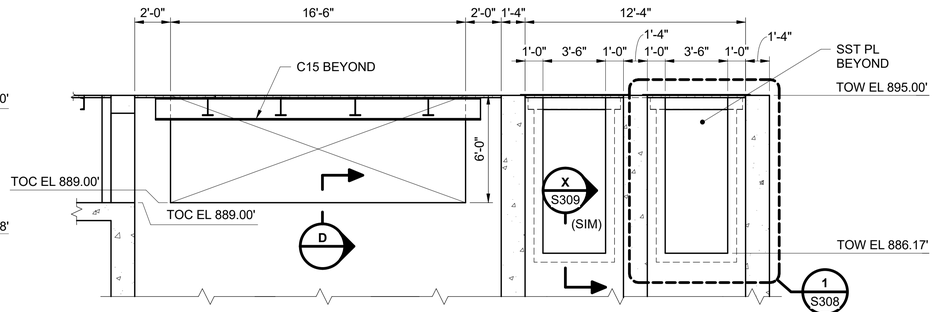
CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	S304

PROJECT NO. 81000927 SHEET 190 OF 643



SECTION A
S302 S304 S306

0 2' 4' 8'
SCALE IN FEET

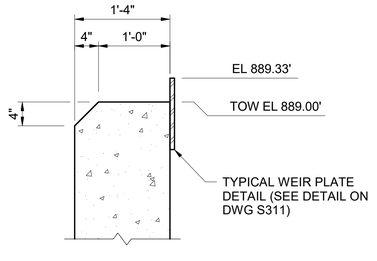


SECTION B
S304 S306

0 2' 4' 8'
SCALE IN FEET

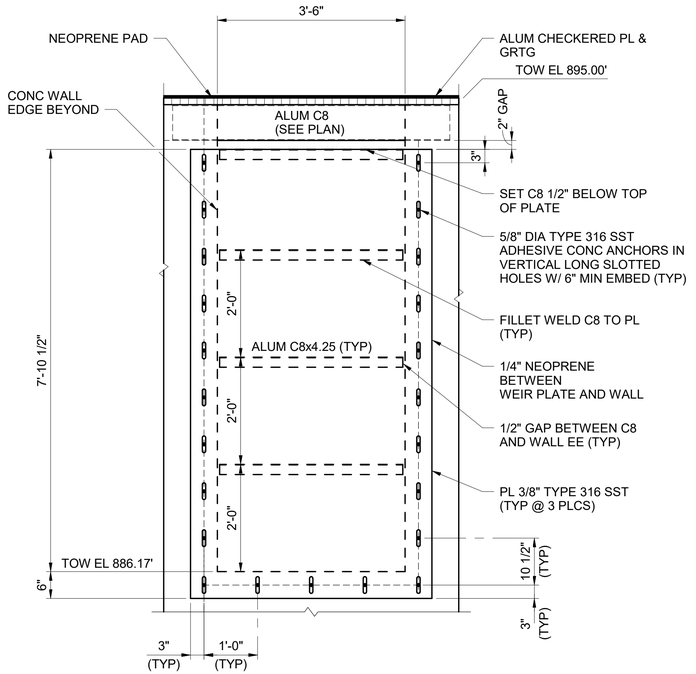
DRAWING NOTES:

1. GEOFOAM FILL:
   A. CONFORM TO ASTM D6817, TYPE EPS15.
   B. STORE AS RECOMMENDED BY MANUFACTURER.
   C. SUBMIT ICC-ES EVALUATION REPORT TO ENGINEER FOR APPROVAL.



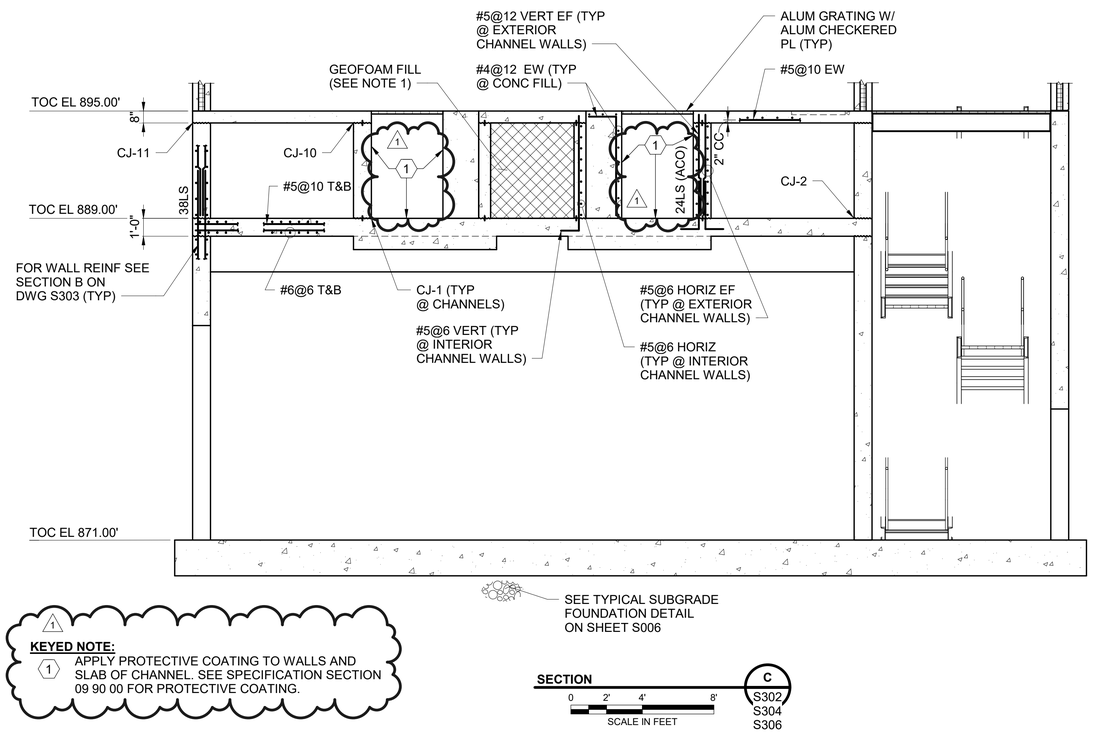
SECTION D

0 1/2' 1' 2'
SCALE IN FEET



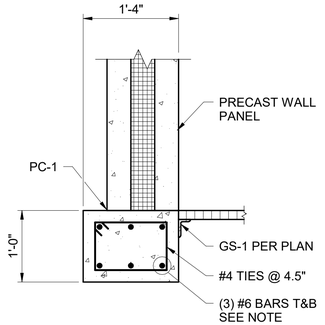
DETAIL 1
S308

0 1' 2' 3'
SCALE IN FEET



SECTION C
S302 S304 S306

0 2' 4' 8'
SCALE IN FEET



NOTE:
LONGITUDINAL BARS SHALL BE CONTINUOUS ABOVE BOTH OPENINGS AND EXTEND 2'-6" BEYOND THE EDGE OF EACH OPENINGS.

SECTION E

0 1/2' 1' 2'
SCALE IN FEET

1 **KEYED NOTE:**
1 APPLY PROTECTIVE COATING TO WALLS AND SLAB OF CHANNEL. SEE SPECIFICATION SECTION 09 90 00 FOR PROTECTIVE COATING.

NO.	DATE	BY:	CHECKED:	DESCRIPTION
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0	12/19/2025	JT	AMH	ISSUED FOR BID

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

HEADWORKS SECTIONS SHEET 1

STATE OF MISSOURI JOHN TSOUFLIAS 2015001427 PROFESSIONAL ENGINEER

JOHN TSOUFLIAS
STRUCTURAL
LICENSE NO. 2015001427

FOR WSD USE:

KCWATER
CUSTOM ENGINEERING MECHANICAL & ELECTRICAL ENGINEERING
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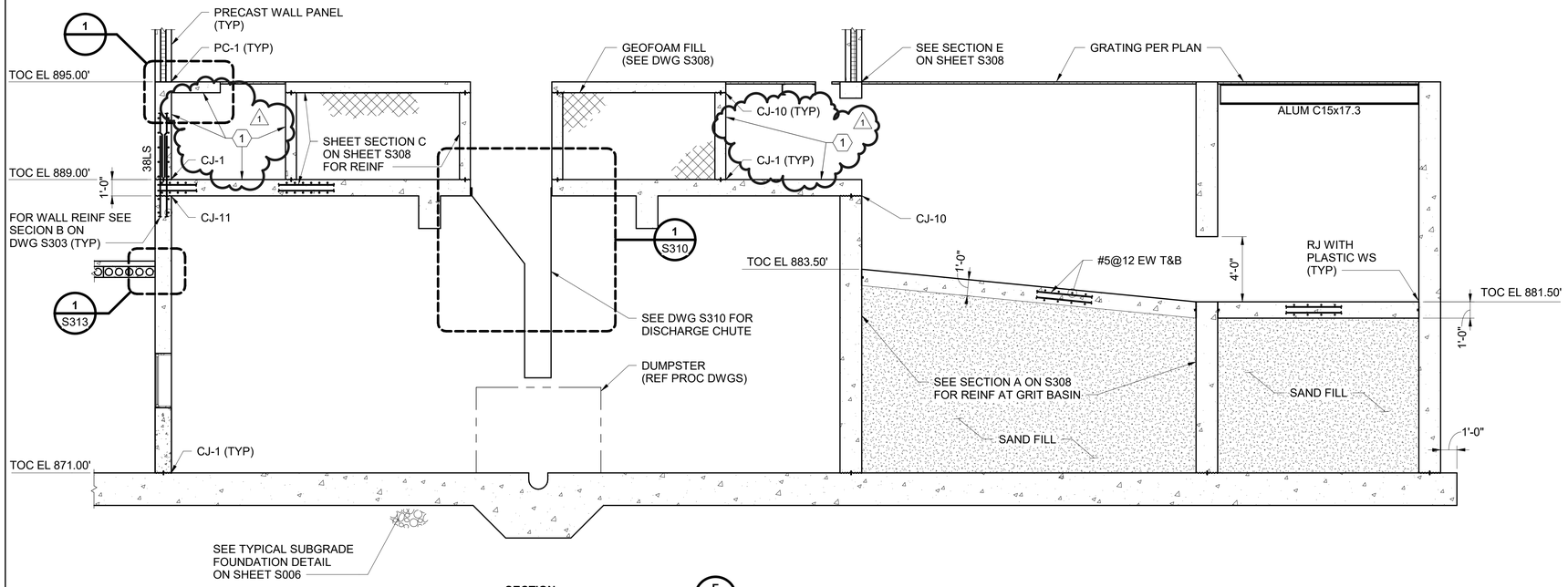
B. BAIR	A. HOLMES	2/13/2026	34W		

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	S308

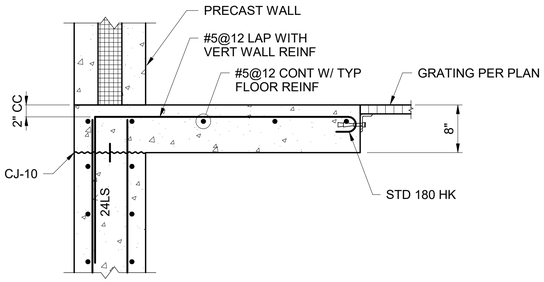
PROJECT NO. 81000927 SHEET 194 OF 643



SECTION F — S302, S303, S304, S305, S306

0 2' 4' 8'

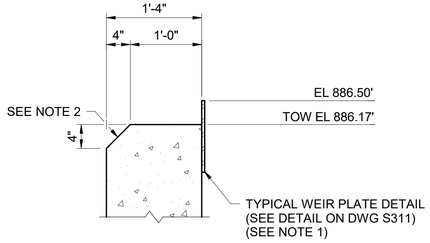
SCALE IN FEET



DETAIL 1

0 1/2' 1' 2'

SCALE IN FEET



NOTES:

1. WEIR PLATE REQUIRED ONLY AT ONE LOCATION PER DRAWING S304.
2. PROVIDE A CHAMFERED WALL AT THE WEIR PLATE AND ALL THREE SST PLATE LOCATIONS PER DRAWING S304.

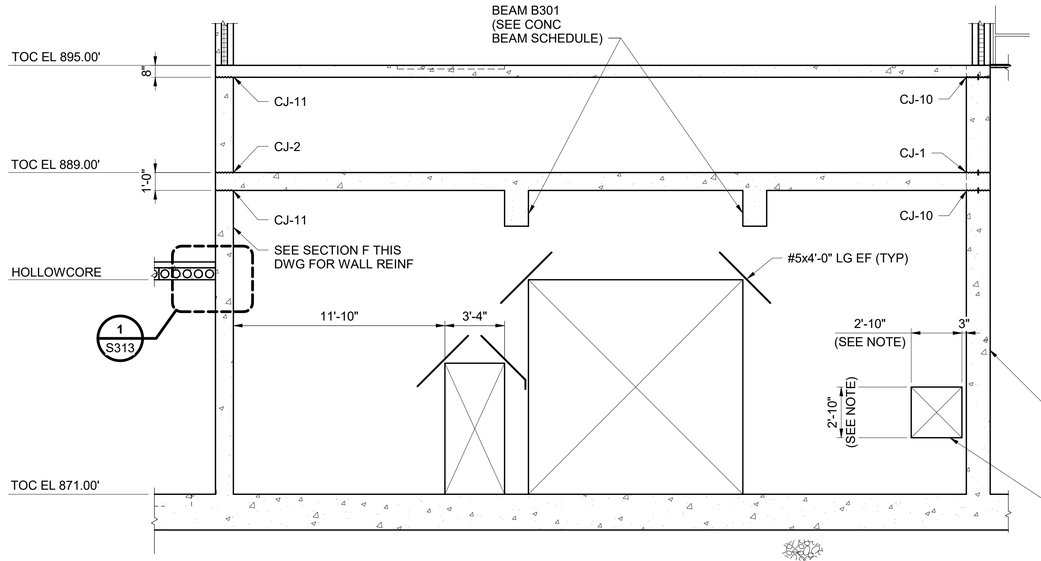
SECTION X — S304, S308

0 1/2' 1' 2'

SCALE IN FEET

KEYED NOTE:

1 APPLY PROTECTIVE COATING TO WALLS AND SLAB OF CHANNEL. SEE SPECIFICATION SECTION 09 90 00 FOR PROTECTIVE COATING.

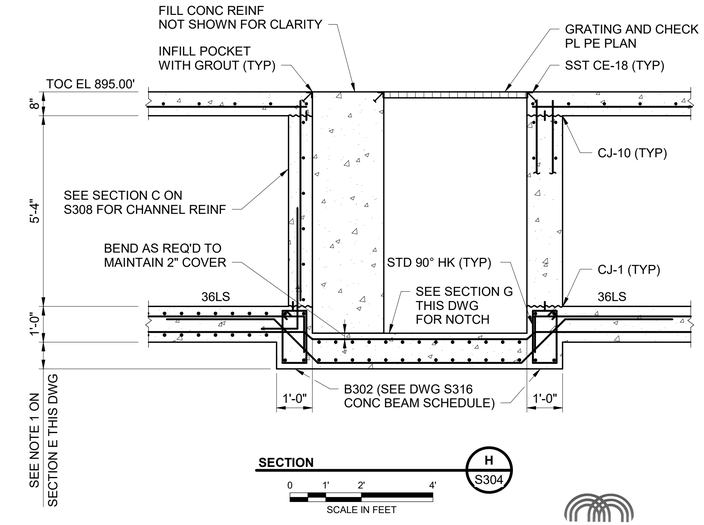


NOTE:
COORDINATE FINAL OPENING DIMENSIONS WITH EQUIPMENT SUPPLIED. REFERENCE MECHANICAL DRAWINGS.

SECTION G — S302, S303, S304, S305, S306

0 2' 4' 8'

SCALE IN FEET



SECTION H — S304

0 1' 2' 4'

SCALE IN FEET

NO.	DATE	BY:	CHECKED:	DESCRIPTION
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REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

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HEADWORKS SECTIONS SHEET 2

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816-333-9400
Licensee No. 000165

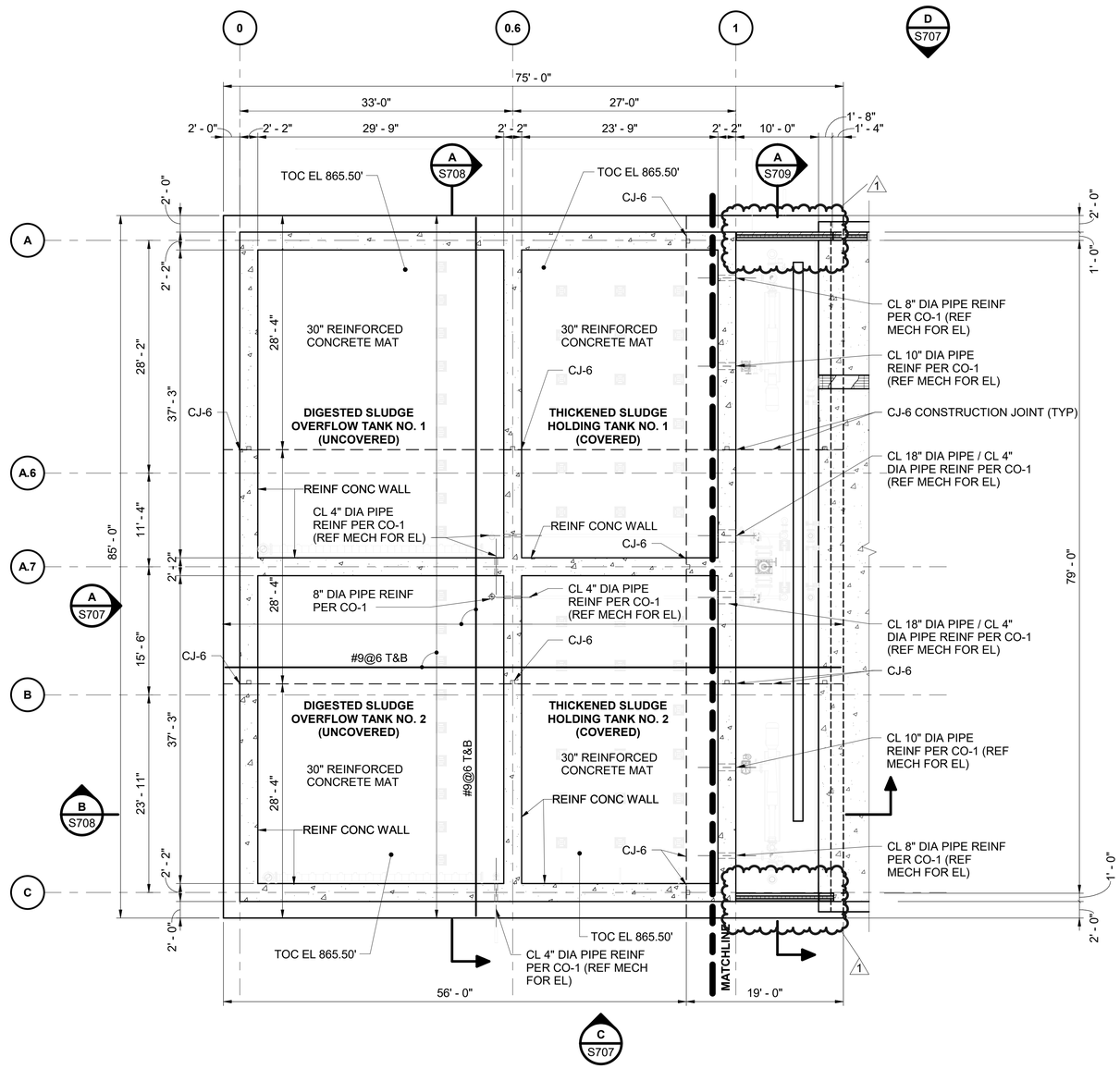
DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
B. BAIR	A. HOLMES	2/13/2026	34W		

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	S309

PROJECT NO. 81000927

SHEET 195 OF 643



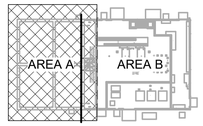
SOLIDS HANDLING TANK FOUNDATION PLAN @ AREA "A"

0 4' 8' 16'
SCALE IN FEET

NORTH

GENERAL NOTES:

1. SEE DRAWING S002 FOR STRUCTURAL GENERAL NOTES.
2. SEE DRAWINGS S001 THROUGH S013 FOR STANDARD DETAILS.
3. REINFORCED CONCRETE TYPICAL DETAILS: SEE DRAWING S002.
4. SEE CIVIL, ARCHITECTURAL, MECHANICAL, PROCESS, AND ELECTRICAL DRAWINGS FOR MISCELLANEOUS STEEL, CONCRETE, ANCHORS AND OPENINGS NOT INDICATED ON STRUCTURAL DRAWINGS.
5. ALL CONCRETE PENETRATIONS SHALL BE REINFORCED PER STANDARD DETAIL CO-1 AND/OR CO-2 AS APPLICABLE.
6. TIGHTNESS TESTING OF LIQUID CONTAINING STRUCTURE: PERFORM IN ACCORDANCE WITH SPECIFICATION 03 30 00.
7. BASIN SHALL NOT BE LEAK-TESTED OR BACKFILLED UNTIL IT HAS REACHED ITS DESIGN STRENGTH.



KEY PLAN

KCWATER
CUSTOM ENGINEERING
MECHANICAL & ELECTRICAL ENGINEERING
DuBois Consultants
CIVIL • STRUCTURAL ENGINEERING
WELLNER architects
BURNS McDONNELL
9400 WARD PARKWAY
KANSAS CITY, MO 64114
Burns & McDonnell Engineering Co, Inc
816-333-9400
Licensee No. 000165

NO.	DATE	BY:	CHECKED:	DESCRIPTION
1	2/2/26	DNG	CS	ADDENDUM 6
0	12/19/25	DNG	CS	ISSUED FOR BID

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

STATE OF MISSOURI
CERVENTE D. SUDDUTH
NUMBER PE-2011015802
PROFESSIONAL ENGINEER
2/2/2026

CERVENTE D. SUDDUTH
PROFESSIONAL ENGINEER
PE-2011015802

FOR WSD USE:

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

SOLIDS HANDLING BASIN FOUNDATION PLAN

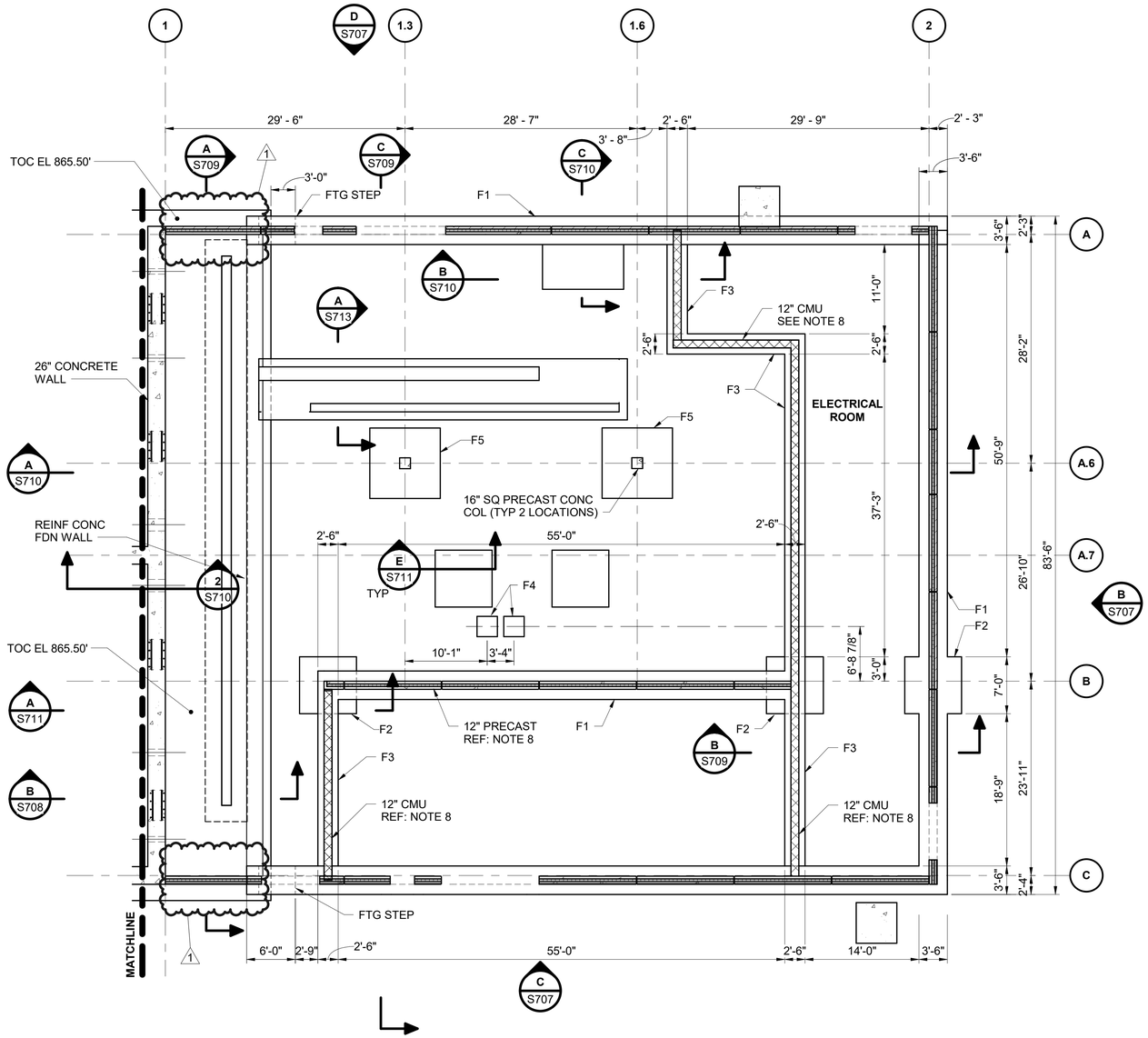
DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
DNG	CDS	2/2/26	34W	53N	36

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	S702

PROJECT NO. 81000927

SHEET 235 OF 643



SOLIDS HANDLING BUILDING AREA B
FOUNDATION PLAN @ EL 872.00

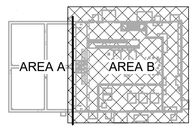
NORTH

0 4' 8' 16'
SCALE IN FEET

GRADE BEAM SCHEDULE		
MARK	DIMENSION	REINFORCING
F1	3'-6"w x 2'-6"h x CONT.	(4) - #7 BARS T&B DOUBLE STIRRUPS #4 @ 12" O.C.
F2	7'-0"w x 7'-0"w x 2'-6"h	(8) - #8 BARS EQ SP EW T&B
F3	2'-6"w x 2'-6"h x CONT.	(3) - #7 BARS T&B STURRUPS #4 @ 12" O.C.
F4	2'-6"w x 2'-6"w x 1'-0"h	(3) - #6 BARS EW T&B
F5	8'-0"w x 8'-0"w x 2'-6"h	(9) - #8 BARS EQ SP EW T&B

GENERAL NOTES:

1. SEE S001 FOR STRUCTURAL LEGEND AND ABBREVIATIONS.
2. SEE S002 FOR STRUCTURAL GENERAL NOTES.
3. SEE S002A AND S002B FOR REQUIRED INSPECTION PROTOCOL.
4. SEE S003 THROUGH S005 FOR TYPICAL CONCRETE DETAILS.
5. SEE S006 FOR TYPICAL EQUIPMENT AND LANDING PAD DETAILS.
6. SEE S007 FOR TYPICAL SLAB AND DOOR STOOP DETAILS.
7. SEE S011 FOR TYPICAL ANCHOR BOLT, GRATING SUPPORT, CONCRETE EDGE, AND OTHER MISCELLANEOUS CONRETE DETAILS.
8. SEE S810 FOR TYPICAL MASONRY DETAILS.
9. SEE ARCHITECTURAL, CIVIL, ELECTRICAL, MECHANICAL, AND PROCESS DRAWINGS FOR MISCELLANEOUS STEEL, CONCRETE, ANCHORS AND OPENINGS NOT INDICATED ON STRUCTURAL DRAWINGS.
10. DESIGN LOADS (IBC 2018) SEE S002 AND BELOW:
    A. ROOF DEAD LOADS:
        1. 10" HOLLOWCORE = 70 PSF
        2. 2.5" TOPPING = 31 PSF
        3. RUBBER MEMBRANE = 1 PSF
        4. RIGID INSULATION = 5 PSF
        5. COVER BOARD = 3 PSF
        6. MECHANICAL/ELECTRICAL ALLOWANCE = 10 PSF
    B. SNOW LOAD: SEE DRAWING S715
    C. WIND LOAD: SEE DRAWING S715
    D. SEISMIC: SEE DRAWING S715
11. GROUND IMPROVEMENT SHALL BE DESIGNED AND INSTALLED BY CONTRACTOR TO PROVIDE A NET ALLOWABLE BEARING PRESSURE OF 3500 PSF. FOR SUBGRADE PREPARATION BELOW FOUNDATIONS. SEE SHEET S006.



KEY PLAN

NO.	DATE	BY:	CHECKED:	DESCRIPTION
1	2/2/26	DNG	CS	ADDENDUM 6
0	12/19/25	DNG	CS	ISSUED FOR BID

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

STATE OF MISSOURI
CERVENTE D. SUDDUTH
NUMBER PE-2011015802
PROFESSIONAL ENGINEER
2/2/2026

CERVENTE D. SUDDUTH
PROFESSIONAL ENGINEER
PE-2011015802

FOR WSD USE:

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

SOLIDS HANDLING BUILDING FOUNDATION PLAN

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
DNG	CDS	2/2/26	34W	53N	36

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	S703

PROJECT NO. 81000927

SHEET 236 OF 643

KCWATER
CUSTOM ENGINEERING
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DuBois Consultants
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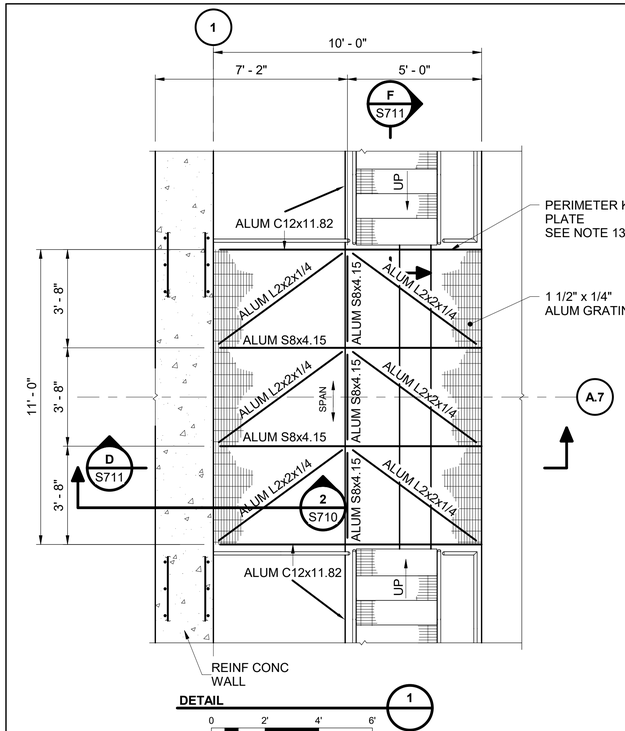
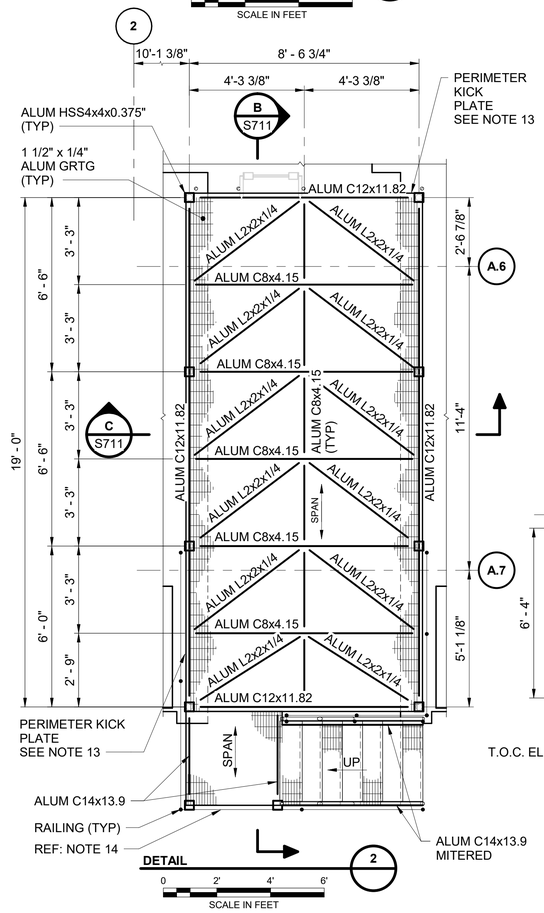
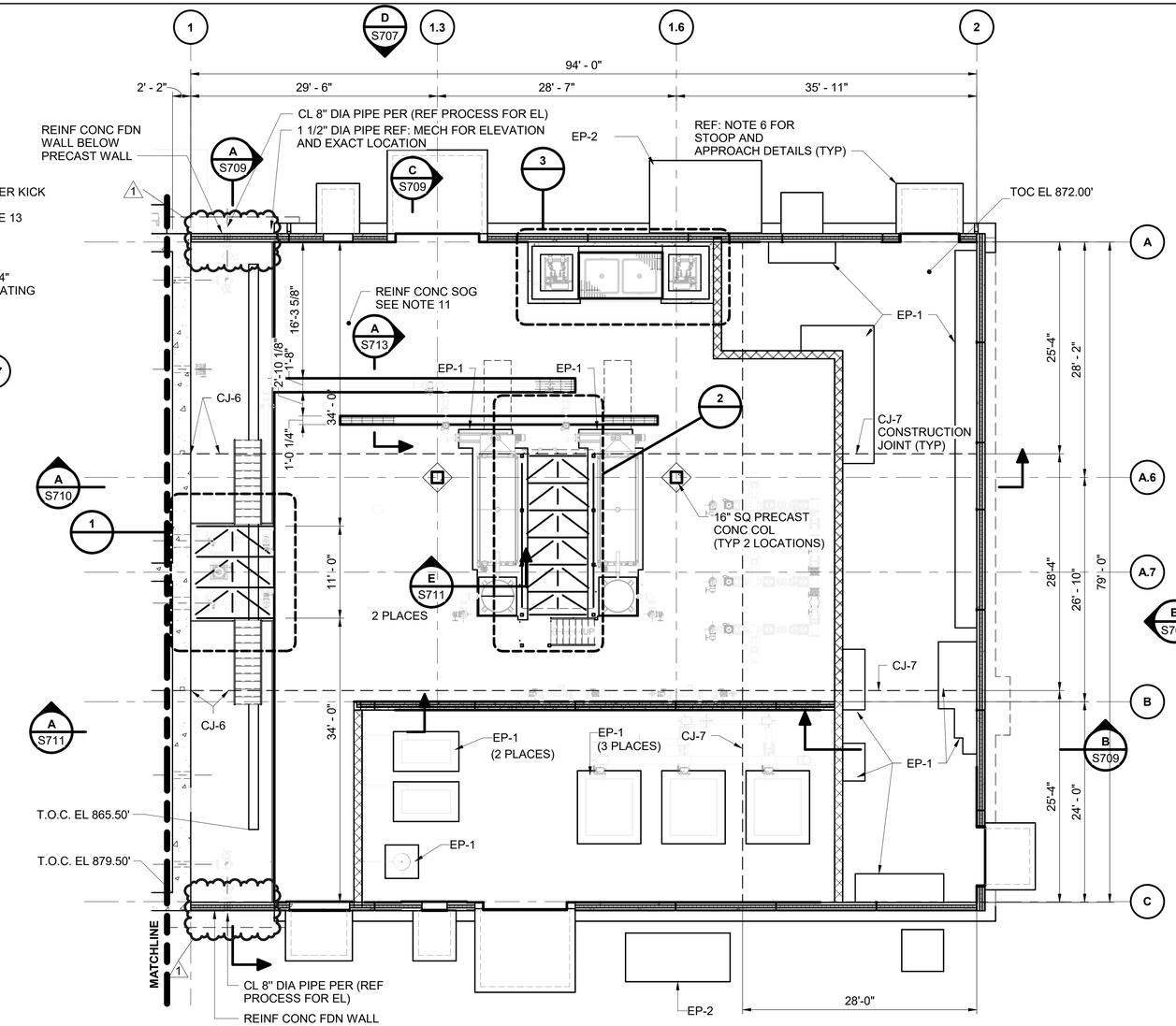
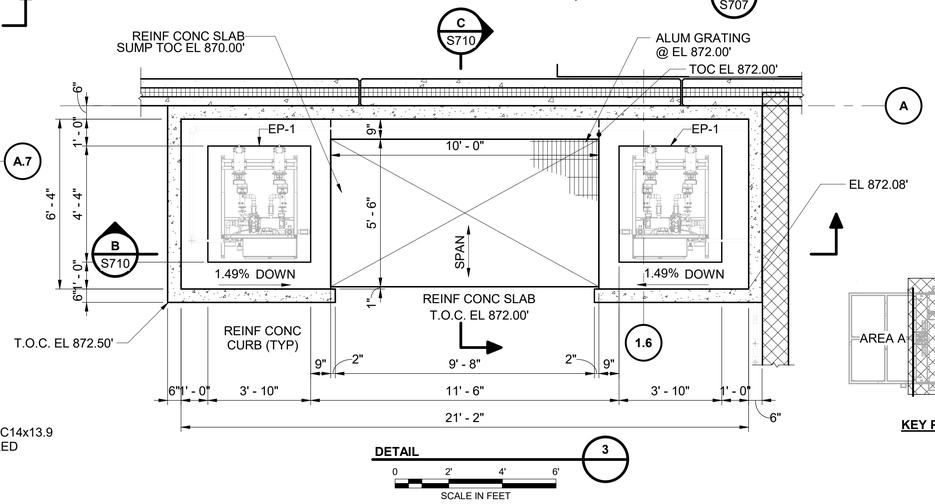
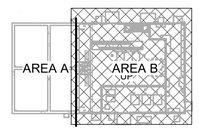
816-333-9400
Licensee No. 000165











KEY PLAN

SOLIDS HANDLING AREA B FLOOR PLAN

0 4' 8' 16'
SCALE IN FEET

NORTH

GENERAL NOTES:

1. SEE S001 FOR STRUCTURAL LEGEND AND ABBREVIATIONS.
2. SEE S002 FOR STRUCTURAL GENERAL NOTES.
3. SEE S002A AND S002B FOR REQUIRED INSPECTION PROTOCOL.
4. SEE S003 THROUGH S005 FOR TYPICAL CONCRETE DETAILS.
5. SEE S006 FOR TYPICAL EQUIPMENT AND LANDING PAD DETAILS.
6. SEE S007 FOR TYPICAL SLAB AND DOOR STOOP DETAILS.
7. SEE S011 FOR TYPICAL ANCHOR BOLT, GRATING SUPPORT, CONCRETE EDGE, AND OTHER MISCELLANEOUS CONRETE DETAILS.
8. SEE S810 FOR TYPICAL MASONRY DETAILS.
9. SEE ARCHITECTURAL, CIVIL, ELECTRICAL, MECHANICAL, AND PROCESS DRAWINGS FOR MISCELLANEOUS STEEL, CONCRETE, ANCHORS AND OPENINGS NOT INDICATED ON STRUCTURAL DRAWINGS.
10. GROUND IMPROVEMENT SHALL BE DESIGNED AND INSTALLED BY CONTRACTOR TO PROVIDE A NET ALLOWABLE BEARING PRESSURE OF 3500 PSF. FOR SUBGRADE PREPARATION BELOW FOUNDATIONS. SEE SHEET S006.
11. 8" THICK CONCRETE SLAB. REINFORCE WITH #6 @12 EACH WAY CENTERED IN SLAB. PLACE OVER VAPOR RETARDER AND GRANULAR MATERIAL. SEE SPECIFICATION (03 15 50) FOR VAPOR RETARDER REQUIREMENTS. SEE DIVISION 31 FOR SUBGRADE REQUIREMENTS.
12. COORDINATE ALL SLAB AND FOUNDATION PENETRATIONS WITH ALL OTHER DISCIPLINE DRAWINGS.
13. PROVIDE MINIMUM 4" x 5/16" x CONT. KICK PLATE AROUND PERIMETER OF PLATFORM, TYPICAL.
14. FINAL DESIGN AND LAYOUT FOR THE ELEVATED EQUIPMENT ACCESS PLATFORM SHALL BE COORDINATED W/EQUIPMENT MFR.

NO.	DATE	BY:	CHECKED:	DESCRIPTION
1	2/2/26	DNG	CS	ADDENDUM 6
0	12/19/25	DNG	CS	ISSUED FOR BID

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

STATE OF MISSOURI · CERVENTE D. SUDDUTH · NUMBER PE-2011015802 · PROFESSIONAL ENGINEER

2/2/2026

CERVENTE D. SUDDUTH
PROFESSIONAL ENGINEER
PE-2011015802

FOR WSD USE:

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

SOLIDS HANDLING BUILDING FLOOR PLAN

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
DNG	CDS	2/2/26	34W	53N	36

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	S704

PROJECT NO. 81000927

SHEET 237 OF 643

KC WATER
CUSTOM ENGINEERING MECHANICAL & ELECTRICAL ENGINEERING
DuBois Consultants CIVIL · STRUCTURAL ENGINEERING
WELLNER architects
BURNS McDONNELL
9400 WARD PARKWAY
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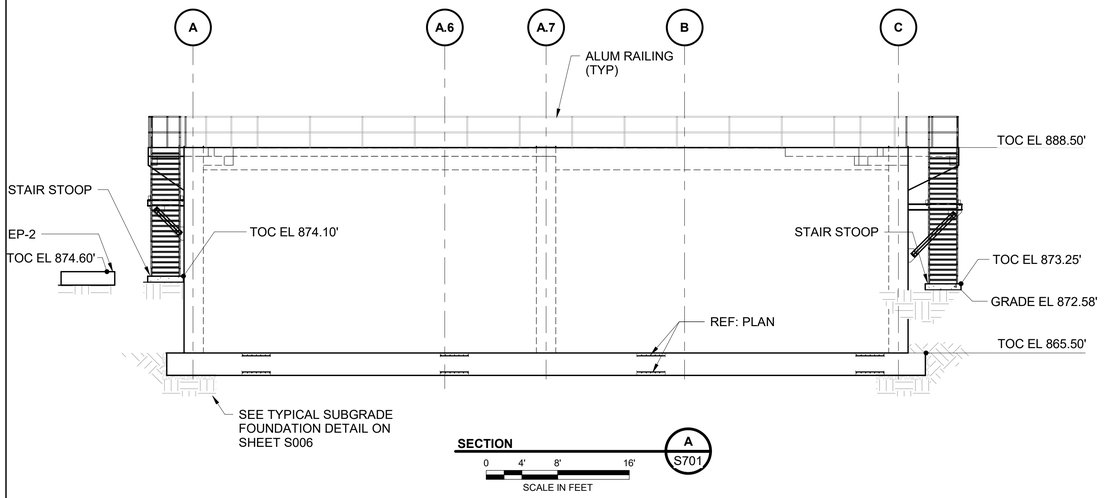
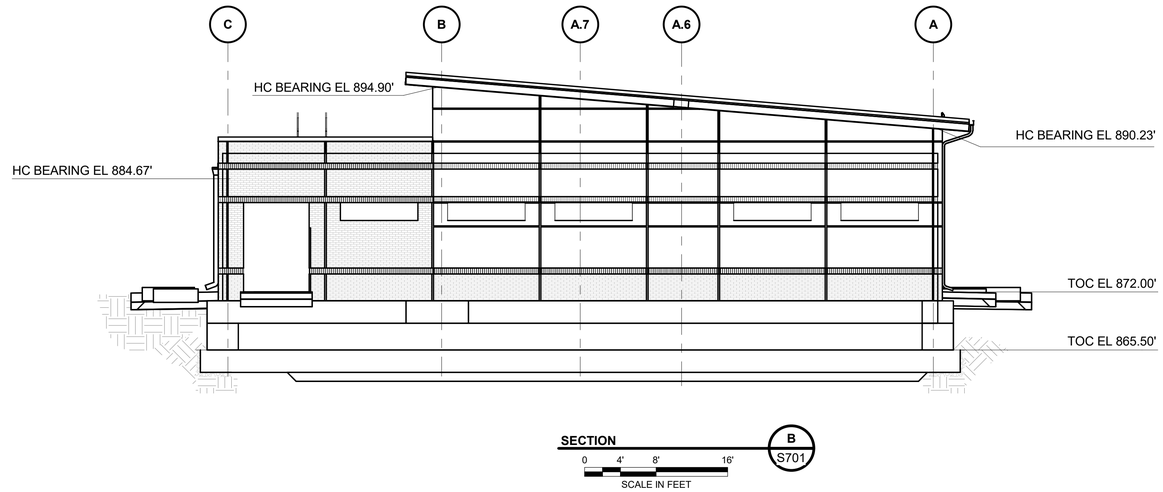


SECTION A S701

0 4' 8' 16'

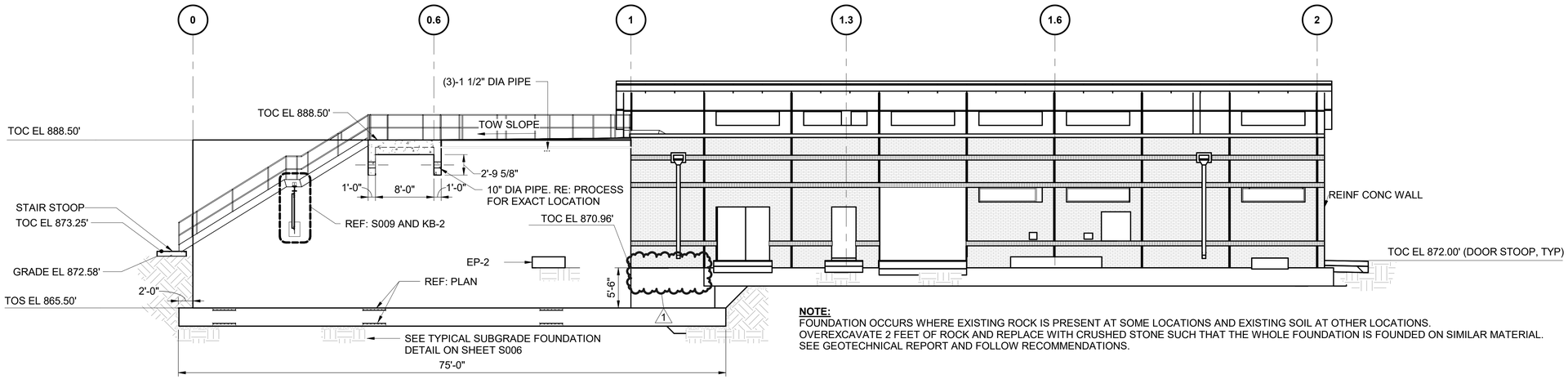
SCALE IN FEET



SECTION B S701

0 4' 8' 16'

SCALE IN FEET

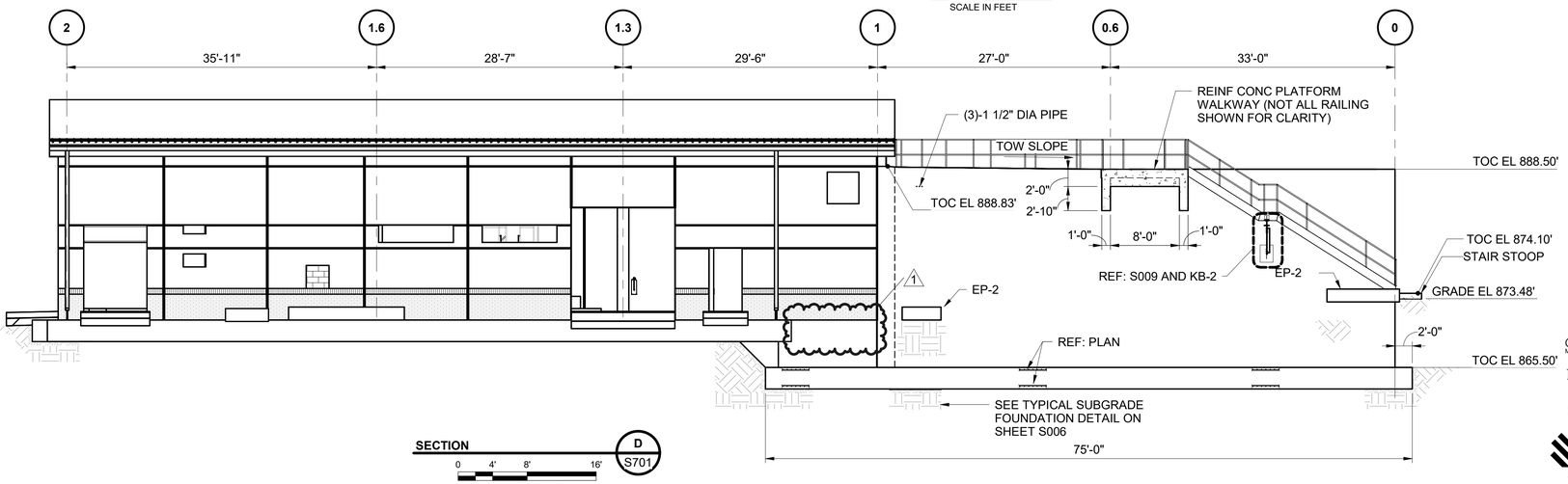


ELEVATION C S701

0 4' 8' 16'

SCALE IN FEET

NOTE:
FOUNDATION OCCURS WHERE EXISTING ROCK IS PRESENT AT SOME LOCATIONS AND EXISTING SOIL AT OTHER LOCATIONS.
OVEREXCAVATE 2 FEET OF ROCK AND REPLACE WITH CRUSHED STONE SUCH THAT THE WHOLE FOUNDATION IS FOUNDED ON SIMILAR MATERIAL.
SEE GEOTECHNICAL REPORT AND FOLLOW RECOMMENDATIONS.



SECTION D S701

0 4' 8' 16'

SCALE IN FEET

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DuBois Consultants CIVIL • STRUCTURAL • MANAGEMENT
WELLNER architects
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9400 WARD PARKWAY
KANSAS CITY, MO 64114
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NO.	DATE	BY:	CHECKED:	DESCRIPTION
1	2/2/26	DNG	CS	ADDENDUM 6
0	12/19/25	DNG	CS	ISSUED FOR BID

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

STATE OF MISSOURI · CERVENTE D. SUDDUTH · NUMBER PE-2011015802 · PROFESSIONAL ENGINEER

2/2/2026

CERVENTE D. SUDDUTH
PROFESSIONAL ENGINEER
PE-2011015802

FOR WSD USE:

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

SOLIDS HANDLING BASIN ELEVATIONS

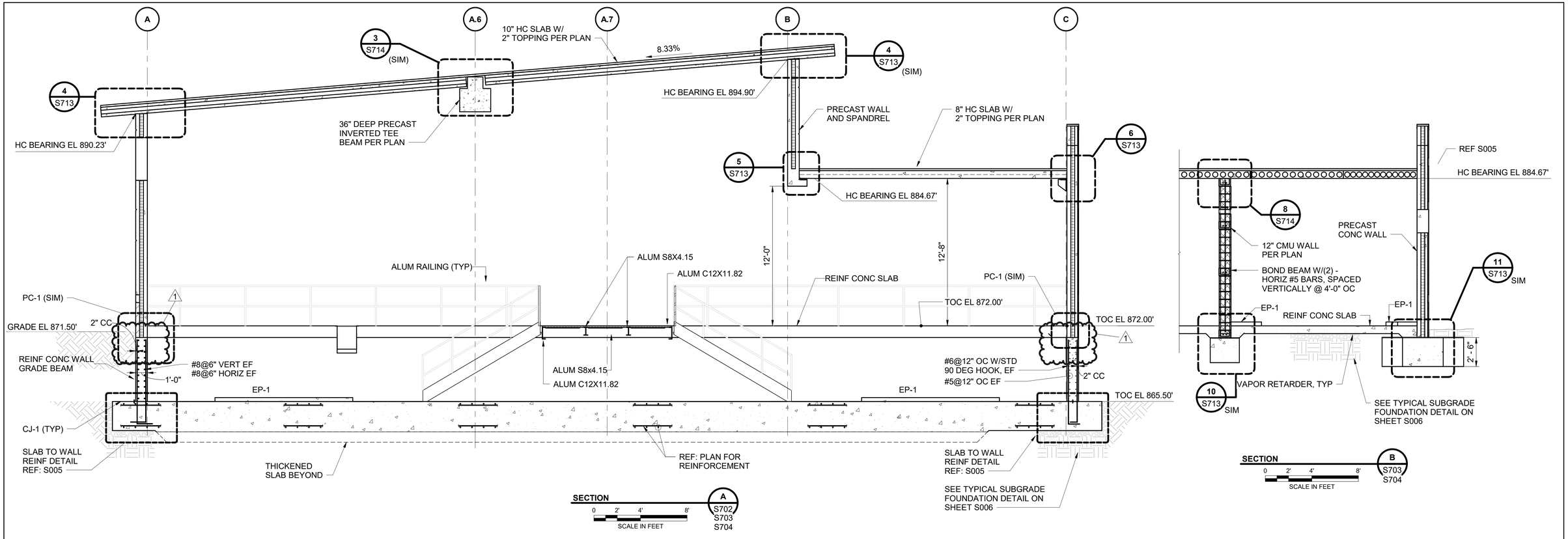
DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
DNG	CDS	2/2/26	34W	53N	36

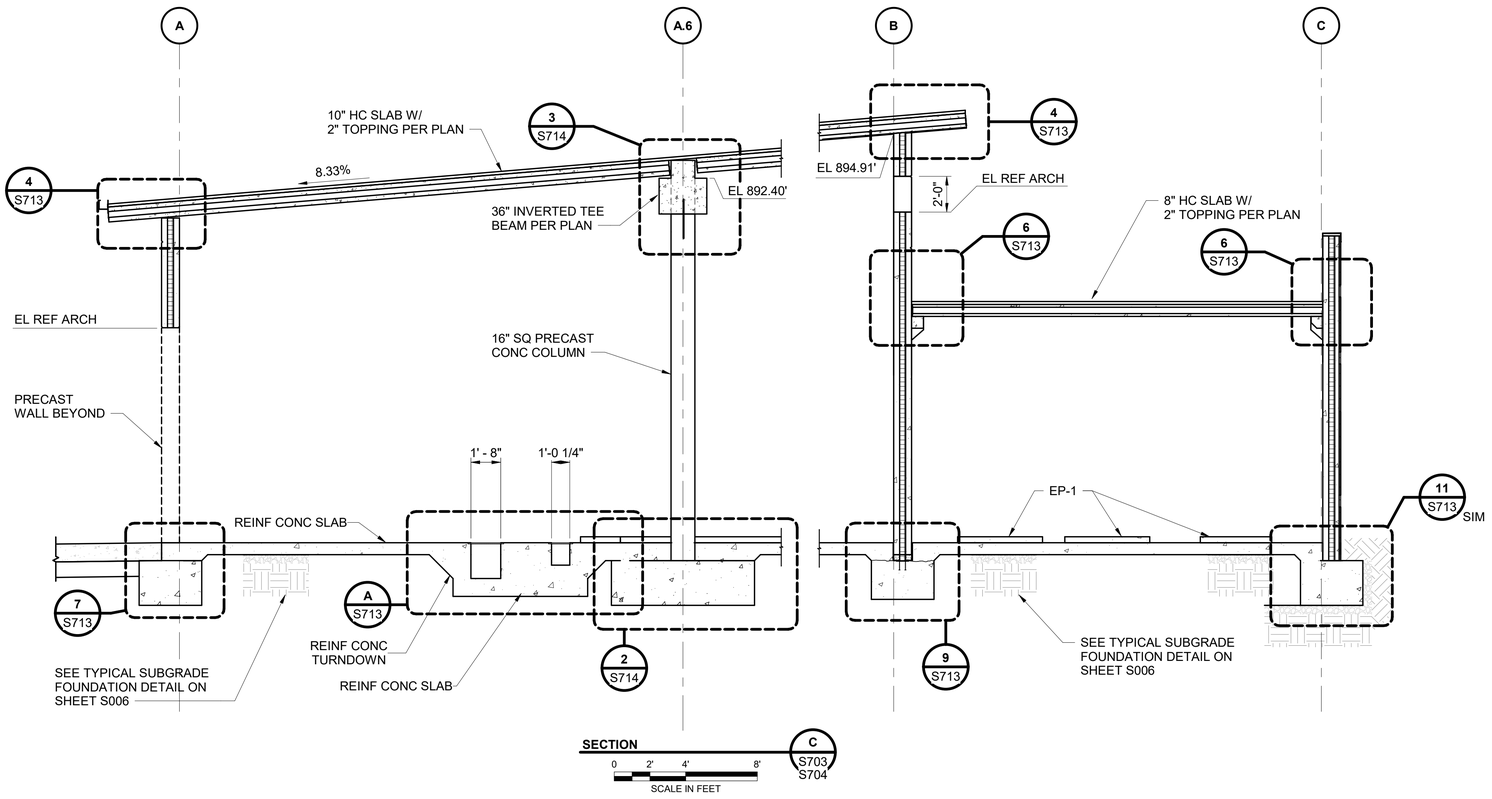
CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	S707

PROJECT NO. 81000927

SHEET 240 OF 643





NO.	DATE	BY:	CHECKED:	DESCRIPTION
1	2/2/26	DNG	CS	ADDENDUM 6
0	12/19/25	DNG	CS	ISSUED FOR BID

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

SOLIDS HANDLING BUILDING SECTIONS

STATE OF MISSOURI · CERVENTE D. SUDDUTH · NUMBER PE-2011015802 · PROFESSIONAL ENGINEER

2/2/2026

CERVENTE D. SUDDUTH
PROFESSIONAL ENGINEER
PE-2011015802

FOR WSD USE:

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
DNG	CDS	2/2/26	34W	53N	36

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	S709

PROJECT NO. 81000927 SHEET 242 OF 643

KCWATER
CUSTOM ENGINEERING MECHANICAL & ELECTRICAL ENGINEERING
DuBois Consultants CIVIL · STRUCTURAL ENGINEERING
WELLNER architects
BURNS McDONNELL
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KANSAS CITY, MO 64114
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816-333-9400
Licensee No. 000165

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

CERTIFICATION PAGE

Project/Contract Numbers: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrades

I am responsible for the following specifications and drawings:

Drawings:

Specifications:

Sections:

07 13 00
07 14 16
07 16 00
09 90 00
41 22 00

_____ (SEAL)

I certify under penalty of law that the document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted, and that the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

SECTION 03 15 50 – VAPOR RETARDER

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes vapor retarder under concrete slabs on grade.

1.03 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 03 30 00 - Concrete.

1.04 REFERENCE STANDARDS:

A. Applicable Standards:
   1. American Concrete Institute (ACI):
      a. 302.1R- Guide to Concrete Floor and Slab Construction
      b. 302.2R - Guide for Slabs that Receive Moisture-Sensitive Flooring Materials
   2. American Society for Testing and Materials (ASTM):
      a. E96/E96M - Test Methods for Water Vapor Transmission of Materials.
      b. E154/E154M- Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
      c. E1643- Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs
      d. E1745 - Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

1.05 SUBMITTALS:

A. Submit as specified in DIVISION 01.
B. Include, but not limited to, the following:
   1. Product specification and data.
   2. Installation instructions.

PART 2 - PRODUCTS

2.01 VAPOR RETARDER:

A. Flexible, preformed sheet membrane material conforming to ASTM E1745, Class A or B having a minimum thickness of 10 mils.
B. Use under concrete slabs as follows:
   1. Admin Building
   2. Headworks Building
   3. UV Disinfection Building
   4. Solids Handling Building and Solids Handling Basin
   5. Blower Building
   6. Influent Pump Station Electrical Building

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install in accordance with ASTM E1643 and the following.
B. Remove sharp edges, projecting materials, and roughness which might penetrate vapor retarder.
C. Level and tamp or roll granular base.
D. Place vapor retarder sheeting with the longest dimension parallel with the direction of the concrete pour.
E. Lap vapor retarder over footing or seal to foundation wall, or both, and seal around penetrations such as utilities and columns to create a monolithic membrane between the surface of the slab and moisture sources below the slab and at the slab perimeter.
F. Lap joints 6 inches, or as instructed by the manufacturer, and seal with the manufacturer's recommended adhesive or pressure sensitive tape, or both.
G. Take precaution to protect vapor retarder from damage during installation of reinforcing steel and utilities and during placement of concrete.
H. Use only concrete brick type reinforcing bar supports, or provide 6-inch by 6-inch protective pads of asphaltic hardboard or other material recommended by the vapor retarder manufacturer to protect the vapor retarder from puncture.
I. Do not drive stakes through the vapor retarder.
J. Repair vapor retarder damaged during placement of reinforcing or concrete as instructed by manufacturer.

END OF SECTION 03 15 50

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

SECTION 07 13 00 – SHEET APPLIED WATERPROOFING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 07 14 16 “Cold Fluid-Applied Waterproofing” for waterproofing of vertical surfaces.

1.02 SUMMARY:

A. This Section includes:

1. Under Slab Sheet Waterproofing System:
    a. Sheet applied membrane waterproofing.

B. Provide waterproofing for under slabs exposed to groundwater including the following locations:

1. Coarse Screening Structure
2. Influent Wet Well/Pump Station

1.03 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

B. American Concrete Institute (ACI):

1. ACI 301 - Specification for Structural Concrete.

C. ASTM International:

1. ASTM C836 – Standard Test Methods for Crack Cycling
2. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension
3. ASTM D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer
4. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
5. ASTM D3767 - Standard Practice for Rubber—Measurement of Dimensions
6. ASTM D1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
7. ASTM D4833 - Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products
8. ASTM D5385/5385M - Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes
9. ASTM E96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials
10. ASTM D4068 - Standard Specification for Chlorinated Polyethylene (CPE) Sheeting for Concealed Water-Containment Membrane
11. ASTM D5385 - Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes
12. ASTM D570 - Standard Test Method for Water Absorption of Plastics

D. National Roofing Contractors Association (NRCA):

1. The NRCA Waterproofing Manual. Rosemont, Ill: NRCA, 2005.

E. Sealant, Waterproofing Contractors Association:

1. Below Grade Waterproofing Manual. Kansas City, MO: SWRI, 2000.

1.04 PREINSTALLATION MEETINGS:

A. Preinstallation Conference: Conduct conference at Project Site.
   1. Review waterproofing requirements including, but not limited to, the following:
      a. Surface preparation specified in other sections.
      b. Minimum curing period.
      c. Forecasted weather conditions.
      d. Special details and sheet flashings.
      e. Repairs.

1.05 SUBMITTALS:

A. Submit as specified in DIVISION 01.
B. Product Data: For each type of product.
   1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
   2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.
C. Shop Drawings:
   1. Show locations and extent of waterproofing.
   2. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
D. Field quality-control reports.
E. Sample Warranties: For special warranties.

1.06 QUALITY ASSURANCE:

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.
B. Mockups: Build mockups to verify selections made under Sample submittals and to set quality standards for installation.

1.07 FIELD CONDITIONS:

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer.
   1. Do not apply waterproofing to a damp or wet substrate, when relative humidity exceeds 85%, or when temperatures are less than 5ºF (3ºC) above dew point.
   2. Do not apply waterproofing in snow, rain, fog or mist, or when such weather conditions are imminent during application and curing period.
B. Maintain adequate ventilation during application and curing of waterproofing materials.

1.08 WARRANTY:

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace waterproofing that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: Ten (10) years from date of Substantial Completion.
B. Installer's Special Warranty: Specified form, signed by Installer, covering Work of this Section, for warranty period of one (1) years.
   1. Warranty includes removing and reinstalling protection board, drainage panels, insulation.
C. Warranties shall comply with the requirements of Section 01 78 36.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL:

A. Source Limitations: Provide waterproofing system materials and accessory products from a single-source system manufacturer.

2.02 PERFORMANCE REQUIREMENTS:

A. General: Waterproofing system shall be capable of performing as a continuous watertight installation and as a moisture drainage plane transitioned to adjacent flashings and discharging water to the building exterior. Waterproofing shall accommodate normal substrate movement, construction material transitions, opening transitions, penetrations, and perimeter conditions without resultant moisture deterioration.

B. Compatibility: Provide waterproofing system materials that are compatible with adjacent materials under conditions of service and substrates on which product is applied, as recommended by waterproofing manufacturer based on testing and field experience

2.03 UNDER SLAB SHEET WATERPROOFING SYSTEM:

A. Multi-Layer Sheet Waterproofing: Composite membrane of 63 mils thickness consisting of an EPDM watertight barrier layer, a hydro-reactive polymer core layer, an EPDM derivative/polymer hydro-reactive layer, and a non-woven polyethylene geotextile facing.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Basis of Design Product: Tremco, Inc., TREMproof Amphibia
   2. Physical Properties:
      a. Elongation, ASTM D412: 709%
      b. Tensile Strength, ASTM D 412: 927 psi
      c. Nail Sealability, ASTM D1970, sect. 7.9: Passed
      d. Low Temp Flexibility @ -20° F, ASTM D1970, sect. 7.6: Unaffected, passed
      e. Peel Adhesion to Concrete, ASTM D903: 7.7 lbs./in.
      f. Strength at Break, ASTM D624: 161.51 psi
      g. Permeance, ASTM E96 B:0.069 US Perms, 0.016 US Perms (BW - Inverted Wet Cup)
      h. Resistance to Hydrostatic Head, ASTM D5385: Pass at 231 ft.²
      i. Thickness, ASTM D3767: 63 mils, 1.6mm
      j. Crack Cycling @ -9.4° F, 100 cycles, ASTM C836: Unaffected, Pass
      k. Puncture Resistance of Geomembranes, ASTM D4833: 52.4 kg/M
      l. Hydrostatic Pressure Resistance, ASTM D4068: Pass at 40 hrs.
      m. Water Absorption, ASTM D570: 0.13%
      n. Installation Temperatures: 32 to 95°F (0 to 35° C)
      o. Freeze/Thaw Cycles: no effect before or after installation
      p. Life Expectancy: Indefinite
      q. Color: Black

B. Accessory Materials:
   1. General: Furnish accessory materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
   2. Tapes: Waterproofing manufacturer's recommended tape for joints between sheets, membranes, or panels.
   3. Safety Overlap Tape: butyl-hybrid adhesive tape with a fleece face.

4. Basis of Design Product: Tremco, Inc. Tremco BG Grip Tape
5. Waterstops: hydro-reactive, water swelling, single component elastic sealant.
   a. Basis of Design Product – Adeka ULTRASEAL P-201
6. Joint Sealants: Termination Seals:
   a. Single component, high performance, medium-modulus, low-VOC, UV-stable, non-sag polyurethane sealant.
   b. Basis of Design Product: Tremco Inc.; Dymonic 100.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
B. Surface Condition: Before applying waterproofing materials, examine substrate conditions.
C. Proceed with installation once unsatisfactory conditions have been corrected.

3.02 INTERFACE WITH OTHER WORK:

A. Sequencing of Work: Coordinate sequencing of waterproofing installation with work of other sections that form portions of building envelope moisture control to ensure that flashings and transition materials can be properly installed and inspected.
B. Subsequent Work: Coordinate waterproofing installation with work of other sections installed subsequent to waterproofing to ensure complete inspection of installed waterproofing and sealing of waterproofing penetrations necessitated by subsequent work.

3.03 PREPARATION:

A. Clean, prepare, and treat substrates. Fill voids with cement grout as recommended by manufacturer.
B. Formed Concrete Surfaces: Remove fins and projections. Fill voids, form-tie holes, and other defects greater than 1/4 inch (6 mm) in depth.
C. Horizontal Concrete Surfaces: Remove standing water, debris, and substances that may impair bonding of patching materials or effectiveness of waterproofing. Fill voids and other defects greater than 1/4 inch (6 mm) in depth.
D. Excavation Support and Protection System: Fill minor gaps and spaces 1 (25 mm) wide or wider with appropriate filling material. Cover or fill large voids and crevices.

3.04 INSTALLATION, GENERAL:

A. Install waterproofing and accessories according to manufacturer's written instructions.
   1. Install a continuous layer of waterproofing membrane with ends and edges lapped a minimum of 2-4 inches (102 mm). Stagger end joints, seal laps and treat fastener penetrations in accordance with manufacturer’s written instructions.
   2. Apply hydro-reactive expandable sealant around penetrations in horizontal and vertical surfaces, construction joints in substrate, and penetrations.
   3. Apply Tremco 830 sealant between all overlaps and compress with a 2” x 2” steel seam roller using pressure sufficient to adequately flatten/spread the sealant bead.
   4. Seal all overlaps with Tremco BG Grip Tape centered on the adjacent sheet edge, adhering to the white, non-woven fleece fabric layer facing the installer and pressing or rolling down to ensure full adhesion.
B. Protect waterproofing from damage during construction. Repair punctures, tears, and cuts.

3.05 BELOW-SLAB WATERPROOFING INSTALLATION:

A. Below Structural Slabs-on-Grade: Apply waterproofing membrane with black EPDM side down, and white, fleece fabric side up.
   1. Install membrane sheets with the fleece fabric side up. Tape all seams where subject to displacement during concrete placement.
   2. Install under footings, grade beams, and pile caps; or continue waterproofing through key joints between footings and foundation walls, and extend a minimum of 8 inches (200 mm) up or beyond perimeter slab forms. Stagger seams minimum 12 inches (305 mm).
   3. Install under slabs starting at lowest point, install a continuous layer of waterproofing membrane, with ends and edges lapped a minimum of 4 inches (102 mm).
   4. Protect waterproofing from damage caused by reinforcing bar supports with sharp edges

3.06 FIELD QUALITY CONTROL:

A. Engage a full time site representative qualified by the waterproofing membrane manufacturer to inspect substrate conditions, surface preparation, and application of the membrane, flashings, protection, and drainage components; and to furnish daily reports to Architect.
B. Reporting: Forward written inspection reports to the Architect of the inspection and test being performed.
C. Correction: Correct deficient applications not passing tests and inspections, make necessary repairs, and retest as required to demonstrate compliance with requirements.

3.07 PROTECTION AND CLEANING:

A. Protect waterproofing membrane from damage prior to concrete placement.

END OF SECTION 07 13 00

SECTION 07 14 16 – COLD FLUID-APPLIED WATERPROOFING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 07 13 00 "Sheet Applied Waterproofing" for under-slab waterproofing systems.

1.02 SUMMARY:

A. This Section includes:

1. Below-Grade Wall Cold Fluid-Applied Waterproofing System:
    a. Single-component polyurethane waterproofing.
    b. Protection Mat.

B. Provide waterproofing for below-grade exterior walls exposed to groundwater, including the following locations:

1. Coarse Screening Structure
2. Influent Wet Well/Pump Station

1.03 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

B. American Concrete Institute (ACI):

1. ACI 301 - Specification for Structural Concrete.

C. ASTM International:

1. ASTM C 140 - Test Methods for Sampling and Testing Concrete and Masonry Units and Related Units.
2. ASTM C 272 - Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions.
3. ASTM C 578 - Specification for Rigid, Cellular Polystyrene Thermal Insulation.
4. ASTM C 836/ C 836M - Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.
5. ASTM C 898/C 898 - Guide for Use of High Solids Content, Cold Liquid-Applied Elastomeric Waterproof Membrane with Separate Wearing Course.
6. ASTM C 920 - Specification for Elastomeric Joint Sealants.
7. ASTM C 1193 - Guide for Use of Joint Sealants.
8. ASTM C 1471 - Guide for the Use of High Solids Content Cold Liquid-Applied Elastomeric Waterproofing Membrane on Vertical Surfaces.
9. ASTM D 1621 - Test Method for Compressive Properties of Rigid Cellular Plastics.
10. ASTM D 4258 - Practice for Surface Cleaning Concrete for Coating.
11. ASTM D 4259 - Practice for Abrading Concrete.
12. ASTM D 4263 - Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
13. ASTM D 5385 - Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes.
14. ASTM D 5957 - Guide for Flood Testing Horizontal Waterproofing Installations.
15. ASTM D 6506 - Specification for Asphalt Based Protection Board for Below-Grade Waterproofing.

D. National Roofing Contractors Association (NRCA):

1. The NRCA Waterproofing Manual. Rosemont, Ill: NRCA, 2005.

E. Sealant, Waterproofing Contractors Association:

1. Below Grade Waterproofing Manual. Kansas City, MO: SWRI, 2000.

1.04 PREINSTALLATION MEETINGS:

A. Preinstallation Conference: Conduct conference at Project Site.
   1. Review waterproofing requirements including, but not limited to, the following:
      a. Surface preparation specified in other sections.
      b. Minimum curing period.
      c. Forecasted weather conditions.
      d. Special details and sheet flashings.
      e. Repairs.

1.05 SUBMITTALS:

A. Submit as specified in DIVISION 01.
B. Product Data: For each type of product.
   1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
   2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.
C. Shop Drawings:
   1. Show locations and extent of waterproofing.
   2. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
D. Field quality-control reports.
E. Sample Warranties: For special warranties.

1.06 QUALITY ASSURANCE:

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.
B. Mockups: Build mockups to verify selections made under Sample submittals and to set quality standards for installation.

1.07 FIELD CONDITIONS:

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer.
   1. Do not apply waterproofing to a damp or wet substrate, when relative humidity exceeds 85%, or when temperatures are less than 5ºF (3ºC) above dew point.
   2. Do not apply waterproofing in snow, rain, fog or mist, or when such weather conditions are imminent during application and curing period.
B. Maintain adequate ventilation during application and curing of waterproofing materials.

1.08 WARRANTY:

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace waterproofing that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: Ten (10) years from date of Substantial Completion.
B. Installer's Special Warranty: Specified form, signed by Installer, covering Work of this Section, for warranty period of one (1) years.
   1. Warranty includes removing and reinstalling protection board, drainage panels, insulation.
C. Warranties shall comply with the requirements of Section 01 78 36.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL:

A. Source Limitations: Provide waterproofing system materials and accessory products from a single-source system manufacturer.

2.02 PERFORMANCE REQUIREMENTS:

A. General: Waterproofing system shall be capable of performing as a continuous watertight installation and as a moisture drainage plane transitioned to adjacent flashings and discharging water to the building exterior. Waterproofing shall accommodate normal substrate movement, construction material transitions, opening transitions, penetrations, and perimeter conditions without resultant moisture deterioration.

B. Compatibility: Provide waterproofing system materials that are compatible with adjacent materials under conditions of service and substrates on which product is applied, as recommended by waterproofing manufacturer based on testing and field experience

2.03 BELOW-GRADE WALL COLD FLUID-APPLIED WATERPROOFING SYSTEM:

A. Single-Component Polyurethane Waterproofing:
   1. Single-Component, Modified Polyurethane Waterproofing: ASTM C836.
      a. Products: Subject to compliance with requirements, provide the following
         (1) TREMproof 250 GC @ 60 mils wet min.
         (2) Or Architect approved equal.

B. Auxiliary Materials:
   1. General: Provide auxiliary materials recommended in writing by waterproofing manufacturer for intended use and compatible with one another and with waterproofing.
      a. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
   2. Primer: Manufacturer's standard primer, sealer, or surface conditioner; factory-formulated acrylic latex, polyurethane, or epoxy.
   3. Sheet Flashing: 50-mil (1.3-mm) minimum, nonstaining, uncured sheet neoprene.
      a. Adhesive: Manufacturer's recommended contact adhesive.
   4. Joint Reinforcing Strip: Manufacturer's recommended fiberglass mesh or polyester fabric.
   5. Joint Sealant: Multicomponent polyurethane sealant, compatible with waterproofing; ASTM C920, Type M, Class 25 or greater; Grade NS for sloping and vertical applications. Use NT exposure and as recommended by manufacturer for substrate and joint conditions.
      a. Backer Rod: Closed-cell polyethylene foam.

2.04 PROTECTION COURSE:

A. Protection Mat:
   1. UV-resistant lightweight polyester mat.
      a. Basis of Design Product:
         (1) Tremco, Protection Mat.
         (2) Or Architect approved equal.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
   1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
   2. Verify that substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D4263.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SURFACE PREPARATION:

A. Clean and prepare substrate according to manufacturer's written recommendations. Provide clean, dust-free, and dry substrate for waterproofing application.
B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage or overspray affecting other construction.
C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, acid residues, and other penetrating contaminants or film-forming coatings from concrete.

3.03 PREPARATION AT TERMINATIONS AND PENETRATIONS:

A. Prime substrate unless otherwise instructed by waterproofing manufacturer.
B. Apply waterproofing in two separate applications, and embed a joint reinforcing strip in the first preparation coat when recommended by waterproofing manufacturer.
   1. Provide sealant cants around penetrations joints when recommended by waterproofing manufacturer.

3.04 JOINT AND CRACK TREATMENT:

A. Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C1471 and waterproofing manufacturer's written instructions. Remove dust and dirt from joints and cracks, complying with ASTM D4258, before coating surfaces.
   1. Comply with ASTM C1193 for joint-sealant installation.
   2. Apply bond breaker between sealant and preparation strip.
   3. Prime substrate and apply a single thickness of preparation strip extending a minimum of 3 inches (75 mm) along each side of joint. Apply waterproofing in two separate applications and embed a joint reinforcing strip in the first preparation coat.
B. Install sheet flashing and bond to wall substrates where indicated or required according to waterproofing manufacturer's written instructions.
   1. Extend sheet flashings onto perpendicular surfaces and other work penetrating substrate according to ASTM C898.

3.05 WATERPROOFING APPLICATION:

A. Apply waterproofing according to ASTM C1471 and manufacturer's written instructions.
B. Start installing waterproofing in presence of manufacturer's technical representative.
C. Apply primer over prepared substrate.
D. Unreinforced Waterproofing Applications: Mix materials and apply waterproofing by spray, roller, notched squeegee, trowel, or other application method suitable to slope of substrate.
   1. Apply one or more coats of waterproofing to obtain a seamless membrane free of entrapped gases, with an average dry film thickness of 60 mils (1.5 mm) and a minimum dry film thickness of 50 mils (1.3 mm) at any point.

2. Apply waterproofing to prepared wall terminations and vertical surfaces.
3. Verify wet film thickness of waterproofing every 100 sq. ft. (9.3 sq. m).

3.06 PROTECTION INSTALLATION:

A. Protection Course: Cover waterproofing with protection course following curing of waterproofing and prior to backfilling. Overlap protection course joints.

3.07 FIELD QUALITY CONTROL:

A. Engage a full time site representative qualified by the waterproofing membrane manufacturer to inspect substrate conditions, surface preparation, and application of the membrane, flashings, protection, and drainage components; and to furnish daily reports to Architect.
B. Flood Testing: Flood test each deck area for leaks, according to recommendations in ASTM D5957, after completing waterproofing but before overlaying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
   1. Flood to an average depth of 2-1/2 inches (64 mm) with a minimum depth of 1 inch (25 mm) and not exceeding a depth of 4 inches (100 mm). Maintain 2 inches (50 mm) of clearance from top of sheet flashings.
   2. Flood each area for 24 hours.
   3. After flood testing, repair leaks, repeat flood tests, and make further repairs until waterproofing installation is watertight.

3.08 CURING, PROTECTION, AND CLEANING:

A. Cure waterproofing according to manufacturer's written recommendations, taking care to prevent contamination and damage during application stages and curing.
B. Protect waterproofing from damage and wear during remainder of construction period.
C. Protect installed insulation drainage panels from damage due to ultraviolet light, harmful weather exposures, physical abuse, and other causes. Immediately after installation, provide temporary coverings where insulation will be subject to abuse and cannot be concealed and protected by permanent construction.
D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 14 16

SECTION 07 16 00 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes the following:

B. Coal Tar-Epoxy dampproofing for all below grade exterior walls with occupiable spaces, non-liquid-containing structures (vaults, manholes, etc..) and structures with interior protective coatings, including the following locations:

1. AGS Basin – Pipe Gallery and Pump Room
2. Solids Handling Building – Foundation, Sludge Loadout Pump Trench, and Sludge Holding Tanks

C. Where below grade walls and slabs are exposed to groundwater, a waterproofing system, in lieu of dampproofing, shall be provided per Section 07 14 16 Cold Fluid-Applied Waterproofing and Section 07 13 00 Sheet Applied Waterproofing.

D. Not to be used in areas in contact with potable water.

1.03 SUBMITTALS:

A. Submit as specified in DIVISION 01.

B. Product data for type of product specified, including data substantiating that materials comply with requirements for dampproofing material specified. Include recommended method of application, recommended primer, number of coats, coverage or thickness, and recommended protection course.

1. Certification by dampproofing manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

1.04 QUALITY ASSURANCE:

A. Installer Qualifications: Engage an experienced Installer who has complete bituminous dampproofing similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Single-Source Responsibility: Obtain primary dampproofing materials and primers from one source and by a single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

1.05 PROJECT CONDITIONS

A. Substrate: Proceed with dampproofing only after substrate construction and penetrating work have been completed.

B. Weather Limitations: Proceed with dampproofing only when existing and forecasted weather conditions will permit work to be performed according to manufacturer’s recommendations and warranty requirements.

C. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has thoroughly cured.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. Deliver materials in sealed containers or cartons bearing the manufacturer’s label.

B. Protect materials to keep clean, dry, and within manufacturer’s temperature limitations.

1.07 WARRANTY

A. The Manufacturer shall warrant that all material shall be free from defects caused by faulty material or workmanship for a minimum period of one (1) year from the date of Substantial Completion, unless otherwise specified.

B. Warranties shall comply with the requirements of Section 01 78 36.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

1. Coal Tar-Epoxy Dampproofing:
   a. Tnemec Tneme-Tar Hi Build Series 46H-413; 16-20 mils DFT.
   b. Or engineer approved equal

2.02 BITUMINOUS DAMPPROOFING:

A. General: Provide products recommended by manufacturer for designated application and suitable for service intended.

B. Cold-Applied, Coal Tar-Epoxy Dampproofing: Roll or spray applied heavy-duty water-resistant epoxy coating made with pitch for protection of concrete from severe chemical fumes and corrosive vapors. Coating shall be suitable for buried or immersion conditions.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Surface Condition: Before applying dampproofing materials, examine substrate conditions.

C. Proceed with installation once unsatisfactory conditions have been corrected.

3.02 PREPARATION:

A. Clean substrate of projections and substances detrimental to Work; comply with recommendations of prime materials manufacturer. Remove oil, grease form release agents, laitance, loose materials, and slick surfaces.

B. Install cant strips and similar accessories as recommended by prime materials manufacturer even though not indicated.

C. Formed Concrete Surfaces: Remove fins and projections. Fill voids, form-tie holes, and other defects greater than 1/4 inch (6 mm) in depth.

D. Fill voids, seal joints, and apply bond breakers, if any, as recommended by prime materials manufactuer, with particular attention at construction joints.

E. Install separate flashings and corner protection stripping, as recommended by prime materials manufacturer, to precede application of dampproofing. Comply with manufacturer's recommendations. Pay particular attention to requirements at building expansion joints, if any.

F. Surface prep per manufacturer recommendations: including abrasive blasting all surfaces per SSPC-SP13/NACE 6; ICRI CSP 2-4 Surface Preparation of Concrete.

G. Prime substrate as recommended by prime materials manufacturer.

H. Protection of Other Work: Do not allow liquid and mastic compounds to enter and clog drains and conductors. Prevent spillage and migration onto other surfaes of work by masking or otherwise protecting adjoining work.

3.03 INSTALLATION, GENERAL:

A. Comply with manufacturer's recommendations except where more stringent requirements are indicated or specified and where Project conditions require extra precautions to ensure satisfactory performance of work.

B. Apply vertical dampproofing down walls from finished-grade line to top of footing, extend over top of footing, and down a minimum of 6 inches (150 mm) over outside face of footing. Extend 12 inches (300 mm) onto intersecting walls and footings, but do not extend onto surfaces exposed to view when the Project is completed.

3.04 PROTECTION AND CLEANING:

A. Protect exterior, below-grade dampproofing membrane from damage until backfill is completed. Remove overspray and spilled materials from surfaces not intended to receive dampproofing.

END OF SECTION 07 16 00

SECTION 09 90 00 – PROTECTIVE COATINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes coating of exterior and interior surfaces throughout the Project and which are listed in PART 2, with systems specified on "coating system" sheets at the end of this Section.

B. Coating systems include surface preparation, prime coat (first coat), finish coats (second and third coats), inspection, cleaning, and touch-up of surfaces and equipment. Shop preparation, prime coat, and finish coats to be shop-applied, may be specified elsewhere or referenced to this Section so that a complete system is specified and coordinated.

1. Where surface preparation and first (prime) coat are specified in other Sections to be shop-applied, such as for structural steel, hollow metal doors or equipment, only the touch-up and finish coats are a part of field painting. Surface preparation is the required degree of preparation prior to application of first (prime) coat regardless if done in shop or field.
2. If materials are provided without shop primer such as miscellaneous steel or sheet metal, then surface preparation, first, second, and third coats are a part of field painting.

1.03 RELATED REQUIREMENTS:

A. Shop Painting and Coatings: All applicable Divisions.

B. Factory Prefinished Items: All applicable Divisions.

1.04 REFERENCE STANDARDS:

A. Applicable Standards:

1. American National Standards Institute (ANSI):
   a. A13.1 - Scheme for the Identification of Piping Systems.
   b. Z53.1 - Safety Color Code for Marking Physical Hazards.
2. American Society for Testing and Materials (ASTM):
   a. D4259 - Abrading Concrete.
3. Society for Protective Coatings (SSPC) Surface Preparation Specifications:
   a. SP1 - Solvent Cleaning: Removes oil, grease, soil, drawing and cutting compounds, and other soluble contaminants.
   b. SP2 - Hand Tool Cleaning: Remove loose material. Not intended to remove adherent mill scale, rust, and paint.
   c. SP3 - Power Tool Cleaning: Removes loose material. Not intended to remove all scale or rust.
   d. SP5 - White Metal Blast Cleaning: Removes all scale, rust, foreign matter. Leaves surface gray-white uniform metallic color.
   e. SP6 - Commercial Blast Cleaning: Two-thirds of every nine square inches free of all visible residues; remainder only light discoloration.
   f. SP10 - Near-White Blast Cleaning: At least 95% of every nine square inches shall be free of all visible residues.
   g. SP11 - Power Tool Cleaning to Bare Metal.
   h. SP13 – Surface Preparation of Concrete.

1.05 SUBMITTALS:

A. Submit as specified in DIVISION 1.

B. Includes, but not limited to, the following:

1. Schedule of products and paint systems to be used. Schedule shall include the following information:
   a. Surfaces for system to be applied.
   b. Surface preparation method and degree of cleanliness.
   c. Product manufacturer, name, and number.
   d. Method of application.
   e. Dry film mil thickness per coat of coating to be applied.
2. Color charts for selection and acceptance.
3. Technical and material safety data sheets.
4. Certification(s) by coating manufacturer(s) that all coatings are suitable for service intended as stated on each coating system sheet. If manufacturer has an equivalent product as that specified, and it is suitable for the intended purpose, Contractor shall submit the recommended product for approval at no increase in cost, and state reasons for substitution.
5. Contractor shall certify in writing to the Engineer/Architect that applicators have previously applied all the systems in this Specification and have the ability and equipment to prepare the surfaces and apply the coatings correctly.

C. Submittals for industrial maintenance coatings shall be prepared by, or have assistance in preparation of, a corrosion engineer or industrial coatings technical representative of the coating manufacturer.

1.06 QUALITY ASSURANCE:

A. Include on label of container:

1. Manufacturer's name, product name, and number.
2. Type of paint and generic name.
3. Color name and number.
4. Storage and temperature limits.
5. Mixing and application instructions, including requirements for precautions which must be taken.
6. Drying, recoat, or curing time.

B. A coating report shall be completed daily by Contractor at each phase of the coating system starting with surface preparation. These shall be submitted on the form attached at end of this Section.

C. In the event a problem occurs with coating system, surface preparation, or application, Contractor shall require coating applicator and coating manufacturer's technical representative to promptly investigate the problem and submit results to Engineer/Architect.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. Delivery of Materials:

1. Deliver in sealed containers with labels and information legible and intact. Containers shall also have correct labels with required information.

1.08 REGULATORY REQUIREMENTS:

A. In addition to requirements specified elsewhere for environmental protection, provide coating materials that conform to the restrictions of the U.S. EPA and the local and regional

jurisdictions. Notify Engineer/Architect of any coating specified herein that fails to conform to the requirements for the location of the Project or location of application.

B. Lead Content: Use only coatings that are totally lead free.
C. Chromate Content: Do not use coatings containing zinc-chromate or strontium chromate.
D. Asbestos Content: Materials shall not contain asbestos.
E. Mercury Content: Materials shall not contain mercury or mercury compounds.

1.09 WARRANTY

A. The Manufacturer shall warrant that all protective coatings shall be free from defects caused by faulty material or workmanship for a minimum period of one (1) year from the date of Substantial Completion, unless otherwise specified.
B. Warranties shall comply with the requirements of Section 01 78 36.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Proprietary names and product numbers are specified in most systems for material identification from these manufacturers:
   1. Ameron Protective Coatings Systems Group, PPG.
   2. Carboline Company, Inc.
   3. Tnemec Company, Inc.
   4. Sherwin-Williams.

2.02 GENERAL:

A. Materials furnished for each coating system must be compatible to the substrate.
B. When unprimed surfaces are to be coated, entire coating system shall be by the same coating manufacturer to assure compatibility of coatings.
C. When shop-painted surfaces are to be coated, ascertain whether finish materials will be compatible with shop coating. Inform Engineer/Architect of any unsuitable substrate or coating conditions.

2.03 COATING SYSTEMS:

A. Specified on the "Protective Coating System" sheets at the end of this Section.

2.04 SURFACES TO BE COATED:

A. System A-5:
   1. Item: Steel Bollards and exterior exposed carbon steel
      a. Reference: DIVISION 05, Architectural, Civil and Structural Drawings
      b. Location: As indicated
B. System B-4:
   1. Item: New Galvanized Steel, Including: Doors and Frames, Veneer Lintels, and Hollowcore Support Angles.
      a. Reference: DIVISION 05, Architectural and Structural Drawings
      b. Location: As indicated
C. System E-1:
   1. Item: New Iron and Steel Process Piping, Valves, Motors, Pipe Supports, Pumps, Drains, Air Lines & Related Accessories. Interior Exposure, Exterior Surfaces & Non-Potable Liquid Immersion:
      a. Reference: DIVISION 22, 33, 41 & 46

b. Location: As indicated
2. Item: Misc. Non-galvanized Steel Interior Exposure, including interior structural steel:
   a. Reference: DIVISION 05 & drawings
   b. Location: As indicated
3. Item: Steel Hangers & Supports for Mechanical Equipment and Piping. Interior Exposure:
   a. Reference: DIVISION 05 & Mechanical Drawings
   b. Location: As indicated

D. System F-3:
1. Item: Interior CMU walls
   a. Reference: Architectural Drawings
   b. Location: As indicated

E. System J-2:
1. Item: Interior Gypsum Board
   a. Reference: Architecural Drawings
   b. Location: As indicated

F. Item: Blower Piping
1. Provide the following Tnemec system or engineer approved equal meeting the design criteria listed below:
   a. Coating System:
      (1) Fully protect, mask and seal off everything in the room that will not receive the coating system.
      (2) Surface preparation: New piping - SSPC-SP10 and profile depth of 1.5 to 2.5 mils
      (3) Prime with one coat of Tnemec Series 135 Chembuild @ 4.0-6.0 mils DFT.
      (4) Intermediate Coat(s): two coats Tnemec Series 971 Aerolon Acrylic at 30.0-50.0 mils DFT.
      (5) Topcoat with Tnemec series 1028-T Enduratone @ 2.0-3.0 mils DFT for a total of 66.0-109.0 mils DFT. Color as selected by the owner/engineer from all manufacturer's standard colors.
      (6) Thermal Conductivity of (ASTM C518 at 77°F): 0.0356 W/m-°K or 0.2468 BTU-in/ft²-hr-°F required.
   b. Reference: Process Drawings
   c. Location: As indicated

G. Item: Interior Chemical Containment Area: Polymer Concrete Containment
1. Provide the following Tnemec system or approved Sherwin Williams or Carboline equal meeting the design criteria listed below:
   a. Coating System:
      (1) Surface Preparation: Allow new cast-in-place concrete to cure a minimum of 28 days at 75°F (24°C). Verify concrete dryness and prepare concrete surfaces in accordance with NACE No. 6/SSPC-SP13 Joint Surface Preparation Standards and ICRI Technical Guidelines. Moisture vapor transmission should not exceed three lbs. per 1,000 sq. ft. in a 24-hour period. Relative humidity should not exceed 80%. Abrasive blast, shot-blast or mechanically abrade concrete surfaces to remove laitance, curing compounds, hardeners, sealers and other contaminants and to provide a minimum ICRI-CSP 5 or greater surface profile. Large cracks, voids and other surface imperfections should be filled with a recommended filler or surfacer.

(2) Primer: Series 251SC @ 6.0-8.0 mils D.F.T.
(3) Base Coat: Series 252SC Chembloc MCK System w/fiberglass mat reinforcement per manufacturer's direction @ 60.0 - 80.0 mils.
(4) Saturant Coat: Series 252SC Chembloc @ 6.0-8.0 mils.
(5) Top Coat: Series 252SC Chembloc @ 6.0-8.0 mils. System Total D.F.T. of 78.0-104.0 mils minimum.

b. Reference: Process Drawings
c. Location: Polymer containment structure inside the Solids Handling Building; exposed concrete including; interior concrete surfaces including walls, curbing, floor, tank pads, sumps, and top of wall.

H. Item: Influent Wet Well/Pump Station, Coarse Screening Structure, Covered Thickened Sludge Holding Tanks, Headworks Channels. Concrete Immersion: Raw sewage.
1. Provide the following Tnemec system or engineer approved equal meeting the design criteria listed below:
a. Coating System:
(1) Fully protect, mask and seal off everything in the space that will not receive the coating system.
(2) Surface Preparation: High pressure water blast all areas with a minimum 3000-5000 lbs. psi at the tip at a rate of 3-5 gallons/minute, utilizing an orbital tip and TSP detergent additive to remove chalk, loose paint and other contaminants, followed by a clean water rinse. ASTM D4258.
(3) Verify concrete dryness and prepare concrete surfaces in accordance with NACE No. 6/SSPC-SP13.
(4) Joint Surface Preparation Standards and ICRI Technical Guidelines. Moisture vapor transmission should not exceed three lbs. per 1,000 sq. ft. in a 24-hour period.
(5) Relative humidity should not exceed 80%.
(6) Abrasive blast, shot-blast or mechanically abrade concrete surfaces to remove laitance, curing compounds, hardeners, sealers and other contaminants and to provide a minimum ICRI-CSP 5 or greater surface profile.
(7) Large cracks, voids and other surface imperfections should be filled. Clean & Dry per ASTM D4258.
(8) Parge coat 1/16” - 1/4" thick with Tnemec Series 218
(9) Finish Coat: Apply one coat of Series G435 Perma-Glaze @ 30.0-40.0 mils DFT per coat for a total of 30.0-40.0 mils DFT. Color as selected by engineer from manufacturer’s standard colors.
(10) Field touch-up.
b. Reference: Structural Drawings, Process Drawings
c. Location: All interior concrete surfaces exposed to wastewater. Including, face of concrete wall, concrete floor, concrete ceiling, and top of concrete wall.
d. Top Coat Color: 31GR Slate Gray

I. Item: Resinous Floor and Base System
1. Provide the following Tnemec system or engineer approved equal meeting the design criteria listed below.
a. Provide resinous floor system 2’-0” by 2’-0” mock-up for approval before applying coating system.
b. Coating System:

(1) Fully protect, mask and seal off everything in the room that will not receive the coating system, including floor drains.
(2) Surface preparation: Prepare concrete surfaces in accordance with NACE No. 6/SSPC-SP13 Joint Surface Preparation Standards and ICRI Technical Guidelines. Abrasive blast, shot-blast, water jet or mechanically abrade concrete surfaces to remove laitance, curing compounds, hardeners, sealers and other contaminants to provide a minimum ICRI-CSP 4-5 surface profile. Large cracks, voids and other surface imperfections should be filled with a recommended filler or surfacer.
(3) Prime with Series 241 Ultra-Tread MVT @ 46.0-52.0 mils DFT w/first broadcast coat
(4) Coat with Series 222 Deco-Tread @ 1/16" minimum DFT w/ one broadcast application
(5) Topcoat with series 248 Everthane @ 2.0-3.0 mils DFT.
(6) Color as selected by the architect from manufacturer's full range of colors.

c. Physical Properties:
(1) Compressive Strength: Minimum 14,000 psi.
(2) Flexural Strength: Minimum 4,500 psi.
(3) Water Absorption: 0.2%.
(4) Chemical resistance of cured floor surfacing system as indicated below. Test to qualify coatings for chemical splash and fumes (NACE TM-01-74 Procedure B):
(5) No effect from the following: Acetic acid (100%), chromic acid (10%), citric acid (20%), formaldehyde (37%), heavy duty detergent, hydrochloric acid (37%), hydrogen peroxide (28%), lactic acid (85%), mineral spirits, nitric acid (40%), oleic acid, oxalic acid (10%), phosphoric acid (85%), potassium hydroxide (50%), sulfuric acid (75%), tannic acid (20%), tartaric acid (10%), urine.
(6) System Thickness: 1/8 inch (6.4 mm).
(7) Wearing surface: Anti-slip.
(8) Components:
(a) Primer.
(b) Chemical-resistant sealing or finish coats.

d. Reference: Architecural Drawings
e. Location: As indicated

J. Item: Resinous Wall System
1. Provide the following Tnemec system or approved equal meeting the design criteria listed below.
a. Provide resinous wall system 2'-0" by 2'-0" mock-up for approval before applying coating system.
b. Coating System:
(1) Coating system to be smooth with a glossy appearance.
(2) Fully protect, mask and seal off everything in the room that will not receive the coating system.
(3) Surface preparation: Prepare concrete surfaces in accordance with NACE No. 6/SSPC-SP13 Joint Surface Preparation Standards and ICRI Technical Guidelines. Abrasive blast, shot-blast, water jet or mechanically abrade concrete surfaces to remove laitance, curing compounds, hardeners, sealers and other contaminants to provide a minimum ICRI-CSP 2-3 surface profile.

Large cracks, voids and other surface imperfections should be filled with a recommended filler or surfacer.

(4) Surfacer: Tnemec Series215 and Series 211 as required. Fill all holes and grout lines smooth.

(5) Glass Mat: Tnemec Series273 mat

(6) Saturate: Tnemec Series 273

(7) Grout Coat: Tnemec Series 280

(8) Finish Coat: Tnemec Series 297

(9) Color as selected by the architect from manufacturer's full range of colors.

c. Reference: Architecural Drawings

d. Location: As indicated

K. Item: Exterior Concrete Secondary Chemical Containment, all interior concrete surfaces at Containment Structures including walls, curbing, floor, tank pads, sumps, and top of wall.

1. Provide the following Tnemec system or engineer approved equal meeting the design criteria listed below:

a. Coating System:

(1) Fully protect, mask and seal off everything that will not receive the coating system.

(2) Surface Preparation: Allow new cast-in-place concrete to cure a minimum of 28 days at 75°F (24°C). Verify concrete dryness and prepare concrete surfaces in accordance with NACE No. 6/SSPC-SP13 Joint Surface Preparation Standards and ICRI Technical Guidelines. Moisture vapor transmission should not exceed three lbs. per 1,000 sq. ft. in a 24-hour period. Relative humidity should not exceed 80%. Abrasive blast, shot-blast or mechanically abrade concrete surfaces to remove laitance, curing compounds, hardeners, sealers and other contaminants and to provide a minimum ICRI-CSP 5 or greater surface profile. Large cracks, voids and other surface imperfections should be filled with a recommended filler or surfacer.

(3) Primer: Series 251SC @ 6.0-8.0 mils D.F.T.

(4) Base Coat: Series 252SC Chembloc MCK System w/fiberglass mat reinforcement per manufacturer's direction @ 60.0 - 80.0 mils.

(5) Saturant Coat: Series 252SC Chembloc @ 6.0-8.0 mils.

(6) Top Coat: Series 252SC Chembloc @ 6.0-8.0 mils. System Total D.F.T. of 78.0-104.0 mils minimum.

(7) Outdoor Chemical Containment Basins Top Coat: Series 290 CRU Aliphatic Urethane @ 2.0-3.0 mils D.F.T.

(a) Reference: Process and Structural Drawings.

(b) Location: Hydrogen Peroxide containment structure exposed concrete, including walls, curbing, floor, tank pads, sumps, and top of curb wall.

(c) Top Coat Color: 31GR Slate Gray

2.05 SURFACES NOT TO BE COATED:

A. Do not field coat any of the following items unless specifically noted otherwise.

1. Copper, stainless steel, aluminum, FRP fabrications, Conduit, PVC piping.

2.06 COLOR CODING OF PIPING AND PHYSICAL HAZARDS:

A. Color Coding of Piping: Exterior and interior by color coding entire pipe.

1. General:
   a. Coat piping with solid colors as specified below for entire length of pipe in exposed finished and unfinished areas. Exclude areas in pipe chases and furred areas.
   b. Piping colors to be selected by Engineer/Architect.
   c. Coat all other piping in colors matching adjacent surfaces. If adjacent area is unfinished, paint in color determined by Engineer/Architect.
   d. After completion of finish coating, identify piping with band, legend and, arrows as specified below. Apply after completion of finish coating.
   e. For most pipe labeling, refer to section 22 05 53. Where not applicable, refer to pipe stenciling parameters below.
2. Color Scheme:

Description	Color	Notes
Potable	Dark Blue	Ref Plumbing/Process Drawings.
Process Non-Potable Water	Purple	Ref Process Drawings. Identification required: "CAUTION: NONPOTABLE WATER – DO NOT DRINK"
Drain	Dark Gray	Ref Process Drawings.
Influent	Gray	Ref Process Drawings
Blower Piping	Light Green	Ref Process Drawings
RAS	Tan	Ref Process Drawings.
WAS	Brown	Ref Process Drawings.
Clarified Effluent	Light Gray	Ref Process Drawings.
Filter Effluent	Light Gray	Ref Process Drawings.
Gas	Yellow	Ref Mechanical Drawings.
Plumbing Non-Potable Water	Purple	Ref Plumbing Drawings. Identification required: "CAUTION: NONPOTABLE WATER – DO NOT DRINK"

3. Location of Legends and Arrows:
   a. Place on piping near connections to Equipment, adjacent to valves or fittings, on both sides of walls penetrated, and at intervals not to exceed 50 feet (15 meters).
   b. Place arrows adjacent to or below legends depending upon visibility. Place arrows in direction of flow. For dual-flow piping, indicate both directions.
   c. Locate legends to be visible from normal line of vision above floor level. Legend locations subject to approval of Engineer/Architect.
4. Letter Size:
   a. Block-style letters, all capitals, conforming to ANSI A13.1.

Outside Diameter of Pipe or Covering	Width of Banding	Size of Letters and Arrows
Less than 3/4" (19 mm)	6" (150 mm)	Approved metal tag or band
3/4" to 1-1/4" (19 mm to 32 mm)	8" (200 mm)	1/2" (13 mm)
1-1/2" to 2" (38 mm to 50 mm)	10" (250 mm)	3/4" (19 mm)
2-1/2" to 6" (64 mm to 150 mm)	12" (300 mm)	1-1/4" (32 mm)

8" to 10" (200 mm to 250 mm)	24" (600 mm)	2-1/2" (64 mm)
Over 10" (250 mm)	32" (800 mm)	3-1/2" (89 mm)

B. Color Coding Physical Hazards: Exterior and interior.
   1. General:
      a. Paint areas indicated to identify physical hazard areas as required by ANSI Z53.1.
      b. All colors shall conform to Federal Safety Color Code requirements.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION:

A. Prepare surfaces for each coating system conforming to SSPC or ASTM surface preparation specifications listed.
   1. If grease or oils are present, SSPC-SP1 shall precede any other method specified for metal substrates.
   2. Remove surface irregularities such as weld spatter, burrs, or sharp edges prior to specified surface preparation.

B. Depth of profile will be as specified or as recommended by the manufacturer for each system, but in no instance shall it exceed one-third of the total dry film thickness of complete system.

C. Prepare only those areas which will receive the first coat of the system on the same day.
   1. On steel substrates, apply coating before rust bloom forms.

3.02 APPLICATION:

A. Apply coatings in accordance with coating manufacturer's recommendations.

B. Use properly designed brushes, rollers, and spray equipment for all applications.

C. On unprimed surfaces apply first coat of the system the same day as surface preparation.

D. Dry film thickness of each system shall meet the minimum specified. Maximum dry film thickness shall not exceed the minimum more than 20% or coating manufacturer's requirements if less. Where a dry film thickness range is specified, the range shall not be less than or exceeded.

E. Shop and field painting shall remain 3 inches (75mm) away from unprepared surface of any substrate such as areas to be welded or bolted.

F. Environmental Conditions:
   1. Atmospheric temperature must be 50°F (10°C) or higher during application, unless otherwise approved by coating manufacturer. Do not apply coatings when inclement weather or freezing temperature may occur within coating recoat cure times.
   2. Wind velocities for exterior applications shall be at a minimum to prevent overspray or fallout and not greater than coating manufacturer's limits.
   3. Relative humidity must be less than 85%. The ambient temperature and the temperature of the surface to be painted must be at least 5°F (2.8°C) above the dew point.
   4. Provide adequate ventilation in all areas of application to ensure that at no time does the content of air exceed the Threshold Limit Value given on the manufacturer's Material Safety Data Sheets for the specific coatings being applied.

G. Recoat Time: In the event a coating, such as an epoxy, has exceeded its recoat time limit, prepare the applied coating in accordance with manufacturer's recommendations.

H. Protection:
   1. Cover or otherwise protect surfaces not to be painted. Remove protective materials when appropriate.
   2. Mask, remove, or otherwise protect finish hardware, machined surfaces, grilles, lighting fixtures, and prefinished units as necessary.

3. Provide cover or shields to prevent surface preparation media and coatings from entering orifices in electrical or mechanical Equipment. Where ventilation systems must be kept in operation at time of surface preparation, take precautions to shield intakes and exhausts to prevent the materials from entering system or being dispersed.
4. Provide signs to indicate fresh paint areas.
5. Provide daily cleanup of both storage and working areas and removal of all paint refuse, trash, rags, and thinners. Dispose of leftover containers, thinners, rags, brushes, and rollers which cannot be reused in accordance with applicable regulations.
6. Do not remove or paint over Equipment data plates, code stamps on piping, or UL fire-rating labels.

3.03 INSPECTION:

A. Contractor shall provide and use a wet film gauges to check each application approximately every 15 minutes in order to immediately correct film thickness under or over that specified.
B. Contractor shall provide and use a dry film gauge to check each coat mil (mm) thickness when dry, and the total system mil (mm) thickness when completed.
C. Use holiday or pinhole detector on systems over metal substrates to detect and correct voids when indicated on system sheet.
D. Check air temperature and temperature of the substrate at regular intervals to be certain surface is 5ºF (2.8ºC) or more above the dew point.

3.04 CLEANING AND REPAIRS:

A. Remove spilled, dripped, or splattered paint from surfaces.
B. Touch up and restore damaged finishes to original condition. This includes surface preparation and application of coatings specified.
C. Provide remainder of open paint cans to owner for touch ups.

END OF SECTION 09 90 00

COATING REPORT

Contract Name: _____ Contract No.: _____
Coating Contractor: _____ Foreman: _____

Unit or Surface Identification: _____
Unit or Surface Location: Exterior: _____, Interior: _____

Surface Preparation:
Date _____; Air Temp _____°F; Relative Humidity _____%
Method of Surface Preparation: _____
Profile achieved _____ mils (if applicable).

Touch-Up:
Date _____; Time _____; Air Temp _____°F; Surface Temp _____°F
Relative Humidity _____%; Dew Point _____°F
Coating Used _____; Dry Film Obtained _____mils.

First Coat:
Date _____; Time _____; Air Temp _____°F; Surface Temp _____°F
Relative Humidity _____%; Dew Point _____°F
Coating Used _____; Dry Time Before Recoat _____ hrs.
Dry Film Obtained _____ mils.

Second Coat:
Date _____; Time _____; Air Temp _____°F; Surface Temp _____°F
Relative Humidity _____%; Dew Point _____°F
Coating Used _____; Dry Time Before Recoat _____ hrs.
Dry Film Obtained _____ mils.

Third Coat:
Date _____; Time _____; Air Temp _____°F; Surface Temp _____°F
Relative Humidity _____%; Dew Point _____°F
Coating Used _____; Dry Film Obtained _____mils.

BURNS McDONNELL	PROTECTIVE COATING SYSTEM **System: A-5**

SERVICE:	Steel - Moderate to Severe Exposure (Nonimmersion)
Surface Preparation:	Shop: SSPC-SP6 and profile depth 1.5 to 2.5 mils (38 to 63 microns). Field: SSPC-SP2/3. Clean and dry.
First Coat:	High solids polyamine or polyamide epoxy with minimum 67% solids by volume. Apply at 5.0 to 7.0 mils (125 to 175 microns) dry film thickness.
Second Coat:	High solids aliphatic acrylic polyurethane gloss enamel with minimum 52% solids by volume. Apply at 3.0 to 5.0 mils (75 to 125 microns) film thickness.
System Total:	Minimum 8.0 mils (200 microns) dry film thickness.
Volatile Organic Content:	Maximum 2.8 lb/gal (340 g/L)

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COATING MANUFACTURER	PRODUCT DESIGNATION		
	FIRST COAT	**TOUCH UP**	**SECOND COAT**
PPG	Amerlock 2 or 400	Same as first coat	Amercoat 450 H
Carboline	Carboguard 890	Same as first coat	Carbothane 134 HG
Tnemec	Hi-Build Epoxoline II, Series N69	Same as first coat	Endura-Shield 1094
Sherwin-Williams	Macropoxy 646 B58-600/B58V600	Same as first coat	HS Polyurethane B65-300 Series

BURNS McDONNELL	PROTECTIVE COATING SYSTEM System: **B-4**

SERVICE:	Nonferrous & Galvanized Metal — Moderate to Severe Exposure Exterior or Interior (Including Galvanized Handrail)
Surface Preparation:	Shop or field first coat: Remove oil or soap film with neutral detergent or emulsion cleaner.
First Coat:	Pretreat and/or allow to weather as recommended by coating manufacturer.
Second Coat:	High build polyamide or polyamidoamine epoxy with minimum 65% solids by volume. Apply at 4.0 - 6.0 mils (100 -150 microns) dry film thickness.
Third Coat:	High solids aliphatic acrylic polyurethane gloss enamel with minimum 60% solids by volume. Apply at 2.0 – 3.0 mils (50 – 75 microns) dry film thickness.
System Total:	Minimum 6.0 mils (150 microns) dry film thickness in addition to galvanizing.
Volatile Organic Content:	Maximum 2.8 lb/gal (340 g/L).

COATING MANUFACTURER	PRODUCT DESIGNATION			
	FIRST COAT	**TOUCH UP**	**SECOND COAT**	**THIRD COAT**
PPG	See above		Amercoat 385	Amercoat 450 H
Carboline	See above		Carboguard 893 SG	Carbothane 134 HG
Sherwin-Williams	See above		Macropoxy 646 B58-600 Series	HS Polyurethane B65-300 Series
Tnemec	See above		F.C. Typoxy Series 27	Endura-Shield 1094

BURNS McDONNELL	PROTECTIVE COATING SYSTEM **System: E-1**

SERVICE: Steel & Iron – Nonpotable Liquid Immersion, Normal to Severe Exposure. Interior of Tank or Basin. Exterior of Steel, Piping, or Equipment in Tank or Basin.

Surface Preparation: Shop or Field First Coat: SSPC-SP10 and profile depth of 1.5 to 2.5 mils (38 to 63 microns).
Field Touch-Up (of Shop-applied first coat): Same as for First Coat.

First Coat: High solids amine, polyamidoamine, or polyamide epoxy coating with minimum 67% solids by volume. Apply at 5.0 to 7.0 mils (125 to 175 microns) dry film thickness.

Second Coat: Same as first coat.

System Total: Minimum 10.0 mils (250 microns) dry film thickness. Check for voids with holiday or pinhole detector.

Volatile Organic Content: Maximum 2.8 lb/gal (340 g/L).

COATING MANUFACTURER	PRODUCT DESIGNATION		
	FIRST COAT	**TOUCH UP**	**SECOND COAT**
PPG	Amerlock 2 or 400	Same as first coat	Same as first coat
Carboline	Carboguard 890	Same as first coat	Same as first coat
Sherwin-Williams	Macropoxy 646 FC B58W610/B58V600	Same as first coat	Same as first coat
Tnemec	Hi-Build Epoxoline II Series N69	Same as first coat	Same as first coat

BURNS McDONNELL	PROTECTIVE COATING SYSTEM **System: F-3**

SERVICE:	Concrete, Concrete Masonry Units (CMU) –Severe Exposure (Nonimmersion) Interior
Surface Preparation:	Concrete: ASTM D4258. Fill pits in concrete with patching compound as recommended by coating manufacturer. CMU: ASTM D4261, clean and dry.
First Coat:	Concrete: High solids epoxy with minimum 67% solids by volume. Apply at 5.0 to 8.0 mils (0.127 to 0.203 mm) dry film thickness. CMU: High solids epoxy block filler with minimum 60% solids by volume. Apply at 10.0 to 20.0 mils (0.254 to 0.508 mm) dry film thickness and as required to fill pores.
Second Coat:	Concrete & CMU: High solids epoxy with minimum 67% solids by volume. Apply at 5.0 to 8.0 mils (0.127 to 0.203 mm) dry film thickness. Semi gloss or gloss finish.
System Total:	Concrete: Minimum 10.0 mils (0.254 mm) dry film thickness. CMU: Minimum 15.0 mils (0.381mm) dry film thickness.
Volatile Organic Content:	Maximum 3.5 lb./gal (425 g/L).

COATING MANUFACTURER	PRODUCT DESIGNATION	
	FIRST COAT	**SECOND COAT**
Concrete		
Carboline	Carboguard 890	Carboguard 890
Sherwin-Williams	Macropoxy HS B58W400 Series	Macropoxy HS B58W 400 Series
Tnemec	Hi-Build Epoxoline II Series N69	Hi-Build Epoxoline II Series N69
CMU		
Carboline	Sanitile 600	Carboguard 890
Sherwin-Williams	Kem CatiCoat HS B42W400	Macropoxy HS B58W 400 Series
Tnemec	Epoxy Block Filler WB 1254	Hi-Build Epoxoline II Series N69

BURNS McDONNELL

PROTECTIVE COATING SYSTEM

System: J-2

SERVICE: Gypsum Board & Plaster – Normal Exposure Interior Walls

Surface Preparation: Clean and dry.

First Coat: Acrylic Sealer. Apply at 1.5 to 2.0 mils (0.038 to 0.051 mm) dry film thickness.

Second Coat: Water reducible acrylic coating with minimum 34% solids by volume, semi-gloss finish. Apply at 1.5 mils (0.038 mm) dry film thickness.

Third Coat: Same as second coat.

System Total: Minimum 4.5 mils (0.114 mm) dry film thickness.

Volatile Organic Content: Maximum 2.8 lb./gal (340 g/L).

COATING MANUFACTURER	PRODUCT DESIGNATION			
	FIRST COAT	**TOUCH UP**	**SECOND COAT**	**THIRD COAT**
Ameron	Amercoat 220		Amercoat 220	Same as second coat
Carboline	Carbocrylic 120		Carbocrylic 3359	Same as second coat
Sherwin-Williams	PrepRite 200 B28W200		ProMar 200 Latex B20W200 Series	Same as second coat
Tnemec	PVA Sealer 51-792		Enduratone Series 1029	Same as second coat

SECTION 32 31 13 – CHAIN LINK FENCE AND GATES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install the chain link fence and gates as shown on the Drawings and as specified herein.
B. Installation of Temporary Security Fence

1.02 SUBMITTALS

A. Submit as specified in DIVISION 1.
B. Includes, but not limited to, the following:
    1. Plan layout.
    2. Details illustrating fence height, sizes of posts, rails, braces, gates, and hardware list.
    3. Erection procedures.

1.03 REFERENCE STANDARDS

Applicable Standards:

A. Federal Specifications (FS):
    1. FF-B-575 - Bolts, Hexagon, and Square.
    2. RR-F-191J/GEN - Fencing, Wire and Post, Metal (and Gates, Chain-Link Fence Fabric, and Accessories) (General Specification).
    3. RR-F-191/2 - Fencing Wire and Post, Metal (Chain-Link Fence Gates) (Detail Specification).
    4. RR-F-191/3 - Fencing Wire and Post, Metal (Chain-Link Fence Posts and Braces) (Detail Specification).
B. ASTM International (ASTM): Equivalent AASHTO standards may be substituted as approved.
    1. ASTM DI 784 – The Extruded product meet or exceed the standard.
    2. ASTM-F668 - Standard Specification for Polyvinyl Chloride (PVC),
    3. ASTM F2919, Specification for Welded Wire Mesh Fence Fabric (Metallic-Coated or Polymer Coated)

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Fences:
    1. Anchor Fence Division, Anchor Post Products Inc.
    2. U.S. Steel Supply Division, U.S. Steel Corp.
    3. Allied Tube & Conduit Corporation.
    4. Broski Fence
    5. Engineer approved equal.

2.02 GENERAL

A. Manufacturer's standard materials where such materials conform to these Specifications.
B. Conform to FS RR-F-191J/GEN except as indicated or specified otherwise.
C. Total Fence Height: 9-feet
    1. Fence Fabric Height: 8-feet.
    2. Height of Barbed Wire: 1-foot.
D. Finish for framework and appurtenances: Galvanized with minimum weight for zinc per square foot as follows:

1. Pipe: Conform to FS RR-F-191/3.
2. Square Tubing: 2.0 ounces.
3. H-Sections: 2.0 ounces.
4. C-Sections: 2.0 ounces.
5. Hardware and accessories: PVC Coated following ASTM DI784 or ASTM F668 specification

2.03 POSTS AND BRACES

Minimum size and weight as follows:

A. Posts:
   1. End, Corner or Pull Posts, Line Posts, and Gate Posts: Conform to FS RR-F-191/3 (Table I).
B. Post Bracing:
   1. Diagonal galvanized truss rods 3/8-inch in diameter equipped with truss tightener.
   2. Horizontal Braces: Size SP1 conforming to FS RR-F-191/3.
C. Stretcher Bars:
   1. One piece. Length to be 1 inch less than fabric height.
   2. 3/16-inch x 3/4-inch, galvanized.
D. Post Tops:
   1. Designed as a weathertight closure cap for tubular posts.
   2. Malleable iron or pressed steel, both galvanized.
   3. Attached to steel posts or intergrate with post top.
   4. Malleable iron or pressed steel, both galvanized.
E. Bolts:
   1. Zinc coated.
   2. Conform to FS FF-B-575.

2.04 FABRIC

A. No. 8-gage (9-gage core), 1-inch diamond mesh chain-link fabric with PVC coating. Minimum breaking strength of the wire shall be 1,200 pounds.
B. Both selvages twisted for fabric 6'-0" and over.
C. Top and bottom selvage knuckled for fabric 5'-0" and under.
D. Fabric fastenings of 9-gage galvanized wire ties.
E. Color: ASTM F934-Black

2.05 SLIDING CANTILEVERED GATE

A. Framing:
   1. Inverted channel track, roller ball-bearing truck assemblies, guides, stays, bracing, hardware, and accessories as required.
   2. Intermediate horizontal and vertical members for proper gate operation and for attachment of fabric, hardware, and accessories. Space so that frame members are not more than 8 ft. apart unless otherwise indicated.
   3. Frames assembled by welding or watertight galvanized steel rigid fittings.
   4. Diagonal cross bracing of 3/8 inch diameter adjustable truss rods to provide frame rigidity.
B. Slide Gate Motor Operator and Accessories:
   1. Motor Operator:
      a) Provide a heavy duty electric-motor operator for operating the sliding cantilevered gate. Operator shall be sized to operate gate specified and indicated.

b) Suitable for outdoor use with all parts suitably protected against corrosion and with lockable weather-resistant cover.
c) Operator shall be designed for either left or right hand mounting and shall be designed for pad mounting.
d) System designed to operate on a 240V, single-phase power supply.
e) Unit shall consist of instantly reversing motor with overload protection, magnetic brake, safety clutch, and automatic limit switch. Provide with releasing switch in case of power failure.
f) Provide with mounting channels. Operator enclosure shall be mounted on a concrete pad, size as required.
g) Flexible hinged connections to conduit, if required.

2. Safety Devices:
a) Provide gate edges with contact sensors to reverse the gate upon contact with an object.
b) Provide one loop detector: Used to sense exiting vehicle traffic and provide a request to exit to the gate access control system. Provide all cabling and components for complete installation.
c) Non-contact sensors, or contact sensors, or a combination thereof, shall be utilized to prevent persons from becoming entrapped in the gate system.
d) Provide units with adjustable entry and exit timers.
e) Provide for emergency vehicle entrance through gate via audible siren detector

2.06 BARBED WIRE:
A. 12-1/2 Gauge 4 point Class 3
B. Number of Strands: 3
C. Barbed Wire Height: 12-inches (Quantity 3 strands above fence fabric)
1. Angled at 30 degree to 45 degree angle above horizon away from the facility.
2. Vertical on sliding cantilevered gate.

PART 3 – EXECUTION

3.01 PREPARATION:
A. Perform final grading prior to installation of fence.
B. Follow general contour of ground and properly align fence. Install as indicated.

3.02 INSTALLATION – POSTS AND BRACES
A. Posts:
1. Set in concrete bases as indicated. Trowel finish tops of footings and dome to direct water away from posts.
2. Install plumb and in straight alignment.
3. Space 10 feet center-to-center maximum.
4. Install pull posts:
a. Every 300 feet.
b. At all abrupt changes in grade.
c. At all changes in direction of 15 degrees or more.
d. Temporarily brace until concrete in bases has set.

B. Post Bracing:
1. Install at each end, pull and gate post, and each side of each corner post.
2. Install after concrete in post bases has set.
3. Install so posts are plumb when diagonal rod is under tension.

C. Stretcher Bars:
    1. Thread through or clamp to fabric 4 inches oc.
    2. Secure to posts with metal bands spaced 14 inches oc maximum.
    3. Install at each gate, pull and end post, and each side of corner post.
D. Post Tops: Install on each gate post.

3.03 INSTALLATION - FABRIC:

A. Fabric:
    1. Stretch taut with equal tension on each side of line posts.
    2. Fasten to steel posts with wire ties.
    3. Space wire ties at 14 inches oc maximum on posts.
    4. Rolls of fabric shall be joined together by weaving a single strand into the end of the roll to form a continuous piece.

3.04 REPAIRING DAMAGED COATINGS

A. Repair any damaged coatings in the shop or field by recoating with compatible and similar coating.
B. Apply per manufacturer's recommendations.

3.05 MOTOR OPERATED GATES:

A. Install all hardware, tracks, framing, supports, electrical devices, wiring, loop controller, and appurtenances required for a complete system and satisfactory operation.
B. Install to conform to manufacturer’s instructions and as indicated.
C. Test and adjust system for smooth proper operation.

END OF SECTION 32 31 13

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

ADDENDUM NUMBER 007

Project/Contract Number: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrade

ISSUE DATE: **February 23, 2026**

Bidders are hereby notified that the Bidding and Contract Documents for the above project, for which Bids are to be received on **February 24, 2026**, are amended as follows:

Information to Bidders The following is provided to Bidders for information only:

Contracting Changes:

1. Davis Bacon Wage Modification for construction types: Heavy and Highway has been updated from General Decision Number: MO20250001 Modification 11 Published 11/21/2025 to General Decision Number: MO20260001 Modification 1 Published on 01/09/2026. See specification 00830.1 FEDERAL PREVAILING WAGE - HEAVY for updated document.
2. Davis Bacon Wage Modification for construction types: Building has been updated from General Decision Number: MO20250079 Modification 11 Published 11/21/2025 to General Decision Number: MO20260079 Modification 1 Published on 01/30/2026. See specification 00830.2 FEDERAL PREVAILING WAGE - BUILDING for updated document.

Specification Changes:

1. Section 33 12 16 – Utility Valves and Accessories
    a. Table 3: Plug Valves Provided by Contractor
        i. Tag SCIN-VLV-111 – Full Port changed from No to Yes
        ii. Tag SCIN-VLV-211 – Full Port changed from No to Yes
        iii. Tag SCIN-VLV-112 – Full Port changed from No to Yes
        iv. Tag SCIN-VLV-212 – Full Port changed from No to Yes
        v. Tag SCIN-VLV-113 – Full Port changed from No to Yes
        vi. Tag SCIN-VLV-213 – Full Port changed from No to Yes
        vii.

Drawings Changes:

1. G005 – Added architectural mockup sheet
2. G006 – Added structural mockup foundation sheet
3. A210 – Updated room number and door number callouts
4. A280 – Updated door schedule
5. A380 – Updated door schedule
6. A481 – Updated door schedule
7. A780 – Updated door schedule
8. C102 – Updated scale

9. C123 – Updated scale
10. C127 – Updated scale
11. C138 – Updated scale
12. D108 – Updated sewer callouts
13. D116 – Original IFB drawing did not upload
14. D119 – Updated potable water material on profile
15. D128 – Updated Plant Sewer -2 Profile
16. D701 – Removed section callout
17. D702 – Removed section callout
18. D705 – Removed section callout; added (2) PS-3 to large bubble diffuser grid; modified general note 1
19. D709 – Added keyed note 5
20. D710 – Removed WAS line from iso view
21. D711 – added callouts to WAS line in iso view

Q1.	Door 200B in Influent Pump Station - Listed as door type "G" but no "G" type is specified... was this supposed to be type "C"? Please advise.
A1.	**Confusion is due to identical room and door numbers between the IPS electrical and coarse screening. The IPS electrical room number is revised to 210 on sheet A210. This in turn changes the doors to 210A and 210B on the plan and door schedule. 210B is changed to Type C. Sheets A210, A280, and A380 are revised.**
Q2.	Door 400A in Blower Building - Listed as door type "E" but no type "E" is specified. Please advise.
A2.	**Sheet A481 - Door 400A is revised to be C.**
Q3.	Door hardware set "B" or "C" are not in the specifications. Please advise.
A3.	**Sheet 780 - Changed B's to 2's and C's to 3's.**
Q4.	Door hardware specs call for Best IC Core in all locks, but hardware sets specifically call for standard cylinder type locks. Please advise.
A4.	**The specification calls for standard cylinders as opposed to high security. Standard cylinders still can be interchangeable or non-interchangeable. All cylinders need to be interchangeable matching the owner's BEST system used in their other facilities as specified.**
Q5.	Sheet D712 is not listed in the List of Drawings but is referenced on sheets D701, D702, and D705. Please advise if the detail should be referenced to another sheet or if the thickened sludge profile section will be added.
A5.	**Sheet D712 is not part of the drawing set. Revised sheets D701, D702, and D705 to remove section callout.**
Q6.	On the potable Water profiles, sheet 313 states 2" DIP which no one is manufacturing that size of DIP.
A6.	**Specification section 33 11 00-2.06 calls for copper piping for lines 2" and less. Use copper. Potable Water Profile 9 on drawing D119 (sheet 313 of 643) is revised.**
Q7.	Sheet no. 310 is missing from the plan package

A7.	**Sheet 310 is drawing D116. Drawing did not upload during initial advertisement on KC Planroom. Drawing is included in this addendum.**
Q8.	Scale on C102 and other Civils sheets showing the entire site seems to be wrong when checking against the Structural Sheets. For example on Sheet C102 the Influent Valve Vault scales at 26' X 14' however on the structural sheets it is called out to be 52' X 28'. Can you please verify?
A8.	**Sheets C102, C123, C127, and C138 are revised to show correct scale.**
Q9.	Can you confirm the blower piping material? The specifications call for carbon steel but some of the drawings call out both 304SS and carbon steel. Reference Sheet D413.
A9.	**Above grade air piping shall be carbon steel. Sheet D413, D414, D415, & D416 have been revised accordingly in addendum 6.**
Q10.	Given the potential impact of tariffs on materials and supplies, could you please share how the City plans to address these challenges? As equipment manufacturers and contractors do not have control over tariff-related cost fluctuations, there is a possibility that certain goods required for this project may be affected.
A10.	**Fixed-price public works contracts inherently allocate market risk to contractors.**
Q11.	Specification 46-21 16 – Screening Equipment, Section 2.04-B.4.g.1 specifies stainless steel chain rollers. Our standard material for chain rollers is polyamide. Can polyamide be approved as an acceptable alternative?
A11.	**Yes, polyamide is an acceptable alternative.**
Q12.	Specification 46-21 16 – Screening Equipment, Section 2.04-B.5.b requires stainless steel side plates for the chains. Please clarify whether this refers to the sealing elements between the filter elements and screen frame, or to the chain guides. If it refers to the sealing elements, would our standard reinforced fiberglass material be acceptable?
A12.	**Vendor standard sealing element material is acceptable. Chain guides are called out separately in Section 2.04-B.5.e.**
Q13.	Specification 46-21 16 – Screening Equipment, Section 2.05.1 specifies a VFD for the wash press. Our standard configuration uses an IEC reversing starter with overload protection. Would this be acceptable in lieu of a VFD?
A13.	**A reversing starter would be acceptable in lieu of a VFD, however this will require NEMA starter, not IEC.**
Q14.	Specification 46-21 16 – Screening Equipment, Section 2.07-B.4 requires a deflector drive. Our design incorporates both spray wash and a rotating brush, which eliminates the need for a deflector drive. Can this requirement be made optional?
A14.	**Yes, this is an acceptable arrangement.**
Q15.	Section 40 67 00: 2.08.D.6 requires an output filter for motor leads longer than 100 feet. The locations of GRSC-MCP-100 and GRSC-MCP-200 indicate that the motor leads are well under 100 feet. Can the output filters therefore be omitted from the controls scope?

A15.	**Yes, the VFD output filters may be omitted.**
Q16.	Section 46 21 16 does not reference Division 26 or Section 40 66 00. Do the spares and any other requirements listed in Division 26 and Section 40 66 00 need to be included within the scope of work under Section 46 21 16?
A16.	**Section 40 66 00 should be referenced for the requirements of network equipment as applicable (as required in 40 67 00, which is referenced in 46 21 16). However, the spares listed in 40 66 00 are not required for the screen system. Spares listed in division 26 are not required.**
Q17.	Section 46 21 16: 2.07.G.8 states that the control panel will include provisions to accept a 120VAC supply from the site's centralized UPS for powering the PLC, network switch, OIT, and related control system loads. Please confirm that the UPS is not provided by the screen manufacturer.
A17.	**Correct. The centralized UPS will not be provided with the screen system.**
Q18.	In specification 01480 it states the owner is furnishing water for the leakage testing from two different locations - "Disinfected Effluent" and "Secondary Effluent". Can you please clarify where these points are? Is the contractor responsible for transfer the water from these discharge points to the CIP basins as needed?
A18.	**Disinfected effluent and secondary effluent are at the existing Todd Creek WWTP site and would have to be trucked or pumped to the new site. Potable water or water for testing will not be available on site at the start of construction. The timeline for construction of the potable waterline is unknown at this time. Bidders shall include in their proposals the procurement and transportation of water from an off-site source for all construction purposes, including but not limited to pipe testing, dust control and other site water needs.**
Q19.	It appears that the Administration Building is the only structure in the drawings with a finish schedule, and it indicates that the interior precast walls will get painted. For the remaining process buildings on the site, there are no finish schedules in the drawings. Would you be able to clarify if the interior precast walls will get painted at those buildings? Also, will the interior floors at the process buildings get sealed concrete?
A19.	**The Administration Building is the only building or structure that receives painting on the interior precast walls. The Administration Building is the only building or structure that receives floor coating/sealing.**
Q20.	What material is the trench drain grating that is shown at the Influent Pump Station on sheet S207? Aluminum, galvanized, or other? Please advise.
A20.	**Per the schedule, the rating for the grates is specified, not the materials. For extra heavy-duty grates in this environment, we would want corrosive resistant material. So either galvanized steel or stainless steel would work best, as long as it meets the extra heavy-duty rating.**
Q21.	See sheet S205, keynote #2. What is the load capacity that will be required for the davit bases by OZ?
A21.	**Davit base shall be OZ Lifting Products part number OZSOC2. Load capacity not provided.**

Q22.	See sheet S205, keynote #6. What is the load capacity that will be required for the Thern model #4HS11M winch? How will it be actuated? What is the maximum distance of travel? What wire rope diameter is needed? Will it be used for vertical and horizontal line pulling? If necessary, please provide a specification to reference.
A22.	**The winch will be used to pull the dumpster into the IPS Screen Bldg. No specific load capacity given. Electric motor driven. Approximately 20' travel distance. ¾" rope.**
Q23.	Please confirm that the structural steel framing and monorail beam at the IPS on sheet S206 will be galvanized steel.
A23.	**Steel framing and monorail are galvanized.**
Q24.	Can more information be provided for the conduit support referenced on sheet S209 detail B? Please provide material and member sizing.
A24.	**Note calling out conduit support refers to detail on S206. See drawing S206.**
Q25.	It is our recommendation to avoid adverse generator interactions because of the low impedance source as well as with redundant/online spare capacity of active front end drives can lead to excessive capacitance inherent in active front end drives, leading to leading power factor that can cause failures throughout the system, including in the front end of the active front end drives. Is the 18 Pulse Drives acceptable for the 60HP and larger drives on this project?
A25.	**Refer to VFD spec section 26 29 23.2.02.B.2.a. – 18 pulse VFD's are an acceptable topology.**
Q26.	Please clarify to the prospective Bidders if it is permissible to perform installation and surveying of settlement monitoring plates by the Contractor's personnel in-lieu of a Licensed Professional Surveyor (PLS).
A26.	**Contractor may perform installation of monitoring plates and markers, but surveying shall be performed by a PLS in the State of the Project.**
Q27.	In the Supplementary Conditions section SC-14.04 A.g. demolitions work for the bridge, sludge holding cells, and existing WWTP is required to be completed in order to meet substantial completion? Since this work cannot occur until after the startup and commissioning of the new WWTP, can it be held outside of Substantial Completion? Also, since this scope of work will occur over 2.5 years after NTP will the owner carry an allowance for escalations on this work?
A27.	**Demolition work can be removed from Substantial Completion. Contractor to price escalation accordingly since demolition phasing is known. Contractor is best able to manage this risk rather than the City.**
Q28.	Plan sheet D103, has a note at 'POT 1' that states, "Future potable water connection (by others)." Please clarify to the prospective Bidders if they are to assume in their bid proposals the aforementioned permanent water line will be available for connection, to use for pipe testing and other site water needs, or should the Bidders include hauling water from offsite until a specified date when this connection will be provided by Others, outside of this contract?
A28.	**Potable water will not be available on site at the start of construction. The timeline for construction of the potable waterline is unknown at this time. Bidders shall include in their proposals the procurement and transportation of**

	water from an off-site source for all construction purposes, including but not limited to pipe testing, dust control and other site water needs.
Q29.	What are the additional permits and regulations required for the creek crossing to connect to the existing Hoover Heights Forcemain? Also do you have any satellite imagery that show this location for us to establish how much clearing would be required? According to the Stationing it looks like there would be 2 creek crossings not just one. Please Clarify.
A29.	**Impacts are anticipated to be under one-tenth of an acre. Construction can be performed under Nationwide Permit. City will document existing conditions and coordinate with USACE. Correct, there are 2 creek crossings. One crossing is shown on D150 between STA 0+34.80 and STA 1+11.49. Another crossing is shown on D161 between STA 12+02.88 and STA 14+79.14.**
Q30.	Is the existing access from Interurban Rd to where construction access connects on sheet C103 considered a gravel drive? Per note 10 on Sheet Y001 should we assume in our bid 8" of gravel restoration work of this approximate 2000 feet of road will required?
A30.	**Yes, this is a gravel drive. Yes, gravel restoration will likely be needed throughout and at project completion.**
Q31.	Per note 1.02 B-5a. in specification 01110 Summary of Work, Contractor to provide seed sludge for AGS basins, shall we assume enough sludge for seeding the basin is available at the existing plant and include this distance for hauling in our bid? Additionally are there any special requirements for sludge haulers to retain operators license, or special permits required to transport active sludge to the new plant?
A31.	**Yes, seeding from the existing Todd Creek plant is permissible. No additional special requirements, licenses, or permits are known requirements at this time since sludge is being transferred plant-to-plant, not a disposal site.**
Q32.	Per Appendix B system information was provided for the preselected AGS equipment, but no additional details have been provided that allow for a proper estimate to be completed. Will all details of basin AGS piping be provided? From our experience with these systems there can be multiple levels of equipment and associated supports and piping within each basin. Please advise if the details for the AGS equipment and basin equipment will be provided.
A32.	**Bidders had the opportunity to request additional information from the AGS equipment supplier and were instructed to do so in Addendum 1, Appendix B. Attn: All Bidders – Additional, proprietary information on the AquaNereda® system by Aqua-Aerobic Systems, Inc. can be obtained by contacting one of the following individuals. Disclosure of proprietary information requires execution of a non-disclosure agreement provided by AquaNereda®.** **Paul Koehler, OTC Industrial Technologies - JCI Industries, Inc.** **paul.koehler@otcindustrial.com** **816-525-3320** **Tatiana Mazzei** **Aqua-Aerobic Systems, Inc.**

	tmazzei@aqua-aerobic.com **815-639-4409**
Q33.	Per Section 01320 there is no note of including weather delays in baseline schedule. Are we to assume that weather delays as documented onsite with RPR will extend the substantial completion date 1 for 1 days?
A33.	**Only historically atypical weather delay days will be considered at the City's discretion.**
Q34.	Will new yard pipe manholes or new chemical manholes require any interior or exterior protective coatings?
A34.	**For new Yard Piping Manholes per current KC Water Services specifications, no interior or exterior protective coatings are specified. For all new manholes designated for chemical service, protective coatings are detailed in Section 09 90 00 – Protective Coatings of the project specifications.**
Q35.	If the monorail structural steel framing at the IPS is galvanized steel, will it still be required to get field painted?
A35.	**Steel framing is galvanized. No painting of the structural framing.**
Q36.	Per Specification 01480 Water Tightness the water for filling the tank will be furnished by Owner. Is contractor to assume all pumping and piping necessary for the filling will be provided by owner?
A36.	**No. Pumping, piping, and any other miscellaneous equipment is by Contractor.**
Q37.	Both Spec Section 03300.2.04 and Drawing Sheet S004 call out 4" PVC waterstop to be used in construction joints. It would be our recommendation to have this upgraded to a required 6" waterstop to provide better installation and protection.
A37.	**4" waterstop meets the hydrostatic pressure requirements anticipated in the basins. 6" is acceptable if bidders wish to use it.**
Q38.	Addendum 5 notes that Attachment 1 Missouri DBE Requirements (00990.01) must be included in the bid submittal. We only see an overview of the DBE program listed in Attachment 1 – we do not see any forms that we could fill out and submit at bid time. Please clarify what is needed at bid time to meet this requirement.
A38.	**Forms are included in specification book under section 00990 CSSRF drop-in specs. Forms include Notice of Requirement for Affirmative Action To Ensure Equal Employment Opportunity (Executive Order 11246); Missouri State Revolving Fund Disadvantaged Business Enterprise Utilization Worksheet; Certification Regarding Debarment and Suspension; U.S. Environmental Protection Agency Water Quality Office Certification of Nonsegregated Facilities; Domestic Products Procurement Act – RSMo 34.350 – 34.359 Certification; Business Entity Certification, Enrollment Documentation, and Affidavit of Work Authorization; USEPA Certification Regarding Lobbying; and American Iron and Steel Certification.**
Q39.	What is the concrete mix color and finish for the precast walls and are there any special admixtures such as a water repellent required?
A39.	**Basis of design shown in public and private renderings is to be Sandstone and will need to be approved by owner. Provide a full range of Buff colors to be**

	approved by owner/Architect. Acceptable admixtures for precast concrete are listed in specification 03 41 00 section 2.04-H. No other specific water repellent admixtures are required and would be at the discretion of the precast plant.
Q40.	Has the brick manufacturer for the precast walls been determined? Endicott is typically recommended.
A40.	**Basis of design shown in public and private renderings is to be Sioux City Brick Fine Art Smooth Modular and will need to be approved by owner. Provide a full range of colors to be approved by owner/Architect.**
Q41.	What is the requirement for electrical work associated with the precast walls? Are conduits required to be embedded in the walls or will they be allowed to be surface mounted?
A41.	**Conduit at all buildings except the Admin building can be surface mounted. The only location for conduit embedded in precast walls is indicated on Admin building power and lighting plans in the general notes. All conduit and boxes in the Admin building must be embedded into the precast concrete or CMU walls. No exposed conduits or boxes for electrical, data, access control, fire, etc. within the admin building except rooms 813 Mechanical and 816 Electrical. Details are provided to show how embed boxes are to be installed. Conduits on the ceiling in 816 Lab and 814 Hallway are to be attached to the hollow core and full coordinated with the Tectum attachments, so the conduit is not exposed to view.**
Q42.	Regarding the removal for formwork, Spec Section 03 10 00.3.02.A states that it is the responsibility of the contractor to make a determination when it is safe to remove forms, while paragraph D states that evidence that concrete has gained sufficient strength to permit removal of forms shall be determined by tests on control cylinders and Paragraph E impresses that a time element is in place. Is this a choice for the contractor to choose from or will one govern over the others?
A42.	**The forms are to be removed when the concrete reaches the strength specified in the spec. It is up to the contractor to determine when the concrete has attained sufficient strength to do so.**
Q43.	Please clarify to the prospective Bidders if it will be permissible for the Contractor to utilize any resultant grindings from the tree clearing as either an additional perimeter erosion control BMP measure or incorporate them with the topsoil placement? If this is not permissible, please clarify to the prospective Bidders that all grindings shall be removed from the project site.
A43.	**Yes, this would be permissible. Grindings do not need to be removed from Site.**
Q44.	Specification section 31 20 50 – Site Preparation And Earthwork, Part 3.08, E. states, "No shale particles, rock, gravel, or stone with any dimension greater than 2 inches shall be placed in the upper 18 inches of any fill or embankment. Rocks or stones within the allowable size limit may be incorporated in the remainder of fills and embankments, provided they are distributed so that they do not interfere with proper compaction." Please clarify the limits of the aforementioned "allowable size limit" (maximum size) for rocks or stones that may be incorporated in the remainder of fills and embankments.

A44.	**Refer to spec 31 20 50 section 2.01-A which states "Materials suitable for use in backfill, fill and embankment include job excavated or borrow material that is free of debris, roots, organic matter, frozen matter and shale particles/rock/stone or gravel with all dimensions less than 2 inches"**
Q45.	Specification section 31 66 12-Cast-In-Place Ground Improvement Elements, Part 1.01, C., 3. states, "Obtaining the applicable State and municipal permits (if required), and for conforming to all State and local regulations." Please clarify to the prospective Bidders what, if any, permits will be required to be obtained as part of the Cast-In-Place Ground Improvement Elements design, furnishing, or installation.
A45.	**Engineer is not aware of any specific CGE permits required, though this is ultimately the responsibility of the Contractor and selected CGE specialty designer/engineer/contractor to identify.**
Q46.	Drawing No. S217 depicts hatching for both Low-Density Cellular Concrete Fill and MoDOT Type 5 Aggregate Leveling Course between the lower slab of the influent pump station wet well at elevation 803.67 and the influent pump station channels at elevation 813.67. The influent pump station channels appear to bear on a 2'-0" MoDOT Type 5 Aggregate Leveling Course. Please clarify to the prospective Bidders that it will be permissible for the Contractor to backfill from the lower slab of the influent pump station wet well at elevation 803.67 to the influent pump station channels at elevation 807.67 with MoDOT Type 5 Aggregate Leveling Course in-lieu of Low-Density Cellular Concrete Fill. This would eliminate a secondary mobilization and setup for the Low-Density Cellular Concrete Fill contractor.
A46.	**That is acceptable. Remaining excavation is required to be backfilled with low-density cellular concrete as specified.**
Q47.	On Sheet D108 – 1" Plant Sewer – Note – Is this the correct note for this line, also is this a 1" Sanitary Line.
Q48.	**Note 1 and 1" plant sewer line are removed. Potable water to the odor control unit is shown on D705 and P701.**
Q49.	The 16" PVC Sanitary Line on Sheet D105, D108 is this PVC SDR-26 or SDR-35?
A49.	**SDR-26**
Q50.	The 6" Sanitary Line on shown on D108 is this Sch 40 or SDR-35"
A50.	**SDR-35**
Q51.	On Sheet C127 in Box Number 6 There is a note that States "Storm Line 17" that doesn't seem to point to anything. In Box 10 it calls out "Storm Line #17" which seems to match the Detail for "Storm Line 17" on sheet C132. Please clarify which is correct?
A51.	**The callout for "Storm Line 17" found in Area box 6 is incorrect and was intended to be deleted. The callout for "Storm Line 17" found in Area box 10 is correct as it points to the detention outfall line, which is shown in profile and labeled Storm Line 17 on sheet C132.**

Bidding Requirements

1. N/A

Contracting Requirements

1. Delete and replace the following section(s):
    a. Delete Document, Section 00130 INVITATION TO BID and replace with the Following Document Section 00130 INVITATION TO BID
    b. Delete Document, Section 00830.1 FEDERAL PREVAILING WAGE - HEAVY and replace with the Following Document Section 00830.1 FEDERAL PREVAILING WAGE - HEAVY.
    c. Delete Document, Section 00830.2 FEDERAL PREVAILING WAGE - BUILDING and replace with the Following Document Section 00830.1 FEDERAL PREVAILING WAGE - BUILDING

Specifications

1. Delete and replace the following section(s):

    a. Delete Document, Section 33 12 16 – UTILITY VALVES AND ACCESSORIES and replace with the Following Document Section 33 12 16 – UTILITY VALVES AND ACCESSORIES

Drawings:

1. Delete Drawing, G005 and Replace with the Following Drawings, G005
2. Delete Drawing, G006 and Replace with the Following Drawings, G006
3. Delete Drawing, A210 and Replace with the Following Drawings, A210
4. Delete Drawing, A280 and Replace with the Following Drawings, A280
5. Delete Drawing, A380 and Replace with the Following Drawings, A380
6. Delete Drawing, A481 and Replace with the Following Drawings, A481
7. Delete Drawing, A780 and Replace with the Following Drawings, A780
8. Delete Drawing, C102 and Replace with the Following Drawings, C102
9. Delete Drawing, C123 and Replace with the Following Drawings, C123
10. Delete Drawing, C127 and Replace with the Following Drawings, C127
11. Delete Drawing, C138 and Replace with the Following Drawings, C138
12. Delete Drawing, D108 and Replace with the Following Drawings, D108
13. Delete Drawing, D116 and Replace with the Following Drawings, D116
14. Delete Drawing, D119 and Replace with the Following Drawings, D119
15. Delete Drawing, D128 and Replace with the Following Drawings, D128
16. Delete Drawing, D701 and Replace with the Following Drawings, D701
17. Delete Drawing, D702 and Replace with the Following Drawings, D702
18. Delete Drawing, D705 and Replace with the Following Drawings, D705
19. Delete Drawing, D709 and Replace with the Following Drawings, D709
20. Delete Drawing, D710 and Replace with the Following Drawings, D710
21. Delete Drawing, D711 and Replace with the Following Drawings, D711

NOTE: Bidders must acknowledge receipt of this Addendum by listing the number and date, where provided, on the Bid Form - Document 00410.

SECTION 33 12 16 - UTILITY VALVES AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes all valves and accessories.

B. Related Work Specified Elsewhere:

1. Section 09 90 00 - Protective Coatings.
2. Section 33 31 50 - Pipe Installation.

1.02 REFERENCES:

A. Applicable Standards:

1. American National Standards Institute (ANSI):
   a. B16.1 - Cast-Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.
2. ASTM International (ASTM):
   a. A126 - Gray Iron Castings for Valves, Flanges and Pipe Fittings.
   b. A276 - Stainless and Heat Resisting Steel Bars and Shapes.
   c. A536 - Ductile Iron Castings.
   d. A564 - Hot-Rolled and Cold-Finished Age-Hardening Stainless and Heat Resisting Steel Bars and Shapes.
3. American Water Works Association (AWWA):
   a. C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   b. C207 - Steel Pipe Flanges for Waterworks Service - Sizes 4 Inch Through 144 Inch.
   c. C500 - Metal-Seated Gate Valves for Water Supply Service.
   d. C502 - Dry-Barrel Fire Hydrants.
   e. C504 - Rubber-Seated Butterfly Valves.
   f. C507 - Ball Valves, 6 Inch Through 48 Inch.
   g. C508 - Swing-Check Valves for Waterworks Service, 2 Inch through 24 Inch NPS.
   h. C509 - Resilient-Seated Gate Valves for Water Supply Service.
   i. C512 - Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service.
   j. C540 - Power-Actuating Devices for Valves and Sluice Gates.
   k. C550 - Protective Epoxy Interior Coatings for Valves and Hydrants.
   l. C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
   m. C606 - Grooved and Shouldered Joints.
4. National Fire Protection Association (NFPA):
   a. 1963 - Screw Threads and Gaskets, Fire Hose Connections.

1.03 SUBMITTALS:

A. Submit as specified in Division 1.

B. Include, but not limited to, the following:

1. Catalog data or illustrations showing principal dimensions, parts, and materials.
2. Spare parts list referenced to illustration of parts.
3. Assembly and disassembly or repair instructions.
4. Dimensions of the clearance required for butterfly valve discs.

C. Certificates and Affidavits: Furnish prior to shipment. Include the following:

1. Test certificates.
2. Affidavit of compliance with applicable AWWA Standard.

1.04 QUALITY ASSURANCE:

A. Manufacturers shall be experienced in the design and manufacture of specific valves and accessories.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Deliver, store, and handle equipment and materials as specified in Division 1.

1.06 RESPONSIBILITY:

A. Actuators, their controls, and accessories shall be the responsibility of the valve manufacturer for sizing, assembly, certification, field testing, and any adjustments necessary to operate the valve as specified.

PART 2 - PRODUCTS

2.01 BUTTERFLY VALVES:

A. Acceptable Manufacturers for process related valves (See Table 1 and Table 2 below for process butterfly valves):
   1. DeZURIK/Sartell - Model BAW
   2. Henry Pratt Company
   3. Val-matic

B. Acceptable Manufacturers for utility related valves (See Civil Drawings for utilities valves):
   1. SPX/DeZurik – Style BOS.
   2. Tyco-Keystone – Figure AR2.

C. Design:
   1. Conform to AWWA C504, AWWA C540, and as specified.
   2. Suitable for type of installation specified.
   3. Conform to criteria indicated in Design Data and Valve Schedule.
   4. All valve end flanges shall conform to the following:
      a. ANSI B16.1, Class 125 for cast-iron body, Class 25A through Class 150B valves.
      b. AWWA C207, Class D with ANSI B16.1 Class 125 drilling for steel body, Class 25A through Class 150B valves.
      c. ANSI B16.1, Class 250 for ductile-iron body, Class 250 valves.
      d. AWWA C207, Class E for steel body, Class 250 valves.
   5. Mechanical or push-on type rubber-gasket joint ends shall conform to AWWA C111.
   6. Valves with a stop or lug cast integrally or mechanically secured to the body for the purpose of limiting disc travel will not be acceptable.

D. Design Data: Refer to Drawings for Valve Schedule.

E. Materials and Construction:
   1. Body shall be of cast iron for Class 25A through Class 150B valves and ductile iron for Class 250 valves or fabricated steel, as indicated in the Valve Schedule.
   2. Shafts shall be ASTM A276 Type 304 or 316 stainless steel for Class 25A through Class 150B valves and ASTM 564 Type 630 stainless steel for Class 250 valves. Design velocity for Class 250 valves shall be 16 fps.
   3. Disc shall be cast or ductile iron for Class 25A through Class 150B valves and ductile iron for Class 250 valves or steel for fabricated steel valves.
   4. Seats shall be synthetic rubber and be body mounted. Provide field replaceable and adjustable seat accessible from down-pressure side of valve for sizes 30-inch and larger. Mating seat surface shall be stainless steel or Monel. Sprayed or plated mating surfaces are not acceptable.

5. Shaft seals shall be designed for use of standard self-adjusting split-V-type packing or standard O-ring seals. Pull-down packing is not acceptable.

F. Actuators:
   1. Manual Actuators:
      a. All valves shall open counterclockwise.
      b. Provide indicators to show position of disc except on buried actuators. Provide handwheels with raised cast arrow and word OPEN on rim oriented to specified opening direction.
      c. Actuators shall be oil or grease-lubricated, totally-enclosed compound lever, traveling nut type to provide characterized closure. Actuator shall be self-locking at all variable opening positions.
      d. Travel limiting stop nuts or collars installed in the actuating mechanisms shall be field adjustable and shall be locked in position by means of a removable roll pin, cotter pin, or other positive locking device. Clamps or setscrews are not acceptable.
      e. Actuators and handwheels shall be located in positions indicated or as otherwise determined when manufacturer's drawings are submitted.
      f. Furnish actuators with AWWA operating nuts for all buried installations unless otherwise scheduled.
      g. Exposed buried actuator case, supports, and connection to the valve shall be cast iron.
      h. Exposed, buried service actuator shafting, bolts, and fastening hardware shall be stainless steel.
      i. Hand chains shall be cadmium plated or stainless steel.
   2. Motor Actuators:
      a. Provide electric motor actuators as specified in sub-section 2.12 ELECTRIC MOTOR ACTUATORS herein.

G. Valve Controls:
   1. Operate valve actuator to perform control function required.
      a. Open or close valve.
      b. Modulating.
   2. Include all pilot valves, needle valves, strainers, interconnecting piping, fittings, positioners, solenoid valves, limit switches, and other accessories essential to valve function factory-assembled on valve body or actuator.
      a. Small control valves shall be bronze or brass; and piping shall be copper.
      b. Provide solenoid valves, limit switches, positioners, and other accessories as required for proper operation.
   3. Equip actuators with heavy-duty, screw type terminal strip assemblies, designed to accept ring-tongue terminals for minimum size number 14 AWG wire.

H. Testing: Furnish certified copies of results of performance, leakage, and hydrostatic tests performed in compliance with Section 5, AWWA C504.

I. Shop Painting: Paint exterior surface of valves in compliance with AWWA C504 for installation as noted. Apply interior coating conforming to AWWA C550 to exposed ferrous metal surfaces. Provide affidavit or certificate of compliance per AWWA C550.

J. Valve Schedule:

Table 1: Butterfly Valves Provided by Contractor

Tag	Size (in)	Max P (psig)	Max T (deg F)	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
AGS-VLV-104	14"	20	300	Air	Flg x Flg	Chainwheel	Vert	CS Vert	O/C	Y402	AGS West Wall Exterior Above Grade ~6.5 ft grade to valve CL
AGS-VLV-106	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y402	AGS West Walkway Exterior Above Grade
AGS-VLV-107	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y402	AGS West Walkway Exterior Above Grade
AGS-VLV-112	4"	20	300	Air	Flg x Flg	Handwheel / Lever	Horiz	CS Vert	O/C	Y402	AGS West Walkway Exterior Above Grade
AGS-VLV-204	14"	20	300	Air	Flg x Flg	Chainwheel	Vert	CS Vert	O/C	Y402	AGS West Wall Exterior Above Grade ~6.5 ft grade to valve CL
AGS-VLV-206	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y402	AGS West Walkway Exterior Above Grade
AGS-VLV-207	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y402	AGS West Walkway Exterior Above Grade
AGS-VLV-212	4"	20	300	Air	Flg x Flg	Handwheel	Horiz	CS Horiz	O/C	Y402	AGS West Walkway Exterior Above Grade
AGS-VLV-304	14"	20	300	Air	Flg x Flg	Chainwheel	Vert	CS Vert	O/C	Y403	AGS West Wall Exterior Above Grade ~6.5 ft grade to valve CL
AGS-VLV-306	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y403	AGS West Walkway Exterior Above Grade
AGS-VLV-307	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y403	AGS West Walkway Exterior Above Grade
AGS-VLV-312	4"	20	300	Air	Flg x Flg	Handwheel	Horiz	CS Horiz	O/C	Y403	AGS West Walkway Exterior Above Grade

Tag	Size (in)	Max P (psig)	Max T (deg F)	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
AGS-VLV-404	14"	20	300	Air	Flg x Flg	Chainwheel	Vert	CS Vert	O/C	Y403	AGS West Wall Exterior Above Grade ~6.5 ft grade to valve CL
AGS-VLV-406	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y403	AGS West Walkway Exterior Above Grade
AGS-VLV-407	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y403	AGS West Walkway Exterior Above Grade
AGS-VLV-412	4"	20	300	Air	Flg x Flg	Handwheel	Horiz	CS Horiz	O/C	Y403	AGS West Walkway Exterior Above Grade
AGS-VLV-913	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y407	Blower BuildingInterior Above Grade
AGS-VLV-923	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y407	Blower Building Interior Above Grade
AGS-VLV-933	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y407	Blower Building Interior Above Grade
AGS-VLV-943	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y408	Blower Building Interior Above Grade
AGS-VLV-953	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y408	Blower Building Interior Above Grade
UV-VLV-001	36"	10	100	Effluent WW	MJ x MJ	Buried Nut w/ Extension	Horiz	DIP Horiz	O/C	Y601	Yard @ UV Structure Buried
UV-VLV-002	36"	10	100	Effluent WW	MJ x MJ	Buried Nut w/ Extension	Horiz	DIP Horiz	O/C	Y601	Yard @ UV Structure Buried
UV-VLV-003	36"	10	100	Effluent WW	MJ x MJ	Buried Nut w/ Extension	Horiz	DIP Horiz	O/C	Y601	Yard @ UV Structure Buried
PW-VLV-112	4"	190	100	Effluent WW	Flg x Flg	Handwheel	Vert	DIP Horiz	O/C	Y601	UV Building Interior Above Grade
PW-VLV-122	4"	190	100	Effluent WW	Flg x Flg	Handwheel	Vert	DIP Horiz	O/C	Y601	UV Building Interior Above Grade
PW-VLV-132	4"	190	100	Effluent WW	Flg x Flg	Handwheel	Vert	DIP Horiz	O/C	Y601	UV Building Interior Above Grade

Tag	Size (in)	Max P (psig)	Max T (deg F)	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
PW-VLV-101	4"	190	100	Effluent WW	Flg x Flg	Handwheel	Vert	DIP Horiz	O/C	Y601	UV Building Interior Above Grade
PW-VLV-102	4"	190	100	Effluent WW	Flg x Flg	Handwheel	Horiz	DIP Vert	O/C	Y601	UV Building Interior Above Grade
WAS-VLV-411	10"	-5 to 0	105	Air	Flg x Flg	Chainwheel	Vert	CS Horiz	O/C	Y705	Solids Processing Bldg Interior Above Grade ~5.85 ft FF to valve CL
WAS-VLV-421	10"	-5 to 0	105	Air	Flg x Flg	Chainwheel	Vert	CS Horiz	O/C	Y705	Solids Processing Bldg Interior Above Grade ~5.85 ft FF to valve CL
WAS-VLV-431	10"	-5 to 0	105	Air	Flg x Flg	Chainwheel	Vert	CS Horiz	O/C	Y705	Solids Processing Bldg Interior Above Grade ~5.85 ft FF to valve CL
WAS-VLV-413	8"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y705	Solids Processing Bldg Interior Above Grade
WAS-VLV-423	8"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y705	Solids Processing Bldg Interior Above Grade
WAS-VLV-433	8"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y705	Solids Processing BldgInterior Above Grade
WAS-VLV-401	10"	20	300	Air	Flg x Flg	Handwheel	Horiz	CS Vert	O/C	Y705	Solids Processing Bldg Interior Above Grade
WAS-VLV-402	10"	20	300	Air	Flg x Flg	Handwheel	Horiz	CS Vert	O/C	Y705	Solids Processing Bldg Interior Above Grade

Table 2: Butterfly Valves provided by Granular Sludge Biological Treatment System Supplier (Section 46 54 60)

Tag	Size (in)	Max P (psig)	Max T (deg F)	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
AGS-VLV-105	10"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Horiz	CS Horiz	Air	Y402	AGS West Walkway Exterior Above Grade
AGS-VLV-108	4"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Vert	CS Horiz	Air	Y402	AGS West Walkway Exterior Above Grade
AGS-VLV-109	4"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Vert	CS Horiz	Air	Y402	AGS West Walkway Exterior Above Grade
AGS-VLV-205	10"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Horiz	CS Horiz	Air	Y402	AGS West Walkway Exterior Above Grade
AGS-VLV-208	4"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Vert	CS Horiz	Air	Y402	AGS West Walkway Exterior Above Grade
AGS-VLV-209	4"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Vert	CS Horiz	Air	Y403	AGS West Walkway Exterior Above Grade
AGS-VLV-305	10"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Horiz	CS Horiz	Air	Y403	AGS West Walkway Exterior Above Grade
AGS-VLV-308	4"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Vert	CS Horiz	Air	Y403	AGS West Walkway Exterior Above Grade
AGS-VLV-309	4"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Vert	CS Horiz	Air	Y403	AGS West Walkway Exterior Above Grade
AGS-VLV-405	10"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Horiz	CS Horiz	Air	Y403	AGS West Walkway Exterior Above Grade

Tag	Size (in)	Max P (psig)	Max T (deg F)	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
AGS-VLV-408	4"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Vert	CS Horiz	Air	Y403	AGS West Walkway Exterior Above Grade
AGS-VLV-409	4"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Vert	CS Horiz	Air	Y403	AGS West Walkway Exterior Above Grade

2.02 ECCENTRIC PLUG VALVES:

A. Acceptable Manufacturers:
   1. DeZurik
   2. Nordstrom
   3. Walworth
   4. Henry Pratt Company

B. Design:
   1. Quarter-turn nonlubricated eccentric type with resilient faced plug. Valves with vane type seat rings are not acceptable. Shutoff up to scheduled rating with pressure in reverse direction where scheduled.
   2. Conform to criteria indicated in Valve Schedule table.
   3. Flanged valve ends shall be faced and drilled to conform to ANSI B16.1, Class 125 for thickness and drilling.
   4. Mechanical or push-on type rubber-gasketed joint ends shall conform to AWWA C111.
   5. Port areas for valves through 500 mm 20-inch shall be at least 80% of full pipe area. Port areas of 24-inch and larger valves shall be at least 70% of full pipe area.
      a. Valves specified as “Full Port”: Bodies shall be Cast Iron ASTM A126 Class B. Ports shall be rectangular and 100% Port Area. The valve port area shall meet or exceed standard pipe area per ASME/ANSI B36.10M.
   6. Plugs shall be eccentric type with no backing ring or frame.
   7. Valve body cavity shall be smooth without protrusions or baffles.
   8. Design velocity for valves shall be 12 fps.

C. Materials and Construction:
   1. Bodies shall be of ASTM A126, Class B cast iron.
   2. Valve plug shall be ASTM A126, Class B cast iron or ASTM A536 ductile iron. Resilient plug facing or replaceable style body seats shall be synthetic rubber, neoprene, or Buna N compound suitable for use with water and wastewater applications.
   3. Seat rings shall be threaded or welded of corrosion-resistant 18-8 stainless steel, nickel, or Monel conforming to AWWA C504. Sprayed or plated mating seat surfaces are not acceptable.
   4. Bearings shall be replaceable. Sleeve type and thrust bearings in the upper and lower journals shall be corrosion-resistant stainless steel or bronze.
   5. Shaft seals shall be multiple O-ring, self-adjusting U-cup or chevron type packing conforming to AWWA C504. Pull-down packing is not acceptable.
   6. Shaft seals shall be field adjustable or replaceable without valve disassembly.
   7. All exposed fastening hardware shall be zinc plated or stainless steel. Provide stainless steel for buried service.

D. Actuators:
   1. Manual Actuators:
      a. All valves shall open counterclockwise.
      b. Provide indicators to show position of plug except on buried actuators.
      c. Nut operators shall be AWWA 2-inch size for operation by valve key, wrench head lever, or a chain lever. Furnish one lever for each valve.
      d. Hand chains shall be cadmium plated or stainless steel.
      e. Worm gear actuators shall be totally enclosed, grease sealed, gear type furnished with AWWA nut, crank, handwheel, or chainwheel. All buried valves shall be provided with worm gear actuators, AWWA nut, and enclosed cover plate. All

valves with reverse pressure capacity requirement shall be provided with worm gear actuators. Worm gear actuators shall be self-locking at all variable opening positions and sized to meet the torque ratings of AWWA C504. The shaft in a worm gear actuator shall have a nonmetallic or bronze sleeve type bearing. Submit manufacturer's parts and materials drawings.

f. Handwheels shall be located in positions indicated or as otherwise determined when manufacturer's drawings are submitted.

2. Motor Actuators:
   a. Provide electric motor actuators as specified in sub-section 2.12 ELECTRIC MOTOR ACTUATORS herein.

E. Valve Controls:
1. Operate valve actuator to perform control function required.
   a. Open or close valve.
   b. Modulating.
2. Include all pilot valves, needle valves, strainers, interconnecting piping, fittings, positioners, solenoid valves, limit switches, and other accessories essential to valve function factory-assembled on valve body or operator.
   a. Small control valves shall be bronze or brass; piping shall be copper.
   b. Provide solenoid valves, limit switches, positioners, and other accessories as required for proper operation.
3. Equip actuators with heavy-duty, screw type terminal strip assemblies, designed to accept ring tongue terminals for minimum size number 14 AWG wire.

F. Testing: Furnish certified copies of results of tests prior to shipment. All valves shall be subjected to an AWWA C504 procedure cycle life and pressure leak test at 150 psi and a body hydrostatic test at 300 psi. Valves shall be capable of providing drip-tight shutoff up to the full leak test rating. Certify reverse pressure capacity.

G. Shop Painting: Apply interior coating conforming to AWWA C550 to exposed ferrous metal surfaces. Provide affidavit or certificate of compliance per AWWA C550.

H. Valve Schedule:

Table 3: Plug Valves Provided by Contractor

Tag	Size (in)	Max P (psig)	Max T (deg F)	Full Port?	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
IPS-VLV-101	24”	120	100	No	Influent Wastewater	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y202	IPS Valve Vault Interior Below Grade
IPS-VLV-102	20”	120	100	No	Influent Wastewater	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y202	IPS Valve Vault Interior Below Grade
IPS-VLV-103	20”	120	100	No	Influent Wastewater	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y202	IPS Valve Vault Interior Below Grade
IPS-VLV-112	14"	120	100	No	Influent Wastewater	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y202	IPS Valve Vault Interior Below Grade
IPS-VLV-122	12"	120	100	No	Influent Wastewater	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y202	IPS Valve Vault Interior Below Grade
IPS-VLV-132	14"	120	100	No	Influent Wastewater	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y202	IPS Valve Vault Interior Below Grade
IPS-VLV-142	12"	120	100	No	Influent Wastewater	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y202	IPS Valve Vault Interior Below Grade
IPS-VLV-152	14"	120	100	No	Influent Wastewater	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y202	IPS Valve Vault Interior Below Grade
GRSC-VLV-001	20"	120	100	No	Influent Wastewater	MJ x MJ	Buried Nut w/ Extension	Horiz	DIP Horiz	O/C	Y301	Yard Exterior of Headworks Buried ~5.9 ft CL of valve to grade
GRSC-VLV-002	20"	120	100	No	Influent Wastewater	FLG x FLG	Chainwheel	Horiz	DIP Vert	O/C	Y301	Headworks First Floor Interior Above Grade ~10 ft FF to CL of valve
GRSC-VLV-003	20"	120	100	**YES**	Influent Wastewater	FLG x FLG	Chainwheel	Horiz	DIP Vert	O/C	Y301	Headworks First Floor Interior Above Grade ~10 ft FF to CL of valve

Tag	Size (in)	Max P (psig)	Max T (deg F)	Full Port?	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
GRSC-VLV-004	20"	120	100	No	Influent Wastewater	FLG x FLG	Chainwheel	Horiz	DIP Vert	O/C	Y301	Headworks First Floor Interior Above Grade ~14.7 ft FF to CL of valve
GRSC-VLV-005	20"	120	100	No	Influent Wastewater	FLG x FLG	Chainwheel	Horiz	DIP Vert	O/C	Y301	Headworks First Floor Interior Above Grade ~14.7 ft FF to CL of valve
GRSC-VLV-103	6"	10	100	No	Influent Wastewater	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y301	Headworks First Floor Interior Above Grade ~13.5 ft FF to CL of valve
GRSC-VLV-203	6"	10	100	No	Influent Wastewater	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y301	Headworks First Floor Interior Above Grade ~13.5 ft FF to CL of valve
PSEW-VLV-101	8”	60	100	No	Plant Sewer Return	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y301	Headworks First Floor Interior Above Grade ~2 ft FF to CL of valve
PSEW-VLV-102	8”	60	100	No	Plant Sewer Return	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y301	Headworks First Floor Interior Above Grade ~5 ft FF to CL of valve
PSEW-VLV-103	8”	60	100	No	Plant Sewer Return	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y301	Headworks First Floor Interior Above Grade ~8 ft FF to CL of valve
PSEW-VLV-104	8”	60	100	No	Plant Sewer Return	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y301	Headworks First Floor Interior Above Grade ~12 ft FF to CL of valve
GRSC-VLV-311	4"	15	100	**YES**	Grit Slurry	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y302	Headworks First Floor Interior Above Grade
GRSC-VLV-313	3"	15	100	No	Grit Slurry	FLG x FLG	Handwheel	Horiz	DIP Vert	O/C	Y302	Headworks First Floor Interior Above Grade

Tag	Size (in)	Max P (psig)	Max T (deg F)	Full Port?	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
GRSC-VLV-315	4"	15	100	**YES**	Grit Slurry	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y302	Headworks First Floor Interior Above Grade ~9 ft FF to CL of valve
GRSC-VLV-316	4"	15	100	**YES**	Grit Slurry	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y302	Headworks First Floor Interior Above Grade ~9 ft FF to CL of valve
GRSC-VLV-317	4"	15	100	**YES**	Grit Slurry	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y302	Headworks First Floor Interior Above Grade ~9 ft FF to CL of valve
AGS-VLV-601	8"	10	100	No	Supernatant	FLG x FLG	Handwheel	Vert	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-602	8"	10	100	No	Supernatant	FLG x FLG	Handwheel	Vert	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-603	8"	30	100	No	Supernatant	FLG x FLG	Chainwheel	Vert	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade ~6.3 ft FF to CL of valve
AGS-VLV-611	8"	10	100	No	Supernatant	FLG x FLG	Handwheel	Vert	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-621	8"	10	100	No	Supernatant	FLG x FLG	Handwheel	Vert	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-631	8"	10	100	No	Supernatant	FLG x FLG	Handwheel	Vert	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-613	8"	30	100	No	Supernatant	FLG x FLG	Chainwheel	Vert	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade ~6.3 ft FF to CL of valve
AGS-VLV-623	8"	30	100	No	Supernatant	FLG x FLG	Chainwheel	Vert	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade ~6.3 ft FF to CL of valve

Tag	Size (in)	Max P (psig)	Max T (deg F)	Full Port?	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
AGS-VLV-633	8"	30	100	No	Supernatant	FLG x FLG	Chainwheel	Vert	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade ~6.3 ft FF to CL of valve
AGS-VLV-701	4"	10	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-702	4"	10	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-703	4"	30	100	No	Sludge	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y405	AGS Pump RoomInterior Above Grade~4.5 ft FF to CL of valve
AGS-VLV-711	4"	10	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-721	4"	10	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-731	4"	10	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-713	4"	30	100	No	Sludge	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade ~4.5 ft FF to CL of valve
AGS-VLV-723	4"	30	100	No	Sludge	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade ~4.5 ft FF to CL of valve
AGS-VLV-733	4"	30	100	No	Sludge	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade ~4.5 ft FF to CL of valve
AGS-VLV-811	6"	10	100	No	Supernatant	FLG x FLG	Handwheel	Vert	DIP Horiz	O/C	Y406	AGS Pump Room Interior Above Grade
AGS-VLV-821	6"	10	100	No	Supernatant	FLG x FLG	Handwheel	Vert	DIP Horiz	O/C	Y406	AGS Pump Room Interior Above Grade

Tag	Size (in)	Max P (psig)	Max T (deg F)	Full Port?	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
AGS-VLV-813	6"	30	100	No	Supernatant	FLG x FLG	Chainwheel	Vert	DIP Horiz	O/C	Y406	AGS Pump Room Interior Above Grade ~5.9 ft FF to CL of valve
AGS-VLV-823	6"	30	100	No	Supernatant	FLG x FLG	Chainwheel	Vert	DIP Horiz	O/C	Y406	AGS Pump Room Interior Above Grade ~5.9 ft FF to CL of valve
AGS-VLV-001	6"	30	100	No	Supernatant	FLG x FLG	Chainwheel	Vert	DIP Vert	O/C	Y401	AGS Utility Corridor Interior Above Grade ~5.6 ft FF to CL of valve
WAS-VLV-101	4"	30	100	No	Sludge	FLG x FLG	Extended w/ Handwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Below Grade ~2 ft CL of valve to walkway above
WAS-VLV-201	4"	30	100	No	Sludge	FLG x FLG	Extended w/ Handwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Below Grade ~2 ft CL of valve to walkway above
WAS-VLV-301	8"	10	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Vert	O/C	Y702	Solids Processing Building Interior Above Grade
WAS-VLV-302	8"	10	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Vert	O/C	Y702	Solids Processing BuildingInterior Above Grade
WAS-VLV-303	8"	10	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade
WAS-VLV-304	8"	10	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade
WAS-VLV-311	6"	10	100	No	Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade
WAS-VLV-321	6"	10	100	No	Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade
WAS-VLV-331	6"	10	100	No	Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade

Tag	Size (in)	Max P (psig)	Max T (deg F)	Full Port?	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
WAS-VLV-313	6"	10	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade
WAS-VLV-323	6"	50	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade
WAS-VLV-333	6"	50	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade
WAS-VLV-305	6"	50	100	No	Sludge	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade ~12 ft FF to CL of valve
WAS-VLV-305A	4”	50	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade ~3 ft FF to CL of valve
WAS-VLV-305B	4”	50	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade ~3 ft FF to CL of valve
WAS-VLV-306	6"	50	100	No	Sludge	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade ~12 ft FF to CL of valve
WAS-VLV-306A	4"	50	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade ~3 ft FF to CL of valve
WAS-VLV-306B	4"	50	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade ~3 ft FF to CL of valve
WAS-VLV-307	6"	50	100	No	Sludge	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade ~13 ft FF to CL of valve

Tag	Size (in)	Max P (psig)	Max T (deg F)	Full Port?	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
WAS-VLV-308	6"	50	100	No	Sludge	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade ~13 ft FF to CL of valve
STH-VLV-101	6"	50	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Vert	O/C	Y702	Solids Processing Building Interior Above Grade
STH-VLV-201	6"	50	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Vert	O/C	Y702	Solids Processing Building Interior Above Grade
SCIN-VLV-101	6"	50	100	No	Sludge	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade ~13 ft FF to CL of valve
SCIN-VLV-201	6"	50	100	No	Sludge	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing BuildingInterior Above Grade~13 ft FF to CL of valve
STH-VLV-132	4"	90	100	**YES**	Thickened Sludge	FLG x FLG	Handwheel	Horiz	DIP Vert	O/C	Y703	Solids Processing Building Interior Above Grade
STH-VLV-232	4"	90	100	**YES**	Thickened Sludge	FLG x FLG	Handwheel	Horiz	DIP Vert	O/C	Y703	Solids Processing Building Interior Above Grade
SCIN-VLV-102	6"	90	100	No	Thickened Sludge	FLG x FLG	Handwheel	Horiz	DIP Vert	O/C	Y703	Solids Processing Building Interior Above Grade
SCIN-VLV-202	6"	90	100	No	Thickened Sludge	FLG x FLG	Handwheel	Horiz	DIP Vert	O/C	Y703	Solids Processing Building Interior Above Grade
SCIN-VLV-001	18"	15	100	No	Thickened Sludge	FLG x FLG	Extended w/ Handwheel	Horiz	DIP Horiz	O/C	Y704	Solids Processing Building Interior Below Grade ~2.1 ft CL of valve to walkway above
SCIN-VLV-111	10"	10	100	**YES**	Thickened Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y704	Solids Processing Building Interior Below Grade
SCIN-VLV-211	10"	10	100	**YES**	Thickened Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y704	Solids Processing Building Interior Below Grade

Tag	Size (in)	Max P (psig)	Max T (deg F)	Full Port?	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
SCIN-VLV-112	8"	60	100	**YES**	Thickened Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Vert	Modulating	Y704	Solids Processing Building Interior Below Grade
SCIN-VLV-212	8"	60	100	**YES**	Thickened Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Vert	Modulating	Y704	Solids Processing Building Interior Below Grade
SCIN-VLV-113	8"	60	100	**YES**	Thickened Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	Modulating	Y704	Solids Processing Building Interior Below Grade
SCIN-VLV-213	8"	60	100	**YES**	Thickened Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	Modulating	Y704	Solids Processing Building Interior Below Grade
PSEW-VLV-112	8"	120	100	No	Return Wastewater	FLG x FLG	Handwheel	Horiz	DIP Vert	O/C	Y801	Headworks First Floor Interior Above Grade
PSEW-VLV-122	8"	120	100	No	Return Wastewater	FLG x FLG	Handwheel	Horiz	DIP Vert	O/C	Y801	Headworks First Floor Interior Above Grade

Table 4: Plug Valves provided by Granular Sludge Biological Treatment System Supplier (Section 46 54 60)

Tag	Size (in)	Max P (psig)	Max T (deg F)	Full Port?	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
AGS-VLV-101	30"	20	100	No	Influent Wastewater	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y401	AGS Utility Corridor Interior Above Grade
AGS-VLV-103	30"	20	100	No	Influent Wastewater	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y401	AGS Utility Corridor Interior Above Grade
AGS-VLV-201	30"	20	100	No	Influent Wastewater	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y401	AGS Utility Corridor Interior Above Grade
AGS-VLV-203	30"	20	100	No	Influent Wastewater	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y401	AGS Utility Corridor Interior Above Grade
AGS-VLV-301	30"	20	100	No	Influent Wastewater	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y401	AGS Utility Corridor Interior Above Grade
AGS-VLV-303	30"	20	100	No	Influent Wastewater	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y401	AGS Utility Corridor Interior Above Grade
AGS-VLV-401	30"	20	100	No	Influent Wastewater	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y401	AGS Utility Corridor Interior Above Grade
AGS-VLV-403	30"	20	100	No	Influent Wastewater	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y401	AGS Utility Corridor Interior Above Grade
AGS-VLV-110	20"	10	100	No	Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	Modulating	Y402	AGS Utility Corridor Interior Above Grade
AGS-VLV-111	20"	10	100	No	Supernatant	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	Modulating	Y402	AGS Utility Corridor Interior Above Grade

Tag	Size (in)	Max P (psig)	Max T (deg F)	Full Port?	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
AGS-VLV-210	20"	10	100	No	Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	Modulating	Y402	AGS Utility Corridor Interior Above Grade
AGS-VLV-211	20"	10	100	No	Supernatant	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	Modulating	Y402	AGS Utility Corridor Interior Above Grade
AGS-VLV-310	20"	10	100	No	Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	Modulating	Y403	AGS Utility Corridor Interior Above Grade
AGS-VLV-311	20"	10	100	No	Supernatant	FLG x FLG	Motor Actuator	Horiz	DIPHoriz	Modulating	Y403	AGS Utility CorridorInterior Above Grade
AGS-VLV-410	20"	10	100	No	Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	Modulating	Y403	AGS Utility Corridor Interior Above Grade
AGS-VLV-411	20"	10	100	No	Supernatant	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	Modulating	Y403	AGS Utility Corridor Interior Above Grade
AGS-VLV-511	20"	10	100	No	Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y405	AGS Utility Corridor Interior Above Grade
AGS-VLV-521	20"	10	100	No	Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y405	AGS Utility Corridor Interior Above Grade

2.03 STANDARD SWING CHECK VALVES:

A. Acceptable Manufacturers less than 4-inches in diameter:
   1. Crane Valve Company - Model: Number 36
   2. Lunkenheimer Company - Model: Figure 554Y

B. Acceptable Manufacturers 4-inches and greater in diameter:
   1. Kennedy Valve Company – Model: 159
   2. M&H – Model 159
   3. Mueller Company – Model A-2600
   4. Apco Willamette Valve and Primer Corporation – Model 250

C. Design:
   1. Conform to AWWA C508 and as specified.
   2. Iron body, bronze mounted, full opening.
   3. Extended stainless steel hinge pin with outside lever and weight.
   4. Design velocity shall be 12 fps.

D. Materials and Construction:
   1. Body and cover shall be cast iron. Flanges shall be ANSI B16.1, Class 125.
   2. Valve disc shall be bronze faced cast iron.
   3. Rubber faced discs or disc rings shall be Buna N for liquid applications and Viton for compressed air applications.
   4. Suitable for listed operating pressure.

E. Valve Schedule:

Table 5: Check Valves Provided by Contractor

Tag	Size (in)	Max P (psig)	Max T (deg F)	Media	Valve Ends	System Pipe	PID	Installation
IPS-VLV-111	14"	120	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y202	IPS Valve Vault Interior Below Grade
IPS-VLV-121	12"	120	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y202	IPS Valve Vault Interior Below Grade
IPS-VLV-131	14"	120	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y202	IPS Valve Vault Interior Below Grade
IPS-VLV-141	12"	120	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y202	IPS Valve Vault Interior Below Grade
IPS-VLV-151	14"	120	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y202	IPS Valve Vault Interior Below Grade
AGS-VLV-102	30"	20	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y401	AGS Pump Room Interior Above Grade
AGS-VLV-202	30"	20	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y401	AGS Pump Room Interior Above Grade
AGS-VLV-302	30"	20	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y401	AGS Pump Room Interior Above Grade
AGS-VLV-402	30"	20	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y401	AGS Pump Room Interior Above Grade
AGS-VLV-612	8"	30	100	Supernatant	FLG x FLG	DIP Horiz	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-622	8"	30	100	Supernatant	FLG x FLG	DIP Horiz	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-632	8"	30	100	Supernatant	FLG x FLG	DIP Horiz	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-712	4"	30	100	Sludge	FLG x FLG	DIP Horiz	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-722	4"	30	100	Sludge	FLG x FLG	DIP Horiz	Y405	AGS Pump Room Interior Above Grade

Tag	Size (in)	Max P (psig)	Max T (deg F)	Media	Valve Ends	System Pipe	PID	Installation
AGS-VLV-732	4"	30	100	Sludge	FLG x FLG	DIP Horiz	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-812	6"	30	100	Supernatant	FLG x FLG	DIP Horiz	Y406	AGS Pump Room Interior Above Grade
AGS-VLV-822	6"	30	100	Supernatant	FLG x FLG	DIP Horiz	Y406	AGS Pump Room Interior Above Grade
PW-VLV-111	4"	30	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y601	UV Disinfection Bldg Interior Above Grade
PW-VLV-121	4"	30	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y601	UV Disinfection Bldg Interior Above Grade
PW-VLV-131	4"	30	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y601	UV Disinfection Bldg Interior Above Grade
WAS-VLV-312	6"	50	100	Sludge	FLG x FLG	DIP Horiz	Y702	Solids Processing Interior Above Grade
WAS-VLV-322	6"	50	100	Sludge	FLG x FLG	DIP Horiz	Y702	Solids Processing Interior Above Grade
WAS-VLV-332	6"	50	100	Sludge	FLG x FLG	DIP Horiz	Y702	Solids Processing Interior Above Grade
STH-VLV-131	4"	30	100	Thickened Sludge	FLG x FLG	DIP Horiz	Y703	Solids Processing Interior Above Grade
STH-VLV-231	4"	30	100	Thickened Sludge	FLG x FLG	DIP Horiz	Y703	Solids Processing Interior Above Grade
PSEW-VLV-111	8"	120	100	Returned Wastewater	FLG x FLG	DIP Vert	Y801	Headworks Building Interior Above Grade
PSEW-VLV-121	8"	120	100	Returned Wastewater	FLG x FLG	DIP Vert	Y801	Solids Processing Interior Above Grade

2.04 BALL VALVES:

A. Acceptable Manufacturers for Ball Valves less than 6-inches in diameter:
   1. Conbraco Industries, Inc. – Apollo Valves.
   2. Metso Automation/Jamesbury.
   3. NIBCO, Inc.
   4. Flow-Tek, Inc.

B. Operational Requirements:
   1. Suitable for isolation service.
   2. Operation of the valve will be continuous.
   3. Operational pressures will be as follows:
      a. Normal system range 0 to 200 psi.

C. Design: Conform to AWWA C507, AWWA C540 and as specified.
   1. Valves shall consist of essentially three main parts:
      a. Body with full unrestricted circular inlet and outlet with diameter equal to rated size of valve.
      b. A moveable plug having a full, unobstructed circular waterway opening equal to valve body opening.
      c. A totally-enclosed operating mechanism mounted on and attached to valve body.
   2. Seats shall consist of flexible metal on the ball or resilient rubber on the body and rigid stainless steel seats opposite and located on both ends of valve.
   3. Shaft seals shall be self-adjusting split-V-type or rubber O-ring type designed for replacement under line pressure.
   4. Valve body shall have flanged ends. Flanges shall be ANSI B16.1, Class 125.

D. Materials and Construction:
   1. Valve body and plug shall match or be compatible with pipe material.
   2. Valve shall be furnished complete with operating mechanism and accessories suitable for accomplishing specified operations.

E. Valve Operating Mechanism:
   1. Valve shall be equipped with a traveling cross-head type operator and shall operate plug by means of a cross-head linked to a rotator lever.
   2. Rotator lever shall impart rotary motion to plug shaft.
   3. Provide an indicator to show position of plug with respect to body opening.

F. Actuators:
   1. Manual Actuators:
      a. Valve shall open counterclockwise.
      b. Provide non-rising stem mechanism self-locking in all positions.

G. Testing: Furnish certified copies of results of tests performed in compliance with Section 13, AWWA C507.

H. Valve Schedule: Refer to Drawings for Valve Schedule.

I. Shop Painting: Apply interior epoxy coating conforming to AWWA C550 and NSF to exposed ferrous metal surfaces. Provide affidavit or certificate of compliance per AWWA C550 and NSF.

J. Valve Schedule:

VALVE TAG	SIZE (IN)	OPERATING PRESSURE (PSI)	LOCATION	INSTALLATION	VALVE ENDS	ACTUATOR			MEDIA	SYSTEM PIPE
						Mechanism	Shaft Position	Function		
STH-VLV-102	3	75	Solids Handling Building	Above Grade	FLG X FLG	Handwheel/ Lever	Horizontal	Open/Close	Process Water	Copper
STH-VLV-202	3	75	Solids Handling Building	Above Grade	FLG X FLG	Handwheel/ Lever	Horizontal	Open/Close	Process Water	Copper
POL-VLV-103	1	65	Solids Handling Building	Above Grade	FLG X FLG	Handwheel/ Lever	Vertical	Open/Close	Polymer	DIP
POL-VLV-203	1	65	Solids Handling Building	Above Grade	FLG X FLG	Handwheel/ Lever	Vertical	Open/Close	Polymer	DIP
SCIN-VLV-301	1 1/2	200	Solids Handling Building Blower Room	Above Grade	FLG X FLG	Lever	Horizontal	Open/Close	Compressed Air	CS
SCIN-VLV-311	1 1/2	200	Solids Handling Building Blower Room	Above Grade	FLG X FLG	Lever	Horizontal	Open/Close	Compressed Air	CS
SCIN-VLV-321	1 1/2	200	Solids Handling Building Blower Room	Above Grade	FLG X FLG	Lever	Horizontal	Open/Close	Compressed Air	CS
POL-VLV-101	1/2	2.2	Solids Handling Building	Above Grade	Threaded	Lever	Horizontal	Open/Close	Polymer	Poly

2.05 PINCH VALVES:

A. Acceptable Manufacturers:
   1. Onyx Valve Company.
   2. Red Valve Company.
   3. RF Valves.

B. Design:
   1. Valves shall be full cast metal body mechanical pinch type with integral flanges on body and flexible sleeve.
   2. All internal metal parts are to be isolated from the process fluid by the flexible rubber sleeve.

C. Materials and Construction:
   1. Valve body shall be ductile iron, stem and pinch bar shall be stainless steel, and sleeve shall be rubber.
   2. Suitable for 150 psi operating pressure.
   3. Valve body shall have flanged ends. Flanges shall be ANSI B16.1, Class 125.

D. Valve Operating Mechanism:
   1. The steel mechanism shall be double acting with pinching of the sleeve trim occurring equally from two sides.
   2. Rotating the handle counterclockwise shall lower a pinch bar above the sleeve, while raising a pinch bar below the sleeve, pinching the sleeve closed at the center of the valve.

E. Actuators:
   1. Manual Actuators:
      a. Valve shall open counterclockwise.
      b. Provide non-rising stem mechanism.
   2. Motor Actuators:
      a. Provide electric motor actuators as specified in sub-section 2.12 ELECTRIC MOTOR ACTUATORS herein.

F. Testing: Furnish certified copies of results of tests prior to shipment.

G. Valve List:

Parameter	**GRSC-VLV-312**	**GRSC-VLV-314**
Size, (in)	4”	4”
Max P (psig)	15	15
Max T (deg F)	100	100
Full Port?	Yes	Yes
Media	Grit Slurry	Grit Slurry
Valve Ends	FLG x FLG	FLG x FLG
Actuator Type	Handwheel	Motor Actuator
Actuator Shaft Position	Horizontal	Horizontal
System Pipe	DIP Vertical	DIP Vertical
Service	Open/Close	Open/Close
PID	Y302	Y302
Installation	Headworks Building Interior Above Grade	Headworks Building Interior Above Grade

2.06 PRESSURE REDUCING VALVES:

A. Provided as indicated on Contract Drawings.

B. Acceptable Manufacturers less than 3-inches in diameter:
   1. Watts Automatic Control Valve Company – Model 500 Series LF223
   2. Wilkins – Model 500 Series
   3. Engineer-approved equal.

C. Acceptable Manufacturers 3-inches and larger in diameter:
   1. Watts Automatic Control Valve Company – Model ACV Series 115
   2. Cla-Val Company – Model 90-01
   3. Engineer-approved equal.

D. Design:
   1. Valves shall be of flanged globe body type.
   2. Inlet flange shall be ANSI B16.1, Class 125. Outlet flange shall be ANSI B16.1, Class 125.
   3. Suitable for operation as follows:
      a. Maximum flow rate condition: 215 GPM.
      b. Normal system inlet pressure: 75 psi to 135 psi.
      c. Regulate downstream pressure at Headworks: 85 psi.
      d. Regulate downstream pressure at Solids Handling Building: 85 psi.
   4. Such that internal main valve assembly can be dismantled without removing valve body from pipeline.

E. Materials and Construction:
   1. Body shall be cast iron, ductile iron, or stainless steel.
   2. Trim shall be bronze or stainless steel.
   3. Seats shall be leather or other resilient material and shall be replaceable.

F. Operational Requirements:
   1. Suitable for pressure-reducing service.
   2. Operation of the valve will be frequent.
   3. Cushioned to permit operation without causing shock or water hammer.
   4. Operate without continuous waste of water.
   5. Provide tight closure when shut and full pipeline opening when open.
   6. The valve shall maintain accurate control of the downstream pressure regardless of fluctuation in flow or upstream pressure.
   7. Adjustable for speed of open and close operation and control pressure.

G. Valve Controls:
   1. Control Function:
      a. Pressure regulation - maintain preadjusted downstream pressure for varying rates of flow and upstream pressure.
      b. Open and close according to downstream pressure transmitter indication.
   2. Include all pilot valves, needle valves, strainers, interconnecting piping, fittings, cylinders, positioners, solenoid valves, limit switches, and other accessories essential to valve function factory assembled on valve body.
      a. Pilot shall be self-cleaning and self-flushing by locating the outlet in the bottom of the pilot ninety degrees to the inlet
      b. Small control valves shall be bronze or brass; pilot tubing shall be stainless steel braided with Teflon lining. Copper/brass fittings and pilot.

2.07 PRESSURE SAFETY VALVES:

A. Provided as indicated on Contract Drawings.

B. Acceptable Manufacturers:
   1. Watts Automatic Control Valve Company – Model ACV Series 116
   2. Cla-Val Company - Model 50-01
   3. Engineer-approved equal.

C. Design:
   1. Valves shall be of flanged globe body pattern.
   2. Inlet and outlet flanges shall be 6-inch ASME B16.1 Class 125.
   1. Valves shall be external pilot actuated with spring to adjust pressure setting.
   2. Provide indicator rod to show position of opening of the piston or diaphragm.
   3. Suitable for operation as follows:
      a. Pump shutoff head 360-460 feet (155-200 psi).
      b. Normal system operating pressure 75 psi to 150 psi.
      c. Open at 160 psi.
   4. Such that internal main valve assembly can be dismantled without removing valve body from pipeline.
   5. Provide shutoff cocks and Y-strainers on control tubing.
   6. Valve shall have a protective fusion bonded epoxy coating internally and externally. The coating shall conform to AWWA C116.

B. Materials and Construction:
   1. Body shall be cast iron, ductile iron, or stainless steel.
   2. Trim shall be bronze or stainless steel.
   3. Seats shall be EPDM rubber and shall be replaceable.

D. Operational Requirements:
   1. Suitable for pressure-reducing service.
   2. Operation of the valve will be intermittent.
   3. Cushioned to permit operation without causing shock or water hammer.
   4. Operate without continuous waste of water.
   5. Provide tight closure when shut and full pipeline opening when open.
   6. Adjustable for speed of open and close operation and control pressure.

E. Valve Controls:
   1. Control Function:
      a. Open when line pressure exceeds preset value.
   2. Include all pilot valves, needle valves, strainers, interconnecting piping, fittings, cylinders, positioners, solenoid valves, limit switches, and other accessories essential to valve function factory assembled on valve body.
      a. Small control valves shall be bronze or brass; piping shall be copper.
      b. Provide orifice plate assembly for flow control function.

2.08 TELESCOPING VALVES:

A. Telescoping Valves shall be specified herein and have the characteristics and dimensions as shown in the drawings

B. Acceptable Manufactures
   1. Watermann Valves
   2. Whipps, Inc
   3. Troy Valve

C. Design

1. The valve shall utilize a low friction seal to mount to engage the slip tube and mount to the flange of the receiving pipe.
2. All welds shall be performed by welders with AWS certification.
3. Finish: Mill finish on stainless steel. Welds shall be sandblasted to remove weld burn and scale.

D. Slip Tube and Bail
1. The slip tube shall be constructed of Schedule 10 minimum thickness stainless steel pipe. The the overflow end slip tube shall be fitted with a V-notch weir and shall be Schedule 10 stainless steel.
2. The bail shall be constructed of stainless steel and shall be bolted to the stem and welded to the slip tube. The bail style shall be comptible for v-notch weir slipe tube.
3. The maximum travel distance of the slip tube shall be 48 inches. The maximum depth of slip tube shall extend more than 12 inches past the center line of the receiving flange into the recieving pipe at a travel distance of 0 inches.
4. Slip tubes shall be equipped with a grease fitting to allow the operator to apply grease to the slip tube from the operator level.

E. Seal Flange
1. The telescoping valve shall be provided with a self-adjusting seal system to restrict leakage between the slip tube and the receiving pipe.
2. If a neoprene seal and separate companion flange is provided, the neoprene seal shall have a minimum thickness of 1/4-inch and the companion flange shall be stainless steel and shall have a minimum thickness of 3/8-inch.
3. The slipe tube gasket shall be replaceable without the rmeoval of the slip tube assmbly from the reciver pipe, or actuator.
4. The companion flange shall be provided with a bolt pattern suitable for attachment to the flange on the receiving pipe.

F. Stem
1. A threaded operating stem shall be utilized to connect the operating mechanism to the bail which in turn is attached to the slip tube. The threaded portion of the rising stem valves shall engage the operating nut in the manual operator and shall provide autmoatic self-locking, infinite valve positioning.
2. The threaded portion of the stem shall have a minimum outside diameter of 1-1/2 inches. Stem extension pipes are not acceptable.
3. The stem shall be constructed of solid stainless steel bar for the entire length, the metal having a tensile strength of not less than 75,000 psi.
4. Maximum L/R ratio for the unsupported part of the stem shall not exceed 200.
5. In compression, the stem shall be designed for a critical buckling load caused by a 40 lb effort on the handwheel with a safety factor of 2, using the Euler column formula.
6. The stem shall be designed to withstand the tension load caused by the application of a 40 lb effort on the handwheel without exceeding 1/5 of the ultimate tensile strength of the stem material.
7. The threaded portion of the stem shall have machine rolled double lead threads of the full Acme type with a 16 microinch finish or better. Stub threads are not acceptable.
8. Stems shall be provided with adjustable stop collars to prevent over travel.

G. Stem Guides
1. Stem guide shall be provided when necessary to ensure that the maximum L/R ratio for the unsupported part of the stem is 200 or less.
2. Stem guide brackets shall be fabricated of stainless steel and shall be outfitted with UHMW or bronze bushings.

3. Adjustable in two directions.

H. Anchor Bolts
1. Anchor bolts shall be provided by the valve manufacturer for mounting the pedestal and appurtenances.
2. Quantity and location shall be determined by the valve manufacturer.

I. Materials of Construction
1. Slip tube and bail shall be stainless steel, Type 304L
2. Stem shall be stainless steel, Type 304L
3. Anchor Studs, Fasteners and Nuts shall be stainless steel, Type 316
4. Seal shall be Urethane, Neoprene or Buna-N
5. Lift Nuts shall be stainless stainless steel, Type 304.
6. Pedestals and wall bracks shall be stainless steel, Type 304L
7. Operator Housing shall be cast aluminum
8. Stem cover shall be a clear plastic Butyrate
9. Companion flange shall be cast iron

J. Valve Operator
1. Valves shall be operated by a manual handwheel. The operator shall be mounted on a pedestal
2. The valve manufacturer shall select the proper gear ratio to ensure that the valve can be operated with no more than a 40 lb effort.
3. An arrow with the word "OPEN" shall be permanently attached or cast onto the operator to indicate the direction or rotation to open the valve
4. Handwheel operators shall be fully enclosed and shall have a cast aluminum housing.
5. The handwheel shall be removable. Pedestals shall be constructed of stainless steel. Aluminum pedestals are not acceptable.
6. The pedestal height shall be such that the handwheel is located approximately 36-in above the top of the tank walls.
7. Operators shall be equipped with fracture-resistant clear butyrate.
   a. The top of the stem cover shall be closed.
   b. The bottom end of the stem cover shall be mounted in a housing or adapter for easy field mounting.
   c. Stem covers shall be complete with a mylar strip type position indicator, calibrated in ¼ inch increments to illustrate valve position. The mylar strip, provided by the manufacturer, will be affixed by the CONTRACTOR after installation to provide a true and accurate indication of the tube elevation by comparing it to the top of the rising stem.
8. Valve Schedule:

Parameter	**WAS-VLV-001**	**WAS-VLV-002**
Size, (in)	6”	6”
Max T (deg F)	100	100
Media	Thin Sludge Decant	Thin Sludge Decant
Actuator Type	Manual, Handwheel	Manual, Handwheel
System Pipe	DIP Vertical	DIP Vertical
Service	Open/Close	Open/Close
PID	Y401	Y401
Installation	Exterior-Exposed	Exterior-Exposed

2.09 TAPPING SADDLES:

A. Provide tapping saddles for services as indicated on the Contract Drawings.
B. Acceptable Manufacturers:
   1. A.Y. McDonald 73805
   2. Ford S90-xxx-NL
   3. Mueller
      a. H-13000 Series
      b. H-13400 Series
      c. S-13000 Series
   4. Engineer approved equal.

2.10 CORPORATION STOPS:

A. Provide corporation stops for service reactivations as indicated on the Contract Drawings.
B. Acceptable Manufacturers:
   1. A.Y. McDonald 74701
   2. Cambridge Brass 302NL Series
   3. Ford FB-600-x-NL
   4. Mueller B25000N
   5. Engineer approved equal.

2.11 SAMPLE/DRAIN TAPS:

A. Provide sample/drain taps on all suction and discharge pump connections and on all common pump headers after last pump connection to main header.
B. Connecting fittings and pipe shall of the same material as the receiving pipe and rated for 150 psi service.
C. Sample/drain taps shall be 1 inch and connected through corporation stops.
D. Isolation valves shall be provided with all sample/drain taps and shall be Crane bronze ball valves or Engineer-approved equal.

2.12 ELECTRIC MOTOR ACTUATORS:

A. Provide factory-mounted electric motor actuators conforming to AWWA C540 for open-close and modulating service to operate on 480V, 3 phase, 60-hertz, ac supply. Motor and control compartment enclosure shall be totally enclosed rated NEMA 4X.
C. For valves installed in Class 1, Division 1 or Class 1, Division 2 areas, motor and control compartment enclosures shall be explosionproof and listed for the classification of the area. Refer to Contract Drawings' Hazardous Area Classification Site Plan for requirements.
D. Motor shall be AC induction type, TEFC, rated 460V.
E. Duration for actuator to move from fully-open to fully-closed position, or reverse as indicated:
   1. Approximately 30 Seconds for eccentric plug valves.
   2. Approximately 5 seconds per diameter inch, but not less than 20 seconds for air service butterfly valves.
F. Equipped with a direct position readout at the valve by means of a mechanical dial-position indicator showing percent of valve opening.
G. Provide with manual handwheel operator and lockable de-clutch mechanism. Handwheel shall not rotate when electrically driven.
H. Provide the following integral accessories:
   1. Integral reversing motor starter.

2. Separate non-fused disconnects. Disconnects shall be operable from outside the enclosure and shall be integral to the assembly. Disconnect enclosure rating shall conform to the valve enclosure rating.
3. Local/Off/Remote (LOR) selector switch with auxiliary remote status contact.
4. Open/Close pushbuttons to operate actuator when LOR is in "Local".
5. Hard-wired I/O points as indicated on the Contract Drawings' Control Diagrams and Section 40 61 96A - I/O List. Discrete outputs shall be provided by dry contacts, rated minimum 2A at 120Vac.
6. Butterfly valves:
   a. Internal 480V to 24VDC power supply (PS).
      (1) PS shall be sized to operate starter, local indicating lights, internal heating systems, and provide sufficient volt-amperes to field power two digital inputs and two digital outputs to PLC.
7. Eccentric plug valves:
   a. Internal 480V to 120VAC control power transformer (CPT).
      (1) CPT shall be sized to operate starter, local indicating lights, internal heating systems, and provide sufficient volt-amperes to field power two digital inputs and two digital outputs to PLC.
8. Modulating Valves:
   a. Shall accept a 4-20mA input signal for position control.
   b. Shall provide an isolated 4-20mA isolated output signal (with integral power supply) for position indication.
9. Open/Close Valves:
   a. Provide with two indicating lights in limit switch compartment cover.
      (1) One red light indicating valve is fully open.
      (2) One green light indicating valve is fully closed.
      (3) Both lights shall be on while valve is in travel
   b. Provide 4 train mechanically driven limit switches and overtorque switches.
   c. Switches shall be gear driven from the actuator gear train, electronic switches with battery pack shall not be allowed.
10. Internal heater to prevent condensation.

I. Products of the following manufacturers shall be acceptable:
   a. Auma Actuators, Inc.
   b. Limitorque Corporation.
   C. Rotork Controls, Incorporated.

2.13 COMBINATION AIR VALVES:

A. Acceptable Manufacturers:
   1. Multiplex Manufacturing Co. Model: Crispin SA Series.
   2. Valve and Primer Corp., DeZurik/APCO Model: Series 401.

B. Design: Conform to AWWA C512 and as specified.
   1. Valve shall be heavy-duty combination air release, water style.
   2. Body and cover shall be cast or ductile iron.
   3. Float shall be stainless steel.
   4. All internal parts shall be stainless steel.

C. Operation:
   1. Release air when filling line.
   2. Admit air when emptying line.
   3. Release accumulated air while pipeline is full and operating under pressure.

D. Connection:
   1. Connect air valves 2 inches and smaller to pipeline through corporation stops.
   2. Connecting fittings and pipe shall be bronze, brass, or copper rated for 250 psi service.
   3. Isolation valves shall be provided for all air valves and shall be bronze gate valves for sizes 3 inches and smaller unless otherwise noted.
      a. Acceptable Manufacturers:
         (1) Crane Model: Figure 431.
         (2) Jenkins Model: Figure 47.
         (3) Lunkenheimer Co. Model: Figure 2151.
   4. Couplings or unions indicated between pipeline and air valve piping shall be insulated style.

2.14 FIRE HYDRANTS:

A. Acceptable Manufacturers:
   1. American Flow Control.
   2. Mueller Company, model Centurion.
   3. Engineer Approved Equal

B. Design:
   1. Conform to AWWA C502 and as specified.
   2. Provide compression type main valve designed to open against pressure. Valve facings shall be of nontoxic materials suitable for potable water service.
   3. Provide internal main valve seat opening of not less than 5 inches diameter.
   4. Design to open counterclockwise.
   5. Provide dry-type bonnet with lubricant reservoir protected by O- or Quad-ring seals.
   6. Provide mechanical joint bell on shoe.
   7. Furnish for minimum bury depth of 3.5 feet. Include extensions as required for blow-offs.
   8. Furnish with two 2-1/2-inch hose nozzles and one 4-1/2-inch pumper nozzle with NFPA 1963 standard threads. Nozzle caps shall be chained to hydrant.
   9. Provide traffic break-off joint located above and near ground surface designed to minimize accident repairs.

C. Shop Painting:
   1. Shop paint exterior of hydrants red.
   2. Interior Coating:
      a. Conform to AWWA C550.
      b. Apply to exposed interior ferrous metal surfaces.

2.15 CORPORATION STOPS:

A. Provide corporation stops as specified to isolate air valves or as manual air release or inlet valves.

B. Mueller Company Style H-10003, H-10013, or H-10045 or Engineer-approved equal as applicable.

2.16 CURB STOPS:

A. Provide curb stops for service isolation.

B. Acceptable Manufacturers:
   1. A.Y. McDonald 74701.
   2. Cambridge Brass 302NL Series.
   3. Ford FB-600-x-NL.

4. Mueller B25000N.

2.17 VALVE BOXES:

A. Acceptable Manufacturers:
   1. Clay and Bailey Manufacturing Company.
   2. Dresser Industries, Inc.
   3. Mueller Company.
   4. Neenah Foundry Company.
   5. Tyler Company.
   6. Engineer Approved Equal
B. Provide for all buried valves.
C. Design:
   1. Boxes shall consist of a cast-iron cover, lid, and base castings with 6-inch cast-iron pipe shaft.
   2. Provide extension stem to bring operating nut within 2 feet of valve box top.
   3. Drop cover shall be marked for the appropriate system (i.e., "WATER", “SEWER”).

2.18 CURB STOP SERVICE BOXES:

A. Provide curb stops and service boxes for all curb stops installed.
B. Acceptable Manufacturers:
   1. Tyler Union, Star Pipe, Castings – SB94ES, SB95ES.

2.19 VALVE IDENTIFICATION TAGS:

A. Exposed interior or exterior valves: Provide heavy duty, permanent plastic ID tags with valve number printed on tag using indelible ink and contrasting colors. Minimum tag size shall be 2"x3" and minimum letter height shall be 1". Tag shall be easily removable and shall be mounted so as not to interfere with normal valve operations. Valve ID shall be as identified in the valve schedule.
B. Vault or Pit Installed Valves: Provide a cast bronze floor plate to be anchored into the top concrete slab of pit or valve adjacent to the floor box or floor stand. Plate shall be minimum of 4"x3"x 3/16". Valve number shall be engraved in plate with minimum letter height of 1 1/2". Plate shall be anchored into concrete using threaded lugs with split stud anchor or other suitable anchoring device. Valve number shall be as identified in the valve schedule.

2.20 VALVE ACCESSORIES:

A. Post Indicator:

2.21 SHOP PAINTING:

A. Prepare surfaces and paint or coat all valves, fire hydrants, floor stands, valve boxes, corporation stops, and all related accessories standard of the manufacturer unless otherwise specified herein.
B. Paint and coatings shall be suitable for the service intended.
C. Submit type of paint or coating proposed with drawings and data for Engineer approval prior to fabrication.

PART 3 - EXECUTION

3.01 INSTALLATION:

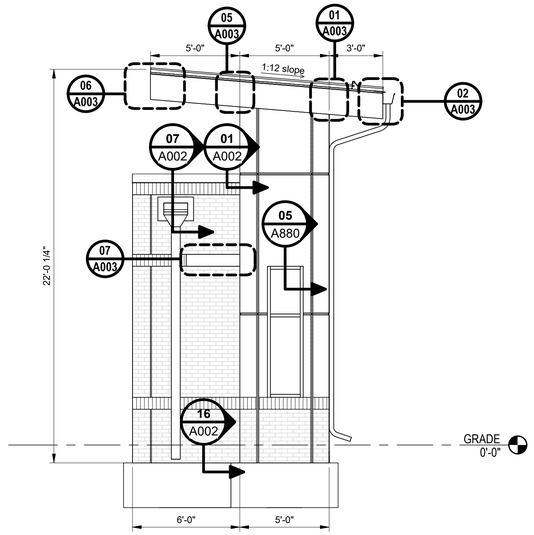
A. Comply with provisions of AWWA C600 and as specified.

B. Thoroughly clean and remove all shipping materials prior to setting. Operate all valves from fully opened to totally closed.
C. Install eccentric plug valves in reverse position, flow and pressure against the plug face when closed, in lines with solids or stringy materials. When installed horizontally with shaft in the horizontal, the plug shall rotate open to the top recess of the valve body.
D. Install double-door wafer check valves with hinge pin in the vertical position for horizontal flow applications.
E. Install single-door wafer swing check valves with hinge pin in the horizontal position for horizontal flow applications.
F. Equip with anchorage where indicated.
G. Set fire hydrants with lowest nozzle 18 inches above finished grade. Check and fill stem bonnet lubricant reservoir.

3.02 FIELD TESTING:

A. Perform on piping and valves as specified in Section 33 31 50 - Pipe Installation and for the following:
    1. Gate valves.
    2. Butterfly valves.
    3. Check valves.
    4. Eccentric plug valves.
    5. Ball valves.
    6. Air and air/vacuum valves.
    7. Fire hydrants.

END OF SECTION 33 12 16

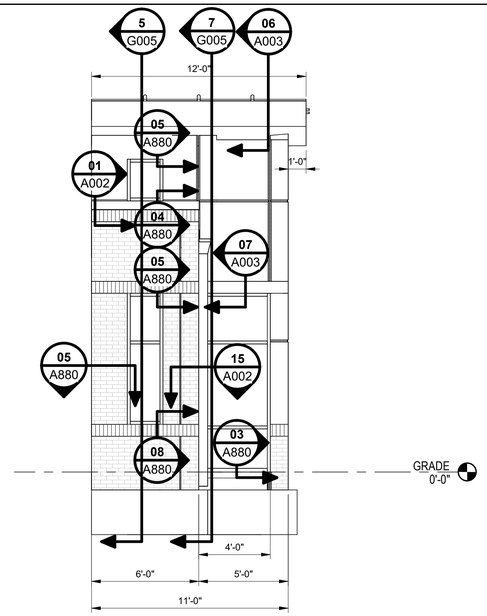


ELEVATION 4 G005

Elevation 4 - a

0 2' 4' 8'

SCALE IN FEET



ELEVATION 3 G005

Elevation 5 - a

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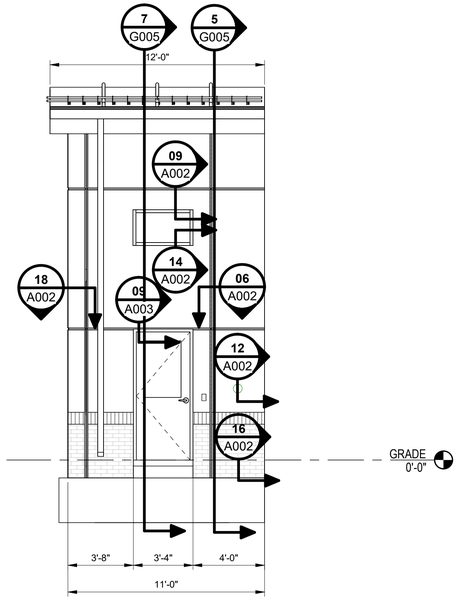

ELEVATION 2 G005

Elevation 6 - a

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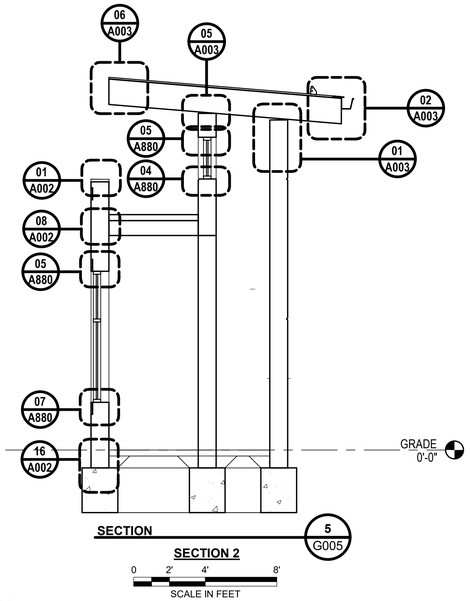

SECTION 5 G005

SECTION 2

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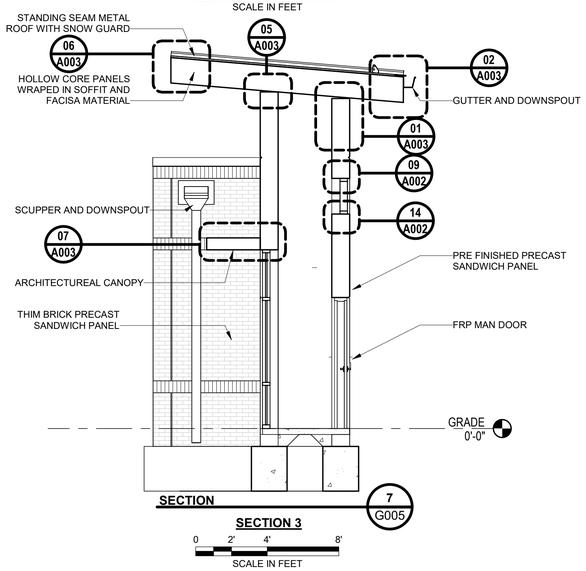
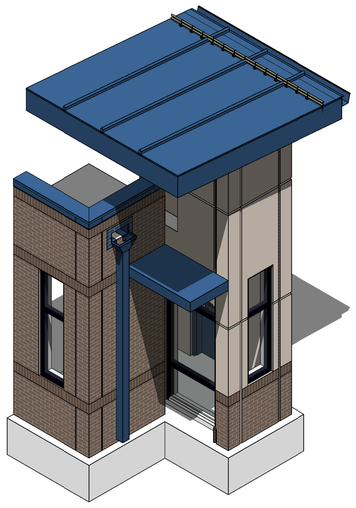


SECTION 7 G005

SECTION 3

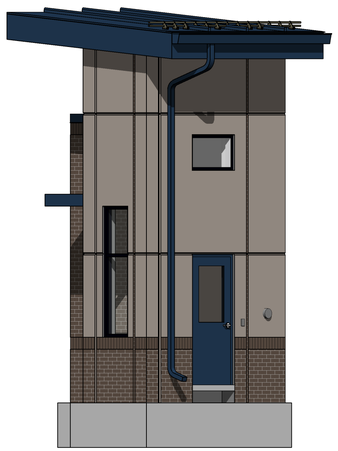
0 2' 4' 8'

SCALE IN FEET



MOCK-UP 3D VIEW 3

NOT TO SCALE

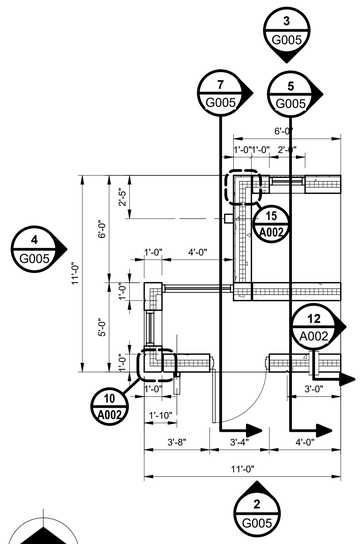


MOCK-UP 3D VIEW 2

NOT TO SCALE

MOCK-UP 3D VIEW 1

NOT TO SCALE



NORTH

MOCKUP PLAN

0 2' 4' 8'

SCALE IN FEET

PRELIMINARY - NOT FOR CONSTRUCTION

KCWATER SERVICES

CUSTOM ENGINEERING
MECHANICAL & ELECTRICAL ENGINEERING

DuBois Consultants
CIVIL + STRUCTURAL ENGINEERING

WELLNER architects

BURNS McDONNELL
9400 WARD PARKWAY
KANSAS CITY, MO 64114
Burns & McDonnell Engineering Co, Inc
816-333-9400
Licensee No. 000165

NO.	DATE	BY:	CHECKED:	DESCRIPTION
REVISION BLOCK				

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

STATE OF MISSOURI
JASON SCOTT BARKER
NUMBER A-2005001198
REGISTERED ARCHITECT

JASON SCOTT BARKER
ARCHITECT
A-2005001198

FOR WSD USE:

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN RD, KANSAS CITY, MO 64163

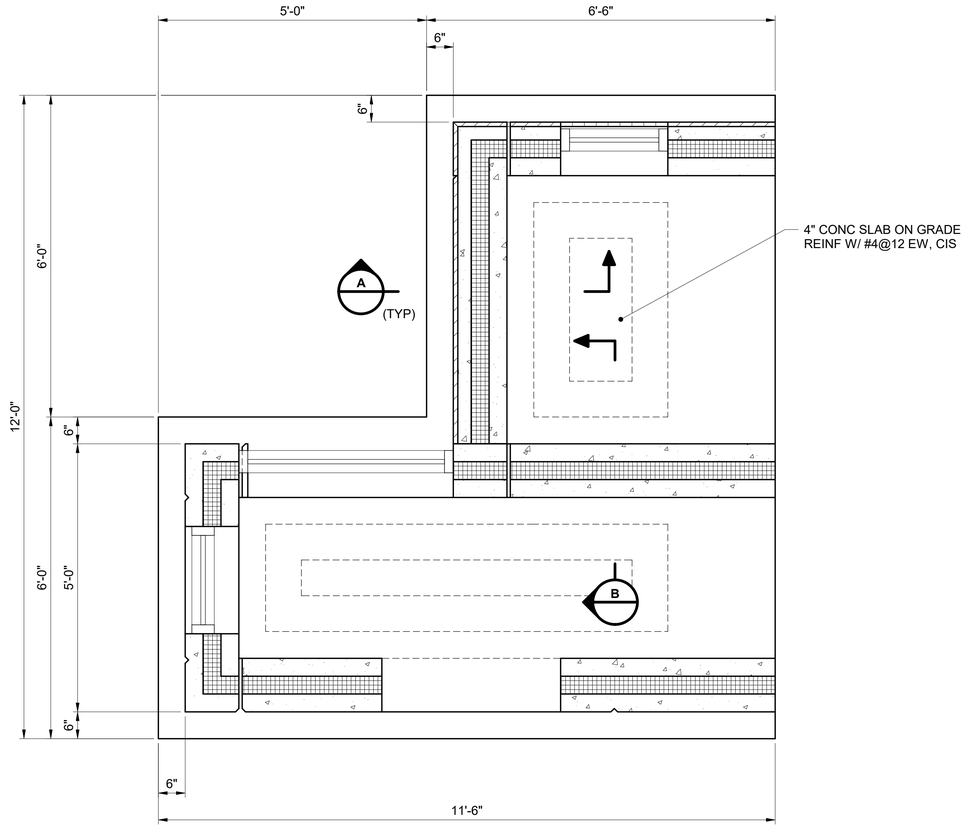
MOCK-UP

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
Author	Checker		34W		

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	02/09/26

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1587	-	-	-	G005

PROJECT NO. 125460 SHEET OF 560

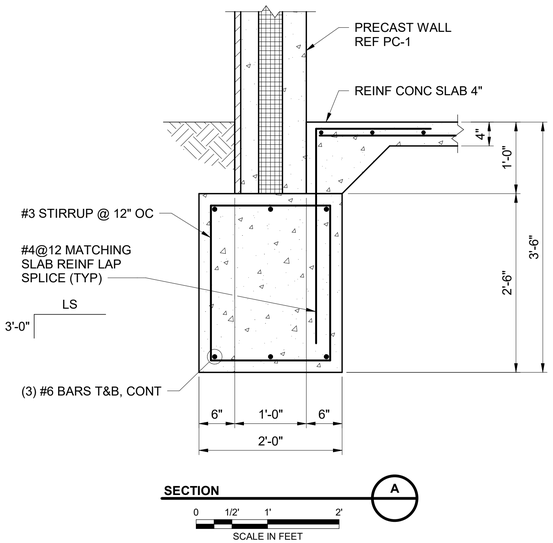


MOCKUP PLAN

0 1' 2' 3'

SCALE IN FEET

NORTH



SECTION A

0 1/2' 1' 2'

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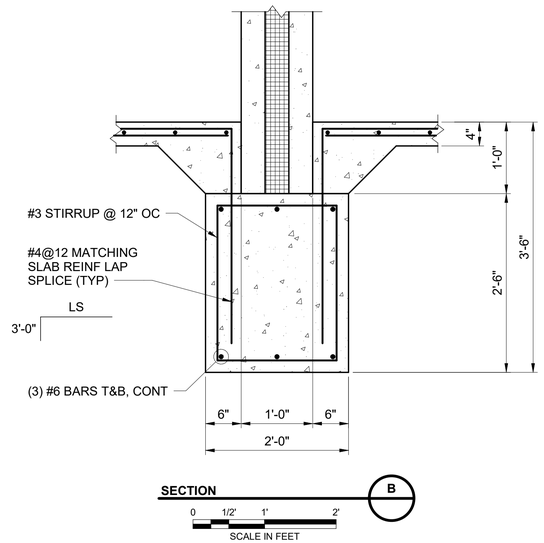

SECTION B

0 1/2' 1' 2'

SCALE IN FEET

ADMINISTRATION BUILDING MOCKUP FOUNDATION NOTES:

1. MOCKUP FOUNDATION IS DESIGNED TO BE REPRESENTATIVE OF THE ACTUAL FOUNDATION FOUND AT THE ADMINISTRATION BUILDING, AND TO REPRESENT THE INSTALLED CONDITION AT THE BUILDING.
2. PROVIDE ALL NECESSARY CONNECTORS TO CONNECT MOCKUP PANELS TO THE FOUNDATION.
3. SEE SPECIFICATION SECTION 01 43 39 FOR ADDITIONAL MOCKUP REQUIREMENTS.
4. SEE DRAWING S002 FOR GENERAL NOTES.
5. SEE DRAWING S003 THROUGH S014 FOR STANDARD DETAILS.
6. FOUNDATION SHALL BEAR ON NATIVE SUBGRADE PREPARED IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS. GROUND IMPROVEMENT IS NOT REQUIRED.
7. CONCRETE WORK SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 03 30 00.
8. THE DRAWING REPRESENT THE FINISHED MOCKUP. CONTRACTOR IS RESPONSIBLE FOR MEANS AND METHODS OF CONSTRUCTION, INCLUDING BUT NOT LIMITED TO, TEMPORARY BRACING AND SHORING DESIGNED IN ACCORDANCE WITH ASCE 37, DESIGN LOADS ON STRUCTURES DURING CONSTRUCTION AND OTHER APPLICABLE CODES AND STANDARDS.

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WELLNER architects
BURNS McDONNELL
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KANSAS CITY, MO 64114
Burns & McDonnell Engineering Co, Inc
816-333-9400
Licensee No. 000165

NO.	DATE	BY:	CHECKED:	DESCRIPTION
0	2/18/2026	JT	AMH	ISSUED FOR BID

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

STATE OF MISSOURI
JOHN TSOUFLIAS
2015001427
PROFESSIONAL ENGINEER

JOHN TSOUFLIAS
STRUCTURAL
LICENSE NO. 2015001427

FOR WSD USE:

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

MOCK-UP

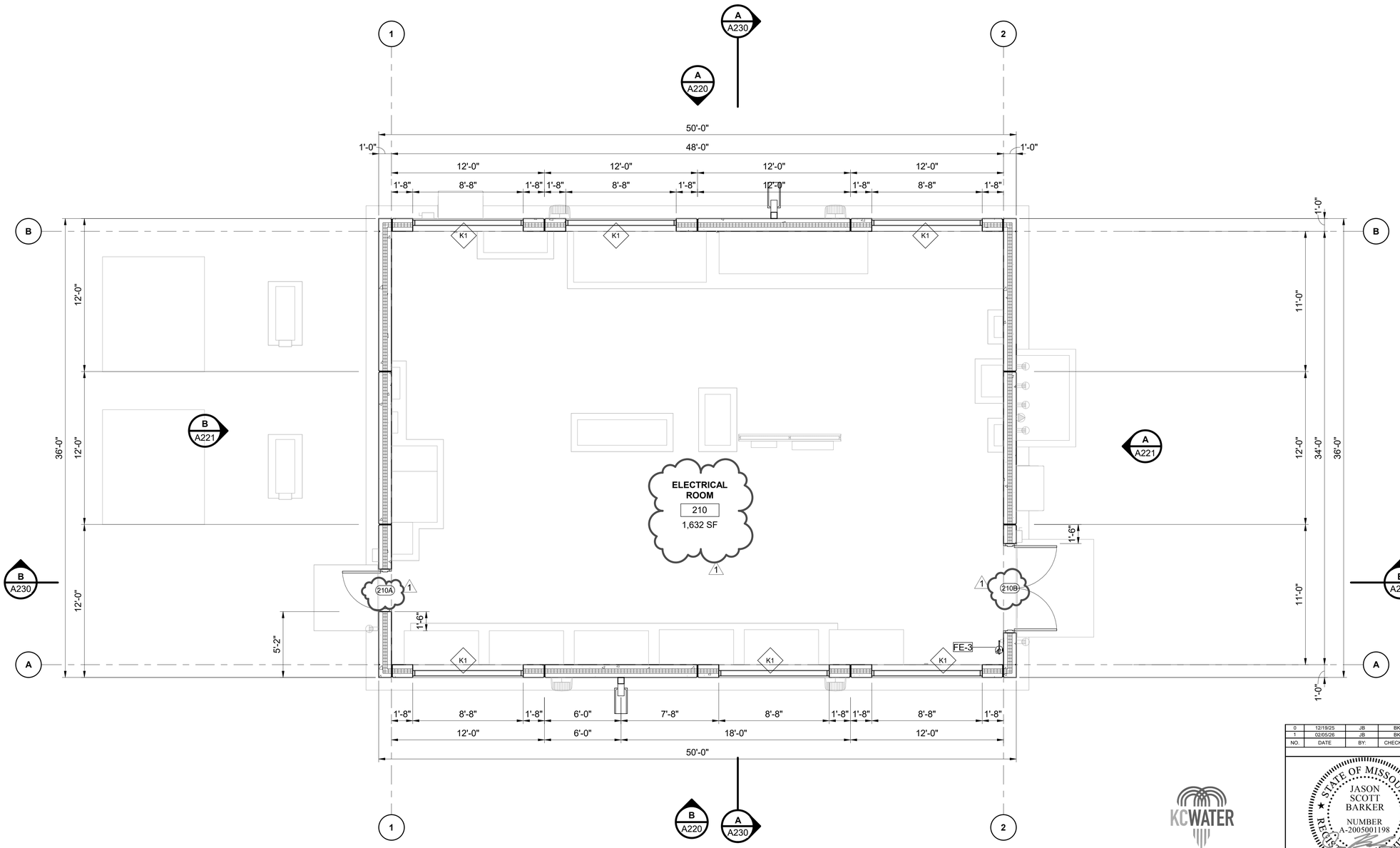
DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
B. BAIR	A. HOLMES	2/18/2026	34W		

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	02/17/26

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	G006

PROJECT NO. 81000927

SHEET OF 643



PLAN

0 2' 4' 8'

SCALE IN FEET

NORTH

NO.	DATE	BY:	CHECKED:	DESCRIPTION
0	12/19/25	JB	BK	ISSUED FOR BID
1	02/05/26	JB	BK	ADDENDUM 6

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

INFLUENT PUMP STATION ELECTRICAL BUILDING FLOOR PLAN

KCWATER

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MECHANICAL & ELECTRICAL ENGINEERING

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WELLNER architects

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STATE OF MISSOURI
JASON SCOTT BARKER
NUMBER A-2005001198
REGISTERED ARCHITECT

JASON SCOTT BARKER
ARCHITECTURAL
A-2005001198

FOR WSD USE:

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
BK	JB		34W	52N	01

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

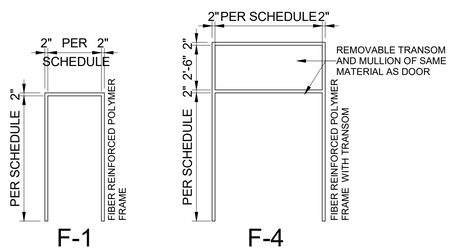
CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	A210

PROJECT NO. 81000927 SHEET OF 643

DOOR SCHEDULE

	DOORS						FRAMES							
DOOR #	TYPE	MATERIAL	FINISH	SIZE WIDTH	SIZE HEIGHT	SIZE THICKNESS	TYPE	MATERIAL	FINISH	DETAILS JAMB	DETAILS HEAD	FIR RATING	HARDWARE SET	REMARKS
210A	B	FRP	POLYESTER GEL COAT	3'-0"	7'-2"	0'-1 3/4"	F-1	FRP	POLYESTER GEL COAT	08/A003	09/A003		2	
210B	C	FRP	POLYESTER GEL COAT	6'-8"	7'-2"	0'-1 3/4"	F-4	FRP	POLYESTER GEL COAT	08/A003	09/A003		3	

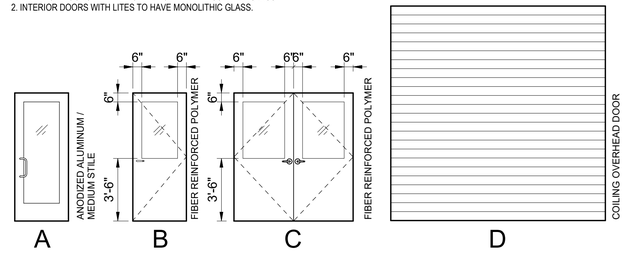
1



FRAME TYPES

REMARKS:

1. EXTERIOR DOORS WITH LITES ARE TO HAVE 1" INSULATED GLASS.
2. INTERIOR DOORS WITH LITES TO HAVE MONOLITHIC GLASS.



*REFER TO DOOR SCHEDULE FOR DOOR SIZES

DOOR TYPES

GENERAL DOOR & HARDWARE NOTES:

1. CONTRACTOR IS RESPONSIBLE FOR PROVIDING CONSTRUCTION CORES.
2. ALL INTERIOR AND EXTERIOR DOORS TO HAVE ROOM IDENTIFICATION SIGNAGE PLACED PER DETAIL.
3. DOORS BETWEEN ROOMS OTHER THAN HALLWAYS/CORRIDORS ARE TO HAVE ROOM IDENTIFICATION SIGNS ON BOTH SIDES OF DOOR.
4. STAIRWELL DOORS TO HAVE ROOM IDENTIFICATION SIGNS INSIDE STAIRWELL AND STAIRWELL SIGNAGE ON EXTERIOR OF STAIRWELL DOORS INDICATING NO ROOF ACCESS, CURRENT FLOOR LEVEL AND WHAT DIRECTION IS THE EXIT LEVEL.
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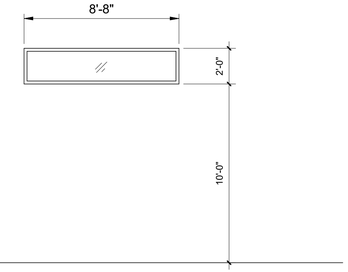

KALWALL FRAMES PER MANUFACTURER

WINDOW TYPES

NO.	DATE	BY:	CHECKED:	DESCRIPTION
0	12/19/25	JB	BK	ISSUED FOR BID
1	02/05/26	JB	BK	ADDENDUM 6

REVISIONS

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JASON SCOTT BARKER
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REGISTERED ARCHITECT

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ARCHITECTURAL
A-2005001198

FOR WSD USE:

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

INFLUENT PUMP STATION ELECTRICAL BUILDING SCHEDULES

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
BK	JB		34W	52N	01

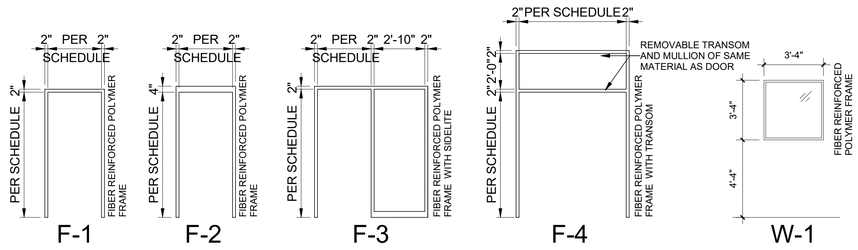
CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	A280

PROJECT NO.	SHEET	OF
81000927		643

DOOR SCHEDULE

DOOR #	DOORS TYPE	DOORS MATERIAL	DOORS FINISH	DOORS SIZE WIDTH	DOORS SIZE HEIGHT	DOORS SIZE THICKNESS	FRAMES TYPE	FRAMES MATERIAL	FRAMES FINISH	DETAILS JAMB	DETAILS HEAD	FIRE RATING	HARDWARE GROUP	REMARKS
300A	C	FRP	POLYESTER GEL COAT	6'-8"	7'-2"	0'-1 3/4"	F-4	FRP	POLYESTER GEL COAT	08/A003	09/A003		3	
300B	B	FRP	POLYESTER GEL COAT	3'-0"	7'-2"	0'-1 3/4"	F-1	FRP	POLYESTER GEL COAT	08/A003	09/A003	CLASS 1/ DIV 1	2	
301A	B	FRP	POLYESTER GEL COAT	3'-0"	7'-2"	0'-1 3/4"	F-1	FRP	POLYESTER GEL COAT	08/A003	09/A003		2	
301B	D	316 S.S.	POLYESTER GEL COAT	12'-0"	12'-0"	0'-3"	-	-	POLYESTER POWDER COAT	10/A003	10/A003	CLASS 1/ DIV 1	-	CLASS 1 DIV 1 MOTOR
301C	B	FRP	POLYESTER GEL COAT	3'-0"	7'-2"	0'-1 3/4"	F-1	FRP	POLYESTER GEL COAT	08/A003	09/A003	45	5	
302A	B	FRP	POLYESTER GEL COAT	3'-0"	7'-2"	0'-1 3/4"	F-1	FRP	POLYESTER GEL COAT	08/A003	09/A003		2	
304A	B	FRP	POLYESTER GEL COAT	3'-0"	7'-2"	0'-1 3/4"	F-1	FRP	POLYESTER GEL COAT	08/A003	09/A003	45	5	
305A	B	FRP	POLYESTER GEL COAT	3'-0"	7'-2"	0'-1 3/4"	F-1	FRP	POLYESTER GEL COAT	08/A003	09/A003		2	



FRAME TYPES

REMARKS:

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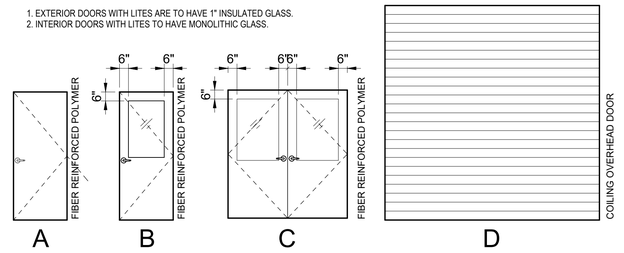
2. INTERIOR DOORS WITH LITES TO HAVE MONOLITHIC GLASS.



*REFER TO DOOR SCHEDULE FOR DOOR SIZES

DOOR TYPES

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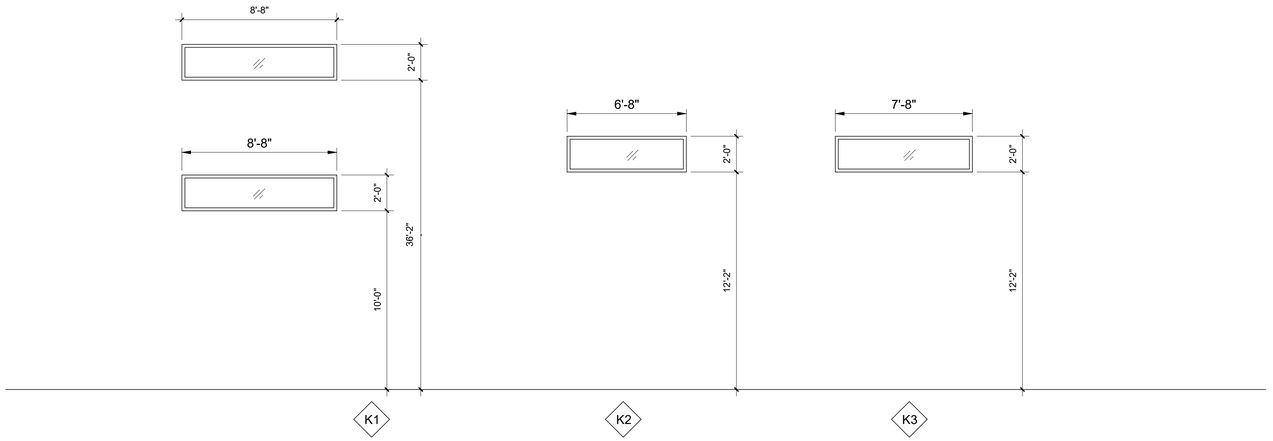
5. ROOMS IDENTIFIED AS BLOWER ARE TO HAVE WARNING SIGNS WITH SYMBOL: DANGER EAR PROTECTION REQUIRED



KALWALL FRAMES PER MANUFACTURER

WINDOW TYPES

NO.	DATE	BY:	CHECKED:	REVISIONS
0	12/19/25	JB	BK	ISSUED FOR BID
1	02/05/26	JB	BK	ADDENDUM 6

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FOR WSD USE:

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

HEADWORKS SCHEDULES

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
BK	JB		34W	53N	36

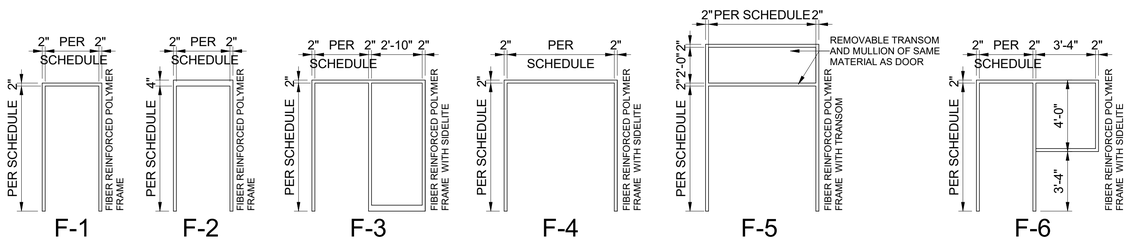
CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	A380

PROJECT NO. 81000927 SHEET OF 643

DOOR SCHEDULE

	DOORS						FRAMES							
DOOR #	TYPE	MATERIAL	FINISH	SIZE WIDTH	SIZE HEIGHT	SIZE THICKNESS	TYPE	MATERIAL	FINISH	DETAILS JAMB	DETAILS HEAD	FIRE RATING	HARDWARE SET	REMARKS
400A	C	FRP	POLYESTER GEL COAT	6'-8"	7'-2"	0'-1 3/4"	F-5	FRP	POLYESTER GEL COAT	08/A003	09/A003		3	
400B	B	FRP	POLYESTER GEL COAT	3'-0"	7'-2"	0'-1 3/4"	F-1	FRP	POLYESTER GEL COAT	08/A003	09/A003		2	
400C	B	FRP	POLYESTER GEL COAT	3'-0"	7'-2"	0'-1 3/4"	F-6	FRP	POLYESTER GEL COAT	08/A003	09/A003		4	
401A	D	316 S.S.	POLYESTER POWDER COAT	12'-0"	12'-0"	0'-3"	F-1	-	-	10/A003	10/A003		-	MOTOR
401B	B	FRP	POLYESTER GEL COAT	3'-0"	7'-2"	0'-1 3/4"	F-1	FRP	POLYESTER GEL COAT	08/A003	09/A003		2	
401C	D	316 S.S.	POLYESTER POWDER COAT	12'-0"	12'-0"	0'-3"	F-1	-	-		10/A003		-	MOTOR
401D	B	FRP	POLYESTER GEL COAT	3'-0"	7'-2"	0'-1 3/4"	F-1	FRP	POLYESTER GEL COAT	08/A003	09/A003		2	



FRAME TYPES

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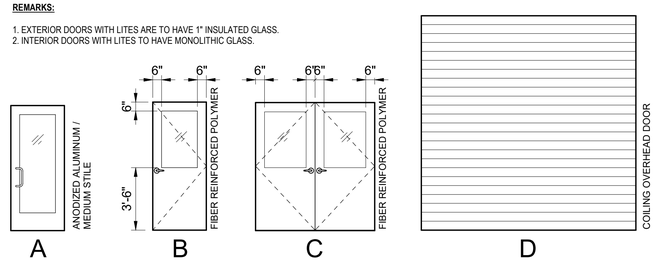

*REFER TO DOOR SCHEDULE FOR DOOR SIZES

DOOR TYPES

GENERAL DOOR & HARDWARE NOTES:

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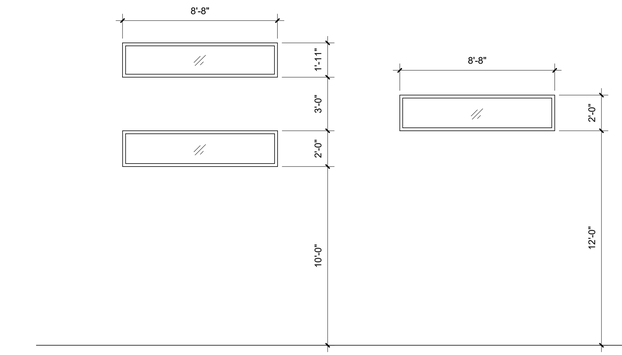

K1 KALWALL FRAMES PER MANUFACTURER

WINDOW TYPES

NO.	DATE	BY:	CHECKED:	DESCRIPTION
0	12/19/25	JB	BK	ISSUED FOR BID
1	02/05/26	JB	BK	ADDENDUM 6

REVISIONS

KCWATER
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FOR WSD USE:

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

BLOWER BUILDING SCHEDULES

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
BK	JB		34W	53N	36

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	A481

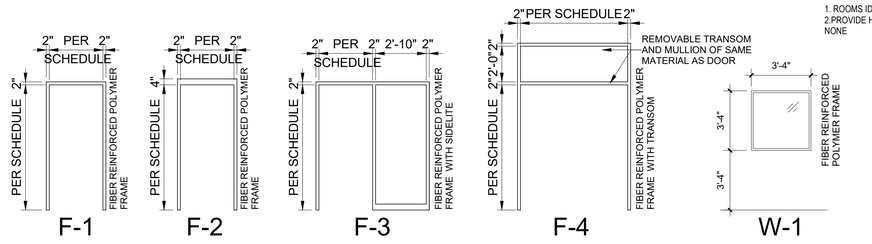
PROJECT NO. 81000927 SHEET OF 643

FINISH SCHEDULE

ROOM NUMBER	ROOM NAME	FLOOR	BASE	WALL				REMARKS
				NORTH	EAST	SOUTH	WEST	
700	BLOWER							
701	ELECTRICAL							
702	PROCESS							

DOOR SCHEDULE

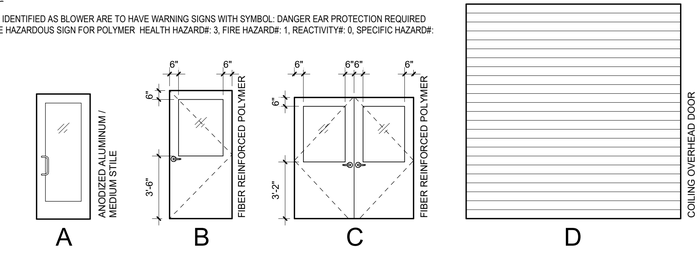
DOOR #	DOORS TYPE	DOORS MATERIAL	DOORS FINISH	SIZE WIDTH	SIZE HEIGHT	SIZE THICKNESS	FRAMES TYPE	FRAMES MATERIAL	FRAMES FINISH	DETAILS JAMB	DETAILS HEAD	FIRE RATING	HARDWARE GROUP	REMARKS
700A	B	FRP	POLYESTER GEL COAT	3'-0"	7'-2"	0'-1 3/4"	F-1	FRP	POLYESTER GEL COAT	08/A003	09/A003	-	2	1
700B	D	316 S.S.	POLYESTER POWDER COAT	12'-0"	10'-0"	0'-3"	-	-	-	10/A003	10/A003	-	-	MANUAL
701A	C	FRP	POLYESTER GEL COAT	7'-0"	7'-2"	0'-1 3/4"	F-4	FRP	POLYESTER GEL COAT	08/A003	09/A003	-	3	
701B	C	FRP	POLYESTER GEL COAT	7'-0"	7'-2"	0'-1 3/4"	F-4	FRP	POLYESTER GEL COAT	08/A003	09/A003	-	3	
702A	C	FRP	POLYESTER GEL COAT	7'-0"	7'-2"	0'-1 3/4"	F-3	FRP	POLYESTER GEL COAT	08/A003	09/A003	-	3	2
702B	B	FRP	POLYESTER GEL COAT	3'-6"	7'-2"	0'-1 3/4"	F-1	FRP	POLYESTER GEL COAT	08/A003	09/A003	-	2	2
702C	D	316 S.S.	POLYESTER POWDER COAT	12'-0"	12'-0"	0'-3"	-	-	-	10/A003	10/A003	-	4	MANUAL



FRAME TYPES

REMARKS:

1. ROOMS IDENTIFIED AS BLOWER ARE TO HAVE WARNING SIGNS WITH SYMBOL: DANGER EAR PROTECTION REQUIRED
2. PROVIDE HAZARDOUS SIGN FOR POLYMER HEALTH HAZARD#: 3, FIRE HAZARD#: 1, REACTIVITY#: 0, SPECIFIC HAZARD#: NONE



*REFER TO DOOR SCHEDULE FOR DOOR SIZES

DOOR TYPES

GENERAL DOOR & HARDWARE NOTES:

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4. EXTERIOR DOORS WITH LITES ARE TO HAVE 1" INSULATED GLASS.
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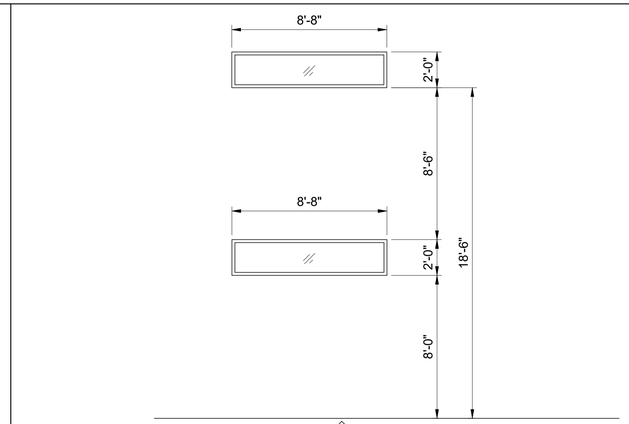

KALWALL FRAMES PER MANUFACTURER

WINDOW TYPES

NO.	DATE	BY:	CHECKED:	REVISIONS
0	12/19/25	JB	BK	ISSUED FOR BID
1	02/05/26	JB	BK	ADDENDUM 6

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FOR WSD USE:

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

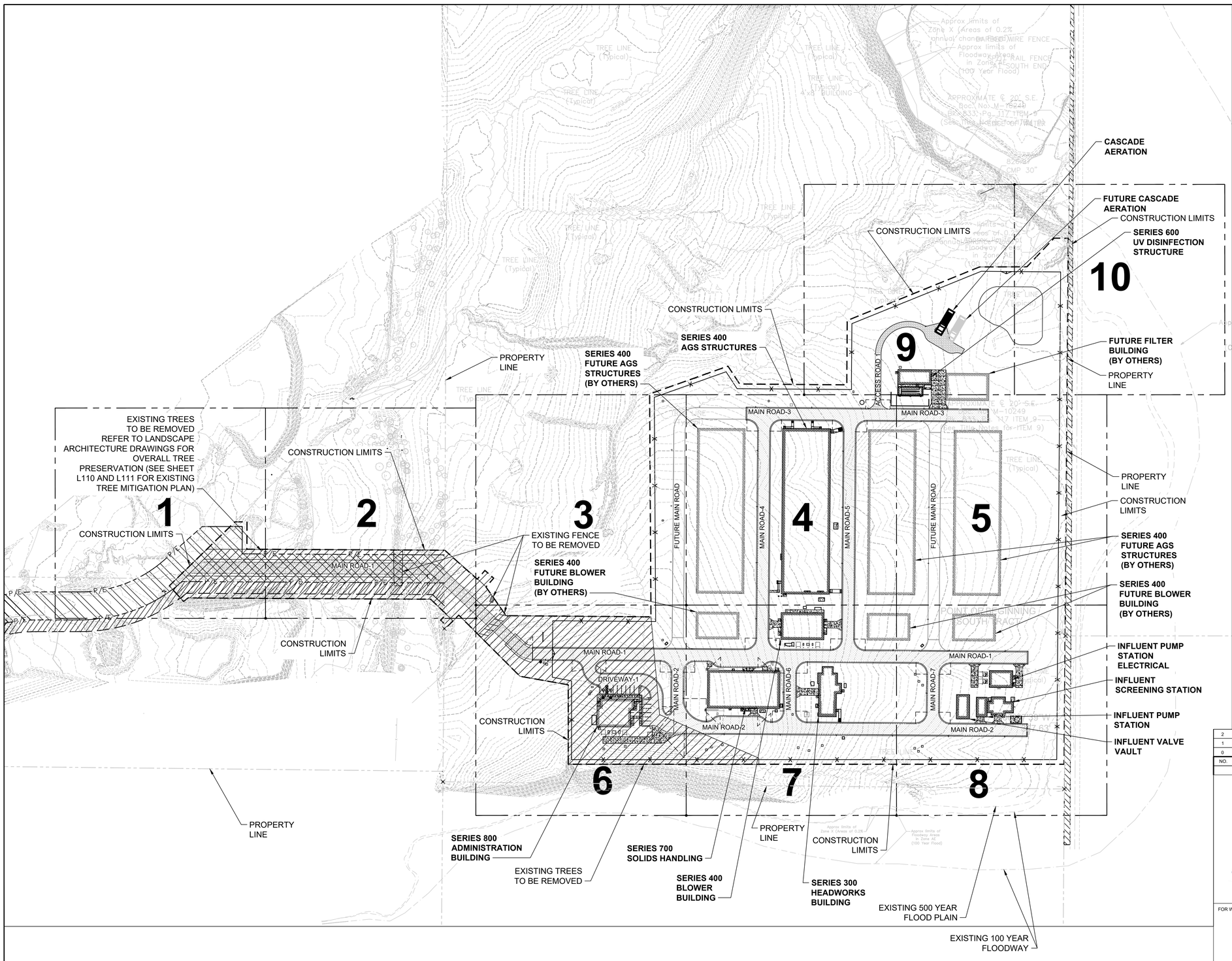
SOLIDS HANDLING SCHEDULES

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
BK	JB		34W	53N	36

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	A780

PROJECT NO. 81000927 SHEET OF 643

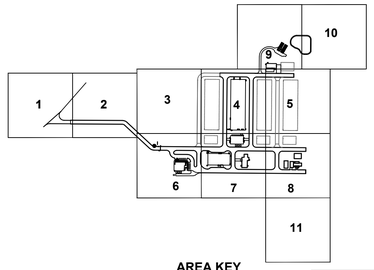


DEMOLITION NOTES:

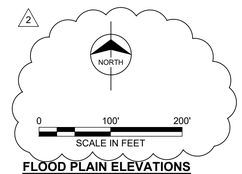
1. CONTRACTOR TO PROTECT ALL TREES THAT WILL NOT BE DESTROYED BY CONSTRUCTION ACTIVITIES. CONTRATOR SHALL REMOVE ONLY THOSE TREES REQUIRED TO GRADE THE SITE TO THE FINAL GRADES SHOWN ON THE GRADING PLAN. IN NO CASE SHALL THE CONTRACTOR REMOVE TREES OR OTHER EXISTING VEGETATION OUTSIDE OF THE LIMITS OF CONSTRUCTION.

LEGEND

TREE AREA TO BE CLEARED WITHIN CONSTRUCTION LIMITS



AREA KEY



FLOOD PLAIN ELEVATIONS

100 YR. 837.00
500 YR. 839.00

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KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

STATE OF MISSOURI · CERVENTE D. SUDDUTH · NUMBER PE-2011015802 · PROFESSIONAL ENGINEER
12/19/2025

FOR WSD USE:

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

GENERAL SITE AND DEMOLITION PLAN

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
ODJ	JPG	12/19/2025	34W	53N 52N	36 01

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698				C102

PROJECT NO.	SHEET	OF
81000927	6	643

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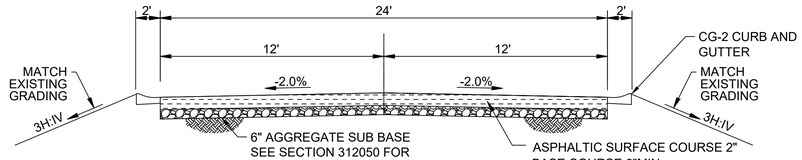
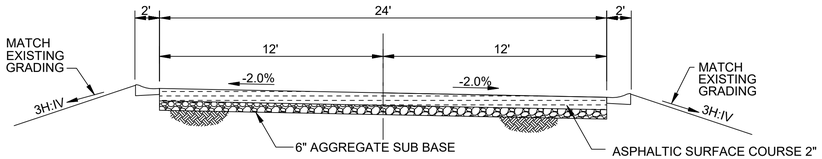
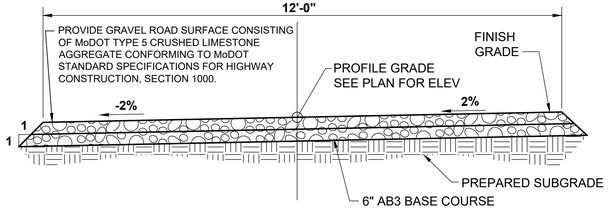


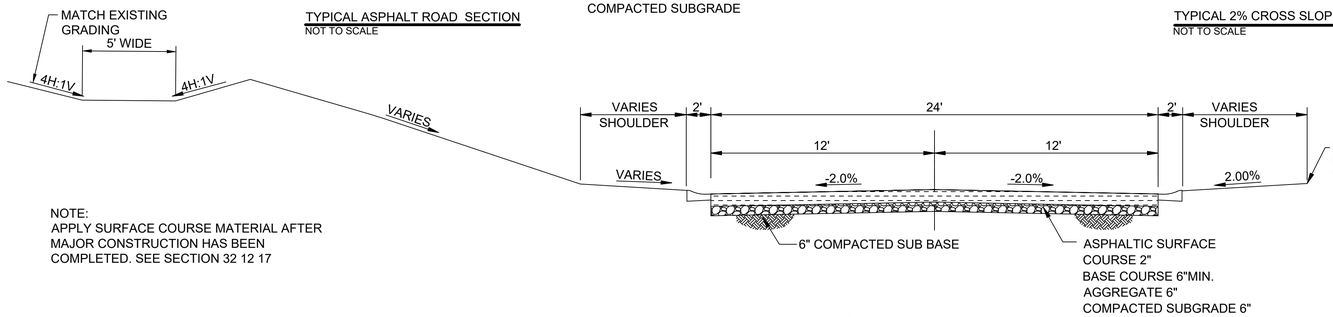
TYPICAL ASPHALT ROAD SECTION
NOT TO SCALE



TYPICAL 2% CROSS SLOPE ASPHALT ROAD SECTION
NOT TO SCALE

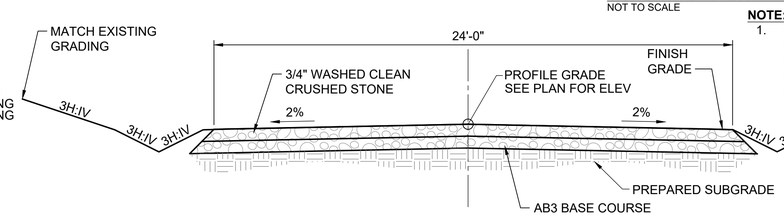


GRAVEL ROAD ACCESS ROAD 1
NOT TO SCALE



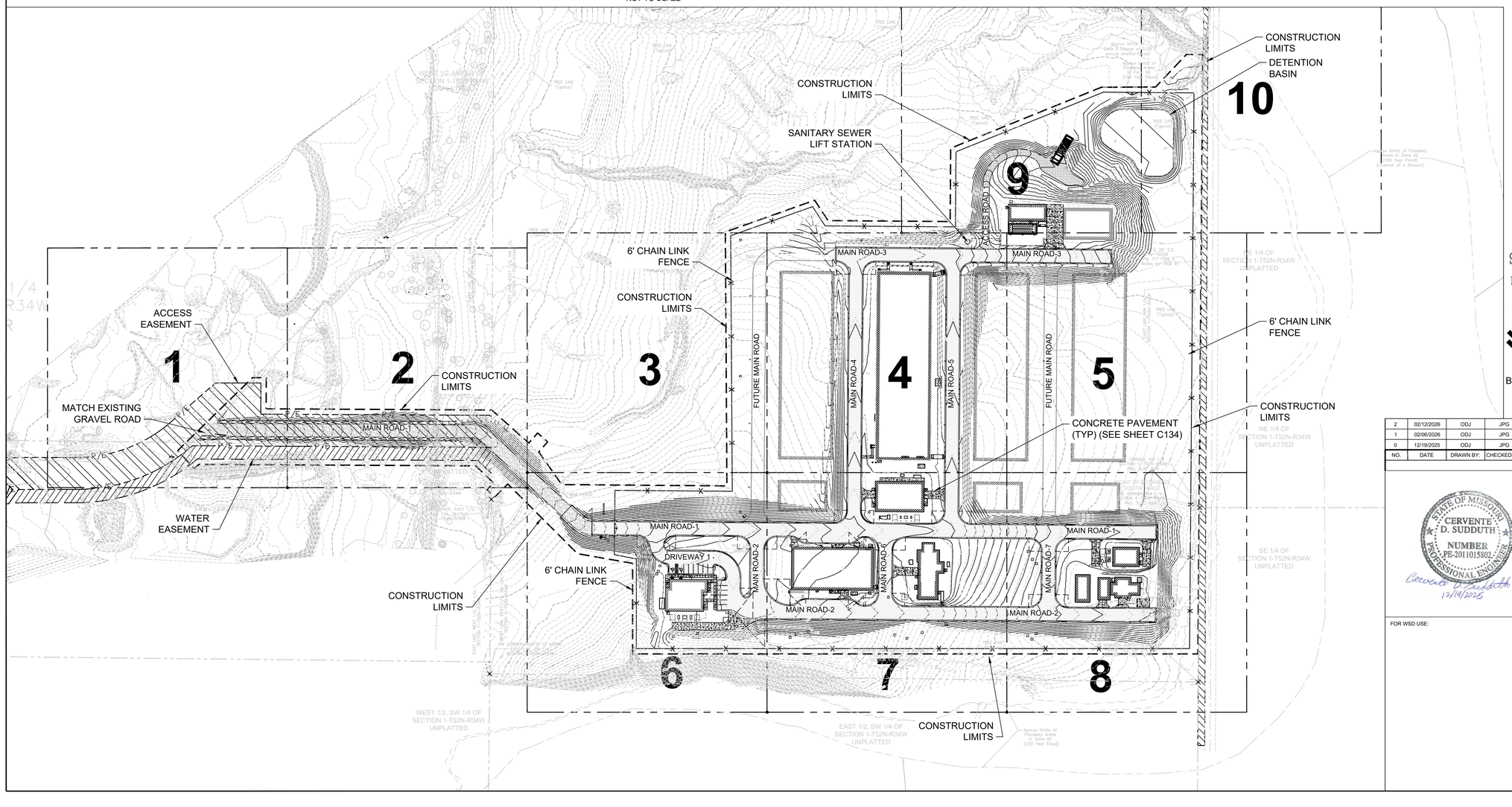
NOTE:
APPLY SURFACE COURSE MATERIAL AFTER MAJOR CONSTRUCTION HAS BEEN COMPLETED. SEE SECTION 32 12 17

TYPICAL ASPHALT ROAD SECTION
NOT TO SCALE



NOTE:
1. GRAVEL DRIVE IS TO CONSIST OF A 6" AB3 BASE COURSE AND A 6" SURFACE COURSE OF 3/4" WASHED CLEAN CRUSHED STONE. SEE SECTION 312050 FOR GRADATION

GRAVEL ROAD (MAIN ROAD 1)
NOT TO SCALE



SIGN LEGEND

STOP = STOP SIGN

RESERVED PARKING VAN ACCESSIBLE = HANDICAP PARKING SIGN

NOTES:
1. SEE SHEET C103-C111 FOR FENCE COORDINATE TABLES.
2. SEE SHEET C134 FOR PAVEMENT DETAILS.
3. SEE SHEET C134 FOR CONCRETE WALK DETAILS.
4. MAINTAIN 20' CLEAR ZONE CENTERED ON FENCE.

PAVEMENT LEGEND

= ASPHALTIC PAVEMENT

= CONCRETE SIDEWALK

= GRAVEL ROAD SURFACING

NORTH
0 100' 200'
SCALE IN FEET

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STATE OF MISSOURI · CERVENTE D. SUDDUTH · NUMBER PE-2011015802 · PROFESSIONAL ENGINEER
12/19/2025

FOR WSD USE:

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

GENERAL SITE ROAD PLAN

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
ODJ	JPG	12/19/2025	34W	53N 52N	36 01

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698				C123

PROJECT NO.	SHEET	OF
81000927	27	643

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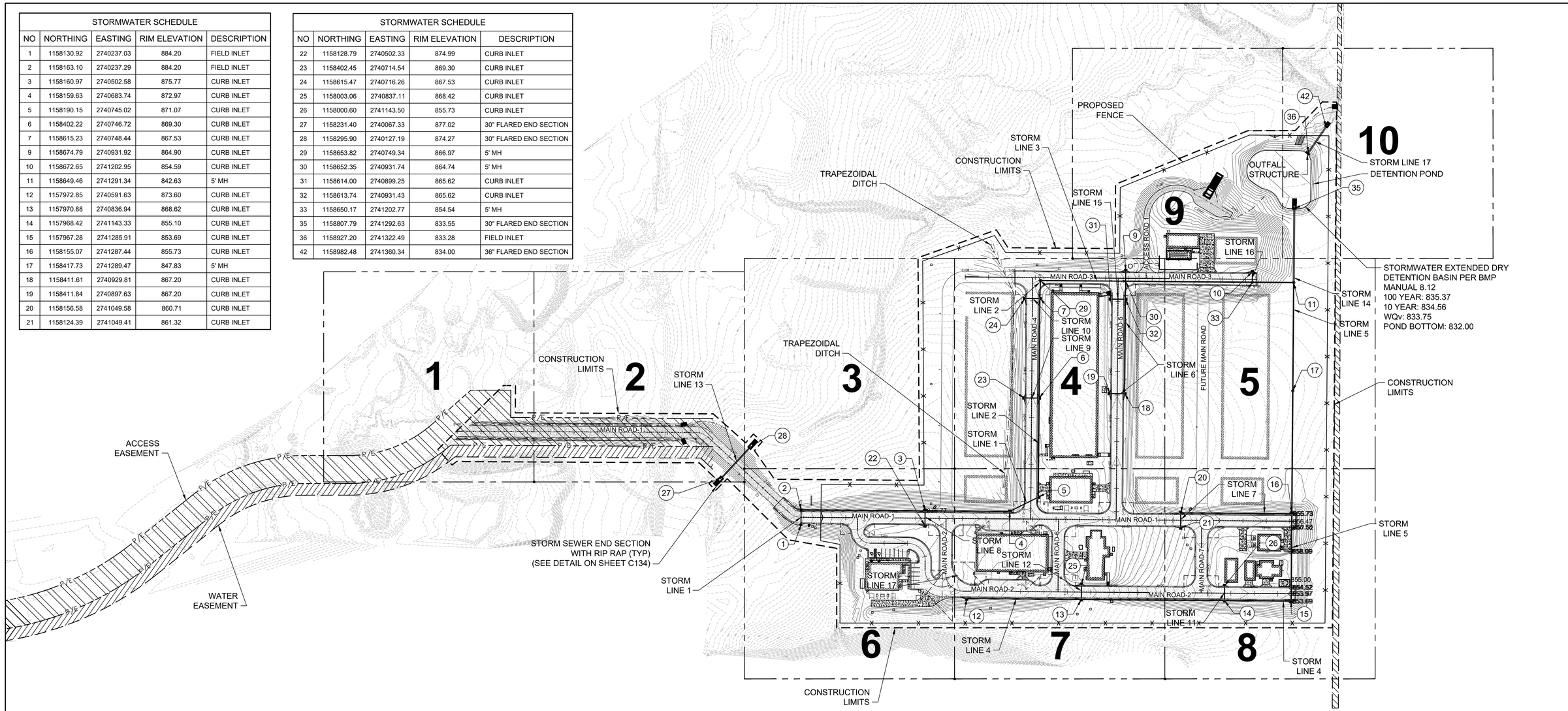
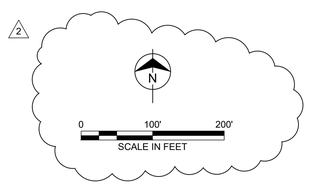
STORMWATER SCHEDULE				
NO	NORTHING	EASTING	RIM ELEVATION	DESCRIPTION
1	1158130.92	2740237.03	884.20	FIELD INLET
2	1158163.10	2740237.29	884.20	FIELD INLET
3	1158160.97	2740502.58	875.77	CURB INLET
4	1158159.63	2740683.74	872.97	CURB INLET
5	1158190.15	2740745.02	871.07	CURB INLET
6	1158402.22	2740746.72	869.30	CURB INLET
7	1158615.23	2740748.44	867.53	CURB INLET
9	1158674.79	2740931.92	864.90	CURB INLET
10	1158672.65	2741202.95	854.59	CURB INLET
11	1158649.46	2741291.34	842.63	5' MH
12	1157972.85	2740591.63	873.60	CURB INLET
13	1157970.88	2740836.94	868.62	CURB INLET
14	1157968.42	2741143.33	855.10	CURB INLET
15	1157967.28	2741285.91	853.69	CURB INLET
16	1158155.07	2741287.44	855.73	CURB INLET
17	1158417.73	2741289.47	847.83	5' MH
18	1158411.61	2740929.81	867.20	CURB INLET
19	1158411.84	2740897.63	867.20	CURB INLET
20	1158156.58	2741049.58	860.71	CURB INLET
21	1158124.39	2741049.41	861.32	CURB INLET

STORMWATER SCHEDULE				
NO	NORTHING	EASTING	RIM ELEVATION	DESCRIPTION
22	1158128.79	2740502.33	874.99	CURB INLET
23	1158402.45	2740714.54	869.30	CURB INLET
24	1158615.47	2740716.26	867.53	CURB INLET
25	1158003.06	2740837.11	868.42	CURB INLET
26	1158000.60	2741143.50	855.73	CURB INLET
27	1158231.40	2740067.33	877.02	30" FLARED END SECTION
28	1158295.90	2740127.19	874.27	30" FLARED END SECTION
29	1158653.82	2740749.34	866.97	5' MH
30	1158652.35	2740931.74	864.74	5' MH
31	1158614.00	2740899.25	865.62	CURB INLET
32	1158613.74	2740931.43	865.62	CURB INLET
33	1158650.17	2741202.77	854.54	5' MH
35	1158807.79	2741292.63	833.55	30" FLARED END SECTION
36	1158927.20	2741322.49	833.28	FIELD INLET
42	1158982.48	2741360.34	834.00	36" FLARED END SECTION





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TODD CREEK WWTP EXPANSION AND UPGRADE

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STORMWATER PLAN

STATE OF MISSOURI
CERVENTE D. SUDDUTH
NUMBER PE-2011015802
PROFESSIONAL ENGINEER
12/19/2025

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CONTRACTOR: BURNS & MCDONNELL ENGINEERING CO			DATE COMPLETED		
CONTRACT NO. 1698	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO. C127	
PROJECT NO. 81000927	SHEET 31 OF 643				

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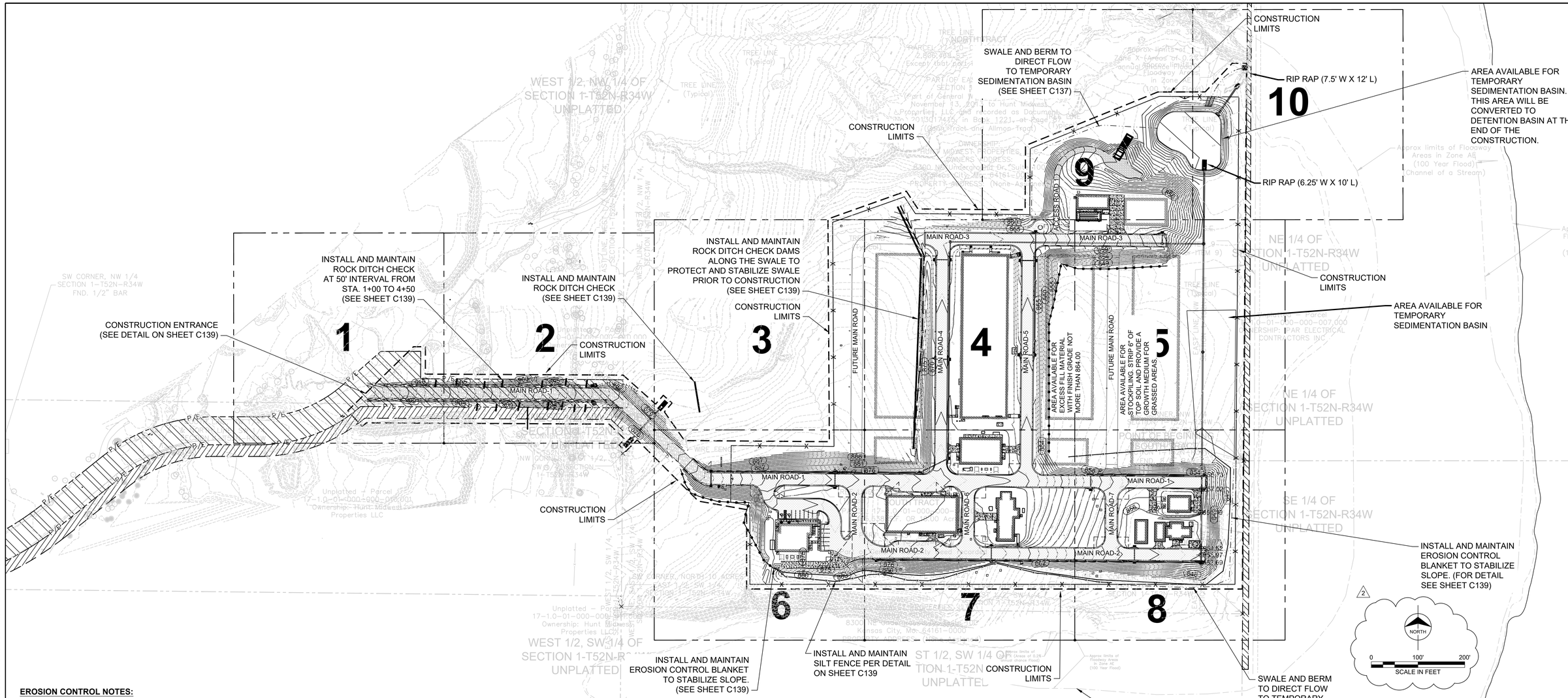

EROSION CONTROL NOTES:

1. SEE SHEET C101 FOR LEGEND AND GENERAL NOTES.
2. ALL DOWNSTREAM CATCH BASINS AND STORM SEWER INLETS MUST BE LINED WITH GEOTEXTILE FILTER FABRIC TO PREVENT SOIL AND DEBRIS FROM ENTERING STORM SEWER SYSTEM. FABRIC MUST BE IN PLACE PRIOR TO ANY CONSTRUCTION ACTIVITY, AND MUST BE MAINTAINED THROUGHOUT AND KEPT FREE OF DEBRIS DURING ENTIRE CONSTRUCTION ACTIVITY. LINERS MUST BE REMOVED UPON COMPLETION OF CONSTRUCTION ACTIVITIES. SEE SECTION 31 20 50
3. EROSION CONTROL METHODS OTHER THAN THOSE SHOWN ON THE DRAWINGS MAY BE UTILIZED IF APPROVED IN WRITING BY ENGINEER PRIOR TO THEIR USE.
4. THE LOCATION AND SIZE OF EROSION CONTROL DEVICES ARE APPROXIMATE ONLY AND REPRESENT THE MINIMUM REQUIREMENTS. THE DEVICES SHALL BE LOCATED GENERALLY AS SHOWN BUT THEIR LOCATIONS SHALL FACILITATE MAXIMUM PROTECTION FOR THE METHOD OF CONSTRUCTION UTILIZED. ADDITIONAL EROSION CONTROL DEVICES MAY BE REQUIRED TO COMPLY WITH SWPPP.
5. CONTRACTOR SHALL PROVIDE DUST CONTROL DURING ENTIRE CONSTRUCTION PERIOD. ALL DISTURBED AREAS SHALL BE MAINTAINED WITH DUST SUPPRESSORS (WATER, ETC.) TO PROHIBIT ENVIRONMENTAL CONTAMINATION. CALCIUM CHLORIDE SHALL NOT BE USED FOR DUST CONTROL.
6. THE CONTRACTOR SHALL PLAN AND CONDUCT GRADING OPERATIONS IN A MANNER THAT WILL MINIMIZE THE EXTENT AND DURATION OF UNPROTECTED SOIL.
7. THE CONSTRUCTION ENTRANCE SHALL BE MAINTAINED IN A CONDITION THAT WILL PREVENT TRACKING OF MATERIALS ONTO PUBLIC PAVEMENT. ALL MATERIALS TRACKED ONTO PUBLIC ROADWAYS SHALL BE IMMEDIATELY REMOVED.
8. DITCH CHECKS SHALL BE CONSTRUCTED OF ROCK UNLESS OTHERWISE APPROVED BY ENGINEER.
9. ALL EROSION CONTROL METHODS SHALL REMAIN IN PLACE UNTIL VEGETATION IS ESTABLISHED.

EROSION CONTROL LEGEND

= ROCK DITCH CHECK

= CONSTRUCTION ENTRANCE
(USE DROP DOWN TO ADJUST FOR SCALE)

= SILT FENCE
= SPOIL AREA
= EROSION CONTROL BLANKET
= CL OF SWALE

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TODD CREEK WWTP EXPANSION AND UPGRADE

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EROSION CONTROL PLAN

STATE OF MISSOURI · CERVENTE D. SUDDUTH · NUMBER PE-2011015802 · PROFESSIONAL ENGINEER
12/19/2025

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ODJ	JPG	12/19/2025	34W	53N 52N	36 01

CONTRACTOR: BURNS & MCDONNELL ENGINEERING CO — DATE COMPLETED:

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698				C138

PROJECT NO. 81000927 — SHEET 44 OF 643

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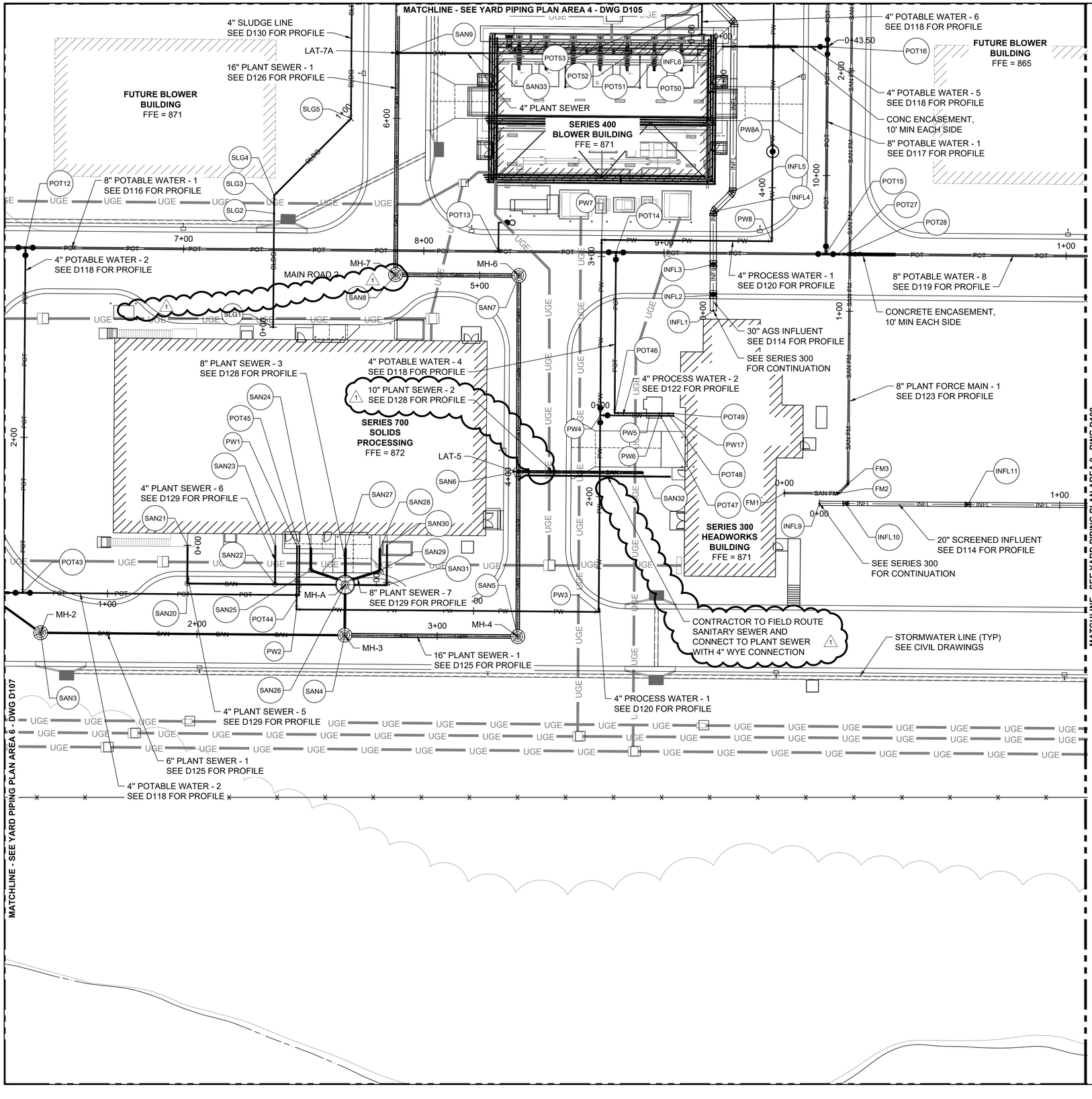

NOTES:

1. NOT USED (1)
2. SEE DWG D108A FOR POINT CONTROL TABLES.

NORTH

0 10' 20' 40'

SCALE IN FEET

NO.	DATE	BY:	CHECKED:	DESCRIPTION
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KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

YARD PIPING PLAN AREA 7

STATE OF MISSOURI
RACHELLE LYNN LOWE
NUMBER PE-2010019568
PROFESSIONAL ENGINEER

RACHELLE LYNN LOWE
CIVIL
PE - 2010019568

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D. HOWARD	M. GALLAGHER	12/19/25			

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698				D108

PROJECT NO. 81000927

SHEET 301 OF 643

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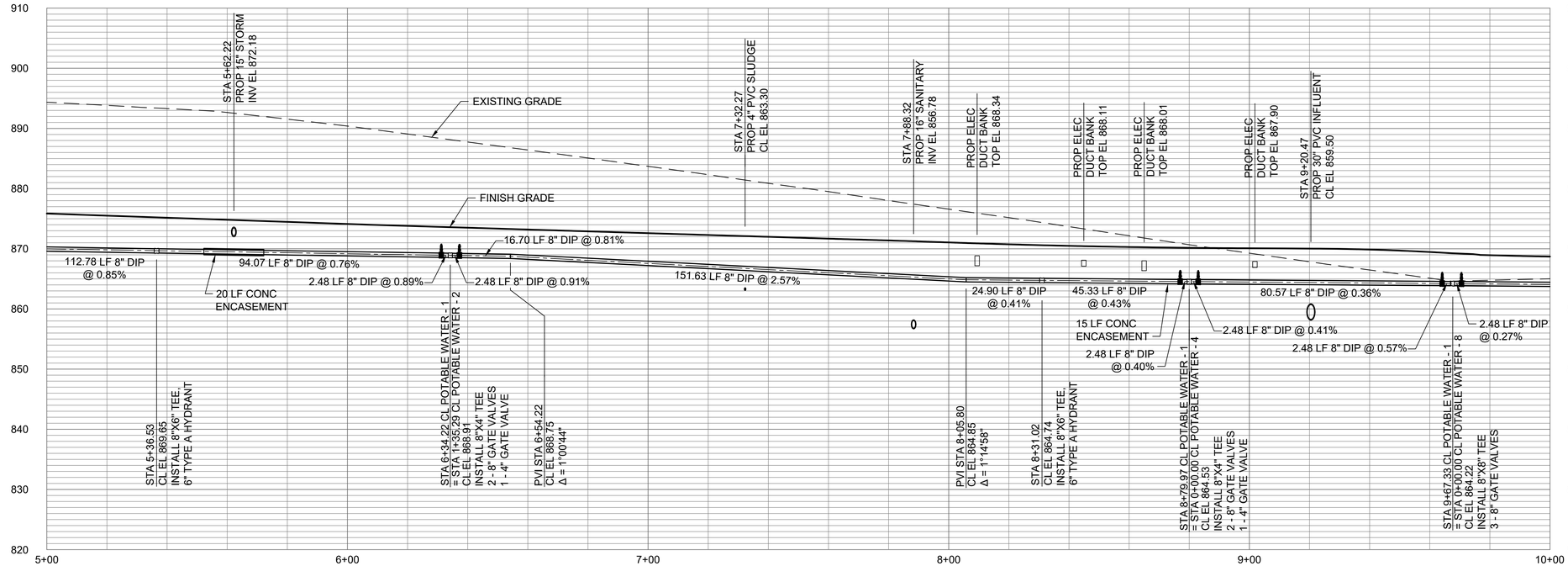

POTABLE WATER - 1 PROFILE

HORIZONTAL 0 10' 20' 40' SCALE IN FEET

VERTICAL 0 10' 20' SCALE IN FEET

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STATE OF MISSOURI
RACHELLE LYNN LOWE
NUMBER PE-2010019568
PROFESSIONAL ENGINEER

RACHELLE LYNN LOWE
CIVIL
PE - 20100019568

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POTABLE WATER PROFILES - SHEET 2

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BURNS & MCDONNELL ENGINEERING CO	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698				D116

PROJECT NO. 81000927 SHEET 310 OF 643

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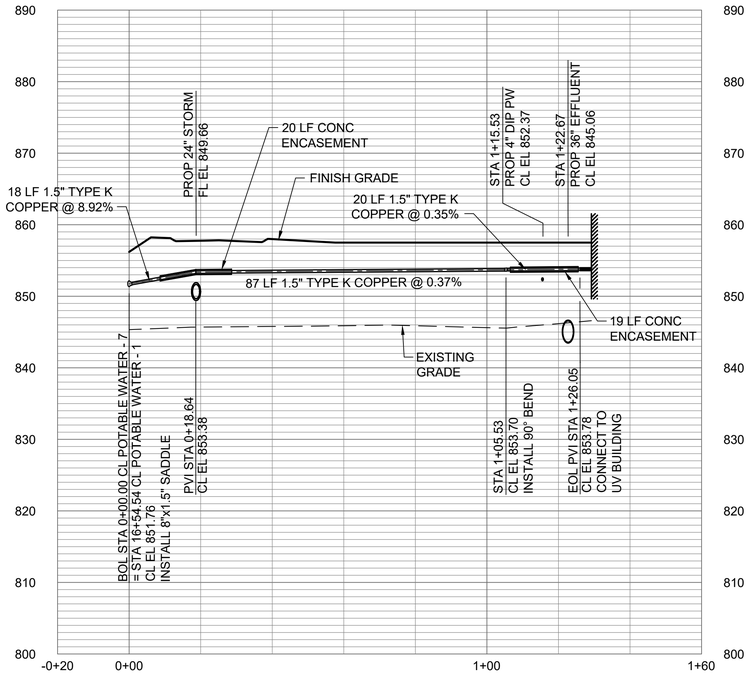
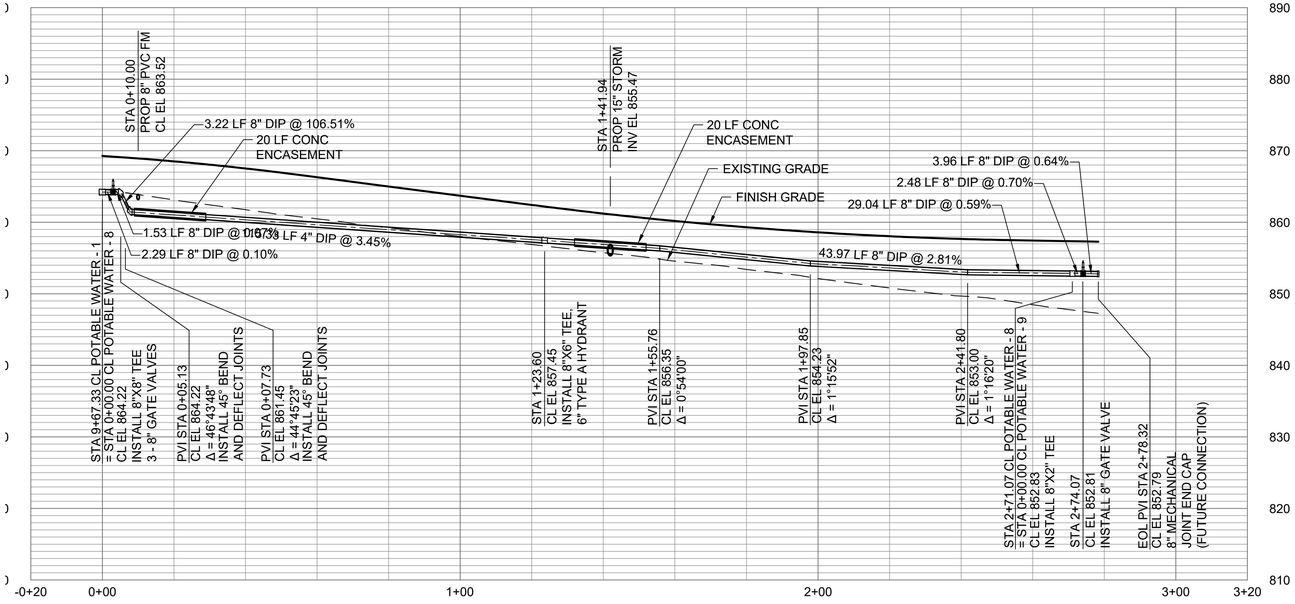
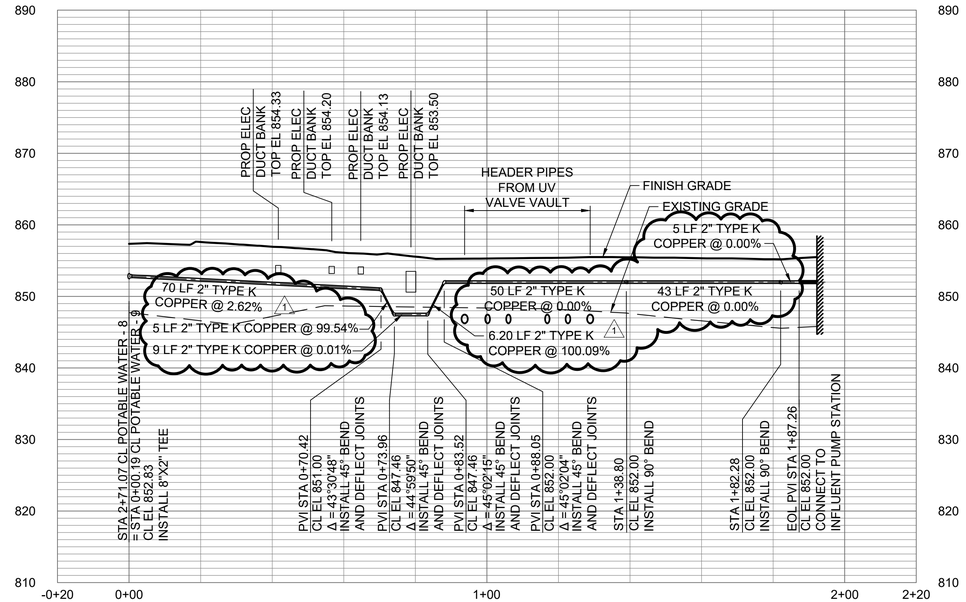


POTABLE WATER - 7 PROFILE



POTABLE WATER - 8 PROFILE



POTABLE WATER - 9 PROFILE

HORIZONTAL 0 10' 20' 40' SCALE IN FEET

VERTICAL 0 10' 20' SCALE IN FEET

NO.	DATE	BY:	CHECKED:	DESCRIPTION
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TODD CREEK WWTP EXPANSION AND UPGRADE

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POTABLE WATER PROFILES - SHEET 5

STATE OF MISSOURI — RACHELLE LYNN LOWE NUMBER PE-2010019568 — PROFESSIONAL ENGINEER

RACHELLE LYNN LOWE
CIVIL
PE - 2010019568

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BURNS McDONNELL

9400 WARD PARKWAY
KANSAS CITY, MO 64114
Burns & McDonnell Engineering Co, Inc
816-333-9400
LICENSEE NO. 000165

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
D. HOWARD	M. GALLAGHER	12/19/25			

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698				D119

PROJECT NO. 81000927 — SHEET 313 OF 643

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PLOT DATE 2/16/2026 9:45:13 AM by DHOWARD
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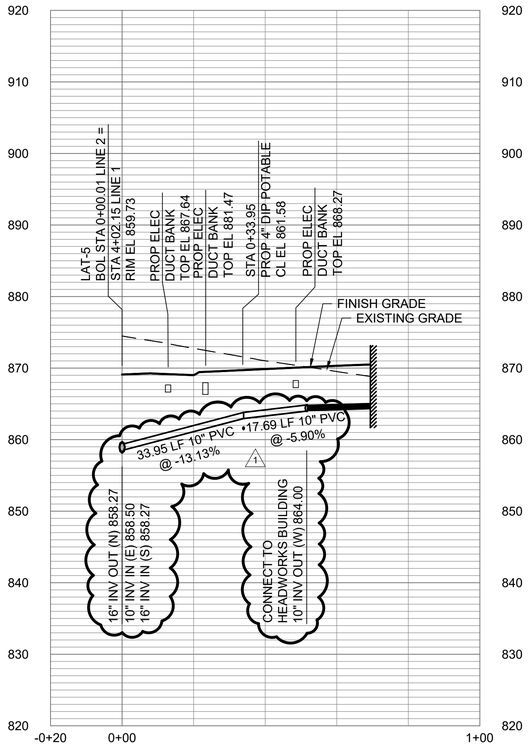
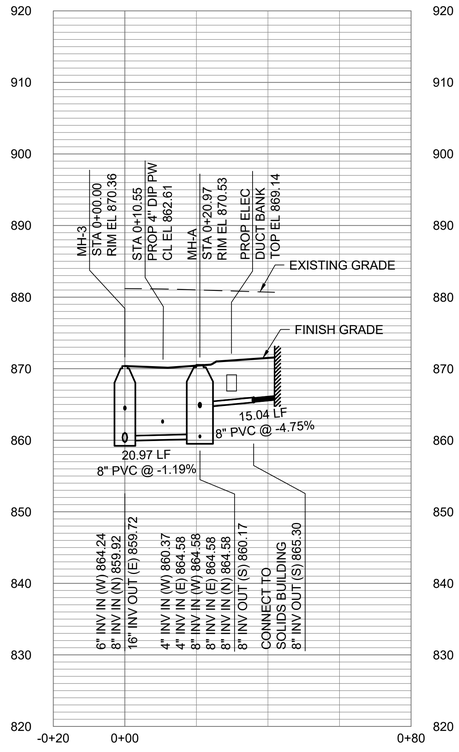


PLANT SEWER - 2 PROFILE



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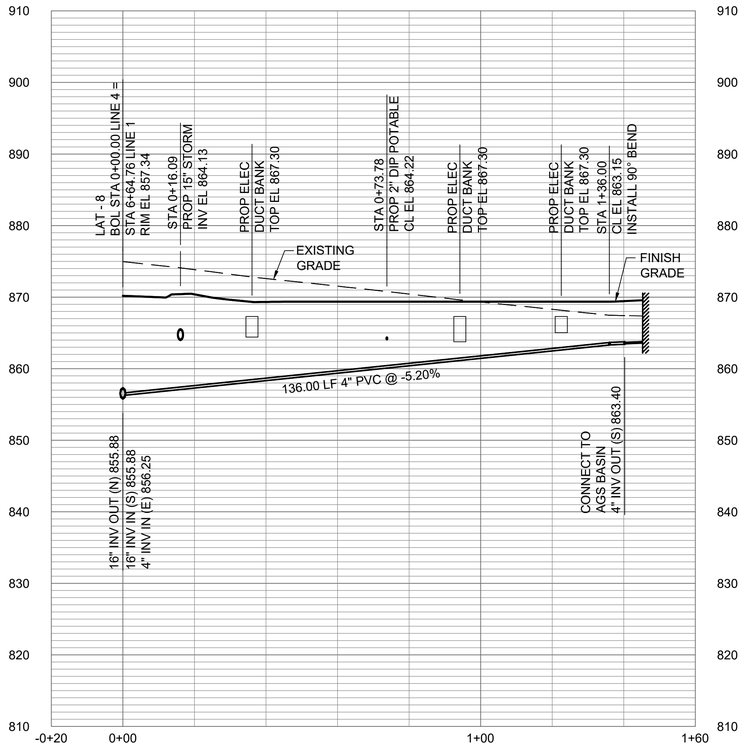

PLANT SEWER - 4 PROFILE

HORIZONTAL 0 10' 20' 40' SCALE IN FEET

VERTICAL 0 10' 20' SCALE IN FEET

NO.	DATE	BY:	CHECKED:	DESCRIPTION
1	2/18/26	RLL	WAP	REVISED PER ADDENDUM NO. 7
0	12/19/25	RLL	MDG	ISSUED FOR BID

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DuBois Consultants
CIVIL / STRUCTURAL ENGINEERING

WELLNER architects

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9400 WARD PARKWAY
KANSAS CITY, MO 64114
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LICENSEE NO. 000165

STATE OF MISSOURI
RACHELLE LYNN LOWE
NUMBER PE-2010019568
PROFESSIONAL ENGINEER

RACHELLE LYNN LOWE
CIVIL
PE - 20100019568

FOR WSD USE:

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

PLANT SEWER PROFILES 4

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
D. HOWARD	M. GALLAGHER	12/19/25			

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698				D128

PROJECT NO. 81000927

SHEET 322 OF 643

Saved 12-17-2025 11:55:38 AM by DHOWARD
PLOT DATE 2/18/2026 8:46:25 AM by DHOWARD
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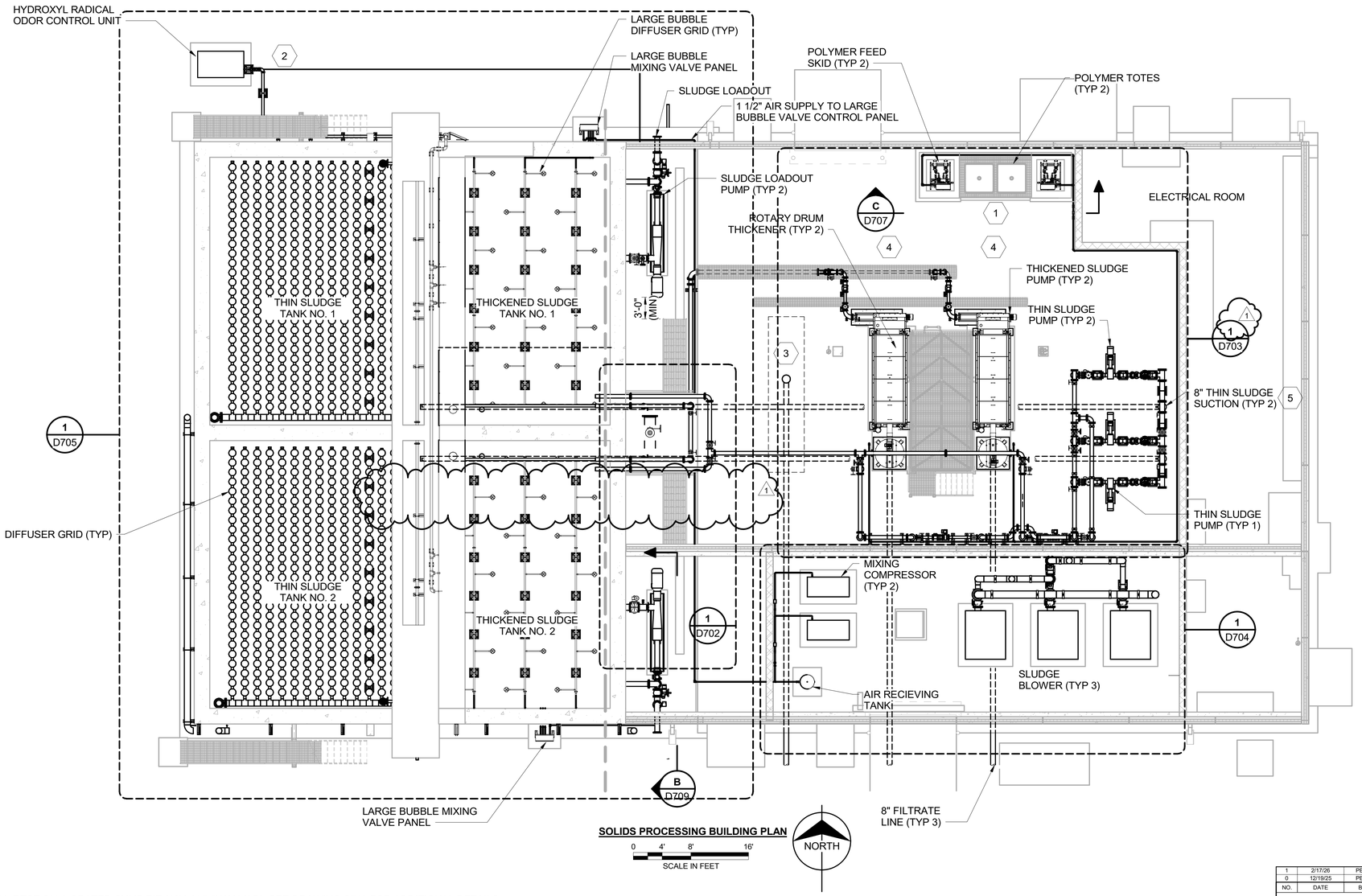

KEYED NOTES:

1. POLYMER TOTES WILL REST ON A GRATED SUMP PIT (10' L X 5.5' W X 2' D). SEE DRAWING S710 FOR ADDITIONAL DETAILS.
2. SEE DRAWING D705 OR D708 FOR ADDITIONAL DETAILS FOR THE HYDROXICAL RADICAL ODOR CONTROL UNIT.
3. SPACE FOR FUTURE ROTARY DRUM THICKENER.
4. TWO (2) MOBILE ELEVATED PLATFORM SHALL BE INCLUDED TO PROVIDE OPERATOR ACCESS TO ROTARY DRUMTHICKENER THICKENED SLUDGE HOPPER. MOBILE ELEVATED PLATFORM SHALL BE A THREE STEP PLATFORM THAT IS OSHA AND ANSI COMPLIANT, WITH LANDING OF 3' X 3' MINIMUM.
5. THIN SLUDGE SUCTION LINES ROUTED BELOW FOUNDATION.

GENERAL NOTES:

1. PIPING WITHIN FOUR FEET OF FINISHED FLOOR SHALL BE SUPPORTED WITH SADDLE TYPE SUPPORT, UNLESS OTHERWISE SPECIFIED. SEE PS-1.
2. ALL PIPE SUPPORTS AT A MINIMUM, SHALL FOLLOW MSS-SP 69, UNLESS SPECIFIED ELSEWHERE.
3. ELEVATED AIR PIPING SHALL BE SUPPORTED WITH CLEVIS HANGER PIPE SUPPORT, UNLESS OTHERWISE SPECIFIED.
4. ALL PIPING BELOW STRUCTURES SHALL BE ENCASED PER STRUCTURAL DETAILS. REFERENCE SHEET S006. ENCASEMENT SHALL EXTEND 4 FEET BEYOND EDGE OF FOOTING.
5. FRP COVERS ON THE THICKENED SLUDGE HOLDING TANKS ARE NOT SHOWN FOR CLARITY. SEE D705 FOR COVER DETAILS.

NO.	DATE	BY:	CHECKED:	DESCRIPTION
1	2/17/26	PEW	ALW	ADDENDUM 7
0	12/19/25	PEW	ALW	ISSUED FOR BID

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

SOLIDS PROCESSING BUILDING PLAN

STATE OF MISSOURI
PAUL E. WARD
NUMBER PE-2016017691
PROFESSIONAL ENGINEER

PAUL E. WARD
PROCESS
PE-2016017691

FOR WSD USE:

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WELLNER architects
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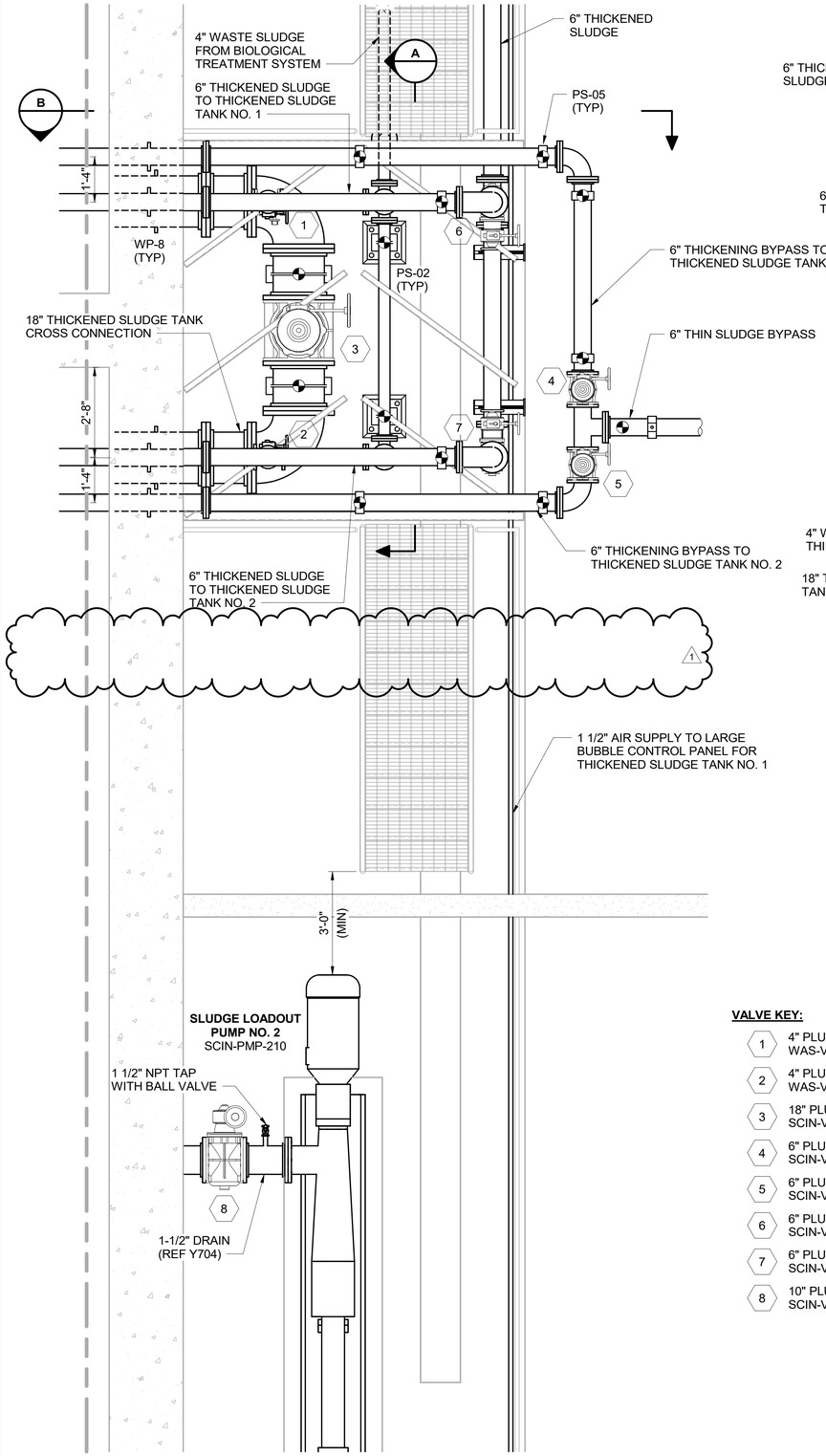
816-333-9400
Licensee No. 000165

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
C. JENSEN	A. WADDOUPS	2/17/26	34W	53N	36

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

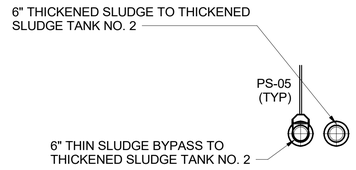
CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	D701

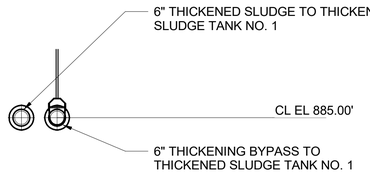
PROJECT NO.	SHEET		OF	
81000927	389		643	

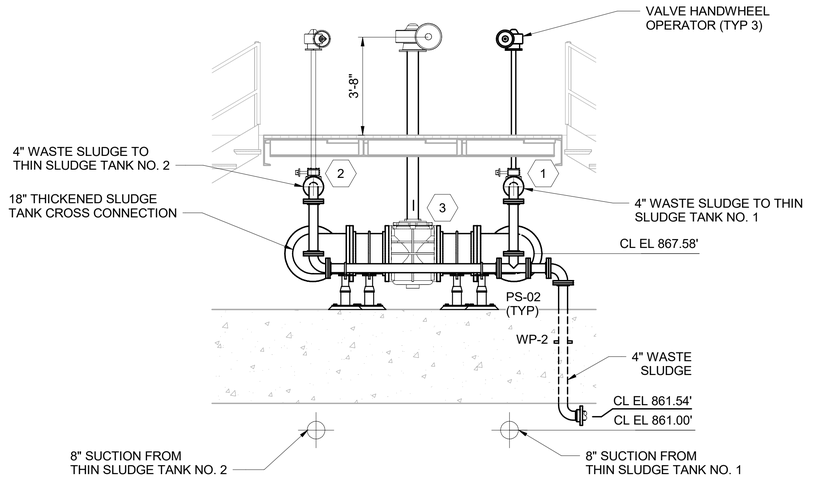


ENLARGED SLUDGE PIPING FLOOR PLAN

0 2' 4' 6'
SCALE IN FEET

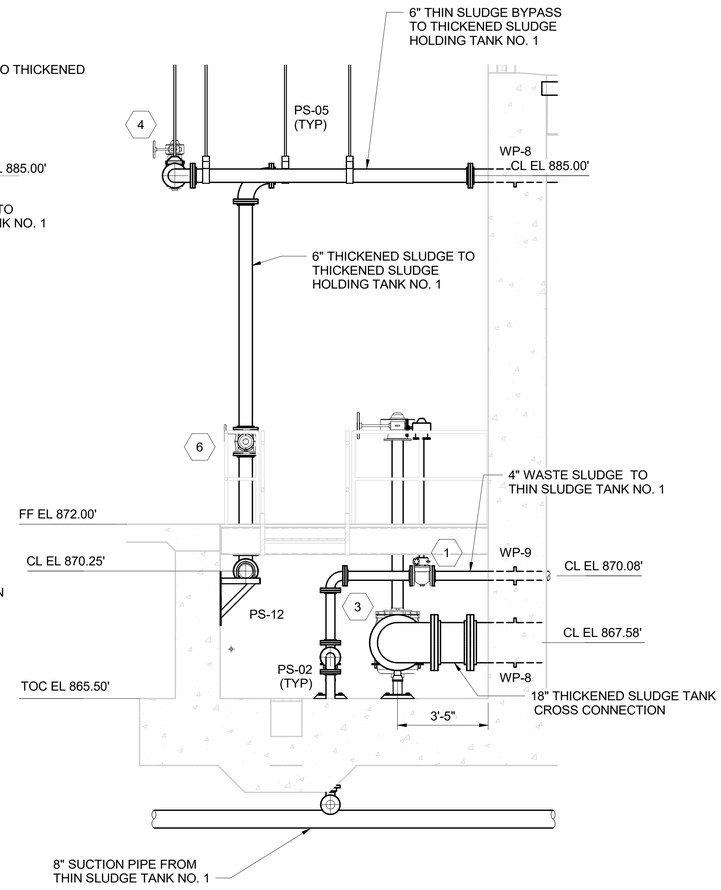






SECTION A

0 2' 4' 6'
SCALE IN FEET



SECTION B

0 2' 4' 6'
SCALE IN FEET

VALVE KEY:

1. 4" PLUG VALVE WAS-VLV-101
2. 4" PLUG VALVE WAS-VLV-201
3. 18" PLUG VALVE SCIN-VLV-001
4. 6" PLUG VALVE SCIN-VLV-101
5. 6" PLUG VALVE SCIN-VLV-201
6. 6" PLUG VALVE SCIN-VLV-102
7. 6" PLUG VALVE SCIN-VLV-202
8. 10" PLUG VALVE SCIN-VLV-211

GENERAL NOTES:

1. PIPING WITHIN FOUR FEET OF FINISHED FLOOR SHALL BE SUPPORTED WITH SADDLE TYPE SUPPORT, UNLESS OTHERWISE SPECIFIED. SEE PS-1.
2. ALL PIPE SUPPORTS AT A MINIMUM, SHALL FOLLOW MSS-SP 69, UNLESS SPECIFIED ELSEWHERE.
3. ELEVATED AIR PIPING SHALL BE SUPPORTED WITH CLEVIS HANGER PIPE SUPPORT, UNLESS OTHERWISE SPECIFIED.
4. ALL 90-DEGREE BENDS IN THICKENED SLUDGE SERVICE SHALL BE LONG RADIUS TYPE.

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Licensee No. 000165

NO.	DATE	BY:	CHECKED:	DESCRIPTION
1	2/17/26	PEW	ALW	ADDENDUM 7
0	12/19/25	PEW	ALW	ISSUED FOR BID

REVISIONS

STATE OF MISSOURI · PAUL E. WARD · NUMBER PE-2016017691 · PROFESSIONAL ENGINEER

PAUL E. WARD
PROCESS
PE-2016017691

FOR WSD USE:

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

ENLARGED SLUDGE PIPING PLAN AND SECTIONS

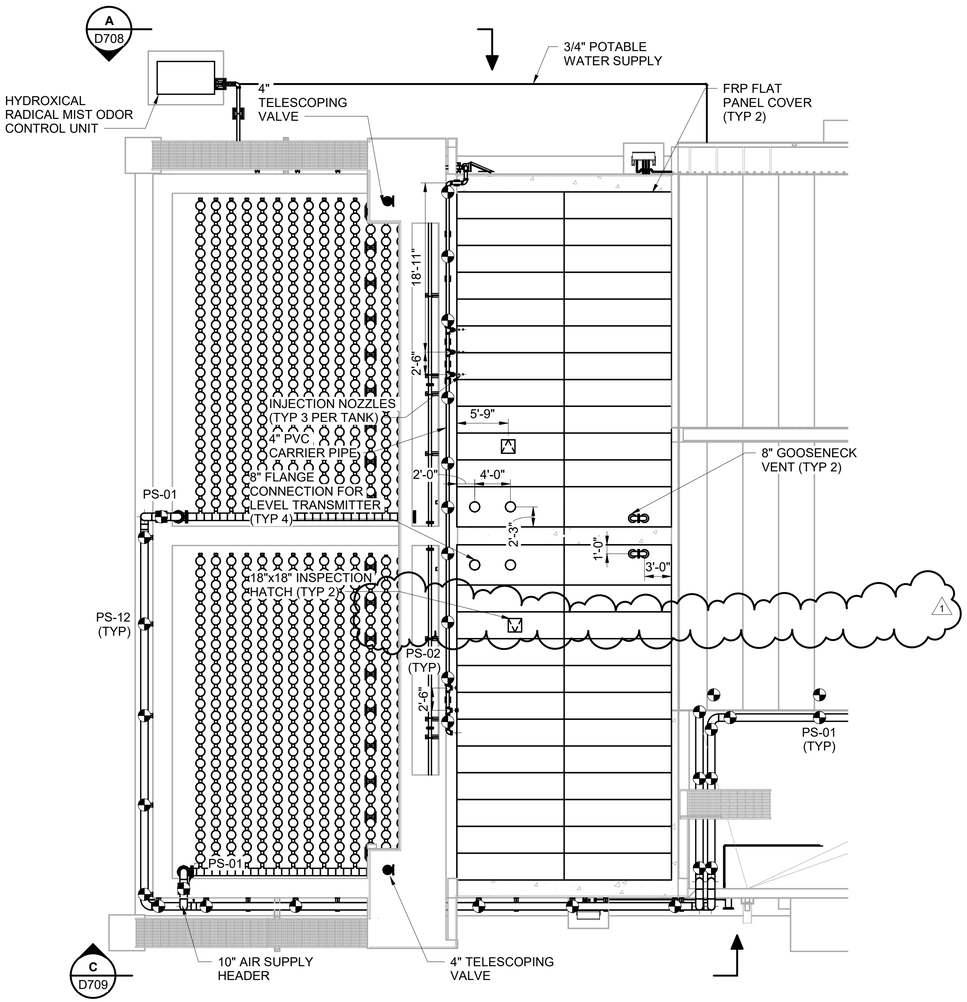
DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
C. JENSEN	A. WADDOUPS	2/17/26	34W	53N	36

CONTRACTOR	DATE COMPLETED
BURNS & McDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	D702

PROJECT NO. 81000927

SHEET 390 OF 643

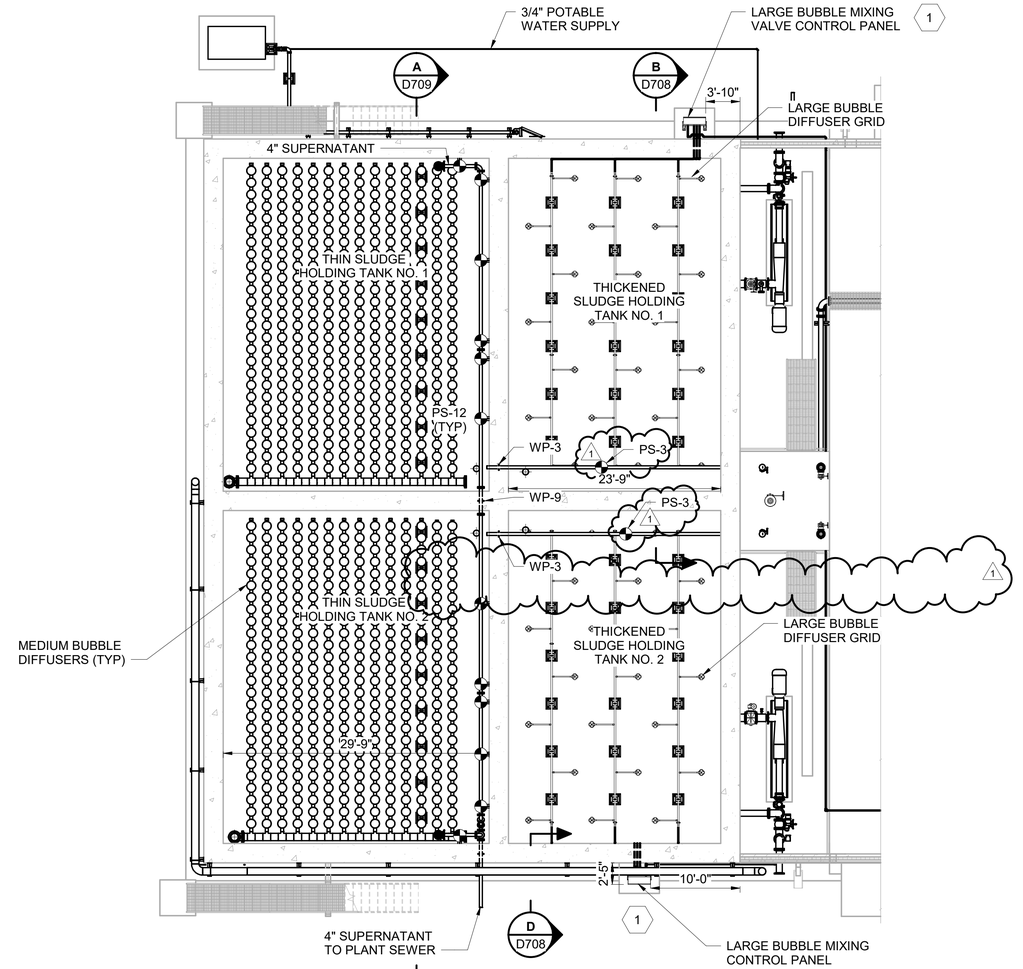


SOLIDS PROCESSING ENLARGED SLUDGE HOLDING BUILDING ROOF PLAN

0 4' 8' 16'

SCALE IN FEET

NORTH



SOLIDS PROCESSING ENLARGED SLUDGE HOLDING BUILDING FLOOR PLAN

0 4' 8' 16'

SCALE IN FEET

NORTH

KEYED NOTES:

1. EACH THICKENED SLUDGE TANK HAS A DEDICATED VALVE CONTROL PANEL FOR THE LARGE BUBBLE MIXING SYSTEM. LARGE BUBBLE MIXING SYSTEM DIFFUSERS SHALL BE INSTALLED PER MANUFACTURER'S DIRECTION AND DESIGN.
2. THE HYDROXYL RADICAL MIST ODOR CONTROL SHALL BE SIZED TO DISCHARGE OXIDANT, WATER AND AIR TO THREE (3) NOZZLES FOR EACH SLUDGE THICKENED HOLDING TANK. PVC CARRIER PIPE FOR OXIDANT AND WATER TUBING SHALL BE PROVIDED BY THE CONTRACTOR. CONTRACTOR SHALL COORDINATE NOZZLE ASSEMBLY INSTALLATION WITH ODOR CONTROL MANUFACTURER.

GENERAL NOTES:

1. FRP COVERS SHALL BE AIR TIGHT AND PITCHED SLIGHTLY TO PREVENT WATER FROM POOLING ON COVER. REFERENCE STRUCTURAL DRAWINGS, SUPPLIER PROVIDED DRAWINGS AND SECTION 06 85 81. 1
2. EACH THIN SLUDGE TANK HAS THE ABILITY TO DECANT VIA A TELESCOPING VALVE. DECANTED SUPERNATANT WILL BE ROUTED TO THE PLANT SEWER.
3. MEDIUM BUBBLE DIFFUSER SYSTEM TO PROVIDED THROUGHOUT EACH THIN SLUDGE HOLDING TANK. REFERENCE SECTION 46 51 21 AND SUPPLIER PROVIDED DRAWINGS.
4. LARGE BUBBLE MIXING SYSTEM TO BE PROVIDED THROUGHOUT EACH THICKENED SLUDGE HOLDING TANK. HOLDING TANK. REFERENCE SECTION 46 42 57 AND SUPPLIER PROVIDED DRAWINGS.

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NO.	DATE	BY:	CHECKED:	DESCRIPTION
1	2/17/26	PEW	ALW	ADDENDUM 7
0	12/19/25	PEW	ALW	ISSUED FOR BID

REVISIONS

STATE OF MISSOURI
PAUL E. WARD
NUMBER PE-2016017691
PROFESSIONAL ENGINEER

PAUL E. WARD
PROCESS
PE-2016017691

FOR WSD USE:

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

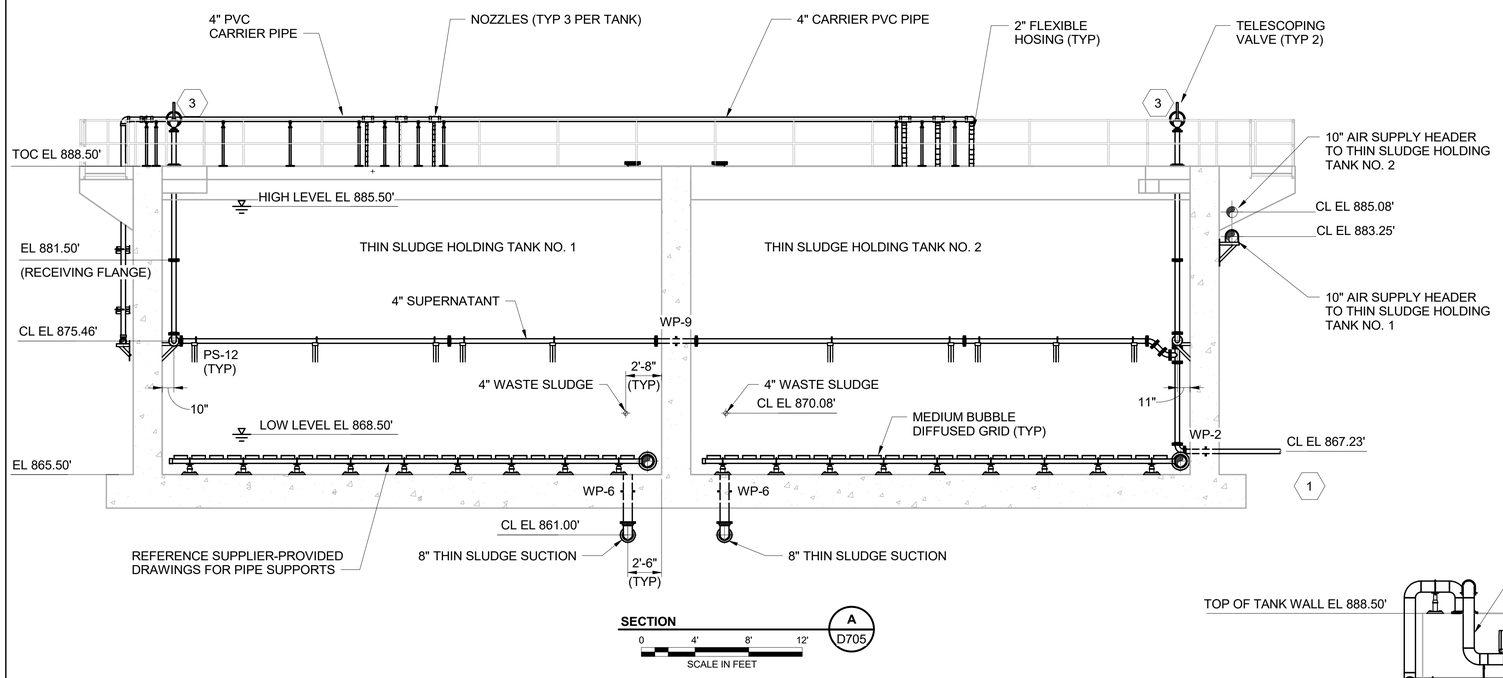
ENLARGED THIN AND THICKENED SLUDGE HOLDING TANKS PLANS

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
C. JENSEN	A. WADDOUPS	2/17/26	34W	53N	36

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	D705

PROJECT NO. 81000927 SHEET 393 OF 643



SECTION A D705

0 4' 8' 12'

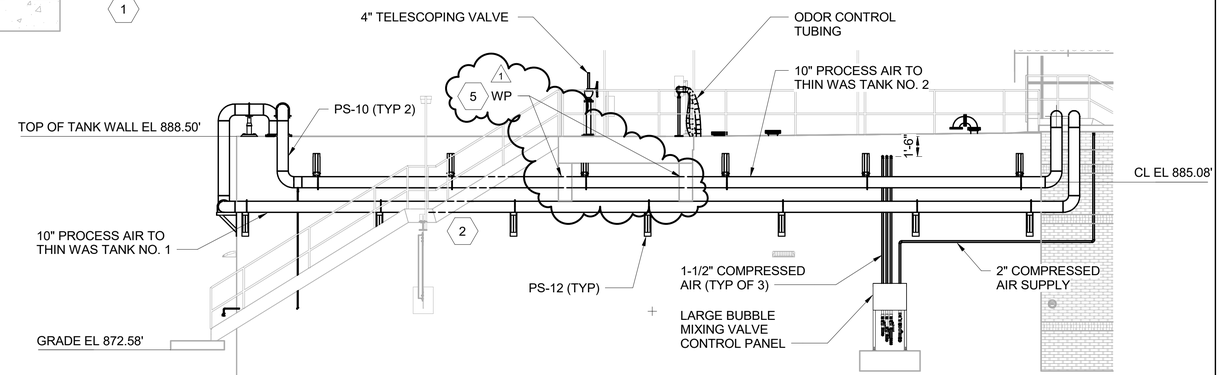
SCALE IN FEET

KEYED NOTE:

1. SEE CIVIL DRAWING C103 FOR SUPERNATANT PIPE ELEVATION IN YARD.
2. CONTRACTOR SHALL SLOPE THE 10" AIR SUPPLY PIPES TO A LOW POINT ADJACENT TO STAIR CASE AS INDICATED. AT THE LOW SPOT, EACH PIPE SHALL HAVE A DRAIN LINE WITH A BALL VALVE TO PROVIDE THE ABILITY DRAIN THE CONDENSATE OUT OF EACH AIR SUPPLY HEADER.
3. FINAL SLAB PENETRATION SIZE FOR TELESCOPING VALVE STEM AND PEDESTAL SHALL BE COORDINATED DURING SUBMITTAL REVIEW.
4. SEE KEYED NOTE ON D202 FOR INSTRUMENT THAT IS SHOWN HERE PER P&ID Y704.
5. OVERSIZE OPENING TO ALLOW HDPE PIPE SLEEVE OR SIMILAR WITH NO MORE THAN 1/4" SPACE BETWEEN AIR PIPE AND PIPE SLEEVE. PIPE COLLAR, WATER STOP ARE NOT REQUIRED.

GENERAL NOTE:

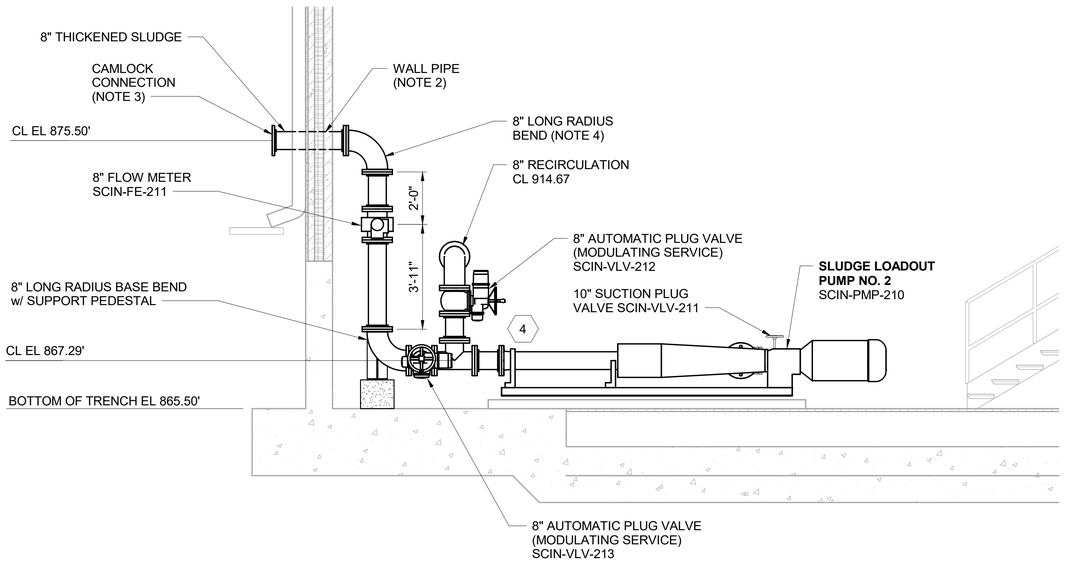
1. CONTRACTOR SHALL FOLLOW MEDIUM BUBBLE DIFFUSER MANUFACTURER'S DIRECTIONS AND DESIGN FOR INSTALLATION.
2. COORDINATE PIPE PENETRATION WITH PRECAST PANEL MANUFACTURER.
3. COORDINATE CAMLOCK CONNECTION TYPE AND SIZE WITH CITY.
4. ALL 90-DEGREE BENDS FOR THICKENED SLUDGE SERVICE SHALL BE LONG RADIUS TYPE.



SECTION C D705

0 4' 8' 12'

SCALE IN FEET



SECTION B D701

0 2' 4' 6'

SCALE IN FEET

NO.	DATE	BY:	CHECKED:	DESCRIPTION
1	2/17/26	PEW	ALW	ADDENDUM 7
0	12/19/25	PEW	ALW	ISSUED FOR BID

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PAUL E. WARD
NUMBER PE-2016017691
PROFESSIONAL ENGINEER

PAUL E. WARD
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PE-2016017691

FOR WSD USE:

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

SOLIDS PROCESSING BUILDING SECTIONS AND DETAILS SHEET 4

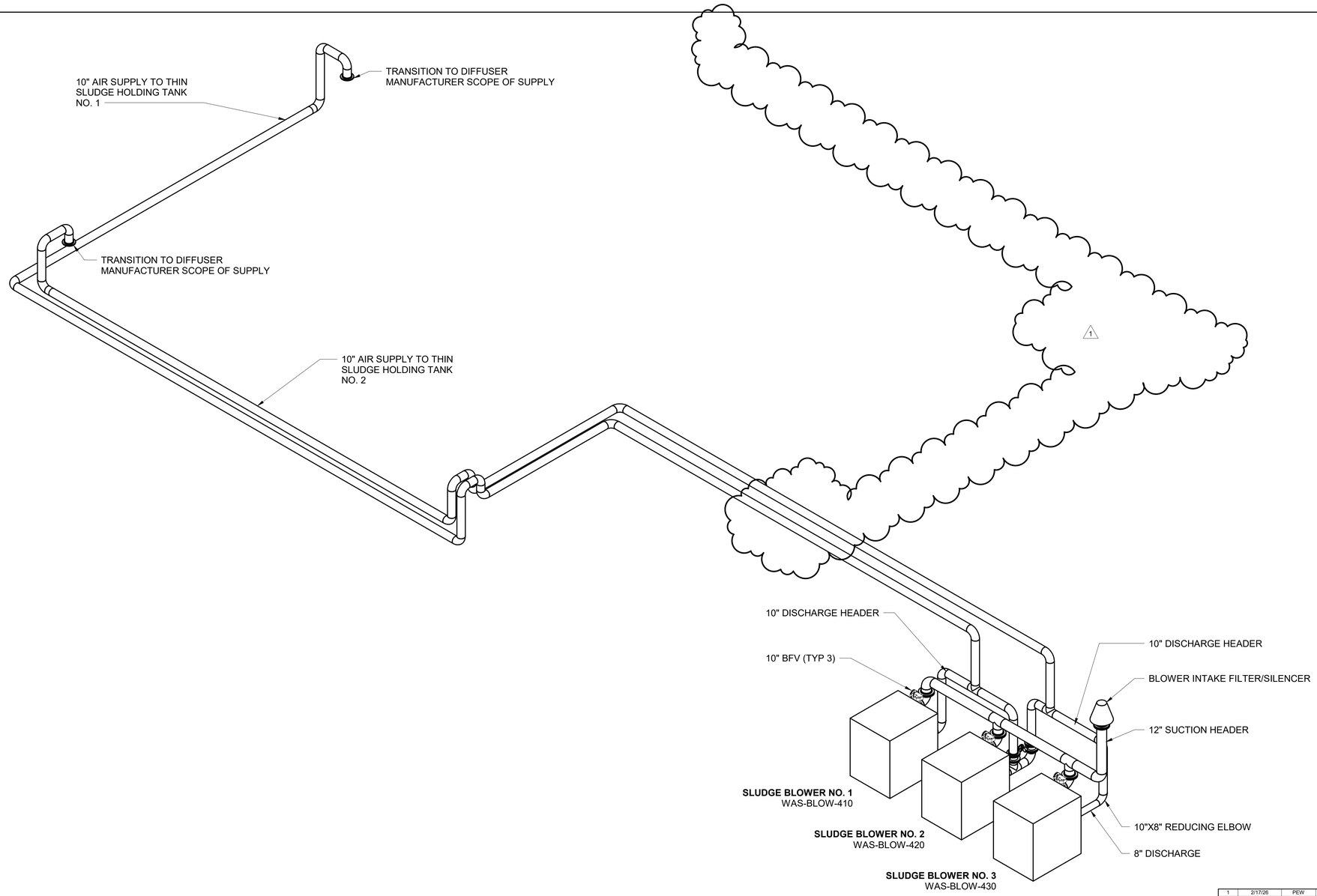
DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
C. JENSEN	A. WADDOUPS	2/17/26	34W	53N	36

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	D709

PROJECT NO. 81000927

SHEET 397 OF 643



BLOWER PIPING ISO VIEW

0 4' 8' 12'

SCALE IN FEET

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1	2/17/26	PEW	ALW	ADDENDUM 7
0	12/19/25	PEW	ALW	ISSUED FOR BID

REVISIONS

KANSAS CITY, MISSOURI WATER SERVICES DEPARTMENT

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PAUL E. WARD
NUMBER PE-2016017691
PROFESSIONAL ENGINEER

PAUL E. WARD
PROCESS
PE-2016017691

FOR WSD USE:

TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

BLOWER PIPING ISOMETRIC VIEW

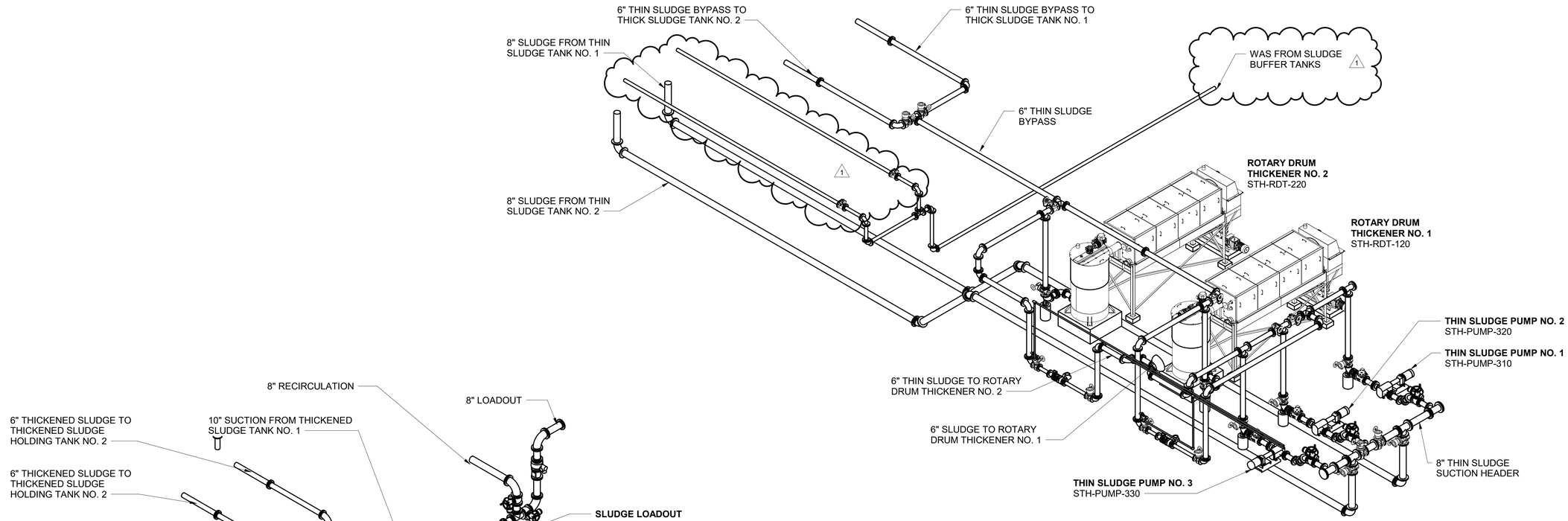
DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
C. JENSEN	A. WADDOUPS	2/17/26	34W	53N	36

CONTRACTOR	DATE COMPLETED
BURNS & MCDONNELL ENGINEERING CO.	

CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	D710

PROJECT NO. 81000927

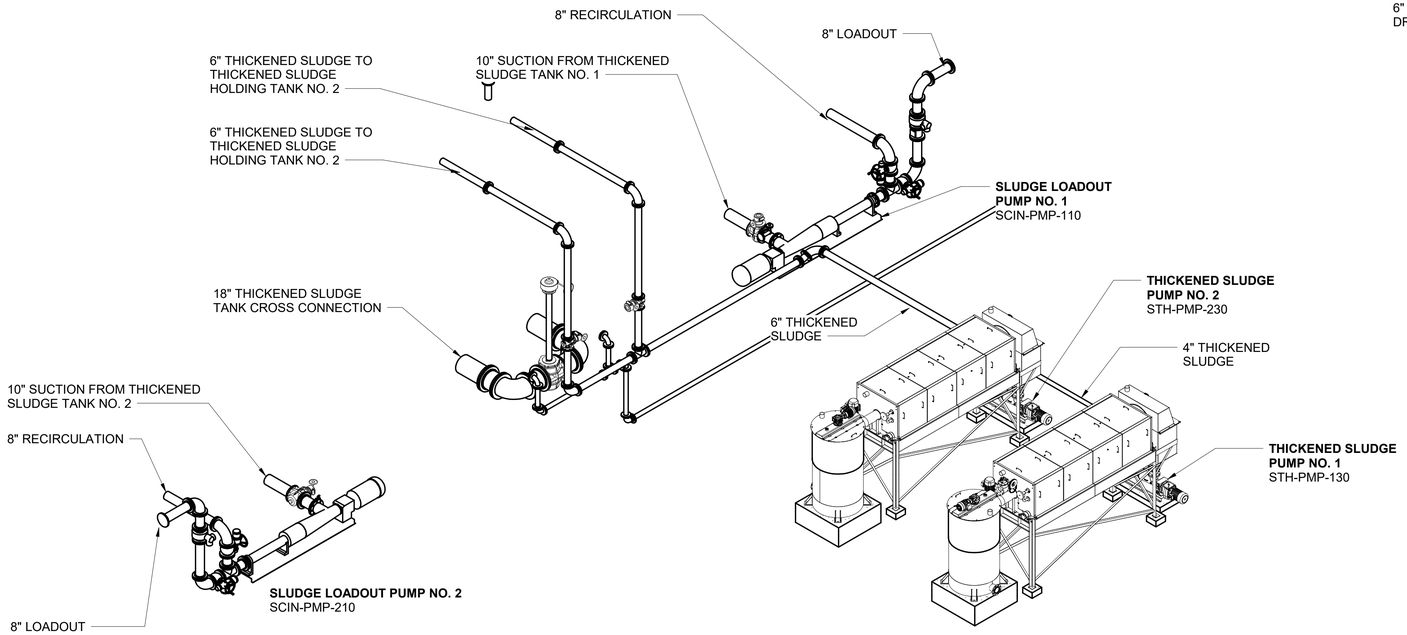
SHEET 398 OF 643



THIN SLUDGE PIPING ISO VIEW

0 4' 8' 12'

SCALE IN FEET



THICKENED SLUDGE PIPING ISO VIEW

0 4' 8' 12'

SCALE IN FEET

NO.	DATE	BY:	CHECKED:	DESCRIPTION
1	2/17/26	PEW	ALW	ADDENDUM 7
0	12/19/25	PEW	ALW	ISSUED FOR BID

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TODD CREEK WWTP EXPANSION AND UPGRADE

14001 NW INTERURBAN ROAD, KANSAS CITY, MO 64163

SLUDGE PIPING ISOMETRIC VIEW

DRAWN BY:	CHECKED BY:	DATE SUBMITTED	RANGE	TOWNSHIP	SECTION
C. JENSEN	A. WADDOUPS	2/17/26	34W	53N	36

CONTRACTOR	DATE COMPLETED
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CONTRACT NO.	CONTRACT DATE	MAP NO.	WORK ORDER NO.	DRAWING NO.
1698	-	-	-	D711

PROJECT NO. 81000927

SHEET 399 OF 643

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

INVITATION TO BID

Project/Contract Numbers: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrade

The General Services Department of Kansas City, Missouri will receive sealed Bids until 2:00 PM, on **February 24, 2026** at 4800 E 63rd Street, Kansas City, Missouri 64130, for **Project No. 81000927/Contract No. 1698, Todd Creek WWTP Expansion & Major Upgrade.** Bids will be opened after that time at the same Location.

City desires that Disadvantaged Business Enterprises (DBE) have an opportunity to participate in the performance of City contracts. The goals for this specific Project are stated in the Missouri State Revolving Fund Procedures for Implementation.

Nondiscrimination in Employment:
Bidders on this work will be required to comply with the President's Executive Order Number 11246. Requirements for bidders and contractors under this order are explained in the specifications.

SRF Statement:
This project is being financed through the Missouri State Revolving Fund, by the Water and Wastewater Loan Revolving Fund and federal Capitalization Grants to Missouri.

Disadvantaged Business Statement (DBE):
The City of Kansas City, Missouri is an Equal Opportunity Employer and invites the submission of bids from Disadvantaged Business Enterprises.

Bidding Documents will be available online to all interested parties at the Kansas City, Missouri Plan Room, http://www.kcmoplanroom.org. All addenda will be posted at this location. Any document or plan may be viewed or downloaded from this location.

Bidders are requested to attend the **mandatory** Pre-Bid Conference at 2:00 PM, January 15, 2026, on TEAMs and in-person at Kansas City Water Services Department, 4800 E 63rd Street, Kansas City, Missouri 64130. Teams Meeting Link: Todd Creek Pre-Bid Conference | Meeting-Join | Microsoft Teams

Microsoft Teams Need help?

Join the meeting now

Meeting ID: 246 468 121 490 43
Passcode: uk6h4cr2

Dial in by phone

+1 872-212-5076,,284320930# United States, Chicago
Find a local number

Project Manager: Shawn Cross
Phone Number: 816-513-0442
Fax Number: 816-513-0343
E-mail: Shawn.Cross@kcmo.org

Contract Administrator: Marzella Newman-Buckner
Phone Number: (816) 513-0319
Fax Number: 816-513-0343
E-mail: Marzella.Newman-Buckner@kcmo.org

View all procurement and contracting opportunities at http://www.kcmo.gov

00830.1 FEDERAL PREVAILING WAGE - HEAVY

"General Decision Number: MO20260001 01/09/2026

Superseded General Decision Number: MO20250001

State: Missouri

Construction Types: Heavy and Highway

Counties: Missouri Statewide.

HEAVY AND HIGHWAY CONSTRUCTION PROJECTS

Modification Number	Publication Date
0	01/02/2026
1	01/09/2026

CARP0002-002 05/01/2024

ST. LOUIS COUNTY AND CITY

	Rates	Fringes
Carpenters	$ 41.71	21.85

CARP0005-006 05/01/2024

CASS (Richards-Gebauer AFB ONLY), CLAY, JACKSON, PLATTE AND RAY COUNTIES

	Rates	Fringes
Carpenters:		
CARPENTERS & LATHERS	$ 44.63	22.40
MILLWRIGHTS & PILEDRIVERS	$ 44.63	22.40

CARP0011-001 05/01/2024

	Rates	Fringes
Carpenter and Piledriver		
ADAIR, AUDRAIN (West of Hwy 19), BOONE, CALLAWAY, CHARITON, COLE, COOPER, HOWARD, KNOX,LINN, MACON, MILLER, MONITEAU,MONROE, OSAGE, PUTNAM, RANDOLPH, SCHUYLER, SHELBY AND SULLIVAN COUNTIES	$ 35.61	22.40
ATCHISON, ANDREW, BATES,		

CALDWELL, CARROLL,DAVIESS,
DEKALB,GENTRY, GRUNDY,
HARRISON, HENRY, HOLT,
LIVINGSTON, MERCER,
NODAWAY,ST. CLAIR, SALINE
AND WORTH COUNTIES.....$ 34.98 22.40
AUDRAIN (East of Hwy.19),
RALLS, MARION, LEWIS,
CLARK AND SCOTLAND COUNTIES.$ 35.61 22.40
BARRY, BARTON, CAMDEN,
CEDAR, CHRISTIAN, DADE,
DALLAS, DOUGLAS, GREENE,
HICKORY,JASPER, LACLEDE,
LAWRENCE, MCDONALD,
NEWTON, OZARK, POLK,
STONE, TANEY, VERNON,
WEBSTER AND WRIGHT COUNTIES.$ 33.25 22.40
BENTON, MORGAN AND PETTIS...$ 34.98 22.40
BOLLINGER, BUTLER, CAPE
GIRARDEAU, DUNKLIN,
MISSISSIPPI, NEW MADRID,
PEMISCOT, PERRY, STE.
GENEVIEVE, SCOTT, STODDARD
AND WAYNE COUNTIES.....$ 35.37 22.40
BUCHANAN, CLINTON, JOHNSON
AND LAFAYETTE COUNTIES.....$ 34.98 22.40
CARTER, HOWELL, OREGON AND
RIPLEY COUNTIES.....$ 34.04 22.40
CRAWFORD, DENT, GASCONADE,
IRON, MADISON, MARIES,
MONTGOMERY, PHELPS,
PULASKI, REYNOLDS, SHANNON
AND TEXAS COUNTIES.....$ 35.37 22.40
FRANKLIN COUNTY.....$ 42.19 22.40
JEFFERSON AND ST. CHARLES
COUNTIES.....$ 42.19 22.40
LINCOLN COUNTY.....$ 38.04 22.40
PIKE, ST. FRANCOIS AND
WASHINGTON COUNTIES.....$ 36.13 22.40
WARREN COUNTY.....$ 38.04 22.40

ELEC0001-002 06/22/2025

BOLLINGER, BUTLER, CAPE GIRARDEAU, CARTER, DUNKLIN, FRANKLIN,
IRON, JEFFERSON, LINCOLN, MADISON, MISSISSIPPI, NEW MADRID,
PEMISCOT, PERRY,REYNOLDS, RIPLEY, ST. CHARLES, ST. FRANCOIS,
ST. LOUIS (City and County), STE. GENEVIEVE, SCOTT, STODDARD,
WARREN, WASHINGTON AND WAYNE COUNTIES

	Rates	Fringes
Electricians.....	$ 49.29	33.642

ELEC0002-001 08/31/2025

ADAIR, AUDRAIN, BOONE, CALLAWAY, CAMDEN, CARTER, CHARITON, CLARK, COLE, COOPER, CRAWFORD, DENT, FRANKLIN, GASCONADE, HOWARD, HOWELL, IRON, JEFFERSON, KNOX, LEWIS, LINCON, LINN, MACON, MARIES, MARION, MILLER, MONITEAU, MONROE, MONTGOMERY, MORGAN, OREGON, OSAGE, PERRY, PHELPS, PIKE, PULASKI, PUTNAM, RALLS, RANDOLPH, REYNOLDS, RIPLEY, ST. CHARLES, ST. FRANCOIS, ST. LOUIS (City and County), STE. GENEVIEVE, SCHUYLER, SCOTLAND, SHANNON, SHELBY, SULLIVAN, TEXAS, WARREN AND WASHINGTON COUNTIES

	Rates	Fringes
Line Construction:		
Equipment Operator.....	$ 49.68	36.5%+7.50
Groundman & Truck Driver....	$ 37.95	36.5%+7.50
Lineman & Cable Splicer.....	$ 57.88	36.5%+7.50

ELEC0053-005 08/31/2025

ANDREW, ATCHINSON, BARRY, BARTON, BATES, BENTON, BUCHANAN, CALDWELL, CARROLL, CASS, CEDAR, CHRISTIAN, CLAY, CLINTON, DADE, DALLAS, DAVIES, DEKALB, DOUGLAS, GENTRY, GREENE, GRUNDY, HARRISON, HENRY, HICKORY, HOLT, LAFAYETTE, JACKSON, JASPER, LACLEDE, LAWRENCE, LIVINGSTON, JOHNSON, MCDONALD, MERCER, NEWTON, NODAWAY, OZARK, PETTIS, PLATTE, POLK, RAY, SALINE, ST. CLAIR, STONE, TANEY, VERNON, WEBSTER, WORTH AND WRIGHT COUNTIES

	Rates	Fringes
Line Construction:		
Groundman Powderman.....	$ 38.44	1.5%+20.18
Groundman.....	$ 35.86	1.5%+25.34
Lineman Operator.....	$ 52.45	1.5%+19.34
Lineman.....	$ 58.15	1.5%+26.69

ELEC0095-001 06/01/2025

BARRY, BARTON, CEDAR, DADE, JASPER, LAWRENCE, MCDONALD, NEWTON, ST CLAIR, AND VERNON COUNTIES

	Rates	Fringes

Electricians:
     Cable Splicers.....$ 25.40   12.19
     Electricians.....$ 32.25   20.81

 ELEC0124-007 09/01/2025

BATES, BENTON, CARROLL, CASS, CLAY, COOPER, HENRY, JACKSON,
JOHNSON, LAFAYETTE, MORGAN, PETTIS, PLATTE, RAY AND SALINE
COUNTIES:

	Rates	Fringes
Electricians.....	$ 54.01	27.85

 ELEC0257-003 03/01/2025

AUDRAIN (Except Cuivre Township), BOONE, CALLAWAY, CAMDEN,
CHARITON, COLE, CRAWFORD, DENT, GASCONADE, HOWARD, MARIES,
MILLER, MONITEAU, OSAGE, PHELPS AND RANDOLPH COUNTIES

	Rates	Fringes
Electricians:		
Cable Splicers.....	$ 30.42	16.085
Electricians.....	$ 40.50	23.26

 ELEC0350-002 12/01/2024

ADAIR, AUDRAIN (East of Highway 19), CLARK, KNOX, LEWIS, LINN,
MACON, MARION, MONROE, MONTGOMERY, PIKE, PUTNAM, RALLS,
SCHUYLER, SCOTLAND, SHELBY AND SULLIVAN COUNTIES

	Rates	Fringes
Electricians.....	$ 37.60	22.145

 ELEC0453-001 09/01/2024

	Rates	Fringes
Electricians:		
CHRISITAN, DALLAS, DOUGLAS, GREENE, HICKORY, HOWELL, LACLEDE, OREGON, OZARK, POLK, SHANNON, WEBSTER and WRIGHT COUNTIES.	$ 32.40	19.11

PULASKI and TEXAS COUNTIES..	$ 39.70	19.84
STONE and TANEY COUNTIES....	$ 28.65	18.34

ELEC0545-003 06/01/2025

ANDREW, BUCHANAN, CLINTON, DEKALB, ATCHISON, HOLT, MERCER, GENTRY, HARRISON, DAVIESS, GRUNDY, WORTH, LIVINGSTON, NODAWAY, AND CALDWELL COUNTIES

	Rates	Fringes
Electricians:.....	$ 43.20	21.50

ELEC0702-004 01/06/2025

BOLLINGER, BUTLER, CAPE GIRARDEAU, DUNKLIN, MADISON, MISSISSIPPI, NEW MADRID, PEMISCOT, SCOTT, STODDARD AND WAYNE COUNTIES

	Rates	Fringes
Line Construction:		
Groundman - Class A.....	$ 38.18	29%+8.85
Groundman-Equipment Operator Class II (all other equipment).....	$ 46.49	29%+8.85
Heavy-Equipment Operator Class I (all crawler type equipment D-4 and larger)...	$ 52.13	29%+8.85
Lineman.....	$ 74.55	29%+8.85

ENGI0101-001 05/01/2025

AREA 1
ANDREW, ATCHISON, BATES, BENTON, BUCHANAN, CALDWELL, CARROLL, CHARITON, CLINTON, COOPER, DAVIESS, DEKALB, GENTRY, GRUNDY, HARRISON, HENRY, HOLT, HOWARD, JOHNSON, LAFAYETTE, LINN, LIVINGSTON, MERCER, NODAWAY, PETTIS, SALINE, SULLIVAN AND WORTH COUNITES

	Rates	Fringes
Power equipment operators:		
GROUP 1.....	$ 38.83	21.87
GROUP 2.....	$ 38.43	21.87
GROUP 3.....	$ 36.43	21.87

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Asphalt roller operator, finish; asphalt paver and spreader; asphalt plant operator; auto grader or trimmer or sub-grader; backhoe; blade operator (all types); boilers - 2; booster pump on dredge; bulldozer operator; boring machine (truck or crane mounted); clamshell operator; concrete mixer paver; concrete plant operator; concrete pump operator; crane operator; derrick or derrick trucks; ditching machine; dragline operator; dredge engineman; dredge operator; drill cat with compressor mounted (self-contained) or similar type self- propelled rotary drill (not air tract); drilling or boring machine (rotary-self-propelled); finishing machine operator; greaser; high loader-fork lift-skid loader (all types); hoisting engineer (2 active drums); locomotive operator (standard guage); mechanics and welders (field and plants); mucking machine operator; pile drive operator; pitman crane or boom truck (all types); push cat; quad track; scraper operators (all types); shovel operator; sideboom cats; side discharge spreader; skimmer scoop operators; slip form paver operator (CMI, Rex, Gomeco or equal); la tourneau rooter (all tiller types); tow boat operator; truck crane; wood and log chippers (all types).

GROUP 2: A-frame truck operator; articulated dump truck; back filler operator; boilers (1); chip spreader; churn drill operator; compressor; concrete mixer operator, skip loader; concrete saws (self-propelled); conveyor operator; crusher operator; distributor operator; elevating grader operator; farm tractor (all attachments); fireman rig; float operator; form grade operator; hoisting engine (one drum); maintenance operator; multiple compactor; pavement breaker, self-propelled hydra-hammer (or similar type); paymill operator; power shield; pumps; roller operator (with or without blades); screening and washing plant; self-propelled street broom or sweeper; siphons and jets; straw blower; stump cutting machine; siphons and jets; tank car heater operator (combination boiler and booster); welding machine; vibrating machine operator (not hand held); welding machine.

GROUP 3: (a) Oiler;
(b) Oiiler driver
(c) Mechanic.

HOURLY PREMIUMS:

THE FOLLOWING CLASSIFICATIONS SHALL RECEIVE ($ .25) ABOVE GROUP 1 RATE: Dragline operator - 3 yds. & over; shovel 3 yds. & over; clamshell 3 yds. & over; Crane, rigs or

piledrivers, 100' of boom or over (incl. jib.), hoist - each additional active drum over 2 drums

THE FOLLOWING CLASSIFICATIONS SHALL RECEIVE ($ .50) ABOVE GROUP 1 RATE: Tandem scoop operator; crane, rigs or piledrivers 150' to 200' of boom (incl. jib.)

THE FOLLOWING CLASSIFICATIONS SHALL RECEIVE ($ .75) ABOVE GROUP 1 RATE: Crane rigs, or piledrivers 200 ft. of boom or over (including jib.)

ENGI0101-005 04/01/2025

CASS, CLAY, JACKSON,PLATTE AND RAY COUNTIES

	Rates	Fringes
Power equipment operators:		
GROUP 1	$ 40.17	22.29
GROUP 2	$ 39.13	22.29
GROUP 3	$ 34.66	22.29
GROUP 4	$ 38.01	22.29

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Asphalt roller operator, finish; asphalt paver and spreader; asphalt plant operator; auto grader or trimmer or sub-grader; backhoe; blade operator (all types); boilers-2; booster pump on dredge; boring machine (truck or crane mounted); bulldozer operator; clamshell operator; concrete cleaning decontamination machine operator; concrete mixer paver; concrete plant operator; concrete pump operator; crane operator; derrick or derrick trucks; ditching machine; dragline operator; dredge engineman; dredge operator; drillcat with compressor mounted (self-contained) or similar type self propelled rotary drill (not air tract); drilling or boring machine (rotary - self-propelled); finishing machine operator; greaser; heavy equipment robotics operator/mechanic; horizontal directional drill operator; horizontal directional drill locator; loader-forklift - skid loader (all types); hoisting engineer (2 active drums); locomotive operator (standard guage); master environmental maintenance mechanic; mechanics and welders (field and plants); mucking machine operator; piledrive operator; pitman crane or boom truck (all types); push cat; quad-track; scraper operators (all types); shovel operator; side discharge spreader; sideboom cats; skimmer scoop operator; slip-form paver (CMI, REX, Gomaco or equal); la tourneau rooter (all

tiller types); tow boat operator; truck crane; ultra high perssure waterjet cutting tool system operator/mechanic; vacuum blasting machine operator/mechanic; wood and log chippers (all types)

GROUP 2: ""A"" Frame truck operator; back filler operator; boilers (1); chip spreader;churn drill operator; concrete mixer operator, skip loader; concrete saws (self-propelled); conveyor operator; crusher operator; distributor operator; elevating grader operator; farm tractor (all attachments); fireman rig; float operator; form grader operator; hoisting engine (1 drum); maintenance operator; multiple compactor; pavement breaker, self-propelled hydra- hammer (or similar type); power shield; paymill operator; pumps; siphons and jets; stump cutting machine; tank car heater operator (combination boiler and booster); compressor; roller operator (with or without blades); screening and washing plant; self-propelled street broom or sweeper; straw blower; tank car heater operator (combination boiler and booster); vibrating machine operator (not hand held)

GROUP 3: Oilers

GROUP 4: Oiler Driver (All Types)

FOOTNOTE:
HOURLY PREMIUMS FOLLOWING CLASSIFICATIONS SHALL RECEIVE ($1.00) ABOVE GROUP 1 RATE:
Clamshells - 3 yd. capacity or over; Cranes or rigs, 80 ft. of boom or over (including jib); Draglines, 3 yd. capacity or over;
Piledrivers 80 ft. of boom or over (including jib);
Shovels & backhoes, 3 yd. capacity or over.

ENGI0101-022 05/01/2025

BARRY, BARTON, CAMDEN, CEDAR, CHRISTIAN, DADE, DALLAS, DOUGLAS, GREENE, HICKORY, JASPER, LACLEDE, LAWRENCE, MCDONALD, NEWTON, OZARK, POLK, ST. CLAIR, STONE, TANEY, VERNON, WEBSTER AND WRIGHT COUNTIES and CITY OF SPRINGFIELD

	Rates	Fringes
Power equipment operators:		
GROUP 1	$ 36.60	19.32
GROUP 2	$ 36.25	19.32
GROUP 3	$ 36.05	19.32

GROUP 4.....$ 34.00 19.32

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Asphalt finishing machine & trench widening spreader; asphalt plant console operator; autograder; automatic slipform paver; backhoe; blade operator - all types; boat operator - tow; boilers-2; central mix concrete plant operator; clamshell operator; concrete mixer paver; crane operator; derrick or derrick trucks; ditching machine; dozer operator; dragline operator; dredge booster pump; dredge engineman; dredge operator; drill cat with compressor mounted on cat; drilling or boring machine rotary self-propelled; highloader; hoisting engine - 2 active drums; launch hammer wheel; locomotive operator; - standard guage; mechanic and welders; mucking machine; off-road trucks; piledriver operator; pitman crane operator; push cat operator; quad trac; scoop operator - all types; shovel operator; sideboom cats; skimmer scoop operators; trenching machine operator; truck crane.

GROUP 2: A-frame; asphalt hot-mix silo; asphalt plant fireman (drum or boiler); asphalt plant man; asphalt plant man; asphalt plant mixer operator; asphalt roller operator; backfiller operator; barber-greene loader; boat operator (bridges and dams); chip spreader; concrete mixer operator - skip loader; concrete plant operator; concrete pump operator; crusher operator; dredge oiler; elevating grader operator; fork lift; greaser-fleet; hoisting engine - 1; locomotive operator - narrow gauge; multiple compactor; pavement breaker; powerbroom - self-propelled; power shield; rooter; side discharge concrete spreader; slip form finishing machine; stumpcutter machine; throttle man; tractor operator (over 50 h.p.); winch truck.

GROUP 3: Boilers - 1; chip spreader (front man); churn drill operator; clef plane operator; concrete saw operator (self-propelled); curb finishing machine; distributor operator; finishing machine operator; flex plane operator; float operator; form grader operator; pugmill operator; roller operator, other than high type asphalt; screening & washing plant operator; siphons & jets; sub-grading machine operator; spreader box operator, self-propelled (not asphalt); tank car heater operator (combination boiler & booster); tractor operator (50 h.p. or less); Ulmac, Ulric or similar spreader; vibrating machine operator, not hand;

GROUP 4: Grade checker; Oiler; Oiler-Driver

HOURLY PREMIUMS:

The following classifications shall receive $ .25 above GROUP 1 rate:
Clamshells - 3 yds. or over; Cranes - Rigs or Piledrivers, 100 ft. of boom or over (including jib);
Draglines - 3 yds. or over; Hoists - each additional active drum over 2 drums; Shovels - 3 yds. or over;

The following classifications shall receive $ .50 above GROUP 1 rate:
Tandem scoop operator; Cranes - Rigs or Piledrivers, 150 ft. to 200 ft. of boom (including jib); Tandem scoop.

The following classifications shall receive $ .75 above GROUP 1 rate:
Cranes - Rigs or Piledrivers, 200 ft. of boom or over (including jib.).

ENGI0513-004 05/05/2025

FRANKLIN, JEFFERSON, LINCOLN, ST CHARLES, AND WARREN COUNTIES

	Rates	Fringes
Power equipment operators:		
GROUP 1	$ 45.96	30.96
GROUP 2	$ 45.96	30.96
GROUP 3	$ 44.66	30.96
GROUP 4	$ 44.22	30.96

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Backhoe, Cable; Backhoe, Hydraulic (2 cu yds bucket and under regardless of attachment, one oiler for 2 or 3, two oilers for 4 through 6); Backhoe, Hydraulic over 2 cu yds; Cableway; Crane, Crawler or Truck; Crane, Hydraulic - Truck or Cruiser mounted, 16 tons and over; Crane, Locomotive; crane with boom including jib over 100 ft from pin to pin; Crane using rock socket tool; Derrick, Steam; Derrick Car and Derrick Boat; Dragline, 7 cu yds and over; Dredge; Gradall, Crawler or tire mounted; Locomotive, Gas, Steam & other powers; Pile Driver, Land or Floating; Scoop, Skimmer; Shovel, Power (Electric, Gas, Steam or other powers); Shovel, Power (7 cu yds and over); Switch Boat; Whirley; Air Tugger with air compressor; Anchor Placing Barge; Asphalt Spreaker; Athey Force Feeder Loader, self-propelled; Backfilling Machine; Boat Operator - Push Boat or Tow Boat (job site); Boiler, High Pressure Breaking in Period; Boom Truck, Placing or Erecting; Boring Machine,

Footing Foundation; Bullfloat; Cherry Picker; Combination Concrete Hoist and Mixer (such as Mixermobile); Compressor, Two 125 CFM and under; Compressor, Two through Four over 125 CFM; Compressor when operator runs throttle; Concrete Breaker (Truck or Tractor mounted); Concrete Pump (such as Pumpcrete machine); Concrete Saw (self-propelled); Concrete Spreader; Conveyor, Large (not selfpropelled) hoisting or moving brick and concrete into, or into and on floor level, one or both; Crane, Cimbing (such as Linden); Crane, Hydraulic - Rough Terrain, self-propelled; Crane, Hydraulic - Truck or Cruiser mounted - under 16 tons; Drilling machine - Self-powered, used for earth or rock drilling or boring (wagon drills and any hand drills obtaining power from other souces including concrete breakers, jackhammers and Barco equipmnet no engineer required); Elevating Grader; Engine Man, Dredge; Excavator or Powerbelt Machine; Finishing Machine, self- propelled oscillating screed; Forklift; Generators, Two through Six 30 KW or over; Grader, Road with power blade; Greaser; Highlift; Hoist, Concrete and Brick (Brick cages or concrete skips operating or on tower, Towermobile, or similar equipment); Hoist, Three or more drums in use; Hoist, Stack; Hydro-Hammer; Lad-A-Vator, hoisting brick or concrete; Loading Machine such as Barber-Greene; Mechanic on job site

GROUP 2: Air Tugger with plant air; Boiler (for power or heating shell of building or temporary enclosures in connection with construction work); Boiler, Temporary; Compressor, One over 125 CFM; Compressor, truck mounted; Conveyor, Large (not self- propelled); Conveyor, Large (not self- propelled) moving brick and concrete (distributing) on floor level; Curb Finishing Machine; Ditch Paving Machine; Elevator (outside); Endless Chain Hoist; Fireman (as required); Form Grader; Hoist, One Drum regardless of size (except brick or concrete); Lad-A-Vator, other hoisting; Manlift; Mixer, Asphalt, over 8 cu ft capacity; Mixer, one bag capacity or less; Mixer, without side loader, two bag capacity or more; Mixer, with side loader, regardless of size, not Paver; Mud Jack (where mud jack is used in conjenction with an air compressor, operator shall be paid $ .55 per hour in addition to his basic hourly rate for covering both operations); Pug Mill operator; Pump, Sump - self powered, automatic controlled over 2""; Scissor Lift (used for hoisting); Skid Steer Loader; Sweeper, Street; Tractor, small wheel type 50 HP and under with grader blade and similar equipment; Welding Machine, One over 400 amp; Winch, operating from truck

GROUP 3: Boat operator - outboard motor, job site; Conveyors (such as Con-Vay-It) regardless of how used; Elevator

(inside); Heater operator, 2 through 6; Sweeper, Floor

GROUP 4: Crane type

HOURLY PREMIUMS:

Backhoe, Hydraulic 2 cu yds or less without oiler - $2.00;
Crane,climbing (such as Linden) - $.50;
Crane, Pile Driving and Extracting - $ .50
Crane with boom (including job) over
100 ft from pin to pin - add $.01 per foot
to maximum of $4.00);
Crane, using rock socket tool - $ .50;
Derrick, diesel, gas or electric hoisting material
and erecting steel (150 ft or more above ground) - $ .50;
Dragline, 7 cu yds and over - $ .50;
Hoist, Three or more drums in use - $ .50;
Scoop, Tandem - $.50;
Shovel, Power - 7 cu yds and over - $ .50;
Tractor, Tandem Crawler - $ .50;
Tunnel, man assigned to work in tunnel or
tunnel shaft - $ .50;
Wrecking, when machines are working on
second floor or higher - $ .50

ENGI0513-006 05/01/2025

ADAIR, AUDRAIN, BOLLINGER, BOONE, BUTLER, CALLAWAY, CAPE GIRARDEAU, CARTER, CLARK, COLE, CRAWFORD, DENT, DUNKLIN, GASCONADE, HOWELL, IRON, KNOX, LEWIS, MACON, MADISON, MARIES, MARION, MILLER, MISSISSIPPI, MONITEAU, MONROE, MONTGOMERY, MORGAN, NEW MADRID, OREGON, OSAGE, PEMISCOT, PERRY, PHELPS, PIKE, PULASKI, PUTNAM, RALLS, RANDOLPH, REYNOLDS, RIPLEY, ST. FRANCOIS, STE. GENEVIEVE, SCHUYLER, SCOTLAND, SCOTT, SHANNON, SHELBY, STODDARD, TEXAS, WASHINGTON, AND WAYNE COUNTIES

	Rates	Fringes
Power equipment operators:		
GROUP 1	$ 40.39	30.33
GROUP 2	$ 40.04	30.33
GROUP 3	$ 39.84	30.33
GROUP 4	$ 36.19	30.33

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Asphalt finishing machine & trench widening spreader, asphalt plant console operator; autograder;

automatic slipform paver; back hoe; blade operator - all types; boat operator tow; boiler two; central mix concrete plant operator; clam shell operator; concrete mixer paver; crane operator; derrick or derrick trucks; ditching machine; dozer operator; dragline operator; dredge booster pump; dredge engineman; dredge operator; drill cat with compressor mounted on cat; drilling or boring machine rotary self-propelled; highloader; hoisting engine 2 active drums; launchhammer wheel; locomotive operator standrad guage; mechanics and welders; mucking machine; piledriver operator; pitman crane operator; push cat operator; guad-trac; scoop operator; sideboom cats; skimmer scoop operator; trenching machine operator; truck crane, shovel operator.

GROUP 2: A-Frame; asphalt hot-mix silo; asphalt roller operator asphalt plant fireman (drum or boiler); asphalt plant man; asphalt plant mixer operator; backfiller operator; barber-greene loader; boat operator (bridge & dams); chip spreader; concrete mixer operator skip loader; concrete plant operator; concrete pump operator; dredge oiler; elevating graded operator; fork lift; grease fleet; hoisting engine one; locomotive operator narrow guage; multiple compactor; pavement breaker; powerbroom self-propelled; power shield; rooter; slip-form finishing machine; stumpcutter machine; side discharge concrete spreader; throttleman; tractor operator (over 50 hp); winch truck; asphalt roller operator; crusher operator.

GROUP 3: Spreader box operator, self-propelled not asphalt; tractor operator (50 h.p. or less); boilers one; chip spreader (front man); churn drill operator; compressor over 105 CFM 2-3 pumps 4"" & over; 2-3 light plant 7.5 KWA or any combination thereof; clef plane operator; compressor maintenance operator 2 or 3; concrete saw operator (self-propelled); curb finishing mancine; distributor operator; finishing machine operator; flex plane operator; float operator; form grader operator; pugmill operator; riller operator other than high type asphalt; screening & washing plant operator; siphons & jets; subgrading machine operator; tank car heater (combination boiler & booster); ulmac, ulric or similar spreader; vibrating machine operator; hydrobroom.

GROUP 4: Oiler; grout machine; oiler driver; compressor over 105 CFM one; conveyor operator one; maintenance operator; pump 4"" & over one.

FOOTNOTE: HOURLY PREMIUMS

Backhoe hydraulic, 2 cu. yds. or under Without oiler - $2.00
Certified Crane Operator - $1.50;
Certified Hazardous Material Operator $1.50;
Crane, climbing (such as Linden) - $0.50;
Crane, pile driving and extracting - $0.50;
  Crane, with boom (including jib) over 100' from pin to pin
  add $0.01 per foot to maximum of $4.00;
Crane, using rock socket tool - $0.50;
  Derrick, diesel, gas or electric, hoisting material and
  erecting steel (150' or more above the ground) - $0.50;
Dragline, 7 cu. yds, and over - $0.50;
  Hoist, three or more drums in use - $0.50; Scoop, Tandem -
  $0.50;
Shovel, power - 7 cu. yds. or more - $0.50;
Tractor, tandem crawler - $0.50;
  Tunnel, man assigned to work in tunnel or tunnel shaft -
  $0.50;
  Wrecking, when machine is working on second floor or higher -
  $0.50;

ENGI0513-007 05/05/2025

ST. LOUIS CITY AND COUNTY

	Rates	Fringes
Power equipment operators:		
GROUP 1	$ 45.96	30.96
GROUP 2	$ 45.96	30.96
GROUP 3	$ 44.66	30.96
GROUP 4	$ 44.22	30.96

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

  GROUP 1: Backhoe, cable or hydraulic; cableway; crane
  crawler or truck; crane, hydraulic-truck or cruiser mounted
  16 tons & over; crane locomotive; derrick, steam; derrick
  car & derrick boat; dragline; dredge; gradall, crawler or
  tire mounted; locomotive, gas, steam & other powers; pile
  driver, land or floating; scoop, skimmer; shovel, power
  (steam, gas, electric or other powers); switch boat;
  whirley.

  GROUP 2: Air tugger w/air compressor; anchor-placing barge;
  asphalt spreader; athey force feeder loader (self-
  propelled); backfilling machine; backhoe-loader; boat
  operator-push boat or tow boat (job site); boiler, high
  pressure breaking in period; boom truck, placing or
  erecting; boring machine, footing foundation; bull- float;

cherry picker; combination concrete hoist & mixer (such as mixer mobile); compressor (when operator runs throttle); concrete breaker (truck or tractor mounted); concrete pump, such as pump-crete machine; concrete saw (self-propelled), concrete spreader; conveyor, large (not self-propelled), hoisting or moving brick and concrete into, or into and on floor level, one or both; crane, hydraulic-rough terrain, self-propelled; crane hydraulic-truck or cruiser mounted-under 16 tons; drilling machines, self-powered use for earth or rock drilling or boring (wagon drills nd any hand drills obtaining power from other sources including concrete breakers, jackhammers and barco equipment-no engineer required); elevating grader; engineman, dredge; excavator or powerbelt machine; finishing machine, self-propelled oscillating screed; forklift; grader, road with power blade; highlift. greaser; hoist, stack, hydro-hammer; loading machine (such as barber-greene); machanic, on job site; mixer, pipe wrapping machines; plant asphalt; plant, concrete producing or ready-mix job site; plant heating-job site; plant mixing-job site; plant power, generating-job site; pumps, two through six self-powered over 2""; pumps, electric submersible, two through six, over 4""; quad-track; roller, asphalt, top or sub-grade; scoop, tractor drawn; spreader box; sub-grader; tie tamper; tractor-crawler, or wheel type with or without power unit, power take-offs and attachments regardless of size; trenching machine; tunnel boring machine; vibrating machine automatic, automatic propelled; welding machines (gasoline or diesel) two through six; well drilling machine

GROUP 3: Conveyor, large (not self-propelled); conveyor, large (not self-propelled) moving brick and concrete distributing) on floor level; mixer two or more mixers of one bag capacity or less; air tugger w/plant air; boiler, for power or heating on construction projects; boiler, temporary; compressor (mounted on truck; curb finishing machine; ditch paving machine; elevator; endless chain hoist; form grader; hoist, one drum regardless of size; lad-a-vator; manlift; mixer, asphalt, over 8 cu. ft. capacity, without side loader, 2 bag capacity or more; mixer, with side loader, regardless of size; pug mill operator; pump, sump-self-powered, automatic controlled over 2"" during use in connection with construction work; sweeper, street; welding machine, one over 400 amp.; winch operating from truck; scissor lift (used for hoisting); tractor, small wheel type 50 h.p. & under with grader blade & similar equipment; Oiler on dredge and on truck crane.

GROUP 4: Boat operator-outboard motor (job site); conveyor (such as con-vay-it) regardless of how used; sweeper, floor

HOURLY PREMIUMS:

Backhoe, hydraulic 2 cu. yds. or under without oiler	$2.00
Certified Crane Operator	1.50
Certified Hazardous Material Operator	1.50
Crane, climbing (such as Linden)	.50
Crane, pile driving and extracting	.50
Crane, with boom (including jib) over 100' (from pin to pin) add $.01 per foot to maximum of	4.00
Crane, using rock socket tool	.50
Derrick, diesel, gas or electric, hoisting material and erecting steel (150' or more above ground)	.50
Dragline, 7 cu. yds. and over	.50
Hoist, three (3) or more drums in use	.50
Scoop, Tandem	.50
Shovel, power - 7 cu. yds. or more	.50
Tractor, tandem crawler	.50
Tunnel, man assigned to work in tunnel or tunnel shaft	.50
Wrecking, when machine is working on second floor or higher	.50

IRON0010-012 04/01/2025

	Rates	Fringes
Ironworkers: ANDREW, BARTON, BENTON, CAMDEN, CEDAR, CHARITON, CHRISTIAN, COOPER, DADE, DALLAS, DAVIESS, DE KALB, GENTRY, GREENE, GRUNDY, HARRISON, HICKORY, HOLT, HOWARD, LACLEDE, LINN, LIVINGSTON, MERCER, MONITEAU, MORGAN, NODAWAY, PETTIS, POLK, PUTNAM, RANDLOPH, ST. CLAIR, SULLIVAN, TANEY, VERNON, WEBSTER, WRIGHT and WORTH Counties and portions of ADAIR, BOONE, MACON, MILLER and RANDOLPH Counties	$ 36.00	34.25
ATCHISON, BATES, BUCHANAN, CALDWELL, CARROLL, CASS,		

CLAY, CLINTON, HENRY,
JACKSON, JOHNSON,
LAFAYETTE, PETTIS, PLATTE,
SALINE, AND RAY COUNTIES....$ 39.00 34.25

IRON0010-020 04/01/2025

BARRY, JASPER, LAWRENCE, MCDONALD, NEWTON AND STONE Counties

	Rates	Fringes
Ironworkers:.....	$ 36.00	34.25

IRON0321-002 08/01/2023

DOUGLAS, HOWELL and OZARK COUNTIES

	Rates	Fringes
Ironworker.....	$ 27.00	20.96

IRON0396-004 08/06/2025

ST. LOUIS (City and County), ST. CHARLES, JEFFERSON, IRON, FRANKLIN, LINCOLN, WARREN, WASHINGTON, ST. FRANCOIS, STE. GENEVIEVE, and REYNOLDS Counties; and portions of MADISON, PERRY, BOLLINGER, WAYNE, and CARTER Counties

	Rates	Fringes
Ironworker.....	$ 44.27	31.65

IRON0396-009 08/07/2024

AUDRAIN, CALLAWAY, COLE, CRAWFORD, DENT, GASCONADE, MARIES, MONTGOMERY, OSAGE, PHELPS, PIKE, PULASKI, TEXAS and WRIGHT Counties; and portions of BOONE, CAMDEN, DOUGLAS, HOWELL, LACLEDE, MILLER, MONROE, OREGON, SHANNON and RALLS Counties

	Rates	Fringes
Ironworker.....	$ 41.67	31.25

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* IRON0577-005 06/01/2025

ADAIR, CLARK, KNOX, LEWIS, MACON, MARION, MONROE, RALLS, SCHUYLER, SCOTLAND, AND SHELBY COUNTIES

	Rates	Fringes
Ironworker	$ 36.30	25.80

IRON0782-003 08/01/2023

CAPE GIRARDEAU, MISSISSIPPI, NEW MADRID, SCOTT, & STODDARD Counties; and portions of BOLLINGER, BUTLER, CARTER, DUNKLIN, MADISON, PEMISCOT, PERRY, RIPLEY, and WAYNE Counties

	Rates	Fringes
Ironworkers:		
Locks, Dams, Bridges and other major work on the Mississippi and Ohio River only	$ 38.77	29.51
All Other Work	$ 33.47	24.12

LABO0042-003 06/04/2025

ST. LOUIS (City and County)

	Rates	Fringes
LABORER		
Plumber Laborer	$ 40.82	17.56

LABO0042-005 06/04/2025

ST. LOUIS (City and County)

	Rates	Fringes
LABORER		
Dynamiter, Powderman	$ 40.82	17.56
Laborers, Flaggers	$ 40.82	17.56
Wrecking	$ 40.82	17.56

LABO0110-005 05/01/2025

Jefferson and Washington Counties

	Rates	Fringes
LABORER (Jefferson County)		
GROUP 1	$ 40.36	15.96
GROUP 2	$ 40.36	15.96

LABORER (Washington County)

GROUP 1.....	$ 37.25	15.96
GROUP 2.....	$ 37.25	15.96

LABORERS CLASSIFICATIONS

GROUP 1 - General laborer-flagman, carpenter tenders; salamander Tenders; Dump Man; Ticket Takers; loading trucks under bins, hoppers, and conveyors; track man; cement handler; dump man on earth fill; georgie buggie man; material batch hopper man; spreader on asphalt machine; material mixer man (except on manholes); coffer dams; riprap pavers rock, block or brick; scaffolds over ten feet not self-supported from ground up; skip man on concrete paving; wire mesh setters on concrete paving; all work in connection with sewer, water, gas, gasoling, oil, drainage pipe, conduit pipe, tile and duct lines and all other pipe lines; power tool operator; all work in connection with hydraulic or general dredging operations; form setters, puddlers (paving only); straw blower nozzleman; asphalt plant platform man; chuck tender; crusher feeder; men handling creosote ties or creosote materials; men working with and handling epoxy material; topper of standing trees; feeder man on wood pulverizers, board and willow mat weavers and cabelee tiers on river work; deck hands; pile dike and revetment work; all laborers working on underground tunnels less than 25 ft. where compressed air is not used; abutement and pier hole men working six (6) ft. or more below ground; men working in coffer dams for bridge piers and footing in the river; barco tamper; jackson or any other similar tamp; cutting torch man; liners, curb, gutters, ditch lines; hot mastic kettlemen; hot tar applicator; hand blade operator; mortar men or brick or block manholes; rubbing concrete, air tool operator under 65 lbs.; caulker and lead man; chain or concrete saw under 15 h.p.; signal Gan; Guard rail and sign erectors.

GROUP 2 - Skilled laborers - Vibrator man; asphalt raker; head pipe layer on sewer work; batterboard man on pipe and ditch work; cliff scalers working from bosun's chairs; scaffolds or platforms on dams or power plants over 10 ft. high; air tool operator over 65 lbs.; stringline man on concrete paving; sandblast man; laser beam man; wagon drill; churn drill; air track drill and all other similar type drills, gunite nozzle man; pressure grout man; screed man on asphalt; concrete saw 15 h.p. and over; grade checker; strigline man on electronic grade control; manhole builder; dynamite man; powder man; welder; tunnel man; waterblaster - 1000 psi or over; asbestos and/or hazardous

waste removal and/or disposal

LABO0579-005 05/01/2023

	Rates	Fringes
LABORER (ANDREW, ATCHISON, BUCHANAN, CALDWELL, CLINTON, DAVIESS, DEKALB, GENTRY, GRUNDY, HARRISON, HOLT, LIVINGSTON, MERCER, NODAWAY and WORTH COUNTIES.)		
GROUP 1	$ 29.04	16.59
GROUP 2	$ 29.39	16.59
LABORER (BARRY, BARTON, BATES, BENTON, CAMDEN, CARROLL, CEDAR, CHRISTIAN, DADE, DALLAS, DOUGLAS, GREENE, HENRY. HICKORY, JASPER, JOHNSON, LACLEDE, LAWRENCE, MCDONALD, MORGAN, NEWTON, OZARK, PETTIS, POLK, ST.CLAIR, SALINE, STONE, TANEY, VERNON, WEBSTER and WRIGHT COUNTIES)		
GROUP 1	$ 28.23	15.60
GROUP 2	$ 28.78	15.60
LABORER (LAFAYETTE COUNTY)		
GROUP 1	$ 29.78	15.85
GROUP 2	$ 30.13	15.85

LABORERS CLASSIFICATIONS

GROUP 1: General Laborers - Carpenter tenders; salamander tenders; loading trucks under bins; hoppers & conveyors; track men & all other general laborers; air tool operator; cement handler-bulk or sack; dump man on earth fill; georgie buggie man; material batch hopper man; material mixer man (except on manholes); coffer dams; riprap pavers - rock, block or brick; signal man; scaffolds over ten feet not self-supported from ground up; skipman on concrete paving; wire mesh setters on concrete paving; all work in connection with sewer, water, gas, gasoline, oil drainage pipe, conduit pipe, tile and duct lines and all other pipe lines; power tool operator, all work in connection with hydraulic or general dredging operations; puddlers (paving only); straw blower nozzleman; asphalt plant platform man; chuck tender; crusher feeder; men handling creosote ties or creosote materials; men working with and handling epoxy

material or materials (where special protection is required); rubbing concrete; topper of standing trees; batter board man on pipe and ditch work; feeder man on wood pulverizers; board and willow mat weavers and cable tiers on river work; deck hands; pile dike and revetment work; all laborers working on underground tunnels less than 25 feet where compressed air is not used; abutment and pier hole men working six (6) feet or more below ground; men working in coffer dams for bridge piers and footings in the river; ditchliners; pressure groutmen; caulker; chain or concrete saw; cliffscalers working from scaffolds, bosuns' chairs or platforms on dams or power plants over (10) feet above ground; mortarmen on brick or block manholes; toxic and hazardous waste work.

GROUP 2: Skilled Laborers - Head pipe layer on sewer work; laser beam man; Jackson or any other similar tamp; cutting torch man; form setters; liners and stringline men on concrete paving, curb, gutters; hot mastic kettleman; hot tar applicator; sandblasting and gunite nozzlemen; air tool operator in tunnels; screed man on asphalt machine; asphalt raker; barco tamper; churn drills; air track drills and all similar drills; vibrator man; stringline man for electronic grade control; manhole builders-brick or block; dynamite and powder men; grade checker.

LABO0660-004 05/01/2025

Clark, Knox, Lewis, Marion, Pike, Ralls, Scotland, Shelby Counties

	Rates	Fringes
LABORER		
GROUP 1	$ 37.25	15.96
GROUP 2	$ 37.25	15.96

LABORERS CLASSIFICATIONS

GROUP 1 - General laborer-flagman, carpenter tenders; salamander Tenders; Dump Man; Ticket Takers; loading trucks under bins, hoppers, and conveyors; track man; cement handler; dump man on earth fill; georgie buggie man; material batch hopper man; spreader on asphalt machine; material mixer man (except on manholes); coffer dams; riprap pavers rock, block or brick; scaffolds over ten feet not self-supported from ground up; skip man on concrete paving; wire mesh setters on concrete paving; all work in

connection with sewer, water, gas, gasoling, oil, drainage pipe, conduit pipe, tile and duct lines and all other pipe lines; power tool operator; all work in connection with hydraulic or general dredging operations; form setters, puddlers (paving only); straw blower nozzleman; asphalt plant platform man; chuck tender; crusher feeder; men handling creosote ties or creosote materials; men working with and handling epoxy material; topper of standing trees; feeder man on wood pulverizers, board and willow mat weavers and cabelee tiers on river work; deck hands; pile dike and revetment work; all laborers working on underground tunnels less than 25 ft. where compressed air is not used; abutement and pier hole men working six (6) ft. or more below ground; men working in coffer dams for bridge piers and footing in the river; barco tamper; jackson or any other similar tamp; cutting torch man; liners, curb, gutters, ditch lines; hot mastic kettlemen; hot tar applicator; hand blade operator; mortar men or brick or block manholes; rubbing concrete, air tool operator under 65 lbs.; caulker and lead man; chain or concrete saw under 15 h.p.; signal Gan; Guard rail and sign erectors.

GROUP 2 - Skilled laborers - Vibrator man; asphalt raker; head pipe layer on sewer work; batterboard man on pipe and ditch work; cliff scalers working from bosun's chairs; scaffolds or platforms on dams or power plants over 10 ft. high; air tool operator over 65 lbs.; stringline man on concrete paving; sandblast man; laser beam man; wagon drill; churn drill; air track drill and all other similar type drills, gunite nozzle man; pressure grout man; screed man on asphalt; concrete saw 15 h.p. and over; grade checker; strigline man on electronic grade control; manhole builder; dynamite man; powder man; welder; tunnel man; waterblaster - 1000 psi or over; asbestos and/or hazardous waste removal and/or disposal

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LABO0660-006 06/02/2025

Lincoln, Montgomery, St Charles and Warren Counties

	Rates	Fringes
LABORER (Common or General).....	$ 36.91	15.62
Lincoln, Monntomery, and Warrner Counties.....	$ 39.76	15.96
St. Charles County.....	$ 41.18	15.96

LABO0662-001 05/01/2025

Callaway, Cole, Miller and Moniteau Counties

	Rates	Fringes
LABORER		
GROUP 1	$ 37.25	15.96
GROUP 2	$ 37.25	15.96

LABORERS CLASSIFICATIONS

GROUP 1 - General laborer-flagman, carpenter tenders; salamander Tenders; Dump Man; Ticket Takers; loading trucks under bins, hoppers, and conveyors; track man; cement handler; dump man on earth fill; georgie buggie man; material batch hopper man; spreader on asphalt machine; material mixer man (except on manholes); coffer dams; riprap pavers rock, block or brick; scaffolds over ten feet not self-supported from ground up; skip man on concrete paving; wire mesh setters on concrete paving; all work in connection with sewer, water, gas, gasoling, oil, drainage pipe, conduit pipe, tile and duct lines and all other pipe lines; power tool operator; all work in connection with hydraulic or general dredging operations; form setters, puddlers (paving only); straw blower nozzleman; asphalt plant platform man; chuck tender; crusher feeder; men handling creosote ties or creosote materials; men working with and handling epoxy material; topper of standing trees; feeder man on wood pulverizers, board and willow mat weavers and cabelee tiers on river work; deck hands; pile dike and revetment work; all laborers working on underground tunnels less than 25 ft. where compressed air is not used; abutement and pier hole men working six (6) ft. or more below ground; men working in coffer dams for bridge piers and footing in the river; barco tamper; jackson or any other similar tamp; cutting torch man; liners, curb, gutters, ditch lines; hot mastic kettlemen; hot tar applicator; hand blade operator; mortar men or brick or block manholes; rubbing concrete, air tool operator under 65 lbs.; caulker and lead man; chain or concrete saw under 15 h.p.; signal Gan; Guard rail and sign erectors.

GROUP 2 - Skilled laborers - Vibrator man; asphalt raker; head pipe layer on sewer work; batterboard man on pipe and ditch work; cliff scalers working from bosun's chairs; scaffolds or platforms on dams or power plants over 10 ft. high; air tool operator over 65 lbs.; stringline man on concrete paving; sandblast man; laser beam man; wagon drill; churn drill; air track drill and all other similar

type drills, gunite nozzle man; pressure grout man; screed man on asphalt; concrete saw 15 h.p. and over; grade checker; strigline man on electronic grade control; manhole builder; dynamite man; powder man; welder; tunnel man; waterblaster - 1000 psi or over; asbestos and/or hazardous waste removal and/or disposal

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LABO0663-002 04/01/2025

CASS, CLAY, JACKSON, PLATTE AND RAY COUNTIES

	Rates	Fringes
LABORER		
GROUP 1	$ 36.24	15.87
GROUP 2	$ 37.45	15.87

LABORERS CLASSIFICATIONS

GROUP 1: General laborers, Carpenter tenders, salamander tenders, loading trucks under bins, hoppers and conveyors, track men and all other general laborers, air tool operator, cement handler (bulk or sack), chain or concrete saw, deck hands, dump man on earth fill, Georgie Buggies man, material batch hopper man, scale man, material mixer man (except on manholes), coffer dams, abutments and pier hole men working below ground, riprap pavers rock, black or brick, signal man, scaffolds over ten feet not self-supported from ground up, skipman on concrete paving, wire mesh setters on concrete paving, all work in connection with sewer,water, gas, gasoling, oil, drainage pipe, conduit pipe, tile and duct lines and all other pipelines, power tool operator, all work in connection with hydraulic or general dredging operations, straw blower nozzleman,asphalt plant platform man, chuck tender, crusher feeder, men handling creosote ties on creosote materials, men working with and handling epoxy material or materials (where special protection is required), topper of standing trees, batter board man on pipe and ditch work, feeder man on wood pulverizers, board and willow mat weavers and cable tiers on river work, deck hands, pile dike and revetment work, all laborers working on underground tunnels less than 25 feet where compressed air is not used, abutment and pier hole men working six (6) feet or more below ground, men working in coffer dams for bridge piers and footings in the river, ditchliners, pressure groutmen, caulker and chain or concrete saw, cliffscalers working from scaffolds, bosuns' chairs or platforms on dams or power plants over (10) feet above ground, mortarmen on brick or block manholes, signal

man.

GROUP 2: Skilled Laborer - spreader or screed man on asphalt machine, asphalt raker, grade checker, vibrator man, concrete saw over 5 hp., laser beam man, barco tamper, jackson or any other similar tamp, wagon driller, churn drills, air track drills and other similar drills, cutting torch man, form setters, liners and stringline men on concrete paving, curb, gutters and etc., hot mastic kettleman, hot tar applicator, hand blade operators, mortar men on brick or block manholes, sand blasting and gunnite nozzle men, rubbing concrete, air tool operator in tunnels, head pipe layer on sewer work, manhole builder (brick or block), dynamite and powder men.

LABO0840-011 05/01/2025

Crawford, Dent, Franklin, Gasconade, Howell, Maries, Oregon, Osage, Phelps, Pulaski, Shannon and Texas Counties

	Rates	Fringes
LABORER (Crawford, Dent, Gasconade, Howell, Maries, Oregon, Osage, Phelps, Pulaski, Shannon and Texas Counties)		
GROUP 1	$ 37.25	15.96
GROUP 2	$ 37.25	15.96
LABORER (Franklin County)		
GROUP 1	$ 40.31	15.96
GROUP 2	$ 40.31	15.96

LABORERS CLASSIFICATIONS

GROUP 1 - General laborer-flagman, carpenter tenders; salamander Tenders; Dump Man; Ticket Takers; loading trucks under bins, hoppers, and conveyors; track man; cement handler; dump man on earth fill; georgie buggie man; material batch hopper man; spreader on asphalt machine; material mixer man (except on manholes); coffer dams; riprap pavers rock, block or brick; scaffolds over ten feet not self-supported from ground up; skip man on concrete paving; wire mesh setters on concrete paving; all work in connection with sewer, water, gas, gasoling, oil, drainage pipe, conduit pipe, tile and duct lines and all other pipe lines; power tool operator; all work in connection with hydraulic or general dredging operations; form setters,

puddlers (paving only); straw blower nozzleman; asphalt plant platform man; chuck tender; crusher feeder; men handling creosote ties or creosote materials; men working with and handling epoxy material; topper of standing trees; feeder man on wood pulverizers, board and willow mat weavers and cabelee tiers on river work; deck hands; pile dike and revetment work; all laborers working on underground tunnels less than 25 ft. where compressed air is not used; abutement and pier hole men working six (6) ft. or more below ground; men working in coffer dams for bridge piers and footing in the river; barco tamper; jackson or any other similar tamp; cutting torch man; liners, curb, gutters, ditch lines; hot mastic kettlemen; hot tar applicator; hand blade operator; mortar men or brick or block manholes; rubbing concrete, air tool operator under 65 lbs.; caulker and lead man; chain or concrete saw under 15 h.p.; signal Gan; Guard rail and sign erectors.

GROUP 2 - Skilled laborers - Vibrator man; asphalt raker; head pipe layer on sewer work; batterboard man on pipe and ditch work; cliff scalers working from bosun's chairs; scaffolds or platforms on dams or power plants over 10 ft. high; air tool operator over 65 lbs.; stringline man on concrete paving; sandblast man; laser beam man; wagon drill; churn drill; air track drill and all other similar type drills, gunite nozzle man; pressure grout man; screed man on asphalt; concrete saw 15 h.p. and over; grade checker; strigline man on electronic grade control; manhole builder; dynamite man; powder man; welder; tunnel man; waterblaster - 1000 psi or over; asbestos and/or hazardous waste removal and/or disposal

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LABO0955-012 05/01/2025

Adair, Audrain, Boone, Chariton, Cooper, Howard, Linn, Macon, Monroe, Putnam, Randolph, Schuyler and Sullivan Counties

	Rates	Fringes
LABORER		
GROUP 1	$ 37.25	15.96
GROUP 2	$ 37.25	15.96

LABORERS CLASSIFICATIONS

GROUP 1 - General laborer-flagman, carpenter tenders; salamander Tenders; Dump Man; Ticket Takers; loading trucks

under bins, hoppers, and conveyors; track man; cement handler; dump man on earth fill; georgie buggie man; material batch hopper man; spreader on asphalt machine; material mixer man (except on manholes); coffer dams; riprap pavers rock, block or brick; scaffolds over ten feet not self-supported from ground up; skip man on concrete paving; wire mesh setters on concrete paving; all work in connection with sewer, water, gas, gasoling, oil, drainage pipe, conduit pipe, tile and duct lines and all other pipe lines; power tool operator; all work in connection with hydraulic or general dredging operations; form setters, puddlers (paving only); straw blower nozzleman; asphalt plant platform man; chuck tender; crusher feeder; men handling creosote ties or creosote materials; men working with and handling epoxy material; topper of standing trees; feeder man on wood pulverizers, board and willow mat weavers and cabelee tiers on river work; deck hands; pile dike and revetment work; all laborers working on underground tunnels less than 25 ft. where compressed air is not used; abutement and pier hole men working six (6) ft. or more below ground; men working in coffer dams for bridge piers and footing in the river; barco tamper; jackson or any other similar tamp; cutting torch man; liners, curb, gutters, ditch lines; hot mastic kettlemen; hot tar applicator; hand blade operator; mortar men or brick or block manholes; rubbing concrete, air tool operator under 65 lbs.; caulker and lead man; chain or concrete saw under 15 h.p.; signal Gan; Guard rail and sign erectors.

GROUP 2 - Skilled laborers - Vibrator man; asphalt raker; head pipe layer on sewer work; batterboard man on pipe and ditch work; cliff scalers working from bosun's chairs; scaffolds or platforms on dams or power plants over 10 ft. high; air tool operator over 65 lbs.; stringline man on concrete paving; sandblast man; laser beam man; wagon drill; churn drill; air track drill and all other similar type drills, gunite nozzle man; pressure grout man; screed man on asphalt; concrete saw 15 h.p. and over; grade checker; strigline man on electronic grade control; manhole builder; dynamite man; powder man; welder; tunnel man; waterblaster - 1000 psi or over; asbestos and/or hazardous waste removal and/or disposal

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LABO1104-005 05/01/2025

Bollinger, Butler, Cape Girardeau, Carter, Dunklin, Iron, Madison, Mississippi, New Madrid, Pemiscot, Perry, Reynolds, Ripley, Scott, St Francois, Ste Genevieve, Stoddard and Wayne

Counties

	Rates	Fringes
LABORER		
GROUP 1	$ 37.25	15.96
GROUP 2	$ 37.25	15.96

LABORERS CLASSIFICATIONS

GROUP 1 - General laborer-flagman, carpenter tenders; salamander Tenders; Dump Man; Ticket Takers; loading trucks under bins, hoppers, and conveyors; track man; cement handler; dump man on earth fill; georgie buggie man; material batch hopper man; spreader on asphalt machine; material mixer man (except on manholes); coffer dams; riprap pavers rock, block or brick; scaffolds over ten feet not self-supported from ground up; skip man on concrete paving; wire mesh setters on concrete paving; all work in connection with sewer, water, gas, gasoling, oil, drainage pipe, conduit pipe, tile and duct lines and all other pipe lines; power tool operator; all work in connection with hydraulic or general dredging operations; form setters, puddlers (paving only); straw blower nozzleman; asphalt plant platform man; chuck tender; crusher feeder; men handling creosote ties or creosote materials; men working with and handling epoxy material; topper of standing trees; feeder man on wood pulverizers, board and willow mat weavers and cabelee tiers on river work; deck hands; pile dike and revetment work; all laborers working on underground tunnels less than 25 ft. where compressed air is not used; abutement and pier hole men working six (6) ft. or more below ground; men working in coffer dams for bridge piers and footing in the river; barco tamper; jackson or any other similar tamp; cutting torch man; liners, curb, gutters, ditch lines; hot mastic kettlemen; hot tar applicator; hand blade operator; mortar men or brick or block manholes; rubbing concrete, air tool operator under 65 lbs.; caulker and lead man; chain or concrete saw under 15 h.p.; signal Gan; Guard rail and sign erectors.

GROUP 2 - Skilled laborers - Vibrator man; asphalt raker; head pipe layer on sewer work; batterboard man on pipe and ditch work; cliff scalers working from bosun's chairs; scaffolds or platforms on dams or power plants over 10 ft. high; air tool operator over 65 lbs.; stringline man on concrete paving; sandblast man; laser beam man; wagon drill; churn drill; air track drill and all other similar

type drills, gunite nozzle man; pressure grout man; screed man on asphalt; concrete saw 15 h.p. and over; grade checker; strigline man on electronic grade control; manhole builder; dynamite man; powder man; welder; tunnel man; waterblaster - 1000 psi or over; asbestos and/or hazardous waste removal and/or disposal

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PAIN0002-002 09/01/2007

CLARK, FRANKLIN, JEFFERSON, LEWIS, LINCOLN, MARION, PIKE, RALLS, ST. CHARLES, ST. LOUIS (CITY & COUNTY), AND WARREN COUNTIES

	Rates	Fringes
Painters:		
Brush and Roller; Taper	$ 28.61	10.24
High work over 60 feet	$ 29.11	10.24
Lead Abatement	$ 29.36	10.24
Pressure Roller; High work under 60 ft	$ 28.86	10.24
Spray & Abrasive Blasting; Water Blasting (Over 5000 PSI)	$ 30.61	10.24
Taper (Ames Tools & Bazooka)	$ 30.21	10.24

PAIN0002-006 04/01/2023

ADAIR, AUDRAIN, BOONE, CALLAWAY, CHARITON, COLE, GASCONADE, HOWARD, KNOX, LINN, MACON, MONROE, MONTGOMERY, OSAGE, PUTNAM, RANDOLPH, SCHUYLER, SCOTLAND, SHELBY AND SULLIVAN COUNTIES and the City of Booneville.

	Rates	Fringes
Painters:		
Bridges, Dams, Locks or Powerhouses	$ 28.49	15.03
Brush and Roll; Taping, Paperhanging	$ 26.49	15.03
Epoxy or Any Two Part Coating; Sandblasting; Stage or other Aerial Work - Platforms over 50 feet high; Lead Abatement	$ 27.49	15.03
Spray; Structural Steel		

(over 50 feet)	$ 27.49	15.03
Tapers using Ames or Comparable Tools	$ 27.24	15.03

PAIN0003-004 04/01/2019

CASS, CLAY, CLINTON, JACKSON, JOHNSON, LAFAYETTE, PLATTE & RAY COUNTIES

	Rates	Fringes
Painters:		
Bridgeman; Lead Abatement; Sandblast; Storage Bin & Tanks	$ 33.41	17.76
Brush & Roller	$ 30.54	17.76
Drywall	$ 31.74	17.76
Paper Hanger	$ 31.04	17.76
Stageman; Beltman; Steelman; Elevator Shaft; Bazooka, Boxes and Power Sander; Sprayman; Dipping	$ 32.41	17.76
Steeplejack	$ 36.98	17.76

PAIN0003-011 04/01/2019

BATES, BENTON, CALDWELL, CARROLL, COOPER, DAVIESS, GRUNDY, HARRISON, HENRY, LIVINGSTON, MERCER, MONITEAU, MORGAN, PETTIS & SALINE COUNTIES

	Rates	Fringes
Painters:		
Bridgeman; Lead Abatement; Sandblast; Storage Bin & Tanks	$ 26.73	17.76
Brush & Roller	$ 24.43	17.76
Drywall	$ 25.39	17.76
Paper Hanger	$ 24.83	17.76
Stageman; Beltman; Steelman; Elevator Shaft; Bazooka, Boxes and Power Sander; Sprayman; Dipping	$ 26.35	17.76
Steeplejack	$ 29.58	17.76

PAIN1185-008 04/01/2025

CAMDEN, CRAWFORD, DENT, LACLEDE, MARIES, MILLER, PHELPS,

PULASKI AND TEXAS COUNTIES

	Rates	Fringes
Painters:		
Brush and Roller	$ 33.90	17.21
Floor Work	$ 34.90	17.21
Lead Abatement	$ 33.25	17.21
Spray	$ 34.90	17.21
Structural Steel, Sandblasting and All Tank Work	$ 35.90	17.21
Taping, Paperhanging	$ 34.90	17.21

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* PAIN1292-002 09/01/2025

BOLLINGER, BUTLER, CAPE GIRARDEAU, CARTER, DUNKLIN, MISSISSIPPI, NEW MADRID, OREGON, PEMISCOT, PERRY, REYNOLDS, RIPLEY, SCOTT, SHANNON, STODDARD and WAYNE COUNTIES

	Rates	Fringes
Painters:		
Bridges, Stacks & Tanks	$ 36.53	17.92
Brush & Roller	$ 29.80	17.92
Spray & Abrasive Blasting; Waterblasting (over 5000 PSI)	$ 38.53	17.92

Height Rates (All Areas):
Over 60 ft. $0.50 per hour.
Under 60 ft. $0.25 per hour.

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* PAIN1292-003 09/01/2025

IRON, MADISON, ST. FRANCOIS, STE. GENEVIEVE and WASHINGTON COUNTIES

	Rates	Fringes
Painters:		
Bridges, Stacks & Tanks	$ 36.53	17.92
Brush & Roller	$ 30.95	17.92
Spray & Abrasive Blasting; Waterblasting (Over 5000 PSI)	$ 38.53	17.92

Height Rates (All Areas):
0ver 60 ft. $0.50 per hour
Under 60 ft. $0.25 per hour.

PAIN2012-001 04/01/2025

ANDREW, ATCHISON, BUCHANAN, DE KALB, GENTRY, HOLT, NODAWAY &
WORTH COUNTIES

	Rates	Fringes
Painters:		
Brush & Roller	$ 36.18	19.97
Sandblaster	$ 40.76	19.97
Steeplejack	$ 44.33	19.97

PAIN2015-001 04/01/2012

BARRY, BARTON, CEDAR, CHRISTIAN, DADE, DALLAS, DOUGLAS, GREENE,
HICKORY, HOWELL, JASPER, LAWRENCE, MCDONALD, NEWTON, OZARK,
POLK, ST. CLAIR, STONE, TANEY, VERNON, WEBSTER, and WRIGHT
COUNTIES

	Rates	Fringes
Painters:		
Finisher	$ 20.18	11.33
Painter	$ 19.75	11.76
Sandblaster, High Man, Spray Man, Vinyl Hanger, Tool Operator	$ 21.18	11.33

PLAS0518-006 03/01/2025

BARRY, BARTON, CEDAR, CHRISTIAN, DADE, DALLAS, DOUGLAS, GREENE,
HICKORY, JASPER, LACLEDE, LAWRENCE, MCDONALD, NEWTON, OZARK,
POLK, ST. CLAIR, STONE, TANEY, VERNON, WEBSTER, AND WRIGHT
COUNTIES

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER	$ 30.37	12.43

PLAS0518-007 04/01/2025

CASS (Richards-Gebaur AFB only), CLAY, JACKSON, PLATTE AND RAY COUNTIES

	Rates	Fringes
Cement Masons:.....	$ 39.06	18.71

PLAS0518-011 04/01/2025

ANDREW, ATCHISON, BATES, BUCHANNAN, CLINTON, DEKALB, GENTRY, HENRY, HOLT, JOHNSON, LAFAYETTE, NODAWAY & WORTH COUNTIES

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	$ 40.13	20.50

PLAS0518-019 03/01/2025

Adair, Audrain, Benton, Boone, Callaway, Caldwell, Camden, Carroll, Chariton, Cole, Cooper, Daviess, Gasconade, Grundy, Harrison, Howard, Linn, Livingston, Macon, Maries, Mercer, Miller, Moniteau, Monroe, Montgomery, Morgan, Osage, Pettis, Putnam, Randolph, Saline, Schuyler, Shelby and Sullivan Counties

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	$ 33.52	15.88

PLAS0527-001 04/01/2023

	Rates	Fringes
CEMENT MASON		
FRANKLIN, LINCOLN AND WARREN COUNTIES.....	$ 37.29	20.23
JEFFERSON, ST. CHARLES COUNTIES AND ST.LOUIS (City and County).....	$ 38.46	20.13

PLAS0527-004 06/01/2023

CRAWFORD, DENT, IRON, MADISON, MARION, PHELPS, PIKE, PULASKI, RALLS, REYNOLDS, ST. FRANCOIS, STE. GENEVIEVE, SHANNON, TEXAS, WASHINGTON COUNTIES

	Rates	Fringes

CEMENT MASON.....$ 32.00 19.72

PLAS0908-001 05/01/2025

BOLLINGER, BUTLER, CAPE GIRARDEAU, CARTER, DUNKLIN, HOWELL, MISSISSIPPI, NEW MADRID, OREGON, PEMISCOT, PERRY, RIPLEY, SCOTT, STODDARD, AND WAYNE COUNTIES

	Rates	Fringes
CEMENT MASON	$ 35.10	18.78

PLUM0008-003 06/01/2024

CASS, CLAY, JACKSON, JOHNSON, AND PLATTE COUNTIES

	Rates	Fringes
Plumbers	$ 56.63	24.54

PLUM0008-017 06/01/2024

BATES, BENTON, CARROLL, HENRY, LAFAYETTE, MORGAN, PETTIS, RAY, ST. CLAIR, SALINE AND VERNON COUNTIES

	Rates	Fringes
Plumbers	$ 56.63	24.54

PLUM0045-003 08/01/2024

ANDREW, ATCHISON, BUCHANAN, CALDWELL, CLINTON, DAVIESS, DEKALB, GENTRY, HARRISON, HOLT, NODAWAY AND WORTH COUNTIES

	Rates	Fringes
Plumbers and Pipefitters	$ 47.45	26.15

PLUM0178-003 11/01/2024

BARRY, CEDAR, CHRISTIAN, DADE, DALLAS, DOUGLAS, GREENE, HICKORY, LACLEDE, LAWRENCE, POLK, STONE, TANEY, WEBSTER AND WRIGHT COUNTIES

	Rates	Fringes

Plumbers and Pipefitters.....$ 39.35 15.72

PLUM0178-006 11/01/2022

BARTON, JASPER, MCDONALD AND NEWTON COUNTIES

	Rates	Fringes
Plumbers and Pipefitters		
Projects $750,000 & under...	$ 32.78	15.32
Projects over $750,000.....	$ 35.75	15.32

PLUM0533-004 06/01/2024

BATES, BENTON, CARROLL, CASS, CLAY, HENRY, HICKORY, JACKSON, JOHNSON, LAFAYETTE, MORGAN, PETTIS, PLATTE, RAY, SALINE, ST. CLAIR AND VERNON COUNTIES

	Rates	Fringes
Pipefitters.....	$ 55.56	25.80

PLUM0562-004 07/01/2023

ADAIR, AUDRAIN, BOLLINGER, BOONE, BUTLER, CALLAWAY,CAMDEN, CAPE GIRARDEAU,CARTER, CHARITON, CLARK, COLE, COOPER, CRAWFORD, DENT, DUNKLIN, FRANKLIN, GASCONADE, GRUNDY, HOWARD, HOWELL, IRON, JEFFERSON, KNOX, LEWIS, LINCOLN, LINN, LIVINGSTON, MACON, MADISON, MARIES, MARION, MERCER, MILLER, MISSISSIPPI, MONITEAU, MONROE, MONTGOMERY, NEW MADRID, OREGON, OSAGE, PEMISCOTT, PERRY, PHELPS, PIKE, PULASKI, PUTNAM, RALLS, RANDOLPH, REYNOLDS, RIPLEY, ST. CHARLES, ST.FRANCOIS, STE. GENEVIEVE, ST. LOUIS, SCHUYLER, SCOTLAND, SCOTT, SHANNON, SHELBY, STODDARD, SULLIVAN, TEXAS, WARREN, WASHINGTON,AND WAYNE COUNTIES.

	Rates	Fringes
Plumbers and Pipefitters		
Mechanical Contracts including all piping and temperature control work $7.0 million & under.....	$ 46.66	21.99
Mechanical Contracts including all piping and temperature control work over $7.0 million.....	$ 46.66	21.99

PLUM0562-016 07/01/2023

CAMDEN, COLE, CRAWFORD, FRANKLIN, JEFFERSON, MARIES, MILLER, MONITEAU, OSAGE, PHELPS, PULASKI, ST. CHARLES, ST. LOUIS (City and County), WARREN and WASHINGTON COUNTIES

	Rates	Fringes
Plumbers		
Mechanical Contracts including all piping and temperature control work $7.0 million & under	$ 46.66	21.99
Mechanical Contracts including all piping and temperature control work over $7.0 million	$ 46.66	21.99

TEAM0013-001 05/01/2025

	Rates	Fringes
Truck drivers (ADAIR, BUTLER, CLARK, DUNKIN, HOWELL, KNOX, LEWIS, OREGON, PUTNAM, RIPLEY, SCHUYLER AND SCOTLAND COUNTIES)		
GROUP 1	$ 35.84	15.85
GROUP 2	$ 35.99	15.85
GROUP 3	$ 36.11	15.85
GROUP 4	$ 35.74	15.85
Truck drivers (AUDRAIN, BOLLINGER, BOONE, CALLAWAY, CAPE GIRARDEAU, CARTER, COLE, CRAWFORD, DENT, GASCONADE, IRON, MACON, MADISON, MARIES, MARION, MILLER, MISSISSIPPI, MONROE, MONTGOMERY, NEW MADRID, OSAGE, PEMISCOT, PERRY, PHELPS, PIKE, PULASKI, RALLS, REYNOLDS, ST. FRANCOIS, STE. GENEVIEVE, SCOTT, SHANNON, SHELBY, STODDARD, TEXAS, WASHINGTON AND WAYNE COUNTIES)		
GROUP 1	$ 36.57	15.85
GROUP 2	$ 36.72	15.85
GROUP 3	$ 36.84	15.85
GROUP 4	$ 36.73	15.85

Truck drivers (FRANKLIN, JEFFERSON and ST. CHARLES COUNTIES)		
GROUP 1	$ 38.93	15.85
GROUP 2	$ 39.08	15.85
GROUP 3	$ 39.15	15.85
GROUP 4	$ 39.04	15.85
Truck drivers (LINCOLN and WARREN COUNTIES)		
GROUP 1	$ 37.58	15.85
GROUP 2	$ 38.73	15.85
GROUP 3	$ 37.80	15.85
GROUP 4	$ 37.69	15.85

TRUCK DRIVERS CLASSIFICATIONS:

GROUP 1: Flat Bed Trucks, Single Axle; Station Wagons; Pickup Trucks; Material Trucks, Single Axle; Tank Wagon, Single Axle

GROUP 2: Agitator and Transit Mix Trucks

GROUP 3: Flat Bed Trucks, Tandem Axle; Articulated Dump Trucks; Material Trucks, Tandem Axle; Tank Wagon, Tandem Axle

GROUP 4: Semi and/or Pole Trailers; Winch, Fork & Steel Trucks; Distributor Drivers and Operators; Tank Wagon, Semi-Trailer; Insley Wagons, Dumpsters, Half-Tracks, Speedace, Euclids and other similar equipment; A-Frame and Derrick Trucks; Float or Low Boy

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TEAM0056-001 05/01/2025

	Rates	Fringes
Truck drivers (ANDREW, BARTON, BATES, BENTON, CALDWELL, CAMDEN, CARROLL, CEDAR, CHARITON, CHRISTIAN, CLINTON, COOPER, DADE, DALLAS, DAVIESS, DEKALB, DOUGLAS, GREENE, HENRY, HICHKORY, HOWARD, JASPER, LACLEDE, LAWRENCE, LINN, LIVINGSTON, MONITEAU, MORGAN, NEWTON, PETTIS, POLK, RANDOLPH, ST. CLAIR, SALINE, VERNON, WEBSTER AND WRIGHT		

COUNTIES)
GROUP 1.....$ 36.27 15.85
GROUP 2.....$ 36.43 15.85
GROUP 3.....$ 36.42 15.85
GROUP 4.....$ 36.54 15.85
Truck drivers: (ATCHISON,
BARRY, GENTRY, GRUNDY,
HARRISON, HOLT, MCDONALD,
MERCER, NODAWAY, OZARK,
STONE, SULLIVAN, TANEY AND
WORTH COUNTIES)
GROUP 1.....$ 35.54 15.85
GROUP 2.....$ 35.70 15.85
GROUP 3.....$ 35.69 15.85
GROUP 4.....$ 35.81 15.85
Truck drivers; (BUCHANAN,
JOHNSON AND LAFAYETTE
COUNTIES)
GROUP 1.....$ 35.93 15.75
GROUP 2.....$ 36.04 15.75
GROUP 3.....$ 36.08 15.75
GROUP 4.....$ 36.08 15.75

TRUCK DRIVER CLASSIFICATIONS

GROUP 1: Flat bed trucks single axle; station wagons; pickup trucks; material trucks single axle; tank wagons single axle.

GROUP 2: Agitator and transit mix-trucks.

GROUP 3: Flat bed trucks tandem axle; articulated dump trucks; material trucks tandem axle; tank wagons tandem axle.

GROUP 4: Semi and/or pole trailers; winch, fork & steel trucks; distributor drivers & operators; tank wagons semi-trailer; insley wagons, dumpsters, half-tracks, speedace, euclids & other similar equipment; A-frames and derrick trucks; float or low boy.

TEAM0245-001 03/26/2012

BARRY, BARTON, CAMDEN, CEDAR, CHRISTIAN, DALLAS, DENT, DOUGLAS, GREENE, HICKORY, HOWELL, JASPER, LACLEDE, LAWRENCE, MCDONALD, MILLER, NEWTON, OZARK, PHELPS, POLK, PULASKI, SHANNON, STONE, TANEY, TEXAS, VERNON, WEBSTER AND WRIGHT COUNTIES

	Rates	Fringes
Truck drivers:		
Traffic Control Service Driver	$ 20.45	0.00

PAID HOLIDAYS: New Year's Day, Decoration Day, July 4th, Labor Day, Thanksgiving Day, Christmas Day, employee's birthday and 2 personal days.

TEAM0541-001 04/01/2025

CASS, CLAY, JACKSON, PLATTE AND RAY COUNTIES

	Rates	Fringes
Truck drivers:		
GROUP 1	$ 38.61	15.85
GROUP 2	$ 38.04	15.85
GROUP 3	$ 37.52	15.85

TRUCK DRIVERS CLASSIFICATIONS

GROUP 1: Mechanics and Welders, Field; A-Frame Low Boy-Boom ruck Driver.

GROUP 2: Articulated Dump Truck; Insley Wagons: Dump Trucks, Excavating, 5 cu yds and over; Dumpsters; Half-Tracks: Speedace: Euclids & similar excavating equipment Material trucks, Tandem Two teams; Semi-Trailers; Winch trucks-Fork trucks; Distributor Drivers and Operators; Agitator and Transit Mix; Tank Wagon Drivers, Tandem or Semi; One Team; Station Wagons; Pickup Trucks; Material Trucks, Single Axle; Tank Wagon Drivers, Single Axle

GROUP 3: Oilers and Greasers - Field

TEAM0682-002 05/01/2025

ST LOUIS CITY AND COUNTY

	Rates	Fringes
Truck drivers:		
GROUP 1	$ 37.83	9.85+a+b+c
GROUP 2	$ 37.83	9.85+a+b+c
GROUP 3	$ 37.83	9.85+a+b+c

a. PENSION: 5/1/2012 - $182.20 per week.

b. HAZMAT PREMIUM: If Hazmat certification on a job site is required by a state or federal agency or requested by project owner or by the employer, employees on that job site shall receive $1.50 premium pay.

TRUCK DRIVERS CLASSIFICATIONS

GROUP 1 - Pick-up trucks; forklift, single axle; flatbed trucks; job site ambulance, and trucks or trailers of a water level capacity of 11.99 cu. yds. or less

GROUP 2 - Trucks or trailers of a water level capacity of 12.0 cu yds. up to 22.0 cu yds. including euclids, speedace and similar equipment of same capacity and compressors

GROUP 3 - Trucks or trailers of a water level capacity of 22.0 cu. yds & over including euclids, speedace & all floats, flatbed trailers, boom trucks, winch trucks, including small trailers, farm wagons tilt-top trailers, field offices, tool trailers, concrete pumps, concrete conveyors & gasoline tank trailers and truck mounted mobile concrete mixers

FOOTNOTE FOR TRUCK DRIVERS:

c. PAID HOLIDAYS: Christmas Day, Independence Day, Labor Day, Memorial Day, Veterans Day, New Years Day, Thanksgiving Day

d. PAID VACATION: 3 days paid vacation for 600 hours of service in any one contract year; 4 days paid vacation for 800 hours of service in any one contract year; 5 days paid vacation for 1,000 hours of service in any one contract year. When such an employee has completed 3 years of continuous employment with the same employer and then works the above required number of hours, he shall receive double the number of days of vacation specified above. When such an employee has completed 10 years of continuous employment with the same employer and then works the above required number of hours, he shall receive triple the number of days of vacation specified above. When such an employee has completed 15 years of continuous employment with the same employer and then works the above required number of hours, he shall receive 4 times the number of days of vacation specified above.

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Note: Executive Order 13658 generally applies to contracts subject to the Davis-Bacon Act that were awarded on or between January 1, 2015 and January 29, 2022, and that have not been renewed or extended on or after January 30, 2022. Executive Order 13658 does not apply to contracts subject only to the Davis-Bacon Related Acts regardless of when they were awarded. If a contract is subject to Executive Order 13658, the contractor must pay all covered workers at least $13.30 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2025. The applicable Executive Order minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under Executive Order 13658 is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the

type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than ""SU"", ""UAVG"", ?SA?, or ?SC? denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The ""SU"" identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted

average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

?SU? wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The ""SA"" identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

a) a survey underlying a wage determination
b) an existing published wage determination
c) an initial WHD letter setting forth a position on a wage determination matter
d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys

Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION"

00830.2 FEDERAL PREVAILING WAGE - BUILDING

"General Decision Number: MO20260079 01/30/2026

Superseded General Decision Number: MO20250079

State: Missouri

Construction Type: Building

County: Platte County in Missouri.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Modification Number	Publication Date
0	01/02/2026
1	01/30/2026

ASBE0027-006 10/07/2024

	Rates	Fringes
HEAT & FROST INSULATOR (Includes Duct, Pipe and Mechanical Systems)	$ 43.60	33.52

BRMO0015-021 06/01/2023

	Rates	Fringes
BRICKLAYER	$ 40.53	16.69

BRMO0018-003 07/05/2023

	Rates	Fringes
TILE SETTER	$ 34.09	20.36

CARP1011-005 05/01/2024

	Rates	Fringes
CARPENTER	$ 44.63	22.40

ELEC0124-012 09/01/2025

	Rates	Fringes
ELECTRICIAN	$ 54.01	27.85

ELEC0124-013 11/25/2024

	Rates	Fringes
ELECTRICIAN (Communication Technician)	$ 48.23	25.35

ELEV0012-005 01/01/2025

	Rates	Fringes
ELEVATOR MECHANIC	$ 60.69	38.435+a+b

a. VACATION: Employer contributes 8% of basic hourly rate to

vacation pay credit for employee who has worked in business more than 5 years and 6% for 6 months to 5 years as Vacation Pay Credit.

b. PAID HOLIDAYS: New Year's Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day, Friday after Thanksgiving Day and Christmas Day.

ENGI0101-052 04/01/2025

	Rates	Fringes
OPERATOR: Forklift	$ 44.14	22.42

ENGI0101-053 04/01/2025

	Rates	Fringes
OPERATOR: Crane	$ 47.29	22.42

ENGI0101-054 04/01/2025

	Rates	Fringes
OPERATOR: Backhoe/Excavator/Trackhoe	$ 45.48	22.42
OPERATOR: Bobcat/Skid Steer/Skid Loader	$ 45.48	22.42

ENGI0513-026 05/01/2025

	Rates	Fringes
POWER EQUIPMENT OPERATOR: Oiler	$ 39.06	30.38

ENGI0513-027 05/07/2025

	Rates	Fringes
POWER EQUIPMENT OPERATOR: Bulldozer	$ 45.96	30.57

IRON0010-003 04/01/2025

	Rates	Fringes
IRONWORKER	$ 39.00	34.25

LABO0110-007 06/04/2025

	Rates	Fringes
LABORER: Pipelayer	$ 40.82	17.56

LABO0264-009 04/01/2023

	Rates	Fringes
LABORER: Common or General	$ 31.60	18.25

LABO1104-007 03/01/2025

	Rates	Fringes

LABORER: Mason Tender -
Cement/Concrete.....$ 31.80 14.91

PLAS0518-015 04/01/2025

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	$ 40.13	20.50

PLUM0008-021 06/01/2025

	Rates	Fringes
PLUMBER.....	$ 58.38	25.29

PLUM0533-014 06/01/2025

	Rates	Fringes
PIPEFITTER.....	$ 57.51	28.35

ROOF0020-023 06/01/2024

	Rates	Fringes
ROOFER.....	$ 38.45	22.29

SFMO0314-002 10/01/2024

	Rates	Fringes
SPRINKLER FITTER.....	$ 45.85	25.50

SHEE0002-036 07/01/2023

	Rates	Fringes
SHEET METAL WORKER.....	$ 50.43	26.45

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* UAVG-MO-0001 01/01/2025

	Rates	Fringes
LABORER: Mason Tender - Brick...	$ 34.05	15.73

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* UAVG-MO-0002 01/01/2025

	Rates	Fringes
OPERATOR: Roller.....	$ 39.61	30.15

SUMO2020-008 10/10/2023

	Rates	Fringes
OPERATOR: Loader.....	$ 38.39	17.55
PAINTER.....	$ 24.14	9.67

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Note: Executive Order 13658 generally applies to contracts subject to the Davis-Bacon Act that were awarded on or between January 1, 2015 and January 29, 2022, and that have not been renewed or extended on or after January 30, 2022. Executive Order 13658 does not apply to contracts subject only to the Davis-Bacon Related Acts regardless of when they were awarded. If a contract is subject to Executive Order 13658, the contractor must pay all covered workers at least $13.30 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2025. The applicable Executive Order minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under Executive Order 13658 is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than ""SU"", ""UAVG"", ?SA?, or ?SC? denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the

example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The ""SU"" identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

?SU? wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The ""SA"" identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

a) a survey underlying a wage determination
b) an existing published wage determination
c) an initial WHD letter setting forth a position on a wage determination matter
d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION"

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

REQUEST FOR INTERPRETATION

Project/Contract Number: 81000927/1698

Project Title Todd Creek WWTP Expansion & Major Upgrade

Contractor _____

RFI Number _____ Date _____

From: _____

To: _____

Re: _____

Spec. Sec. Ref: Paragraph: Drawing Ref: Detail:

Signed:

Response:

❑ Attachments

Response From: To: Date Transmitted:_____ Date Rec'd:_____

Signed:_____ Signed:_____
Design Professional Owner's Representative

Distribution:
- ❑ Owner
- ❑ Contractor
- ❑ Construction Manager
- ❑ Design Professional
- ❑ Consultant _____
- ❑ Other _____

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

REQUEST FOR INTERPRETATION LOG

Project/Contract Number: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrade

CONTRACTOR _____

OWNER _____

RFI No.	Issue Date	Brief Description of issue and response	Respond Date

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

SUPPLEMENTAL DESIGN INSTRUCTION

Project/Contract Number: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrade

To Contractor _____

From: _____ SDI No _____ Issue Date: _____

The Work shall be carried out in accordance with the following supplemental instructions issued in accordance with the Contract Documents without change in Contract Price or Contract Times. Proceeding with the Work in accordance with these instructions indicates your acknowledgement that there will be no change in the Contract Price or Contract Times.

Description:

❑ Attachments *(List)*

(Signature) Design Professional Date

Distribution:
- ❑ Owner
- ❑ Contractor
- ❑ Construction Manager
- ❑ Design Professional
- ❑ Consultant _____
- ❑ Other _____

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

REQUEST FOR PROPOSAL

Project/Contract Number: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrade

To Contractor _____

From: _____ RFP No _____ Issue Date: _____

Please submit an itemized proposal for changes in the Contract Price and Contract Times for proposed modifications to the Contract Documents described herein. Submit proposal within _____ days, or notify the Owner in writing of the date on which you anticipate submitting your proposal.

This is NOT a Change Order, a Work Change Directive or a direction to proceed with the work described in the proposed modifications.

Description:

❑ Attachments

Prepared by Design Professional

Prepared by Construction Manager

REQUESTED by OWNER'S Representative

Distribution:
- ❑ Owner
- ❑ Contractor
- ❑ Construction Manager
- ❑ Design Professional
- ❑ Consultant _____
- ❑ Other _____

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

REQUEST FOR PROPOSAL LOG

Project/Contract Number: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Major Upgrade

CONTRACTOR _____

OWNER _____

RFP No.	Issue Date	Brief Description of Request	Respond Date	Amount	CO No.

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

CHANGE ORDER

Project Number _____

Project Title _____

Change Order No: _____ Date of Issuance: _____

Ordinance No: _____ Ordinance Effective Date: _____

Contract Notice To Proceed Date: _____

To CONTRACTOR:

The Contract is changed as follows: _____

This Change Order constitutes compensation in full on behalf of the Contractor and its subcontractors and suppliers for all costs, including impact costs and extended general conditions, and markups directly and indirectly attributable to the Work changes ordered herein, for all delays related thereto and for performance of the changes within the time stated. Contractor hereby releases all claims for delay, interruption, extended general conditions, impact and cumulative impact claims for this Work.

[**Note**: Identify the specific attachments; example:"Attachment A, Additional Scope of Services." Delete **all** notes before printing final]

□ See Attached Document(s).

[**Note:** If the CO does not change the Contract Price, use "Director" instead of "Director of Finance"]

Not valid until signed by the Director of Finance.

The original Contract Price was	$0.00
Net change by previously authorized Change Orders	$0.00
The Contract Price prior to this Change Order was	$0.00
The Contract Price will be (□ increased by) (□ decreased by) (□ unchanged)	$0.00
The new Contract Price including this Change Order will be	$0.00
[Note: If revised, establish and enter new dates. If unchanged, enter current contract dates.	
If you are only changing the Final Completion date, add the following reference:	
"The Contract Time for Final Completion will be . . ."]	
The Contract Time will be (□ increased by) (□ decreased by) (□ unchanged)	( ) calendar days
The date of Substantial Completion as of the date of this Change Order therefore is	Enter Date
The date of Final Completion as of the date of this Change Order therefore is	Enter Date

Project No. & Title
Change Order No.
[**Note:** Include any required additional signatures.]

DESIGN PROFESSIONAL:	**By:** **Title:**	**Date:**
CONTRACTOR:	**By:** **Title:**	**Date:**
CITY:	**By** **Title:**	**Date:**

Approved as to form: _____
Assistant City Attorney

[**Note**: If this CO does not change the Contract Price, delete the cert. of funds by Finance Director but send signed copy to Finance.]

I certify there is a balance otherwise unencumbered to the credit of the appropriation to which the above amount is chargeable, and a cash balance otherwise unencumbered in the treasury to the credit of the fund from which payment is to be made, each sufficient to meet the above obligation.

By: _____
Director of Finance Date

Distribution:
- ❑ CITY
- ❑ CONTRACTOR
- ❑ DESIGN PROFESSIONAL

REMINDER: CONTRACTOR is responsible for considering the effect this Change Order may have on its ability to meet or exceed the D/M/WBE participation amounts in its Contractor Utilization Plan (CUP) as amended by any previously approved Request for Modification/Substitution. If CONTRACTOR will not be able to achieve the approved participation amounts in performing the work included within this Change Order, or if CONTRACTOR needs to retain the services of additional D/M/WBEs not previously listed in its CUP, CONTRACTOR is advised to submit a Request for Modification/Substitution.

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

WORK CHANGE DIRECTIVE

Project/Contract Number: 81000927/1698

Project Title: Todd Creek WWTP Expansion & Upgrade

No.: _____ Date of Issuance: _____

TO:
(CONTRACTOR)

You are directed to proceed promptly with the following work:

Description:

Purpose of Work Change Directive:

Attachments: *(List documents supporting change)*

If the above work results on a change in the Contract Price or Contract Times, any request for a Change Order based thereon will involve one or more of the following methods of determining the effect of the change(s).

Method of determining change in Contract Price:	Method of determining change in Contract Times:
❑ Unit Prices	❑ CONTRACTOR's Records
❑ Lump Sum	❑ DESIGN PROFESSIONAL's Records
❑ As Stipulated in General Conditions	❑ City's Records
❑ Other _____	❑ Other _____
Estimated increase (decrease) in Contract Price:	Estimated increase (decrease) in Contract Times:
$ _____	Substantial Completion: _____ days;
If the change involves an increase, the estimated Amount is not to be exceeded without further authorization.	Final Completion: _____ days. If the change involves an increase, the estimated times are not to be exceeded without further authorization.

Recommended:	Recommended:	Recommended:
DESIGN PROFESSIONAL	Construction Manager	City
By (Authorized Signature)	By (Authorized Signature)	By (Authorized Signature)

Distribution:
❑ City
❑ Contractor
❑ Construction Manager
❑ Design Professional
❑ Consultant
❑ Other

WORK CHANGE DIRECTIVE ("WCD") INSTRUCTIONS

[Note: Do not attach these instructions to the WCD Form]

A. GENERAL INFORMATION

This document was developed for use in situations involving changes in the Work which, if not processed expeditiously, might delay the Project. These changes are often initiated in the field and may affect the Contract Price or the Contract Times. This is not a Change Order, but only a directive to proceed with Work that may be included in a subsequent Change Order. If the WCD may result in an increase in the Contract Price, a contract impact cost analysis must be performed prior to issuing the WCD. Availability of funds and authorization to expend funds must be part of the analysis.

For supplemental instructions and minor changes not involving a possible change in the Contract Price or the Contract Times a Supplemental Design Instruction may be used.

B. COMPLETING THE WORK CHANGE DIRECTIVE FORM

Based on conversations between Design Professional, City's Representative and CONTRACTOR, Design Professional must complete the following:

DESCRIPTION: shall include a summary of the Work included in the WCD. Additional information may be attached to the WCD to further define the scope.

PURPOSE OF WORK CHANGE DIRECTIVE: will identify clearly if the Work included in the WCD is an addition, deletion, revision, or some combination.

ATTACHMENTS: shall identify all attachments included in and made a part of the WCD. Be certain that attachments are clearly labeled.

METHOD OF DETERMINING CHANGE, IF ANY, IN CONTRACT PRICE: Mark the method to be used in determining the final cost of Work involved and the estimated net effect on the Contract Price. If the change involves an increase in the Contract Price and the estimated amount is approached before the additional or changed Work is completed, another WCD must be issued to change the estimated price. Do not leave blank spaces or write "To be determined" (or "TBD"). An estimated dollar figure must be assigned to the Work. If the WCD is not likely to change the Contract Price, the space for estimated increase (decrease) should be marked "No Change in Price".

METHOD OF DETERMINING CHANGE, IF ANY, IN CONTRACT TIMES: Mark the method to be used in determining the change in Contract Times and the estimated increase or decrease in Contract Times. If the change involves an increase in the Contract Times and the estimated times are approached before the additional or changed Work is completed, another WCD must be issued to change the times or CONTRACTOR may stop the changed Work when the estimated times are reached. Do not leave blank spaces or write "To be determined" (or "TBD"). If the WCD is not likely to change the Contract Times, the space for estimated increase (decrease) should be marked "No Change in Times".

Once Design Professional has completed and signed the form, all copies should be sent to CITY for authorization because Design Professional does not have authority to authorize changes in Price or Times. Once authorized by CITY, a copy must be sent by Design Professional to CONTRACTOR. Price and Times may only be changed by Change Order signed by CITY, Design Professional, and CONTRACTOR. If the value of the work included in the WCD exceeds the contingency or budget available for the contract, staff must obtain written approval from the Director or his or her designee before the WCD is issued. A Director or his or her designee may not approve a WCD that will exceed City Council authorization. If the work included in the WCD is needed as a result of an emergency, staff may proceed with the issuance of the WCD without

prior written approval even if the value of the work added is expected to exceed the contract contingency balance.

Once the Work covered by this directive is completed or final cost and times are determined. CONTRACTOR must submit proper documentation for inclusion in a Change Order.

IF THIS IS A DIRECTIVE TO PROCEED WITH A CHANGE THAT MAY AFFECT THE CONTRACT PRICE OR THE CONTRACT TIMES A CHANGE ORDER, IF ANY, MUST BE PROCESSED PROMPTLY.

Clean Water State Revolving Fund
Specifications Requirements

State Revolving Fund: This project is being financed through the Missouri State Revolving Fund, by the Water and Wastewater Loan Revolving Fund and federal Capitalization Grants to Missouri.

Equal Employment Opportunity and Nondiscrimination in Employment – 41 CFR 60-4; E.O. 11246: 41 CFR 60-4 published April 7, 1978 and amended October 3, 1980, requires that the SRF funding applicant and selected bidders comply with Executive Order 11246 for bids, contracts, and subcontracts for all federally assisted construction contracts exceeding $10,000. The specifications explain the requirements for bidders and contractors under E.O. 11246.

- Bidders please see document titled "Standard Federal Equal Employment Opportunity Construction Contract Specifications (Executive Order 11246)"

Disadvantaged Business Enterprises (DBE) (includes Minority-owned Business Enterprises/Women-owned Business Enterprises, MBE/WBE) – 40 CRF Part 33, 10 CSR 20-4.040(17), E.O. 11625 and 12138: The applicant is an Equal Opportunity Employer and invites the submission of bids from Disadvantaged Business Enterprises.

- Bidders please see document titled "Missouri State Revolving Fund Procedures for Implementation Minority Business Enterprise/Women's Business Enterprise"

- The selected bidders must complete the "Missouri State Revolving Fund Disadvantaged Business Enterprise (Minority and Women's Business Enterprise) Utilization Worksheet"

Employment of Unauthorized Aliens Prohibited – §285.530 RSMo: Pursuant to §285.530.1, RSMo, the contractor assures that it, as well as its subcontractors, does not knowingly employ, hire for employment, or continue to employ an unauthorized alien to perform work within the State of Missouri, and shall affirm, by sworn affidavit and provision of documentation, its enrollment and participation in a federal work authorization program with respect to the employees working in connection with the contracted services. Further, the contractor assures that it, as well as its subcontractor shall sign an affidavit affirming that it does not knowingly employ any person who is an unauthorized alien in connection with the contracted services.

In accordance with §285.525 to 285.550, RSMo a general contractor or subcontractor of any tier shall not be liable when such contractor or subcontractor contracts with its direct subcontractor who violates subsection 1 of §285.530, RSMo if the contract binding the contractor and subcontractor affirmatively states that the direct subcontractor is not knowingly in violation of subsection 1 of §285.530, RSMo and shall not henceforth be in such violation and the contractor or subcontractor receives a sworn affidavit under the penalty of perjury attesting to the fact that the direct subcontractor's employees are lawfully present in the United States.

- The selected contractor(s) must complete the "Business Entity Certification, Enrollment Documentation, and Affidavit of Work Authorization" form.
- In addition, the selected contractor(s) must enroll in the federal E-verify system, provide supporting documentation of enrollment, and provide verification documentation for enrollment in the Federal E-Verify system.

Davis-Bacon Act:

- Bidders please see "Davis Bacon Act Requirements"
- Bidders please see "Davis-Bacon Act Requirements Funding Recipient Requirements"

Contract Work Hours and Safety Standards Act – 40 U.S.C. 327-330: The contractor(s) and subcontractor(s) shall comply with Sections 103 and 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 327–330) as supplemented by Department of Labor regulations (29 CFR part 5).

U.S. Environmental Protection Agency Certification of Non-segregated Facilities:

- The selected bidders must complete this form.

OSHA Training – §292.675, RSMo: Any person signing a contract to work on the construction of public works for any public body shall provide a ten-hour Occupational Safety and Health Administration (OSHA) construction

safety program for their on-site employees which includes a course in construction safety and health approved by OSHA or a similar program approved by the Missouri Department of Labor and Industrial Relations which is at least as stringent as an approved OSHA program. All employees are required to complete the program within sixty days of beginning work on such construction project.

Debarment and Suspension – 10 CSR 20-4.040(17); E.O. 12549: The Code of Federal Regulations at Title 2, Part 180, prohibits participation in USEPA funded contracts by persons excluded or disqualified from doing business with the federal government. Bidders are responsible for advising the Owner if they are excluded or disqualified, and to check whether subcontractors they intend to use are excluded or disqualified. All tiers of subcontractors have the same responsibility to notify the one for which they are providing services if they are excluded or disqualified, and to check the status of any subcontractors they intend to use. Status can be checked on the System for Award Management (SAM) located on the Internet at https://www.sam.gov/SAM/. All subcontracts at any tier should include this language.

- The selected bidders must complete the "Certification Regarding Debarment and Suspension" form.

Small Business Act – P.L. 100-590: Prior to awarding contracts, the SRF funding applicant and any contractor awarding subcontracts must take the following affirmative steps in accordance with Section 129 of Public Law 100-590, Small Business Administration Reauthorization and Amendment Act of 1988:

a. Placing Small Business in Rural Areas (SBRA) on solicitation lists;
b. Ensuring that SBRAs are solicited whenever they are potential sources;
c. Dividing total requirements, when economically feasible, into small tasks or quantities to permit maximum participation by SBRAs;
d. Establishing delivery schedules, where the requirements of work will permit which would encourage participation by SBRAs; and
e. Utilizing the services of the Small Business Administration and the Minority Business Development Agency of the U.S. Department of Commerce, as appropriate.

Award of Contract – 10 CSR 20-4.040(18): The applicant will award the contract to the lowest responsive, responsible bidder. The contract must be for a firm fixed-price.

The contract award will be awarded only to responsible contractors possessing the ability to perform successfully, which will be determined by considering such matters as contractor integrity, compliance with public policy, record of past performance, and financial and technical resources.

Privity of Contract: The Missouri Department of Natural Resources, its divisions, nor its employees are or will be a party to the contract(s) at any tier.

Protests: Neither the U.S. Environmental Protection Agency (USEPA) nor the Missouri Department of Natural Resources will be involved in protest(s) and their resolution.

Domestic Products Procurement Law – 10 CSR 20-4.040(17); §§34.350 - 34.359 RSMo: All manufactured goods or commodities used or supplied in the performance of any contract or subcontract awarded on this project shall be manufactured, assembled or produced in the United States, unless obtaining American-made products would increase the cost of the contract by more than ten percent (10%). In accordance with §34.350 through 34.359 RSMo, a waiver may be requested from the owner.

- The selected bidders must complete the "Domestic Products Procurement Act – §§34.350 - 34.359 RSMo Certification" form.

Anti-Lobbying Act – P.L. 101-121: Sub-recipients who request or receive from the grant recipient a sub-grant, contract, or sub-contract exceeding $100,000, at any tier under a federal grant shall comply with the Anti-Lobbying Act, Section 319 of Public Law 101-121, and file an Anti-Lobbying Certification form, and the Disclosure of Lobbying Activities form, if required, to the next tier above.

- Selected bidders must complete one of the following forms:
  - If the selected bidder lobbied on the behalf of this project, the contractor will complete the "Disclosure of Lobbying Activities" form.
  - If the selected bidder did not lobby on the behalf of this project, the contractor will complete the "Certification Regarding Lobbying" form.

Record Retention: The contractor(s) and sub-contractor(s) shall retain all project related records for three years after final payment(s) and all other pending matters are closed.

Access to Construction Site and Contract Records – 10 CSR 20-4.040(17); Clean Water Act sec. 308 (B)i: The contractor shall provide access to the project site and project records by, the Missouri State Auditor, the Missouri Department of Natural Resources, the Missouri Clean Water Commission, the Environmental Improvement and Energy Resources Authority, the USEPA, the Comptroller General of the United States, or any of their duly authorized representatives to any books, documents, papers, and records of the contractor which are directly pertinent to that specific contract for the purpose of making audit, examination, excerpts, and transcriptions.

Payment Provisions – 10 CSR 20-4.040(20): The owner shall make payment to the contractor in accordance with §8.960, RSMo. Retainage can be no more than 5%.

False Claims Act: The contractor(s) and sub-contractor(s)s, if required by future OMB guidance, shall promptly refer to the State of Missouri or other appropriate Inspector General any credible evidence that a principal, employee, agent, contractor, sub-grantee, subcontractor or other person has submitted a false claim under the False Claims Act or has committed a criminal or civil violation of laws pertaining to fraud, conflict of interest, bribery, gratuity or similar misconduct involving those funds.

Clean Air Act - 42 U.S.C. 7506(C): The contractor(s) and sub-contractor(s) shall comply with the Clean Air Act.

Clean Water Act - 33 U.S.C. 1368: The contractor(s) and sub-contractor(s) shall comply with the Clean Water Act.

Energy Efficiency Requirements – Energy Policy and Conservation Act (P.L.94-163, 89 Stat. 871): The contractor(s) and sub-contractor(s) shall comply with the mandatory standards and policies relating to energy efficiency which are contained in the State energy conservation plan issued in compliance with the Energy Policy and Conservation Act (P.L. 94-163, 89 Stat. 871).

Recycled Materials – U.S.C. 6962 (RCRA Section 6002): In accordance with Section 6002 of the Resource Conservation and Recovery Act (RCRA), preference shall be given to the procurement of specific products containing recycled materials identified in guidelines developed by the USEPA. Current guidelines are contained in 40 CFR Part 247-254.

Historical and Archaeological – P.L. 93-291: If during the course of construction evidence of deposits of historical or archaeological interest is found, the contractor shall cease operations affecting the find and shall notify the owner who shall notify the Missouri Department of Natural Resources and the Director, Division of State Parks, P.O. Box 176, Jefferson City, Missouri 65102-0176, Telephone (573) 751-2479. The contractor shall halt any further disturbances of the deposits until notified by the owner that they may proceed. The owner will issue a notice to

proceed only after the state official has surveyed the find and made a determination to the Missouri Department of Natural Resources and the owner. Compensation to the contractor, if any, for lost time or changes in construction to avoid the find, shall be determined in accordance with changed conditions or change order provisions of the specifications.

Missouri Products – Chap. 71.140 RSMo: Preference shall be given to Missouri products in accordance with Chapter 71.140, Revised Statutes of Missouri.

- This applies to loan only funded projects. Please contact the solicitor to determine if applicable to this project.

Missouri Firms – §34.076 RSMo: Pursuant to §34.076, Revised Statutes of Missouri, preference shall be given to those persons doing business as Missouri firms, corporations, or individuals, or which maintain Missouri offices or places of business, when the quality of performance promised is equal or better and the price quoted is the same or less. In addition, in order for a non-domiciliary Missouri bidder to be successful, his bid must be that same percentage lower than a domiciliary Missouri bidder's bid, as would be required for a Missouri bidder to successfully bid in the non-domiciliary's state.

- This applies to loan only funded projects. Please contact the solicitor to determine if applicable to this project.

Prohibition on certain telecommunications and video surveillance services or equipment Certification – 2 CFR 200.216: In accordance with 2 CFR 200.216, recipients and sub-recipients are prohibited from obligating or expending loan or grant funds to procure or obtain, extend or renew a contract to procure or obtain, or enter into a contract (or extend or renew a contract) to procure or obtain equipment, services, or systems that uses covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. As described in Public Law 115-232, section 889, covered telecommunications equipment is telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).

For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities).

Anti-Discrimination Against Israel Act – §34.600, RSMo: In compliance with §34.600 RSMo, the contracting company certifies that it is not currently engaged in and shall not, for the duration of the contract, engage in a boycott of goods or services from the State of Israel; companies doing business in or with Israel or authorized by, licensed by, or organized under the laws of the State of Israel; or persons or entities doing business in the State of Israel, in accordance with §34.600, RSMo. Any contract that fails to comply with the provisions of this section shall be void against public policy.

- This provision does not apply to contracts with a total potential value of less than one hundred thousand dollars or to contractors with fewer than ten employees.

American Iron and Steel – Sec. 608(a) of the Federal Water Pollution Control Act: In accordance with Sec. 608(a) of the Federal Water Pollution Control Act, the Participant assures that it, as well as its contractors and sub-contractors, will only use iron and steel products in the Project which are produced in the United States in a manner consistent with United States obligations under international agreements. The term “iron and steel products” means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.

The Participant understands that this requirement may only be waived by the applicable federal agency in limited situations as set out in §608(d) of the Federal Water Pollution Control Act.

The contractor shall submit all AIS certifications for any iron and steel requested for reimbursement. No applicable items will be reimbursed without the necessary AIS documentation.

- Bidders please see AIS guidance titled "Implementation of American Iron and Steel provisions."
- Bidders please see AIS waivers:
  - De-Minimis Waiver
  - National Product Waiver for Pig Iron and Direct Reduced Iron for State Revolving Fund Projects
  - National Product Waiver for Minor Components within Iron and Steel Products (with cost ceiling) for State Revolving Fund Projects
- Contractors bidding on this project must complete and include with their bid the "American Iron and Steel Certification" form.

Stormwater Permit – 10 CSR 20-6.200

The Department requires the SRF funding applicant to verify their existing National Pollutant Discharge Elimination System (NPDES) permit(s) cover stormwater discharges or obtain the necessary permit(s). The following scenarios may be applicable:

1. The SRF funding applicant is a regulated Municipal Separate Storm Sewer System (MS4) per 10 CSR 20-6.200(1)(D)24 and their NPDES MS4 permit outlines compliance with construction stormwater requirements,
2. The design flow of the wastewater treatment plant is greater than or equal to 1 million gallon per day and the NPDES permit also regulates construction stormwater, or
3. Neither 1 or 2 above applies and the proposed project disturbs one (1) or more acres of total land area or less than one (1) acre as part of a common plan or sale resulting in the need for a land disturbance permit to discharge construction stormwater.

For further information, contact the Missouri Department of Natural Resources, Water Protection Program, Operating Permits Section, P.O. Box 176, Jefferson City, Missouri 65102. Telephone: (573) 522-4502.

STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY
CONSTRUCTION CONTRACT SPECIFICATIONS
(EXECUTIVE ORDER 11246)

1. As used in these specifications:

a. "Covered area" means the geographical area described in the solicitation from which this contract resulted;

b. "Director" means Director, Office of Federal Contract Compliance Programs United States Department of Labor, or any person to whom the Director delegates authority;

c. "Employer identification number" means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941.

d. "Minority" includes:

(i) Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);

(ii) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race);

(iii) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and

(iv) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

2. Whenever the Contractor, or any Subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of $10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.

3. If the contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each Contractor or Subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other Contractors or Subcontractors toward a goal in an approved Plan does not excuse any covered Contractor's or Subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.

4. The Contractor shall implement the specific affirmative action standards provided in paragraphs 7 a through p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. Covered Construction Contractors performing construction work in geographical areas where they do not have a Federal or federally assisted construction contract shall apply the minority and female goals established for the geographical area where the work is being performed. Goals are published periodically in the FEDERAL REGISTER in notice form, and such notices may be obtained from any Office of Federal Contract Compliance Programs office or from Federal procurement contracting officers. The Contractor is expected to make substantially uniform progress in meeting its goals in each craft during the period specified.

5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.

6. In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.

7. The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign

two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.

c. Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefore, along with whatever additional actions the Contractor may have taken.

d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and training programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under 7b above.

f. Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting it's EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific review of these items with onsite supervisory personnel such as Superintendents, General Foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the Contractor's EEO policy with other Contractors and Subcontractors with whom the Contractor does or anticipates doing business.

i. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than once month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment sources, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a Contractor's work force.

k. Validate all tests and other selection requirements where there is an obligation to do so under CFR Part 60-3.

l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.

m. Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory affect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations under these Specifications are being carried out.

n. Ensure that all facilities and company activities re nonsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female

construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

p. Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's EEO policies and affirmative action obligations.

8. Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (7a through p). The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 7a through p of these Specifications providing that the Contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female workforce participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

9. A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved its goals for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is underutilized).

10. The Contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

11. The Contractor shall not enter into any Subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

12. The Contractor shall carry out such sanctions and penalties for violation of these Specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these Specifications and Executive Order 11246, as amended.

13. The Contractor, in fulfilling its obligation under these Specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these Specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these Specifications, the Director shall proceed in accordance with 41-CFR 60-4.8.

14. The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, Contractors shall not be required to maintain separate records.

15. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY (EXECUTIVE ORDER 11246)

1. The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Specifications" set forth herein.

2. The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Timetables	Goals for minority participation for each trade	Goals for female participation in each trade
All years	%	6.9%

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area. If the contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the contractor also is subject to the goals for both its federally involved and nonfederally involved construction.

The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade, and the contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the Executive Order and the regulations in 41 CFR Part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within 10 working days of award of any construction subcontract in excess of $10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the name, address and telephone number of the subcontractor; employer identification number of the subcontractor; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the subcontract is to be performed.

4. As used in this Notice, and in the contract resulting from this solicitation, the "covered area" is (insert description of the geographical areas where the contract is to be performed giving the state, county and city, if any)

Construction Technical Assistance Guide
https://www.dol.gov/sites/dolgov/files/OFCCP/Construction/508_cctag_12032020.pdf

MISSOURI STATE REVOLVING FUND

Procedures for Implementation

Minority Business Enterprise/Women's Business Enterprise

Each bidder/offeror must fully comply with the requirements, terms, conditions of 40 CFR Part 33 and DNR's regulations to award a fair share of subagreements to minority and women's business enterprises. The bidder/offeror commits itself to taking affirmative steps and complying with the Six Good Faith Efforts contained herein. Bidders/offerors will take affirmative steps prior to submission of bids/proposals.

Affirmative Steps

1. When feasible, segmenting total work requirements to permit maximum minority business and women business enterprises (MBE/WBE) participation.

2. Assuring that MBEs and WBEs are solicited whenever they are potential sources of goods or services. This step may include:

    a. Sending letters or making other personal contacts with MBEs and WBEs (e.g. those whose names appear on lists prepared by the Missouri Office of Administration, the Missouri Department of Transportation, or the funding recipients and other MBEs and WBEs known to the bidder/offeror.) MBEs and WBEs should be contacted when other potential subcontractors are contacted, within reasonable time (fifteen days) prior to bid submission or closing date for receipt of initial offers. Those letters or other contacts should communicate the following:

        i. Specific description of the work to be subcontracted;

        ii. How and where to obtain a copy of plans and specifications or other detailed information needed to prepare a detailed price quotation;

        iii. Date the quotation is due to the bidder/offeror;

        iv. Name, address, and phone number of the person in the bidder/offeror's firm whom the prospective MBE/WBE subcontractor should contact for additional information.

    b. Sending letters or making other personal contacts with local, state, federal and private agencies and DBE associations relevant to the project. Such contacts should provide the same information provided in the direct contacts to DBE firms.

3. Where feasible, establishing delivery schedules which will encourage participation by MBEs and WBEs.

Determination of Compliance

It is to be noted that bidders/offerors must demonstrate compliance with DBE requirements in order to be deemed responsible. Demonstration of compliance shall include, but is not limited to, the following information:

1. Names, addresses and phone numbers of MBEs/WBEs expected to perform work;

2. Work to be performed by the MBEs and WBEs;

3. Aggregate dollar amount of work to be performed by MBEs and WBEs, showing aggregate to MBEs and aggregate to WBEs separately;

4. Description of contacts to MBE and WBE organizations, agencies and associations which serve MBEs/WBEs, including names of organizations, agencies and associations and dates of contacts;

5. Description of contacts to MBEs and WBEs, including number of contacts, fields, (i.e. equipment or material supplier, excavators, transport services, electrical subcontractors, plumbers, etc.) and dates of contacts.

The Six Good Faith Efforts, and Minority and Women's Business Enterprise Utilization Worksheet shall be included in the specifications.

All bidders/offerors should complete the Minority and Women's Business Enterprise Utilization Worksheet and submit to the funding recipient prior to contract award.

Additional information on DBE requirements can be found at https://www.epa.gov/osbp/dbe_team.htm

Lists of Certified Disadvantaged Business Enterprises – To help comply with the Six Good Faith Efforts, please visit the following web sites to access existing lists of certified DBEs:

Small Business Administration https://www.sba.gov/search?query=dynamic+small+business+search

Missouri Department of Transportation https://www.modot.mo.gov/ecr/index.htm

Office of Equal Opportunity https://oeo.mo.gov/

The contractor shall not discriminate on the basis of race, color, nation origin or sex in the performance of this contract. The contractor shall carry out applicable requirements of 40 CFR Part 33 in the award and administration of contracts awarded under EPA financial assistance agreements. Failure by the contractor to carry out these requirements is a material breach of this contract which may result in the termination of this contract or other legally available remedies.

(Funding recipients may establish alternative methods of compliance equivalent to or more stringent than the above.)

"Six Good Faith Efforts"

The Six Good Faith Efforts are required methods to be used by all Loan and Grant recipients to ensure that all disadvantaged business enterprises (DBEs) have the opportunity to compete for procurements funded by EPA financial assistance dollars.

The prime contractor must pay its subcontractor for satisfactory performance no more than 30 days from the prime contractor's receipt of payment from the recipient.

A recipient must be notified in writing by its prime contractor prior to any termination of a DBE subcontractor for convenience by the prime contractor.

If a DBE subcontractor fails to complete work under its subcontract for any reason, the recipient must require the prime contractor to employ the six good faith efforts described below if soliciting a replacement subcontractor.

A recipient must require its prime contractor to employ the six good faith efforts even if the prime contractor has achieved its Fair Share Goals. The current Fair Share Goals are 10% for Minority Business Enterprises and 5% for Women Business Enterprises in accordance with 40 CFR, Part 33, Subpart D.

The Six Good Faith Efforts are:

1. Ensure DBEs are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities. For Indian Tribal, State and Local Government recipients, this will include placing DBEs on solicitation lists and soliciting them whenever they are potential sources.

2. Make information on forthcoming opportunities available to DBEs and arrange time frames for contracts and establish delivery schedules, where requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive process. This includes, whenever possible, posting solicitations for bids or proposals for a minimum of 30 calendar days before bid or proposal closing date.

3. Consider in the contracting process whether firms competing for large contracts could subcontract with DBEs. For Indian Tribal, State and Local Government recipients, this will include dividing total requirements when economically feasible into smaller tasks or quantities to permit maximum participation by DBEs in the competitive process.

4. Encourage contracting with a consortium of DBEs when a contract is too large for one of these firms to handle individually.

5. Use the services and assistance of the SBA and the Minority Business development Agency of the Department of Commerce.

6. If the prime contractor awards subcontracts, require the prime contractor to take the above steps.

MISSOURI STATE REVOLVING FUND
DISADVANTAGED BUSINESS ENTERPRISE
(MINORITY AND WOMEN'S BUSINESS ENTERPRISE)
UTILIZATION WORKSHEET

Funding Recipient _____
Project No.: _____

Contractor/Engineer: _____
Contract Name: _____
Contract Contact Person: _____
Contractor MBE/WBE: Yes ☐ No
OA / MODOT / EPA Certification No.: _____
Address: _____
Telephone No.: _____ Email Address _____
Amount of Contract _____ Total Contract MBE% _____ WBE % _____

1. MBE _____Subcontractor _____
   WBE _____Address _____
   Contact Person _____Telephone No. _____
   Email Address: _____
   OA MBE/WBE Certification Number _____
   MODOT MBE/WBE Certification (Yes) _____ (No) _____
   Amount of Subcontract _____
   Scope of Work _____
   _____
   _____

2. MBE _____Subcontractor _____
   WBE _____Address _____
   Contact Person _____Telephone No. _____
   Email Address: _____
   OA MBE/WBE Certification Number _____
   MODOT MBE/WBE Certification (Yes) _____ (No) _____
   Amount of Subcontract _____
   Scope of Work _____
   _____
   _____

3. MBE _____Subcontractor _____
WBE _____Address _____
Contact Person _____Telephone No. _____
Email Address: _____
OA MBE/WBE Certification Number _____
MODOT MBE/WBE Certification (Yes) _____ (No) _____
Amount of Subcontract _____
Scope of Work _____
_____
_____

4. MBE _____Subcontractor _____
WBE _____Address _____
Contact Person _____Telephone No. _____
Email Address: _____
OA MBE/WBE Certification Number _____
MODOT MBE/WBE Certification (Yes) _____ (No) _____
Amount of Subcontract _____
Scope of Work _____
_____
_____

5. MBE _____Subcontractor _____
WBE _____Address _____
Contact Person _____Telephone No. _____
Email Address: _____
OA MBE/WBE Certification Number _____
MODOT MBE/WBE Certification (Yes) _____ (No) _____
Amount of Subcontract _____
Scope of Work _____
_____
_____

6. MBE _____Subcontractor _____
WBE _____Address _____
Contact Person _____Telephone No. _____
Email Address: _____
OA MBE/WBE Certification Number _____
MODOT MBE/WBE Certification (Yes) _____ (No) _____
Amount of Subcontract _____
Scope of Work _____
_____
_____

Comments: _____
_____
_____
_____
_____
_____

Prepared By: _____

Telephone Number: _____

Date: _____

RECEIVED & FILED

SEP 0 8 2005

SECRETARY OF STATE
COMMISSION DIVISION

EXECUTIVE ORDER
05-30

WHEREAS, since 1990, the Office of Administration, State of Missouri has endeavored to "establish and implement a plan to increase and maintain the participation of certified socially and economically disadvantaged small business concerns or minority business enterprises, directly or indirectly, in contracts for supplies, services, and construction contracts, consistent with targets determined after an appropriate study conducted to determine the availability of socially and economically disadvantaged small business concerns and minority business enterprises in the marketplace;" pursuant to Senate Bills 808 & 672 passed by the General Assembly and signed into law by then Governor Ashcroft; and

WHEREAS, such a study was conducted and found statistically significant disparities in state contractual expenditures for construction and the purchase of goods and services, as compared to the ready, willing and able minority and women-owned business enterprises (M/WBEs) in the state; and

WHEREAS, Executive Order 98-21 established goals to increase the percentage of goods and services procured from certified M/WBEs; and

WHEREAS, the goals for M/WBE participation established in Executive Order 98-21 have not been substantially met; and statistically significant disparities in state contractual expenditures for construction and the purchase of goods and services from minority and women-owned businesses in the state still exist; and

WHEREAS, on September 27, 2004, Behavioral Interventions, Inc. filed a lawsuit in the U.S. District Court, in the Western District of Missouri challenging the propriety of Missouri's M/WBE program. In January 2005, a preliminary injunction was issued ordering the Office of Administration, State of Missouri to suspend the placing of M/WBE requirements in any procurement by the State of Missouri. Because of the uncertainty created in the aftermath of the litigation, the program has undergone comprehensive revision not only to withstand constitutional scrutiny, but also to more adequately address the compelling needs and obstacles of minority and women-owned businesses to gain greater access to business opportunities, both public and private, within the state of Missouri; and

WHEREAS, the State of Missouri is dedicated to the compelling governmental interest in remedying race and sex based discrimination in a manner consistent with state and federal law; and

WHEREAS, the State of Missouri is committed to enhancing the economic health and prosperity of the state by promoting the greater use of minority and women-owned businesses. Job creation for Missouri residents, and therefore the success of minority and women-owned businesses, are paramount goals of this Administration; and

WHEREAS, the State of Missouri will gain enormously from improvements in expanded business opportunities for Missouri residents created by the expansion of minority and women-owned businesses and through the additional tax revenues generated by those individuals and businesses; and

WHEREAS, to further these goals, which are of the highest priority of this Administration, it is the policy of this Administration to develop economic opportunities for minority and women-owned businesses wherever possible.

NOW, THEREFORE, I, Matt Blunt, Governor of the State of Missouri, under the authority vested in me under the constitution and the laws of this state, to fulfill the mandate of the General Assembly in Senate Bills 808 & 672 and to pursue the compelling interest of remedying discrimination, do hereby declare the following narrowly tailored policies and procedures shall be adopted by the Executive Branch of state government in procuring all types of goods and services:

1. The Office of Supplier and Workforce Diversity (OSWD) is established to replace the Office of Equal Opportunity. All the authority, powers and privileges of the Office of Equal Opportunity is transferred to the OSWD. The Director of OSWD shall be appointed by the Governor. The Director of OSWD shall report to the Commissioner of Administration. The Director shall have primary responsibility for assisting in the coordination and implementation of affirmative action throughout all departments of the executive branch of state government, including programs to increase M/WBE participation, and advising the Governor on issues regarding equal employment opportunity, affirmative action, and efforts to administer affirmative action goals and timetables for implementation throughout the departments of the executive branch.

   The Office of State Compliance Officer is hereby abolished. The Director of OSWD shall be the State's chief compliance officer for the executive branch of state government to ensure that the State of Missouri is complying with all federal and state laws concerning equal employment opportunity and affirmative action. If needed, the Director shall assist each department in developing an Affirmative Action Plan of Implementation. Additionally, the Director of OSWD shall review progress reports of the departments and shall meet biannually with each department director to evaluate departmental results and determine the course of future affirmative action goals, timetables, recruiting, planning, and implementation. The results of each meeting shall be reported in writing to the Governor and Commissioner of Administration.

   Not later than January first of each calendar year, the Director of OSWD shall provide a report to the Governor and the Commissioner of Administration which summarizes the activities of each department pursuant to this Order and which contains recommendations for additional programs to accomplish the purposes of this Order.

   The Commissioner of Administration shall provide the Director of OSWD with such facilities, staff, resources, equipment, and supplies as are necessary to carry out the duties set forth herein. The Director of OSWD shall submit a proposal each fiscal year to the Commissioner of Administration detailing the needs of the Office of Supplier and Workforce Diversity.

2. All state agencies shall continue to make every feasible effort to target the percentage of goods and services procured from certified MBEs and WBEs to 10% and 5%, respectively. These efforts shall include participation in an Executive Branch Contract Compliance Council which shall, in cooperation with the OSWD, review procurement efforts to assist in meeting the requirements of this Executive Order.

3. The Divisions of Purchasing and Materials Management (PMM) and Facilities Management, Design and Construction (FMDC) within the Office of Administration shall be authorized to implement the following programs to increase M/WBE procurement:

   a. PMM shall be authorized to encourage prime contractors to subcontract with M/WBEs on all contracts of $100,000 or greater. OSWD contracts shall include a provision for participation which will allow the bidders to tailor a plan to fit the contract. Mandatory percentage goals of M/WBE participation shall not be established in violation of federal or state law. M/WBE participation shall be encouraged by PMM in consultation with OSWD and the user agency depending on the availability of M/WBE vendors in the applicable commodity/service and geographical area. PMM shall consider M/WBE participation as a significant factor in a contract bid. The M/WBE participation will be evaluated along with other criteria in the award of a bid. It is intended that 10% MBE and 5% WBE percentage is desired. The participation can be met through the use of prime contractors, subcontractors, suppliers, joint ventures, or other arrangements that afford meaningful opportunities for M/WBE participation.

OSWD in conjunction with PMM shall also appoint a M/WBE Purchasing Manager for the purpose of promoting and coordinating the participation of M/WBEs in State of Missouri contracts.

b. FMDC shall be authorized to evaluate M/WBE participation in design contracts, as part of the quality-based selection process, for construction projects worth $1.5 million or more. On contracts with lesser value, FMDC shall make special efforts to target M/WBEs as prime contractors. Overall participation targets for each fiscal year shall be 10% MBE and 5% WBE; however, mandatory percentage goals shall not be established in violation of federal or state law. The targets may be met through the use of prime contractors, subcontractors, joint ventures, or other arrangements that afford meaningful opportunities for M/WBE participation.

FMDC shall also be authorized to seek participation of M/WBEs on construction contracts. The targets shall be set on a project by project basis by FMDC in consultation with the OSWD, taking into account the availability of M/WBE contractors in the applicable geographic area and construction trade, with the overall participation targets for each fiscal year at 10% MBE and 5% WBE. The targets may be met through the use of prime contractors, subcontractors, suppliers, joint ventures, or other arrangements that afford meaningful opportunities for M/WBE participation.

c. Both FMDC and the PMM shall establish policies or rules to implement these programs which shall include a waiver provision for prime contractors who make a good faith effort to attain such targets but do not succeed. They shall also establish enforcement procedures in cooperation with the OSWD to assist contractors to meet subcontracting commitments. Their programs shall be reviewed annually to determine whether targets should be modified.

d. FMDC and PMM are authorized and directed to identify and consult with such entities as the St. Louis Minority Business Council, the Kansas City Minority Supplier Council and the Kansas City Council of Women Business Owners in identifying M/WBEs to participate in state procurements.

4. OSWD shall monitor the programs and work with FMDC and PMM in their implementation. The OSWD shall have the following responsibilities and carry out the following tasks:

a. to actively recruit, facilitate and serve as a clearinghouse for M/WBE contractors to participate in the programs;

b. to cooperate with the PMM and the FMDC in the administration and enforcement of the M/WBE participation programs;

c. to cooperate with the PMM and the FMDC in the development of policies, forms, and procedures to carry out the requirements of the M/WBE participation programs;

d. to participate in M/WBE target setting;

e. to perform fact-gathering and record-keeping to determine both the effectiveness of state participation programs and the availability and utilization of eligible M/WBEs on individual projects, including levels of participation and availability in specific areas;

f. to certify contractors as M/WBEs;

g. to assess the continuing need for M/WBE participation targets for specific contracting areas;

h. to monitor contractor participation with M/WBE targets; and

i. to recommend sanctions for contractors who fail to faithfully execute M/WBE participation plans during the course of contract performance.

5. The programs shall be reviewed annually to monitor the level of M/WBE participation achieved in state contracting areas during the previous year. An assessment of the programs and whether their continuation is necessary shall be delivered to the Governor and the General Assembly. After it is determined that M/WBEs participate in state contracts in a manner commensurate with their presence and capability in the state marketplace, the programs set forth in section 2 will be terminated.

6. Executive Order No. 98-21 (1998) and article II of Executive Order 94-03 (1994) are hereby superseded and replaced by this Executive Order.

IN WITNESS WHEREOF, I have hereunto set my hand and caused to be affixed the Great Seal of the State of Missouri, in the City of Jefferson, on this 8th day of September, 2005.

Matt Blunt
Governor

ATTEST:

Robin Carnahan
Secretary of State

RECEIVED & FILED

OCT 21 2015

SECRETARY OF STATE
COMMISSIONS DIVISION

EXECUTIVE ORDER
15-06

WHEREAS, the State of Missouri is committed to enhancing the economic health and prosperity of Minority and Women Business Enterprises (M/WBEs) through the use of M/WBE contract benchmarks established in state contracts for supplies, services, and construction that are consistent with §§37.020 – 37.023, RSMo, and the findings of the most current disparity study; and

WHEREAS, upon funding being appropriated by the General Assembly in 2013, the Office of Administration (OA) commissioned a Disparity Study which was completed on October 24, 2014, that studied the utilization of M/WBEs in state contracts and the availability of M/WBEs in the applicable marketplace; and

WHEREAS, Executive Order 14-07 established the Disparity Study Oversight Review Committee to review the findings of the 2014 Disparity Study and to produce meaningful recommendations to assist the State of Missouri in developing a contracting process that is inclusive, promotes diversity, and provides greater opportunity for M/WBEs; and

WHEREAS, after conducting a thorough review and analysis of the findings of the 2014 Disparity Study, the Disparity Study Oversight Review Committee submitted its report to the Governor on January 27, 2015; and

WHEREAS, the Disparity Study Oversight Review Committee's report sets forth recommendations to help eliminate the lingering effects of discrimination to ensure a level playing-field for all Missouri business owners; and

WHEREAS, on September 14, 2015, the Ferguson Commission, created pursuant to Executive Order 14-15, released its final report which called for Missouri to implement a statewide M/WBE program "with outcomes measures that incorporate capacity building, mentoring, and education with respect to the state and local procurement system;" and

WHEREAS, the State of Missouri is dedicated to the compelling governmental interest of remedying race and sex based discrimination in a manner consistent with state and federal law.

NOW, THEREFORE, I, JEREMIAH W. (JAY) NIXON, GOVERNOR OF THE STATE OF MISSOURI, in recognition of the obligations of the State of Missouri and by virtue of the authority vested in me by the Constitution and the Laws of the State of Missouri, do hereby state that the following narrowly tailored policies and procedures shall be adopted by the Executive Branch of state government in procuring goods and services:

1. All state agencies shall make every feasible effort to increase the percentage of goods and services procured from certified M/WBEs in order to achieve the annual goals of 10% MBEs and 10% WBEs of all annual Executive Branch procurement funds. These efforts shall include participation in an Executive Branch Contract Compliance Council which shall, in cooperation with the Office of Administration, Office of Equal Opportunity (OEO), review procurement efforts to assist in meeting the requirements of this Executive Order.

2. Both the Division of Purchasing and Facilities Management, Design and Construction (FMDC) within the Office of Administration shall be authorized to implement the following program to increase M/WBE procurements:

   a. Division of Purchasing and FMDC shall encourage prime contractors to subcontract with M/WBEs on state contracts. Division of Purchasing and FMDC contracts are permitted to include a provision setting forth participation of M/WBEs as prime contractors or subcontractors who perform a commercially useful function. M/WBE participation requirements shall be determined by the Division of Purchasing and FMDC, in consultation with OEO and the user agency, by evaluating the availability of M/WBE vendors in the applicable commodity/service and geographical area as determined by the most recent disparity study and other applicable factors. Division of Purchasing and FMDC shall use individual contract percentages to help meet the

state's annual program goals. The M/WBE participation will be evaluated for responsiveness along with other criteria in the award of a bid. The participation can be met through the use of prime contractors, subcontractors, suppliers, joint ventures, or other arrangements that afford meaningful opportunities for M/WBE participation.

b. Division of Purchasing and FMDC shall revise their policies and regulations to further implement this program which shall include a waiver provision for prime contractors who make a good faith effort to take all necessary and reasonable steps to attain such percentages but are otherwise unable to achieve them. Division of Purchasing and FMDC shall also establish enforcement procedures, in cooperation with OEO and the Contract Oversight Office within the Office of Administration, which shall include consequences for failure to meet percentage commitments unless a good faith waiver is obtained from the Division of Purchasing or FMDC, respectively.

c. Division of Purchasing and FMDC are authorized and directed to identify and consult with such other certifying entities as recommended by OEO in order to facilitate M/WBEs to participate in state procurements.

3. The Office of Administration shall also be authorized to:

a. Conduct a comprehensive review of OEO and determine the need for increased funding and personnel to enable OEO to carry out the work it has been assigned.

b. Evaluate the state's current M/WBE eligibility standards and determine what revisions, if any, should be considered to applicable statutes and regulations. This includes an evaluation of whether M/WBE eligibility should be capped based upon a firm's gross income and/or personal net worth. The Office of Administration should refer to the Disparity Study and the Committee's report as a reference regarding potential revisions to the program's eligibility standards.

c. Research existing bonding and financing programs for small vendors that enhance access to bonding and working capital in order to reduce barriers to business development and success, and determine the feasibility of developing such a program within OEO.

d. Evaluate the existing experience and surety bonding requirements and determine what adjustments, if any, should be considered to facilitate increased M/WBE participation.

e. Evaluate the possibility of lengthening solicitation periods for vendors, whenever possible, in an effort to increase M/WBE participation.

f. Research the feasibility and consider establishing a Mentor-Protégé Program within OEO, whereby a larger firm provides instruction and training to an emerging firm to increase the protégé's skills, capacities, and business areas.

g. Educate and advise state agencies on implementing internal procedures that ensure compliance with §8.690 RSMo.

h. Implement an electronic contracting system that provides access to state contracting information and collects measureable data to document the achievement of M/WBE goals.

4. OEO shall work with the Division of Purchasing and FMDC in the implementation of this Executive Order, and shall have the following responsibilities:

a. Actively recruit, certify, and serve as a clearinghouse for M/WBEs to participate in the program.

b. Partner with agencies and organizations that conduct similar services that can provide technical assistance and supportive services.

c. Cooperate with the Division of Purchasing, FMDC, and the Contract Oversight Office in the administration and enforcement of the M/WBE participation program and contract requirements.

d. Cooperate with the Division of Purchasing and FMDC in the development of policies, forms, and procedures to carry out the requirements of the M/WBE participation program.

e. Provide guidance to the Division of Purchasing and FMDC in the setting of M/WBE individual contract percentages.

f. Review and record the effectiveness of the state agencies' participation in the program in light of the availability and utilization of eligible M/WBEs on individual contracts, and make recommendations to the agencies for improvement and enforcement of the program.

g. Provide outreach to M/WBEs to educate firms about the program, the state's procurement process, and business elements such as obtaining bonding, lines of credit, or other related services. Outreach efforts shall also serve to foster enhanced working relationships between M/WBEs and prime contractors.

h. Recommend sanctions for contractors who fail to faithfully execute M/WBE participation requirements during the course of contract performance.

5. OEO shall review the program annually to monitor the level of M/WBE participation achieved in state contracting areas during the previous fiscal year. An assessment of the program and whether the continuation is necessary shall be prepared by OEO and delivered to the Governor and the General Assembly by March after the completion of the fiscal year. After it is determined by OEO that M/WBEs participate in state contracts at a level commensurate with their presence and capability in the state marketplace, then the program set forth in this Executive Order shall be terminated. If the program is still deemed to be necessary on March 1, 2019, a new Disparity Study should be conducted and a new Disparity Study Oversight Review Committee should be appointed to review the results of that study.

6. This Order shall take effect immediately and supersedes Executive Order 05-30.

IN WITNESS WHEREOF, I have hereunto set my hand and cause to be affixed the Great Seal of the State of Missouri, in the City of Jefferson, on this 21st day of October, 2015.

Jeremiah W. (Jay) Nixon
Governor

ATTEST:

Jason Kander
Secretary of State

MISSOURI DEPARTMENT OF NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL QUALITY
FINANCIAL ASSISTANCE CENTER

Certification Regarding Debarment and Suspension

Applicant Name: _____

Project Name: _____

Project No.: _____ SAM.gov UEI No.: _____

The prospective participant certifies to the best of its knowledge and belief that it and its principals:

a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any governmental (federal, state, or local) entity;

b) Have not within a three-year period preceding this certification been convicted of or had a civil judgment rendered against them for:
    1) Commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (federal, state, or local) transaction or contract under a public transaction;
    2) Violation of federal or state antitrust statutes relating to the submission of offers; or
    3) Commission of embezzlement, theft, forgery, bribery, falsification ordestruction of records, making false statements, or receiving stolen property;

c) Are not presently indicted for, or otherwise criminally or civilly charged by a governmental entity (federal, state, or local) with, commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and

d) Have not, within a three-year period preceding this certification, had one or more public transactions (federal, state, or local) terminated for cause or default.

I understand that a false statement on this certification may be grounds for rejection of this proposal or termination of the award.

☐ I am able to certify to the above statements.

☐ I am unable to certify to the above statements and attached my explanation.

_____ _____
Typed Name of Authorized Representative Title of Authorized Representative

_____ _____
Signature of Authorized Representative Date

MISSOURI DEPARTMENT OF NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL QUALITY
FINANCIAL ASSISTANCE CENTER

Certification Regarding Debarment and Suspension
Instructions

The Missouri Department of Natural Resources receives assistance from the federal government, and the funds provided to a community constitute a sub-agreement. Accordingly, each prospective recipient of a grant, loan, or cooperative agreement and any contractor or subcontractor must agree to fully comply with Executive Order 12549, 2 C.F.R. Part 180, and 2 C.F.R. Part 1532 regarding Debarment and Suspension.

"Principals," for the purposes of this certification, means officers; directors; owners; partners; and persons having primary management or supervisory responsibilities within an entity (e.g., general manager; plant manager; head of a subsidiary, division, or business segment, and similar positions).

The prospective grant, loan, or cooperative agreement recipient should return the signed certification, and explanation if needed, with its application to:

Missouri Department of Natural Resources
Financial Assistance Center
PO Box 176
Jefferson City, MO 65102-0176

Or email to fac@dnr.mo.gov.

The recipient of funding should also obtain a certification from their consulting engineer and prime contractor. The funding recipient shall also check the status on the System for Award Management (SAM) located on the Internet at https://www.sam.gov/portal/public/SAM/.

Each prospective subcontractor should submit a completed certification or explanation to the prime contractor for the project.

U.S. ENVIRONMENTAL PROTECTION AGENCY
WATER QUALITY OFFICE

CERTIFICATION OF NONSEGREGATED FACILITIES

(Applicable to federally assisted construction contracts and related sub-contracts exceeding $10,000 which are not exempt from the Equal Opportunity clause.)

The federally assisted construction contractor certifies that he does not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The federally assisted construction contractor certifies further that he will not maintain or provide for his employees any segregated facilities at any of his establishments, and that he will not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The federally assisted construction contractor agrees that a breach of this certification is a violation of the Equal Opportunity clause in this contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, creed, color, or national origin, because of habit, local custom, or otherwise. The federally assisted construction contractor agrees that (except where he has obtained identical certifications from proposed subcontractors for specific time periods) he will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity clause, and that he will retain such certifications in his files.

Signature _____ Date_____

Name and Title of Signer _____
(Print or Type)

Firm Name _____

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

Domestic Products Procurement Act – RSMo 34.350 – 34.359 Certification

Each contract for the purchase or lease of manufactured goods or commodities by any public agency, and each contract made by a public agency for construction, alteration, repair, or maintenance of any public works shall contain a provision that any manufactured goods or commodities used or supplied in the performance of that contract or any subcontract thereto shall be manufactured or produced in the United States. (34.353.1 RSMo)

Project Name: _____

Project Number: _____

Contract Name: _____

Please check one of the following and sign where indicated.

☐ All of the iron, steel, and manufactured goods used in the project are produced in the United States.

☐ A waiver is being requested from the _____ (owner) to the domestic products provision due to the following exception:

- ☐ The specified products are not manufactured or produced in the United States in sufficient quantities or manufactured or produced in the United States within the necessary time frames in sufficient quantities.
- ☐ The cost for the specified products would increase the contract by more than 10 percent*; or
- ☐ Only one line of a product is manufactured or produced in the United States.

Documentation of at least one of the cases above must be provided. List below the materials that cannot comply with the Domestic Product Procurement Act provisions.

_____

_____

_____

_____

☐ Additional sheets (attach if necessary)

_____ _____ _____

Name of Contracting Firm Signature Date

_____

Name and Title of Signer (Please type)

***In accordance with the Federal Water Pollution Control Act, Section 608, all iron and steel products used in a State Revolving Fund project should be produced in the United States. This requirement does not apply where the inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent.**

Instructions for Completing the Business Entity Certification Form

Box A: Non-Business Entity

Fill in Box A only if applicant qualifies for one of the following types of entities:

1. Self-employed individuals with no employees,
2. State agencies,
3. Federal government entities, or
4. Entities utilizing the services of "direct sellers" as defined in §288.034.12(17), RSMo.

Box B or Box C: Business Entity

Complete Box B or C if the applicant is a "business entity" as defined in §285.525, RSMo. Business entity includes Missouri schools, Missouri universities (other than stated in Box C), out-of-state agencies, out-of-state schools, out-of-state universities, and *political subdivisions.*

Most State Revolving Fund applicants are political subdivisions; and therefore, would need to fill out Box B if they have not submitted documentation previously or Box C if they already had work authorization documentation on file with a state agency or public university on or after September 1, 2009.

For questions, contact the Missouri Department of Natural Resources' Financial Assistance Center at fac@dnr.mo.gov, 573-751-1192, or toll free 800-361-4827.

BUSINESS ENTITY CERTIFICATION, ENROLLMENT DOCUMENTATION, AND AFFIDAVIT OF WORK AUTHORIZATION

BUSINESS ENTITY CERTIFICATION:
The bidder/contractor must certify their current business status by completing either Box A or Box B or Box C on this Exhibit.

BOX A:	To be completed by a non-business entity as defined below.
BOX B:	To be completed by a business entity who has not yet completed and submitted documentation pertaining to the federal work authorization program as described at http://www.dhs.gov/xprevprot/programs/gc_1185221678150.shtm.
BOX C:	To be completed by a business entity who has already submitted documentation with a notarized date on or after **September 1, 2009**, to a Missouri state agency including Division of Purchasing and Materials Management.

Business entity, as defined in section 285.525, RSMo pertaining to section 285.530, RSMo is any person or group of persons performing or engaging in any activity, enterprise, profession, or occupation for gain, benefit, advantage, or livelihood. The term "**business entity**" shall include but not be limited to self-employed individuals, partnerships, corporations, contractors, and subcontractors. The term "**business entity**" shall include any business entity that possesses a business permit, license, or tax certificate issued by the state, any business entity that is exempt by law from obtaining such a business permit, and any business entity that is operating unlawfully without such a business permit. The term "**business entity**" shall not include a self-employed individual with no employees or entities utilizing the services of direct sellers as defined in subdivision (17) of subsection 12 of section 288.034, RSMo.

Note: Regarding governmental entities, business entity includes Missouri schools, Missouri universities (other than stated in Box C), out of state agencies, out of state schools, out of state universities, and political subdivisions. A business entity does not include Missouri state agencies and federal government entities.

BOX A – CURRENTLY NOT A BUSINESS ENTITY

I certify that _____ (Company/Individual Name) **DOES NOT CURRENTLY MEET** the definition of a business entity, as defined in section 285.525, RSMo pertaining to section 285.530, RSMo as stated above, because: (check the applicable business status that applies below)

- ❒ I am a self-employed individual with no employees, **OR**
- ❒ The company that I represent utilizes the services of direct sellers as defined in subdivision (17) of subsection 12 of section 288.034, RSMo.

I certify that I am not an alien unlawfully present in the United States and if _____ (Company/Individual Name) is awarded a contract for the services requested herein under _____ (Bid/SFS/Contract Number) and if the business status changes during the life of the contract to become a business entity as defined in section 285.525, RSMo pertaining to section 285.530, RSMo then, prior to the performance of any services as a business entity, _____ (Company/Individual Name) agrees to complete Box B, comply with the requirements stated in Box B and provide the _____(insert agency name) with all documentation required in Box B of this exhibit.

_____ Authorized Representative's Name (Please Print)

_____ Authorized Representative's Signature

_____ Company Name (if applicable)

_____ Date

BOX B – CURRENT BUSINESS ENTITY STATUS

I certify that _____ (Business Entity Name) **MEETS** the definition of a business entity as defined in section 285.525, RSMo pertaining to section 285.530.

_____
Authorized Business Entity
Representative's Name (Please Print)

_____
Authorized Business Entity
Representative's Signature

_____
Business Entity Name

_____
Date

_____
E-Mail Address

As a business entity, the bidder/contractor must perform/provide the following. The bidder/contractor should check each to verify completion/submission:

- ☐ Enroll and participate in the E-Verify federal work authorization program (Website: http://www.dhs.gov/xprevprot/programs/gc_1185221678150.shtm; Phone: 888-464-4218; Email: e-verify@dhs.gov) with respect to the employees hired after enrollment in the program who are proposed to work in connection with the services required herein; AND
- ☐ Provide documentation affirming said company's/individual's enrollment and participation in the E-Verify federal work authorization program. Documentation shall include a page from the E-Verify Memorandum of Understanding (MOU) listing the bidder's/contractor's name and the MOU signature page completed and signed, at minimum, by the bidder/contractor and the Department of Homeland Security – Verification Division. If the signature page of the MOU lists the bidder's/contractor's name and company ID, then no additional pages of the MOU must be submitted.; AND
- ☐ Submit a completed, notarized Affidavit of Work Authorization provided on the next page of this Exhibit.

AFFIDAVIT OF WORK AUTHORIZATION:

The bidder/contractor who meets the section 285.525, RSMo definition of a business entity must complete and return the following Affidavit of Work Authorization.

Comes now _____ (Name of Business Entity Authorized Representative) as _____ (Position/Title) first being duly sworn on my oath, affirm _____ (Business Entity Name) is enrolled and will continue to participate in the E-Verify federal work authorization program with respect to employees hired after enrollment in the program who are proposed to work in connection with the services related to contract(s) with the State for the duration of the contract(s), if awarded in accordance with subsection 2 of section 285.530, RSMo. I also affirm that _____ (Business Entity Name) does not and will not knowingly employ a person who is an unauthorized alien in connection with the contracted services provided to the contract(s) for the duration of the contract(s), if awarded.

In Affirmation thereof, the facts stated above are true and correct. (The undersigned understands that false statements made in this filing are subject to the penalties provided under section 575.040, RSMo.)

_____ Authorized Representative's Signature

_____ Printed Name

_____ Title

_____ Date

_____ E-Mail Address

Subscribed and sworn to before me this _____ (DAY) of _____ (MONTH, YEAR). I am commissioned as a notary public within the County of _____ (NAME OF COUNTY), State of _____ (NAME OF STATE), and my commission expires on _____ (DATE).

_____ Signature of Notary

_____ Date

BOX C – AFFIDAVIT ON FILE – CURRENT BUSINESS ENTITY STATUS

I certify that _____ (Business Entity Name) **MEETS** the definition of a business entity as defined in section 285.525, RSMo pertaining to section 285.530, RSMo and have enrolled and currently participates in the E-Verify federal work authorization program with respect to the employees hired after enrollment in the program who are proposed to work in connection with the services related to contract(s) with the State of Missouri. We have previously provided documentation to a Missouri state agency or public university that affirms enrollment and participation in the E-Verify federal work authorization program. The documentation that was previously provided included the following.

- ✓ A page from the E-Verify Memorandum of Understanding (MOU) listing the bidder's/contractor's name and the MOU signature page completed and signed by the bidder/contractor and the Department of Homeland Security – Verification Division.
- ✓ A completed, notarized Affidavit of Work Authorization signed and dated on or after **September 1, 2009**.

_____ Authorized Business Entity Representative's Name (Please Print)	_____ Authorized Business Entity Representative's Signature
_____ E-Verify MOU Company ID Number	_____ E-Mail Address
_____ Business Entity Name	_____ Date

Missouri State Agency or Public University* Name _____

Date of Submission _____

Bid/Contract Number _____
(If known)

* Public University includes the following five schools:
- Harris-Stowe State University - St. Louis
- Missouri Southern State University - Joplin
- Missouri Western State University - St. Joseph
- Northwest Missouri State University – Maryville
- Southeast Missouri State University - Cape Girardeau
- Division of Purchasing & Materials Management

United States
ENVIRONMENTAL PROTECTION AGENCY
Washington, DC 20460

OMB Control No. 2030-0020
Approval expires 04/30/2021

_____
EPA Project Control Number

CERTIFICATION REGARDING LOBBYING

CERTIFICATION FOR CONTRACTS, GRANTS, **LOANS AND COOPERATIVE AGREEMENTS**

The undersigned certifies, to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, “Disclosure Form to Report Lobbying,” in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all sub-awards at all tiers (including sub-contracts, sub-grants, and contracts under grants, loans, and cooperative agreements) and that all sub-recipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31 U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

_____
Typed Name & Title of Authorized Representative

_____
Signature and Date of Authorized Representative

The public reporting and recordkeeping burden for this collection of information is estimated to average 15 minutes per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

Approved by OMB
0348-0046

Disclosure of Lobbying Activities

Complete this form to disclose lobbying activities pursuant to 31 U.S.C. 1352
(See reverse for public burden disclosure)

1. Type of Federal Action: a. contract ____ b. grant c. cooperative agreement d. loan e. loan guarantee f. loan insurance	**2. Status of Federal Action:** a. bid/offer/application _____ b. initial award c. post-award	**3. Report Type:** a. initial filing _____ b. material change **For material change only:** Year _____ quarter _____ Date of last report_____
4. Name and Address of Reporting Entity: ____ Prime _____ Subawardee Tier_____, if Known: **Congressional District,** *if known*:	**5. If Reporting Entity in No. 4 is Subawardee,** Enter Name and Address of Prime: **Congressional District,** *if known*:	
6. Federal Department/Agency:	**7. Federal Program Name/Description:** CFDA Number, *if applicable*: _____	
8. Federal Action Number, *if known:*	**9. Award Amount**, *if known:* **$**	
10. a. Name and Address of Lobbying Registrant *(if individual, last name, first name, MI):*	**b. Individuals Performing Services** *(including address if different from No. 10a)* *(last name, first name, MI):*	
11. Information requested through this form is authorized by title 31 U.S.C. section 1352. This disclosure of lobbying activities is a material representation of fact upon which reliance was placed by the tier above when this transaction was made or entered into. This disclosure is required pursuant to 31 U.S.C. 1352. This information will be reported to the Congress semi-annually and will be available for public inspection. Any person who fails to file the required disclosure shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.	**Signature: _____** **Print Name: _____** **Title: _____** **Telephone No.: _____ Date: _____**	
Federal Use Only	**Authorized for Local Reproduction** **Standard Form - LLL (Rev. 7-97)**	

INSTRUCTIONS FOR COMPLETION OF SF-LLL, DISCLOSURE OF LOBBYING ACTIVITIES

This disclosure form shall be completed by the reporting entity, whether subawardee or prime Federal recipient, at the initiation or receipt of a covered Federal action, or a material change to a previous filing, pursuant to title 31 U.S.C. section 1352. The filing of a form is required for each payment or agreement to make payment to any lobbying entity for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with a covered Federal action. Complete all items that apply for both the initial filing and material change report. Refer to the implementing guidance published by the Office of Management and Budget for additional information.

1. Identify the type of covered Federal action for which lobbying activity is and/or has been secured to influence the outcome of a covered Federal action.

2. Identify the status of the covered Federal action.

3. Identify the appropriate classification of this report. If this is a followup report caused by a material change to the information previously reported, enter the year and quarter in which the change occurred. Enter the date of the last previously submitted report by this reporting entity for this covered Federal action.

4. Enter the full name, address, city, State and zip code of the reporting entity. Include Congressional District, if known. Check the appropriate classification of the reporting entity that designates if it is, or expects to be, a prime or subaward recipient. Identify the tier of the subawardee, e.g., the first subawardee of the prime is the 1st tier. Subawards include but are not limited to subcontracts, subgrants and contract awards under grants.

5. If the organization filing the report in item 4 checks "Subawardee," then enter the full name, address, city, State and zip code of the prime Federal recipient. Include Congressional District, if known.

6. Enter the name of the federal agency making the award or loan commitment. Include at least one organizational level below agency name, if known. For example, Department of Transportation, United States Coast Guard.

7. Enter the Federal program name or description for the covered Federal action (item 1). If known, enter the full Catalog of Federal Domestic Assistance (CFDA) number for grants, cooperative agreements, loans, and loan commitments.

8. Enter the most appropriate Federal identifying number available for the Federal action identified in item 1 (e.g., Request for Proposal (RFP) number; Invitations for Bid (IFB) number; grant announcement number; the contract, grant, or loan award number; the application/proposal control number assigned by the Federal agency). Included prefixes, e.g., "RFP-DE-90-001."

9. For a covered Federal action where there has been an award or loan commitment by the Federal agency, enter the Federal amount of the award/loan commitment for the prime entity identified in item 4 or 5.

10. (a) Enter the full name, address, city, State and zip code of the lobbying registrant under the Lobbying Disclosure Act of 1995 engaged by the reporting entity identified in item 4 to influence the covered Federal action.

    (b) Enter the full names of the individual(s) performing services, and include full address if different from 10(a). Enter Last Name, First Name, and Middle Initial (MI).

11. The certifying official shall sign and date the form, print his/her name, title, and telephone number.

According to the Paperwork Reduction Act, as amended, no persons are required to respond to a collection of information unless it displays a valid OMB control Number. The valid OMB control number for this information collection is OMB No. 0348-0046. Public reporting burden for this collection of information is estimated to average 10 minutes per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Office of Management and Budget, Paperwork Reduction Project (0348-0046), Washington, DC 20503

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAR 2 0 2014

OFFICE OF WATER

MEMORANDUM

SUBJECT: Implementation of American Iron and Steel provisions of P.L. 113-76, Consolidated Appropriations Act, 2014

FROM: Andrew D. Sawyers, Director
Office of Wastewater Management (4201M)

Peter C. Grevatt, Director
Office of Ground Water and Drinking Water (4601M)

TO: Water Management Division Directors
Regions I- X

P.L. 113-76, Consolidated Appropriations Act, 2014 (Act), includes an "American Iron and Steel (AIS)" requirement in section 436 that requires Clean Water State Revolving Loan Fund (CWSRF) and Drinking Water State Revolving Loan Fund (DWSRF) assistance recipients to use iron and steel products that are produced in the United States for projects for the construction, alteration, maintenance, or repair of a public water system or treatment works if the project is funded through an assistance agreement executed beginning January 17, 2014 (enactment of the Act), through the end of Federal Fiscal Year 2014.

Section 436 also sets forth certain circumstances under which EPA may waive the AIS requirement. Furthermore, the Act specifically exempts projects where engineering plans and specifications were approved by a State agency prior to January 17, 2014.

The approach described below explains how EPA will implement the AIS requirement. The first section is in the form of questions and answers that address the types of projects that must comply with the AIS requirement, the types of products covered by the AIS requirement, and compliance. The second section is a step-by-step process for requesting waivers and the circumstances under which waivers may be granted.

Implementation

The Act states:

Sec. 436. (a)(1) None of the funds made available by a State water pollution control revolving fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C. 1381 et seq.) or made available by a drinking water treatment revolving loan fund as authorized by section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j–12) shall be used for a project for the construction, alteration, maintenance, or repair of a public water system or treatment works unless all of the iron and steel products used in the project are produced in the United States.

(2) In this section, the term ''iron and steel products'' means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.

(b) Subsection (a) shall not apply in any case or category of cases in which the Administrator of the Environmental Protection Agency (in this section referred to as the ''Administrator'') finds that—

(1) applying subsection (a) would be inconsistent with the public interest;

(2) iron and steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality; or

(3) inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

(c) If the Administrator receives a request for a waiver under this section, the Administrator shall make available to the public on an informal basis a copy of the request and information available to the Administrator concerning the request, and shall allow for informal public input on the request for at least 15 days prior to making a finding based on the request. The Administrator shall make the request and accompanying information available by electronic means, including on the official public Internet Web site of the Environmental Protection Agency.

(d) This section shall be applied in a manner consistent with United States obligations under international agreements.

(e) The Administrator may retain up to 0.25 percent of the funds appropriated in this Act for the Clean and Drinking Water State Revolving Funds for carrying out

the provisions described in subsection (a)(1) for management and oversight of the requirements of this section.

(f) This section does not apply with respect to a project if a State agency approves the engineering plans and specifications for the project, in that agency's capacity to approve such plans and specifications prior to a project requesting bids, prior to the date of the enactment of this Act.

The following questions and answers provide guidance for implementing and complying with the AIS requirements:

Project Coverage

1) What classes of projects are covered by the AIS requirement?

All treatment works projects funded by a CWSRF assistance agreement, and all public water system projects funded by a DWSRF assistance agreement, from the date of enactment through the end of Federal Fiscal Year 2014, are covered. The AIS requirements apply to the entirety of the project, no matter when construction begins or ends. Additionally, the AIS requirements apply to all parts of the project, no matter the source of funding.

2) Does the AIS requirement apply to nonpoint source projects or national estuary projects?

No. Congress did not include an AIS requirement for nonpoint source and national estuary projects unless the project can also be classified as a 'treatment works' as defined by section 212 of the Clean Water Act.

3) Are any projects for the construction, alteration, maintenance, or repair of a public water system or treatment works excluded from the AIS requirement?

Any project, whether a treatment works project or a public water system project, for which engineering plans and specifications were approved by the responsible state agency prior to January 17, 2014, is excluded from the AIS requirements.

4) What if the project does not have approved engineering plans and specifications but has signed an assistance agreement with a CWSRF or DWSRF program prior to January 17, 2014?

The AIS requirements do not apply to any project for which an assistance agreement was signed prior to January 17, 2014.

5) What if the project does not have approved engineering plans and specifications, but bids were advertised prior to January 17, 2014 and an assistance agreement was signed after January 17, 2014?

If the project does not require approved engineering plans and specifications, the bid advertisement date will count in lieu of the approval date for purposes of the exemption in section 436(f).

6) What if the assistance agreement that was signed prior to January 17, 2014, only funded a part of the overall project, where the remainder of the project will be funded later with another SRF loan?

If the original assistance agreement funded any construction of the project, the date of the original assistance agreement counts for purposes of the exemption. If the original assistance agreement was only for planning and design, the date of that assistance agreement will count for purposes of the exemption only if there is a written commitment or expectation on the part of the assistance recipient to fund the remainder of the project with SRF funds.

7) What if the assistance agreement that was signed prior to January 17, 2014, funded the first phase of a multi-phase project, where the remaining phases will be funded by SRF assistance in the future?

In such a case, the phases of the project will be considered a single project if all construction necessary to complete the building or work, regardless of the number of contracts or assistance agreements involved, are closely related in purpose, time and place. However, there are many situations in which major construction activities are clearly undertaken in phases that are distinct in purpose, time, or place. In the case of distinct phases, projects with engineering plans and specifications approval or assistance agreements signed prior to January 17, 2014 would be excluded from AIS requirements while those approved/signed on January 17, 2014, or later would be covered by the AIS requirements.

8) What if a project has split funding from a non-SRF source?

Many States intend to fund projects with "split" funding, from the SRF program and from State or other programs. Based on the Act language in section 436, which requires that American iron and steel products be used in any project for the construction, alteration, maintenance, or repair of a public water system or treatment works receiving SRF funding between and including January 17, 2014 and September 30, 2014, any project that is funded in whole or in part with such funds must comply with the AIS requirement. A "project" consists of all construction necessary to complete the building or work regardless of the number of contracts or assistance agreements involved so long as all contracts and assistance agreements awarded are closely related in purpose, time and place. This precludes the intentional splitting of SRF projects into separate and smaller contracts or assistance agreements to avoid AIS coverage on some portion of a larger

project, particularly where the activities are integrally and proximately related to the whole. However, there are many situations in which major construction activities are clearly undertaken in separate phases that are distinct in purpose, time, or place, in which case, separate contracts or assistance agreement for SRF and State or other funding would carry separate requirements.

9) What about refinancing?

If a project began construction, financed from a non-SRF source, prior to January 17, 2014, but is refinanced through an SRF assistance agreement executed on or after January 17, 2014 and prior to October 1, 2014, AIS requirements will apply to all construction that occurs on or after January 17, 2014, through completion of construction, unless, as is likely, engineering plans and specifications were approved by a responsible state agency prior to January 17, 2014. There is no retroactive application of the AIS requirements where a refinancing occurs for a project that has completed construction prior to January 17, 2014.

10) Do the AIS requirements apply to any other EPA programs, besides the SRF program, such as the Tribal Set-aside grants or grants to the Territories and DC?

No, the AIS requirement only applies to funds made available by a State water pollution control revolving fund as authorized by title VI of the Federal Water Pollution Control Act (33 U.S.C. 1381 et seq.) or made available by a drinking water treatment revolving loan fund as authorized by section 1452 of the Safe Drinking Water Act (42 U.S.C. 300j–12)

<u>Covered Iron and Steel Products</u>

11) What is an iron or steel product?

For purposes of the CWSRF and DWSRF projects that must comply with the AIS requirement, an iron or steel product is one of the following made primarily of iron or steel that is permanently incorporated into the public water system or treatment works:

Lined or unlined pipes or fittings;
Manhole Covers;
Municipal Castings (defined in more detail below);
Hydrants;
Tanks;
Flanges;
Pipe clamps and restraints;
Valves;
Structural steel (defined in more detail below);
Reinforced precast concrete; and
Construction materials (defined in more detail below).

12) What does the term 'primarily iron or steel' mean?

'Primarily iron or steel' places constraints on the list of products above. For one of the listed products to be considered subject to the AIS requirements, it must be made of greater than 50% iron or steel, measured by cost. The cost should be based on the material costs.

13) Can you provide an example of how to perform a cost determination?

For example, the iron portion of a fire hydrant would likely be the bonnet, body and shoe, and the cost then would include the pouring and casting to create those components. The other material costs would include non-iron and steel internal workings of the fire hydrant (i.e., stem, coupling, valve, seals, etc). However, the assembly of the internal workings into the hydrant body would not be included in this cost calculation. If one of the listed products is not made primarily of iron or steel, United States (US) provenance is not required. An exception to this definition is reinforced precast concrete, which is addressed in a later question.

14) If a product is composed of more than 50% iron or steel, but is not listed in the above list of items, must the item be produced in the US? Alternatively, must the iron or steel in such a product be produced in the US?

The answer to both question is no. Only items on the above list must be produced in the US. Additionally, the iron or steel in a non-listed item can be sourced from outside the US.

15) What is the definition of steel?

Steel means an alloy that includes at least 50 percent iron, between .02 and 2 percent carbon, and may include other elements. Metallic elements such as chromium, nickel, molybdenum, manganese, and silicon may be added during the melting of steel for the purpose of enhancing properties such as corrosion resistance, hardness, or strength. The definition of steel covers carbon steel, alloy steel, stainless steel, tool steel and other specialty steels.

16) What does 'produced in the United States' mean?

Production in the United States of the iron or steel products used in the project requires that all manufacturing processes, including application of coatings, must take place in the United States, with the exception of metallurgical processes involving refinement of steel additives. All manufacturing processes includes processes such as melting, refining, forming, rolling, drawing, finishing, fabricating and coating. Further, if a domestic iron and steel product is taken out of the US for any part of the manufacturing process, it becomes foreign source material. However, raw materials such as iron ore, limestone and iron and steel scrap are not covered by the AIS requirement, and the

material(s), if any, being applied as a coating are similarly not covered. Non-iron or steel components of an iron and steel product may come from non-US sources. For example, for products such as valves and hydrants, the individual non-iron and steel components do not have to be of domestic origin.

17) Are the raw materials used in the production of iron or steel required to come from US sources?

No. Raw materials, such as iron ore, limestone, scrap iron, and scrap steel, can come from non-US sources.

18) If an above listed item is primarily made of iron or steel, but is only at the construction site temporarily, must such an item be produced in the US?

No. Only the above listed products made primarily of iron or steel, permanently incorporated into the project must be produced in the US. For example trench boxes, scaffolding or equipment, which are removed from the project site upon completion of the project, are not required to be made of U.S. Iron or Steel.

19) What is the definition of 'municipal castings'?

Municipal castings are cast iron or steel infrastructure products that are melted and cast. They typically provide access, protection, or housing for components incorporated into utility owned drinking water, storm water, wastewater, and surface infrastructure. They are typically made of grey or ductile iron, or steel. Examples of municipal castings are:

Access Hatches;
Ballast Screen;
Benches (Iron or Steel);
Bollards;
Cast Bases;
Cast Iron Hinged Hatches, Square and Rectangular;
Cast Iron Riser Rings;
Catch Basin Inlet;
Cleanout/Monument Boxes;
Construction Covers and Frames;
Curb and Corner Guards;
Curb Openings;
Detectable Warning Plates;
Downspout Shoes (Boot, Inlet);
Drainage Grates, Frames and Curb Inlets;
Inlets;
Junction Boxes;
Lampposts;
Manhole Covers, Rings and Frames, Risers;

Meter Boxes;
Service Boxes;
Steel Hinged Hatches, Square and Rectangular;
Steel Riser Rings;
Trash receptacles;
Tree Grates;
Tree Guards;
Trench Grates; and
Valve Boxes, Covers and Risers.

20) What is 'structural steel'?

Structural steel is rolled flanged shapes, having at least one dimension of their cross-section three inches or greater, which are used in the construction of bridges, buildings, ships, railroad rolling stock, and for numerous other constructional purposes. Such shapes are designated as wide-flange shapes, standard I-beams, channels, angles, tees and zees. Other shapes include H-piles, sheet piling, tie plates, cross ties, and those for other special purposes.

21) What is a 'construction material' for purposes of the AIS requirement?

Construction materials are those articles, materials, or supplies made primarily of iron and steel, that are permanently incorporated into the project, not including mechanical and/or electrical components, equipment and systems. Some of these products may overlap with what is also considered "structural steel". This includes, but is not limited to, the following products: wire rod, bar, angles, concrete reinforcing bar, wire, wire cloth, wire rope and cables, tubing, framing, joists, trusses, fasteners (i.e., nuts and bolts), welding rods, decking, grating, railings, stairs, access ramps, fire escapes, ladders, wall panels, dome structures, roofing, ductwork, surface drains, cable hanging systems, manhole steps, fencing and fence tubing, guardrails, doors, and stationary screens.

22) What is not considered a 'construction material' for purposes of the AIS requirement?

Mechanical and electrical components, equipment and systems are not considered construction materials. Mechanical equipment is typically that which has motorized parts and/or is powered by a motor. Electrical equipment is typically any machine powered by electricity and includes components that are part of the electrical distribution system.

The following examples (including their appurtenances necessary for their intended use and operation) are NOT considered construction materials: pumps, motors, gear reducers, drives (including variable frequency drives (VFDs)), electric/pneumatic/manual accessories used to operate valves (such as electric valve actuators), mixers, gates, motorized screens (such as traveling screens), blowers/aeration equipment, compressors, meters, sensors, controls and switches, supervisory control and

data acquisition (SCADA), membrane bioreactor systems, membrane filtration systems, filters, clarifiers and clarifier mechanisms, rakes, grinders, disinfection systems, presses (including belt presses), conveyors, cranes, HVAC (excluding ductwork), water heaters, heat exchangers, generators, cabinetry and housings (such as electrical boxes/enclosures), lighting fixtures, electrical conduit, emergency life systems, metal office furniture, shelving, laboratory equipment, analytical instrumentation, and dewatering equipment.

23) If the iron or steel is produced in the US, may other steps in the manufacturing process take place outside of the US, such as assembly?

No. Production in the US of the iron or steel used in a listed product requires that all manufacturing processes must take place in the United States, except metallurgical processes involving refinement of steel additives.

24) What processes must occur in the US to be compliant with the AIS requirement for reinforced precast concrete?

While reinforced precast concrete may not be at least 50% iron or steel, in this particular case, the reinforcing bar and wire must be produced in the US and meet the same standards as for any other iron or steel product. Additionally, the casting of the concrete product must take place in the US. The cement and other raw materials used in concrete production are not required to be of domestic origin.

If the reinforced concrete is cast at the construction site, the reinforcing bar and wire are considered to be a construction material and must be produced in the US.

Compliance

25) How should an assistance recipient document compliance with the AIS requirement?

In order to ensure compliance with the AIS requirement, specific AIS contract language must be included in each contract, starting with the assistance agreement, all the way down to the purchase agreements. Sample language for assistance agreements and contracts can be found in Appendix 3 and 4.

EPA recommends the use of a step certification process, similar to one used by the Federal Highway Administration. The step certification process is a method to ensure that producers adhere to the AIS requirement and assistance recipients can verify that products comply with the AIS requirement. The process also establishes accountability and better enables States to take enforcement actions against violators.

Step certification creates a paper trail which documents the location of the manufacturing process involved with the production of steel and iron materials. A step certification is a process under which each handler (supplier, fabricator, manufacturer,

processor, etc) of the iron and steel products certifies that their step in the process was domestically performed. Each time a step in the manufacturing process takes place, the manufacturer delivers its work along with a certification of its origin. A certification can be quite simple. Typically, it includes the name of the manufacturer, the location of the manufacturing facility where the product or process took place (not its headquarters), a description of the product or item being delivered, and a signature by a manufacturer's responsible party. Attached, as Appendix 5, are sample certifications. These certifications should be collected and maintained by assistance recipients.

Alternatively, the final manufacturer that delivers the iron or steel product to the worksite, vendor, or contractor, may provide a certification asserting that all manufacturing processes occurred in the US. While this type of certification may be acceptable, it may not provide the same degree of assurance. Additional documentation may be needed if the certification is lacking important information. Step certification is the best practice.

26) How should a State ensure assistance recipients are complying with the AIS requirement?

In order to ensure compliance with the AIS requirement, States SRF programs must include specific AIS contract language in the assistance agreement. Sample language for assistance agreements can be found in Appendix 3.

States should also, as a best practice, conduct site visits of projects during construction and review documentation demonstrating proof of compliance which the assistance recipient has gathered.

27) What happens if a State or EPA finds a non-compliant iron and/or steel product permanently incorporated in the project?

If a potentially non-compliant product is identified, the State should notify the assistance recipient of the apparent unauthorized use of the non-domestic component, including a proposed corrective action, and should be given the opportunity to reply. If unauthorized use is confirmed, the State can take one or more of the following actions: request a waiver where appropriate; require the removal of the non-domestic item; or withhold payment for all or part of the project. Only EPA can issue waivers to authorize the use of a non-domestic item. EPA may use remedies available to it under the Clean Water Act, the Safe Drinking Water Act, and 40 CFR part 31 grant regulations, in the event of a violation of a grant term and condition.

It is recommended that the State work collaboratively with EPA to determine the appropriate corrective action, especially in cases where the State is the one who identifies the item in noncompliance or there is a disagreement with the assistance recipient.

If fraud, waste, abuse, or any violation of the law is suspected, the Office of Inspector General (OIG) should be contacted immediately. The OIG can be reached at 1-

888-546-8740 or OIG_Hotline@epa.gov. More information can be found at this website: http://www.epa.gov/oig/hotline.htm.

28) How do international trade agreements affect the implementation of the AIS requirements?

The AIS provision applies in a manner consistent with United States obligations under international agreements. Typically, these obligations only apply to direct procurement by the entities that are signatories to such agreements. In general, SRF assistance recipients are not signatories to such agreements, so these agreements have no impact on this AIS provision. In the few instances where such an agreement applies to a municipality, that municipality is under the obligation to determine its applicability and requirements and document the actions taken to comply for the State.

Waiver Process

The statute permits EPA to issue waivers for a case or category of cases where EPA finds (1) that applying these requirements would be inconsistent with the public interest; (2) iron and steel products are not produced in the US in sufficient and reasonably available quantities and of a satisfactory quality; or (3) inclusion of iron and steel products produced in the US will increase the cost of the overall project by more than 25 percent.

In order to implement the AIS requirements, EPA has developed an approach to allow for effective and efficient implementation of the waiver process to allow projects to proceed in a timely manner. The framework described below will allow States, on behalf of the assistance recipients, to apply for waivers of the AIS requirement directly to EPA Headquarters. Only waiver requests received from states will be considered. Pursuant to the Act, EPA has the responsibility to make findings as to the issuance of waivers to the AIS requirements.

Definitions

The following terms are critical to the interpretation and implementation of the AIS requirements and apply to the process described in this memorandum:

Reasonably Available Quantity: The quantity of iron or steel products is available or will be available at the time needed and place needed, and in the proper form or specification as specified in the project plans and design.

Satisfactory Quality: The quality of iron or steel products, as specified in the project plans and designs.

Assistance Recipient: A borrower or grantee that receives funding from a State CWSRF or DWSRF program.

Step-By-Step Waiver Process

Application by Assistance Recipient

Each local entity that receives SRF water infrastructure financial assistance is required by section 436 of the Act to use American made iron and steel products in the construction of its project. However, the recipient may request a waiver. Until a waiver is granted by EPA, the AIS requirement stands, except as noted above with respect to municipalities covered by international agreements.

The waiver process begins with the SRF assistance recipient. In order to fulfill the AIS requirement, the assistance recipient must in good faith design the project (where applicable) and solicit bids for construction with American made iron and steel products. It is essential that the assistance recipient include the AIS terms in any request for proposals or solicitations for bids, and in all contracts (see Appendix 3 for sample construction contract language). The assistance recipient may receive a waiver at any point before, during, or after the bid process, if one or more of three conditions is met:

1. Applying the American Iron and Steel requirements of the Act would be inconsistent with the public interest;
2. Iron and steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality; or
3. Inclusion of iron and steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

Proper and sufficient documentation must be provided by the assistance recipient. A checklist detailing the types of information required for a waiver to be processed is attached as Appendix 1.

Additionally, it is strongly encouraged that assistance recipients hold pre-bid conferences with potential bidders. A pre-bid conference can help to identify iron and steel products needed to complete the project as described in the plans and specifications that may not be available from domestic sources. It may also identify the need to seek a waiver prior to bid, and can help inform the recipient on compliance options.

In order to apply for a project waiver, the assistance recipient should email the request in the form of a Word document (.doc) to the State SRF program. It is strongly recommended that the State designate a single person for all AIS communications. The State SRF designee will review the application for the waiver and determine whether the necessary information has been included. Once the waiver application is complete, the State designee will forward the application to either of two email addresses. For CWSRF waiver requests, please send the application to: cwsrfwaiver@epa.gov. For DWSRF waiver requests, please send the application to: dwsrfwaiver@epa.gov.

Evaluation by EPA

After receiving an application for waiver of the AIS requirements, EPA Headquarters will publish the request on its website for 15 days and receive informal comment. EPA Headquarters will then use the checklist in Appendix 2 to determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver – that it is quantitatively and qualitatively sufficient – and to determine whether or not to grant the waiver.

In the event that EPA finds that adequate documentation and justification has been submitted, the Administrator may grant a waiver to the assistance recipient. EPA will notify the State designee that a waiver request has been approved or denied as soon as such a decision has been made. Granting such a waiver is a three-step process:

1. Posting – After receiving an application for a waiver, EPA is required to publish the application and all material submitted with the application on EPA's website for 15 days. During that period, the public will have the opportunity to review the request and provide informal comment to EPA. The website can be found at: https://water.epa.gov/grants_funding/aisrequirement.cfm

2. Evaluation – After receiving an application for waiver of the AIS requirements, EPA Headquarters will use the checklist in Appendix 2 to determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver – that it is quantitatively and qualitatively sufficient – and to determine whether or not to grant the waiver.

3. Signature of waiver approval by the Administrator or another agency official with delegated authority – As soon as the waiver is signed and dated, EPA will notify the State SRF program, and post the signed waiver on our website. The assistance recipient should keep a copy of the signed waiver in its project files.

Public Interest Waivers

EPA has the authority to issue public interest waivers. Evaluation of a public interest waiver request may be more complicated than that of other waiver requests so they may take more time than other waiver requests for a decision to be made. An example of a public interest waiver that might be issued could be for a community that has standardized on a particular type or manufacturer of a valve because of its performance to meet their specifications. Switching to an alternative valve may require staff to be trained on the new equipment and additional spare parts would need to be purchased and stocked, existing valves may need to be unnecessarily replaced, and portions of the system may need to be redesigned. Therefore, requiring the community to install an alternative valve would be inconsistent with public interest.

EPA also has the authority to issue a public interest waiver that covers categories of products that might apply to all projects.

EPA reserves the right to issue national waivers that may apply to particular classes of assistance recipients, particular classes of projects, or particular categories of iron or steel products. EPA may develop national or (US geographic) regional categorical waivers through the identification of similar circumstances in the detailed justifications presented to EPA in a waiver request or requests. EPA may issue a national waiver based on policy decisions regarding the public's interest or a determination that a particular item is not produced domestically in reasonably available quantities or of a sufficient quality. In such cases, EPA may determine it is necessary to issue a national waiver.

If you have any questions concerning the contents of this memorandum, you may contact us, or have your staff contact Jordan Dorfman, Attorney-Advisor, State Revolving Fund Branch, Municipal Support Division, at dorfman.jordan@epa.gov or (202) 564-0614 or Kiri Anderer, Environmental Engineer, Infrastructure Branch, Drinking Water Protection Division, at anderer.kirsten@epa.gov or (202) 564-3134.

Attachments

Appendix 1: Information Checklist for Waiver Request

The purpose of this checklist is to help ensure that all appropriate and necessary information is submitted to EPA. EPA recommends that States review this checklist carefully and provide all appropriate information to EPA. This checklist is for informational purposes only and does not need to be included as part of a waiver application.

Items	✓	Notes
General • Waiver request includes the following information: — Description of the foreign and domestic construction materials — Unit of measure — Quantity — Price — Time of delivery or availability — Location of the construction project — Name and address of the proposed supplier — A detailed justification for the use of foreign construction materials • Waiver request was submitted according to the instructions in the memorandum • Assistance recipient made a good faith effort to solicit bids for domestic iron and steel products, as demonstrated by language in requests for proposals, contracts, and communications with the prime contractor		
Cost Waiver Requests • Waiver request includes the following information: — Comparison of overall cost of project with domestic iron and steel products to overall cost of project with foreign iron and steel products — Relevant excerpts from the bid documents used by the contractors to complete the comparison — Supporting documentation indicating that the contractor made a reasonable survey of the market, such as a description of the process for identifying suppliers and a list of contacted suppliers		
Availability Waiver Requests • Waiver request includes the following supporting documentation necessary to demonstrate the availability, quantity, and/or quality of the materials for which the waiver is requested: — Supplier information or pricing information from a reasonable number of domestic suppliers indicating availability/delivery date for construction materials — Documentation of the assistance recipient's efforts to find available domestic sources, such as a description of the process for identifying suppliers and a list of contacted suppliers. — Project schedule — Relevant excerpts from project plans, specifications, and permits indicating the required quantity and quality of construction materials • Waiver request includes a statement from the prime contractor and/or supplier confirming the non-availability of the domestic construction materials for which the waiver is sought • Has the State received other waiver requests for the materials described in this waiver request, for comparable projects?		

Appendix 2: HQ Review Checklist for Waiver Request

Instructions: To be completed by EPA. Review all waiver requests using the questions in the checklist, and mark the appropriate box as Yes, No or N/A. Marks that fall inside the shaded boxes may be grounds for denying the waiver. If none of your review markings fall into a shaded box, the waiver is eligible for approval if it indicates that one or more of the following conditions applies to the domestic product for which the waiver is sought:

1. The iron and/or steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality.
2. The inclusion of iron and/or steel products produced in the United States will increase the cost of the overall project by more than 25 percent.

Review Items	Yes	No	N/A	Comments
Cost Waiver Requests • Does the waiver request include the following information? — Comparison of overall cost of project with domestic iron and steel products to overall cost of project with foreign iron and steel products				
— Relevant excerpts from the bid documents used by the contractors to complete the comparison				
— A sufficient number of bid documents or pricing information from domestic sources to constitute a reasonable survey of the market				
• Does the Total Domestic Project exceed the Total Foreign Project Cost by more than 25%?				
Availability Waiver Requests • Does the waiver request include supporting documentation sufficient to show the availability, quantity, and/or quality of the iron and/or steel product for which the waiver is requested? — Supplier information or other documentation indicating availability/delivery date for materials — Project schedule — Relevant excerpts from project plans, specifications, and permits indicating the required quantity and quality of materials				
• Does supporting documentation provide sufficient evidence that the contractors made a reasonable effort to locate domestic suppliers of materials, such as a description of the process for identifying suppliers and a list of contacted suppliers?				
• Based on the materials delivery/availability date indicated in the supporting documentation, will the materials be unavailable when they are needed according to the project schedule? (By item, list schedule date and domestic delivery quote date or other relevant information)				
• Is EPA aware of any other evidence indicating the non-availability of the materials for which the waiver is requested? Examples include: — Multiple waiver requests for the materials described in this waiver request, for comparable projects in the same State — Multiple waiver requests for the materials described in this waiver request, for comparable projects in other States — Correspondence with construction trade associations indicating the non-availability of the materials				
• Are the available domestic materials indicated in the bid documents of inadequate quality compared those required by the project plans, specifications, and/or permits?				

Appendix 3: Example Loan Agreement Language

ALL ASSISTANCE AGREEMENT MUST HAVE A CLAUSE REQUIRING COMPLIANCE WITH THE AIS REQUIREMENT. THIS IS AN EXAMPLE OF WHAT COULD BE INCLUDED IN SRF ASSISTANCE AGREEMENTS. EPA MAKES NO CLAIMS REGARDING THE LEGALITY OF THIS CLAUSE WITH RESPECT TO STATE LAW:

Comply with all federal requirements applicable to the Loan (including those imposed by the 2014 Appropriations Act and related SRF Policy Guidelines) which the Participant understands includes, among other, requirements that all of the iron and steel products used in the Project are to be produced in the United States ("American Iron and Steel Requirement") unless (i) the Participant has requested and obtained a waiver from the Agency pertaining to the Project or (ii) the Finance Authority has otherwise advised the Participant in writing that the American Iron and Steel Requirement is not applicable to the Project.

Comply with all record keeping and reporting requirements under the Clean Water Act/Safe Drinking Water Act, including any reports required by a Federal agency or the Finance Authority such as performance indicators of program deliverables, information on costs and project progress. The Participant understands that (i) each contract and subcontract related to the Project is subject to audit by appropriate federal and state entities and (ii) failure to comply with the Clean Water Act/Safe Drinking Water Act and this Agreement may be a default hereunder that results in a repayment of the Loan in advance of the maturity of the Bonds and/or other remedial actions.

Appendix 4: Sample Construction Contract Language

ALL CONTRACTS MUST HAVE A CLAUSE REQUIRING COMPLIANCE WITH THE AIS REQUIREMENT. THIS IS AN EXAMPLE OF WHAT COULD BE INCLUDED IN ALL CONTRACTS IN PROJECTS THAT USE SRF FUNDS. EPA MAKES NO CLAIMS REGARDING THE LEGALITY OF THIS CLAUSE WITH RESPECT TO STATE OR LOCAL LAW:

The Contractor acknowledges to and for the benefit of the City of _____ ("Purchaser") and the _____ (the "State") that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund and/or Drinking Water State Revolving Fund that have statutory requirements commonly known as "American Iron and Steel;" that requires all of the iron and steel products used in the project to be produced in the United States ("American Iron and Steel Requirement") including iron and steel products provided by the Contactor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Purchaser and the State that (a) the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Purchaser or the State. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or State to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the Purchaser or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Purchaser). While the Contractor has no direct contractual privity with the State, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

Appendix 5: Sample Certifications

The following information is provided as a sample letter of **step** certification for AIS compliance. Documentation must be provided on company letterhead.

Date

Company Name

Company Address

City, State Zip

Subject: American Iron and Steel Step Certification for Project (XXXXXXXXXX)

I, (company representative), certify that the (melting, bending, coating, galvanizing, cutting, etc.) process for (manufacturing or fabricating) the following products and/or materials shipped or provided for the subject project is in full compliance with the American Iron and Steel requirement as mandated in EPA's State Revolving Fund Programs.

Item, Products and/or Materials:

1. Xxxx
2. Xxxx
3. Xxxx

Such process took place at the following location:

_____

If any of the above compliance statements change while providing material to this project we will immediately notify the prime contractor and the engineer.

Signed by company representative

The following information is provided as a sample letter of certification for AIS compliance. Documentation must be provided on company letterhead.

Date

Company Name

Company Address

City, State Zip

Subject: American Iron and Steel Certification for Project (XXXXXXXXXX)

I, (company representative), certify that the following products and/or materials shipped/provided to the subject project are in full compliance with the American Iron and Steel requirement as mandated in EPA's State Revolving Fund Programs.

Item, Products and/or Materials:

1. Xxxx
2. Xxxx
3. Xxxx

Such process took place at the following location:

_____

If any of the above compliance statements change while providing material to this project we will immediately notify the prime contractor and the engineer.

Signed by company representative

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF WATER

DECISION MEMORANDUM

SUBJECT: De Minimis Waiver of Section 436 of P.L. 113-76, Consolidated Appropriations Act (CAA), 2014

FROM: Nancy K. Stoner
Acting Assistant Administrator

The EPA is hereby granting a nationwide waiver pursuant to the "American Iron and Steel (AIS)" requirements of P.L. 113-76, Consolidated Appropriations Act, 2014 (Act), section 436 under the authority of Section 436(b)(1) (public interest waiver) for de minimis incidental components of eligible water infrastructure projects. This action permits the use of products when they occur in de minimis incidental components of such projects funded by the Act that may otherwise be prohibited under section 436(a). Funds used for such de minimis incidental components cumulatively may comprise no more than a total of 5 percent of the total cost of the materials used in and incorporated into a project; the cost of an individual item may not exceed 1 percent of the total cost of the materials used in and incorporated into a project.

P.L. 113-76, Consolidated Appropriations Act, 2014 (Act), includes an "American Iron and Steel" (AIS) requirement in section 436 that requires Clean Water State Revolving Loan Fund (CWSRF) and Drinking Water State Revolving Loan Fund (DWSRF) assistance recipients to use specific domestic iron and steel products that are produced in the United States if the project is funded through an assistance agreement executed beginning January 17, 2014 (enactment of the Act), through the end of Fiscal Year 2014, unless the agency determines it necessary to waive this requirement based on findings set forth in Section 436(b). The Act states, "[the requirements] shall not apply in any case or category of cases in which the Administrator of the Environmental Protection Agency…finds that— (1) applying subsection (a) would be inconsistent with the public interest" 436(b)(1).

In implementing section 436 of the Act, the EPA must ensure that the section's requirements are applied consistent with congressional intent in adopting this section and in the broader context of the purposes, objectives, and other provisions applicable to projects funded under the SRF. Water infrastructure projects typically contain a relatively small number of high-cost components incorporated into the project. In bid solicitations for a project, these high-cost components are generally described in detail via project specific technical specifications. For these major components, utility owners and their contractors are generally familiar with the conditions of availability, the potential alternatives for each detailed specification, the approximate cost, and the country of manufacture of the available components.

Every water infrastructure project also involves the use of thousands of miscellaneous, generally low-cost components that are essential for, but incidental to, the construction and are incorporated into the physical structure of the project. For many of these incidental components, the country of manufacture and the availability of alternatives is not always readily or reasonably identifiable prior to procurement in the normal course of business; for other incidental components, the country of manufacture may be known but the miscellaneous character in conjunction with the low cost, individually and (in total) as typically procured in bulk, mark them as properly incidental. Examples of incidental components could include small washers, screws, fasteners (i.e., nuts and bolts), miscellaneous wire, corner bead, ancillary tube, etc. Examples of items that are clearly not incidental include significant process fittings (i.e., tees, elbows, flanges, and brackets), distribution system fittings and valves, force main valves, pipes for sewer collection and/or water distribution, treatment and storage tanks, large structural support structures, etc.

The EPA undertook multiple inquiries to identify the approximate scope of de minimis incidental components within water infrastructure projects during the implementation of the American Reinvestment and Recovery Act (ARRA) and its requirements (Buy American provisions, specifically). The inquiries and research conducted in 2009 applies suitably for the case today. In 2009, the EPA consulted informally with many major associations representing equipment manufacturers and suppliers, construction contractors, consulting engineers, and water and wastewater utilities, and performed targeted interviews with several well-established water infrastructure contractors and firms who work in a variety of project sizes, and regional and demographic settings to ask the following questions:

- What percentage of total project costs were consumables or incidental costs?

- What percentage of materials costs were consumables or incidental costs?

- Did these percentages vary by type of project (drinking water vs. wastewater treatment plant vs. pipe)?

The responses were consistent across the variety of settings and project types, and indicated that the percentage of total costs for drinking water or wastewater infrastructure projects represented by these incidental components is generally not in excess of 5 percent of the total cost of the materials used in and incorporated into a project. In drafting this waiver, the EPA has considered the de minimis proportion of project costs generally represented by each individual type of these incidental components within the many types of such components comprising those percentages, the fact that these types of incidental components are obtained by contractors in many different ways from many different sources, and the disproportionate cost and delay that would be imposed on projects if the EPA did not issue this waiver.

Assistance recipients who wish to use this waiver should in consultation with their contractors determine the items to be covered by this waiver and must retain relevant documentation (i.e., invoices) as to those items in their project files.

If you have any questions concerning the contents of this memorandum, please contact Timothy Connor, Chemical Engineer, Municipal Support Division, at connor.timothy@epa.gov or (202) 566-1059 or Kirsten Anderer, Environmental Engineer, Drinking Water Protection Division, at anderer.kirsten@epa.gov or (202) 564-3134.

Issued on: APR 15 2014

Approved by: _____

Nancy K. Stoner
Acting Assistant Administrator

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

FEB 18 2015

OFFICE OF WATER

DECISION MEMORANDUM

SUBJECT: National Product Waiver for Pig Iron and Direct Reduced Iron for State Revolving Fund Projects

FROM: Kenneth J. Kopocis
Deputy Assistant Administrator

The U.S. Environmental Protection Agency is hereby granting a national product waiver pursuant to the "American Iron and Steel" provisions of the Clean Water Act and Public Law 113-235, the "Consolidated and Further Continuing Appropriations Act, 2015," for certain intermediate goods used in the manufacture of iron and steel products.[1] This waiver permits the use of pig iron and direct reduced iron manufactured outside of the United States in domestic manufacturing processes for iron and steel products used in projects funded by a Clean Water or Drinking Water State Revolving Fund that may otherwise be prohibited absent this waiver. The waiver is retroactive and thus also applies to the use of non-domestic pig iron and direct reduced iron before the signature date.

Background: Pig iron and direct reduced iron are intermediate products of iron and steel manufacturing used as material feed sources in iron and steel foundries and steel mills. Pig iron is a product of iron ore smelting in a blast furnace. It is made from molten iron, which has been cast in the shape of "pigs" as it comes from the blast furnace. Direct reduced iron ore is produced from iron ore, pellets or fines, which are reduced in a solid state using natural gas. Hot briquetted iron, or HBI, is a compacted form of direct reduced iron with enhanced physical characteristics for shipment and storage.

Coverage: This waiver permits the use of iron and steel products that were manufactured using non-domestic pig iron and direct reduced iron in projects that receive funds from either the CWSRF or DWSRF. Any project that received or will receive funds from the CWSRF or DWSRF beginning with the enactment of P.L. 113-76, the "Consolidated Appropriations Act, 2014," may use this waiver for iron and steel that use these intermediate goods.

Rationale: The AIS provisions require CWSRF and DWSRF assistance recipients to use specific domestic iron and steel products that are produced in the United States if the project is funded

[1]Absent a waiver, all treatment works and drinking water facilities that are constructed, in whole or in part, with funds from the CWSRF or the DWSRF, must use American made iron and steel. EPA is allowed under certain circumstances to provide waivers of this requirement.

through an SRF assistance agreement unless the Agency determines that it is necessary to waive this requirement. EPA has authority to issue waivers in accordance with Section 608(c)(2) of the Clean Water Act and the AIS provisions extended by P.L. 113-235, the "Consolidated and Further Continuing Appropriations Act, 2015," under the authority of Section 424(b)(2). The provision states in part: "[the requirements] shall not apply in any case or category of cases in which the Administrator of the Environmental Protection Agency…finds that – iron and steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality."

Product manufacturers and suppliers informed EPA of concerns about the sufficient availability of domestically produced pig iron and direct reduced iron. The iron and steel products produced at steel mills and foundries that use non-domestic intermediate goods are not compliant with the AIS requirements. AIS compliant products used at water and wastewater projects could be in extremely short supply should a waiver of the intermediate goods not be available.

EPA conducted extensive market research on the supply of pig iron and direct reduced iron and found that domestic supplies of these goods sold on the open market are generally not available. There are three major types of facilities that manufacture iron and steel finished products: basic oxygen furnace steel mills (BOF), electric arc furnace steel mills (EAF) and foundries. BOF steel mills undertake both iron making and steel making, as molten iron from the blast furnace is the required feedstock for BOF steel production. EAF steel mills and foundries, on the other hand, use iron and steel scrap as their principal feedstock, which must be supplemented with the use of pig iron and/or direct reduced iron in their manufacturing processes to achieve required steel qualities.

EPA market research has shown that BOF steel mills are able to produce adequate amounts of pig iron to meet their own demands, but these mills use the bulk of this production for their own processes and do not sell pig iron on the open market in sufficient quantities. At this time, there is only one producer of direct reduced iron operating in the U.S. and the company uses the output internally for EAF steel production. Therefore, EAF steel mills and foundries must import pig iron and direct reduced iron to meet their iron needs.

At least 60 percent of the nation's steel production comes from the EAF steel mills that use non-domestic pig iron and direct reduced iron in their manufacturing processes. Consequently, the majority of steel used in water and wastewater projects would not be compliant with the AIS requirements absent this waiver. Similarly, most, if not all, of the iron foundries in the United States use non-domestic pig iron and direct reduced iron to produce cast and ductile iron products used by water and wastewater projects. Therefore, the majority of iron used in water and wastewater projects would not be compliant with the AIS requirements absent this waiver. Hence, EPA is hereby providing a nationwide waiver pursuant to AIS requirements to cover the non-domestic intermediate iron goods used in the manufacture of iron and/or steel components and products for water and wastewater projects.

Public Comments: EPA requested comments on the draft national waiver and a majority of the comments received were supportive of a national waiver. The commenters in support of the waiver agreed with the Agency's conclusion that pig iron and direct reduced iron are not

produced in the United States in sufficient and reasonably available quantities to meet the needs of many domestic foundries and steel mills. These commenters believe that the waiver will ensure that pig iron and direct reduced iron are treated similarly to raw material inputs in iron and steel manufacturing and by doing so the EPA will preserve the viability of the AIS requirement. These commenters also state that the waiver would treat pig iron and direct reduced iron in a manner consistent with the implementation of other similar federal laws such as the Federal Highway Administration's Buy America requirement. The FHWA issued a similar nationwide waiver of the Buy America requirements in 1995 for pig iron and processed, pelletized and reduced iron ore.

A few commenters challenged the Agency's issuance of a nationwide waiver of the AIS requirements for pig iron and direct reduced iron. These commenters disagreed with the Agency's interpretation of the AIS requirements and stated that raw materials used in iron and steel production must also be produced in the United States. In addition, the commenters questioned whether the Agency could exempt iron and steel products that are composed of non-domestic materials.

The statutory language lists the categories of products that are considered "iron and steel products." The statutory requirements include provisions that allow the EPA to issue waivers under defined conditions, including the case where iron and steel products are not produced in the United States in sufficient and reasonably available quantities. The Agency's market research, supported by comments from manufacturers, has shown that pig iron and direct reduced iron are not produced in the United States in sufficient and reasonably available quantities. Therefore the Agency is authorized to issue a waiver for iron and steel products composed of non-domestic pig iron and direct reduced iron.

Legal Authority: Legal authority for the AIS requirements for CWSRF projects is included under Sec. 608(c)(2) of the Clean Water Act and previously under P.L. 113-76, the "Consolidated Appropriations Act, 2014," under the authority of Section 436(b)(2). Legal authority for the AIS requirements for DWSRF projects is included under P.L. 113-235, the "Consolidated and Further Continuing Appropriations Act, 2015," under the authority of Section 424(b)(2) and also previously under P.L. 113-76. This waiver will continue in force for DWSRF projects under any continuing resolutions or statutes that use similar language as in Section 424 of the "Consolidated and Further Continuing Appropriations Act, 2015."

If you have questions concerning the contents of this memorandum, please contact Timothy Connor, Chemical Engineer, Municipal Support Division, at connor.timothy@epa.gov or (202) 566-1059 or Kiri Anderer, Environmental Engineer, Drinking Water Protection Division, at anderer.kirsten@epa.gov or (202) 564-3134.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OCT 2 7 2015

OFFICE OF WATER

DECISION MEMORANDUM

SUBJECT: National Product Waiver for Minor Components within Iron and Steel Products (with Cost Ceiling) for State Revolving Fund Projects

FROM: Kenneth J. Kopocis
Deputy Assistant Administrator

The U.S. Environmental Protection Agency is hereby granting a national product waiver pursuant to the "American Iron and Steel" provisions of the Clean Water Act and Public Law 113-235, the "Consolidated and Further Continuing Appropriations Act, 2015," (hereinafter referred to as "the Acts") for minor components within a product under an established cost ceiling.[1] The waiver will permit projects funded by the Clean Water State Revolving Fund or Drinking Water State Revolving Fund to use non-domestically produced miscellaneous minor components within an otherwise domestically produced iron and steel product for up to 5 percent of the total material cost of the product. These products could be prohibited absent this waiver. This waiver is retroactive, and so also applies to products purchased before the signature date of this waiver.

Coverage: The items covered by this waiver include miscellaneous minor components within iron and steel products as defined in the AIS provisions of the Acts. The specific minor components in covered iron and steel products will vary by product and manufacturer. Pursuant to this waiver, non-domestically produced miscellaneous minor components comprising up to 5 percent of the total material cost of an otherwise domestically produced iron and steel product may be used. This waiver does not exempt the whole product from the AIS requirements, and the primary iron or steel components of the product must be produced domestically. Unless subject to a separate waiver, all other iron and steel components in these products must still meet the AIS requirements. Valves and hydrants are also subject to the cost ceiling requirements described here. This waiver supersedes the EPA's previous guidance issued on May 30, 2014, (Question 1) related to minor components in valves and hydrants.

The coverage of this waiver is different from that of the existing national de minimis waiver. While the national de minimis waiver covers entire products (when those products are generally of low cost and incidental to the construction of the project), this waiver covers minor components within an iron and steel product. In addition, the national de minimis waiver is intended for assistance recipients to use for their projects, while this minor components waiver is intended to allow manufacturers to certify that their products comply with the AIS requirements.

[1] Absent a waiver, all treatment works and drinking water facilities that are constructed, in whole or in part, with funds from the CWSRF or the DWSRF, must use American made iron and steel. The EPA is allowed under certain circumstances to provide waivers of this requirement.

Rationale: The AIS provisions require recipients of CWSRF and DWSRF assistance to use specific domestically-produced iron and steel products in their project, unless the Agency determines it is necessary to waive this requirement. The EPA has authority to issue waivers in accordance with Section 608(c)(1) of the Clean Water Act and the AIS provisions extended by P.L. 113-235, the "Consolidated and Further Continuing Appropriations Act, 2015," under the authority of Section 424(b)(1). The provisions state in part: "[the requirements] shall not apply in any case or category of cases in which the Administrator of the Environmental Protection Agency…finds that…applying subsection (a) would be inconsistent with the public interest."

Many product manufacturers and suppliers identified significant compliance challenges absent this waiver. Water and wastewater utilities are generally unable to obtain a range of AIS compliant iron and steel products (such as valves, hydrants and pipe restraints) that contain 100 percent domestic components. The manufacturers stated that the origin of a significant proportion of very small minor components cannot be reliably tracked or even discerned. They provided examples of product lines that would need duplicative inventories of extremely low-cost miscellaneous minor components in order to supply AIS compliant products. Manufacturers also raised concerns related to challenges of inventory tracking, inventory control and excessive costs associated with duplicative inventory needed to supply utilities with essential domestic products.

The EPA concludes that requiring manufacturers and suppliers to overcome the challenges identified above would be inconsistent with the public's interest. In order to balance the reliability, availability and maximum supply of domestically produced iron and steel products, it is acceptable for a manufacturer to incorporate a relatively small proportion of miscellaneous minor components of non-domestic or unknown origin within an otherwise domestically manufactured product.

Legal Authority: Legal authority for the AIS requirements for CWSRF projects is included under Sec. 608(c)(1) of the Clean Water Act and previously under P.L. 113-76, "Consolidated Appropriations Act, 2014," under the authority of Section 436(b)(1). Legal authority for the AIS requirements for DWSRF projects is included under P.L. 113-235, the "Consolidated and Further Continuing Appropriations Act, 2015", under the authority of Section 424(b)(1) and also previously under P.L. 113-76. This waiver will continue in force for DWSRF projects under any continuing resolutions or statutes that use similar language as Section 424 of the "Consolidated and Further Continuing Appropriations Act, 2015."

If you have any questions concerning the contents of this memorandum, please contact Timothy Connor, Chemical Engineer, Municipal Support Division, at connor.timothy@epa.gov or (202) 566-1059 or Kiri Anderer, Environmental Engineer, Drinking Water Protection Division, at anderer.kirsten@epa.gov or (202) 564-3134.

American Iron and Steel Certification

The Contractor acknowledges to and for the benefit of _____ and the State of Missouri that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund and/or Drinking Water State Revolving Fund that have statutory requirements (see attached) commonly known as "American Iron and Steel;" that requires all of the iron and steel products used in the project to be produced in the United States ("American Iron and Steel Requirement") including iron and steel products provided by the Contactor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Purchaser and the State that (a) the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Purchaser or the State. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or State to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the Purchaser or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Purchaser). While the Contractor has no direct contractual privity with the State, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

_____

Name of Contracting Firm

_____

Signature Date

_____

Name and Title of Signer (Please type)

Davis Bacon Act Requirements

Pursuant to the Federal Appropriations Act, all laborers and mechanics employed by contractors and subcontractors on projects funded directly by or assisted in whole or in part by and through the Federal Government pursuant to the Appropriations Act shall be paid wages at rates not less than those prevailing on projects of a character similar in the locality as determined by the Secretary of Labor in accordance with subchapter IV of chapter 31 of title 40, United States Code.

Additional guidance can be located at DOL's web site at https://www.wdol.gov/index.aspx

1. The Davis-Bacon (DB) prevailing wage requirements apply to the construction, alteration, and repair activity of infrastructure, including all construction, alteration and repair activity involving waste water or drinking water treatment plants is subject to DB. Prime contractors and subcontractors must follow the wage determination incorporated into the prime contract.

2. Contract and Subcontract provisions.

(a) Minimum wages.

(1) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(2) of this section) and the Davis-Bacon poster (WH-1321) shall be

posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(2) Any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The EPA award official shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(i) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(ii) The classification is utilized in the area by the construction industry; and

(iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(3) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the funding recipient(s) agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the funding recipient (s) to the MDNR. The MDNR will transmit the report, to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the MDNR or will notify the MDNR within the 30-day period that additional time is necessary.

(4) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the and the funding recipient(s) do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the funding recipient shall refer the questions, including the views of all interested parties and the recommendation of the MDNR, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(5) The wage rate (including fringe benefits where appropriate) shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(6) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an

hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(7) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(b) Withholding.

(1) The funding recipient(s), shall upon written request of the EPA Award Official or an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(c) Payrolls and basic records.

(1) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been

communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(2) The contractor shall submit weekly, for each week in which any contract work is performed, a copy of all payrolls to the funding recipient, that is, the entity that receives the grant or loan from the MDNR. As to each payroll copy received, the funding recipient shall provide written confirmation in a form satisfactory to the MDNR indicating whether or not the project is in compliance with the requirements of 29 CFR 5.5(a)(1) based on the most recent payroll copies for the specified week. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on the weekly payrolls. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at http://www.dol.gov/esa/whd/forms/wh347instr.htm or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the funding recipient (s) for transmission to the MDNR or EPA if requested by EPA, the MDNR, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the funding recipient (s).

(3) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(i) That the payroll for the payroll period contains the information required to be provided under § 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(ii) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid

the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(4) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (c)(3) of this section.

(5) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(6) The contractor or subcontractor shall make the records required under paragraph (c)(1) of this section available for inspection, copying, or transcription by authorized representatives of the MDNR, EPA or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency or State may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(d) Apprentices and trainees.

(1) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate,

who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(2) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the

wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(e) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.

(f) Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(g) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the EPA determines may by appropriate, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(h) Contract termination: debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(i) Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(j) Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and funding recipient(s), MDNR, EPA, the U.S. Department of Labor, or the employees or their representatives.

(k) Certification of eligibility.

(1) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(2) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(3) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

3. Contract Provision for Contracts in Excess of $100,000.

(a) Contract Work Hours and Safety Standards Act. The following clauses shall be inserted in full in any contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (a)(1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (a)(1) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (a)(1) of this section.

(3) Withholding for unpaid wages and liquidated damages. The funding recipient, upon written request of the EPA Award Official or an authorized representative of the Department of Labor, shall withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (a)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier

subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (a)(1) through (4) of this section.

(b) In any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1, the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the MDNR and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

4. Compliance Verification

(a) The funding recipient shall periodically interview a sufficient number of employees entitled to DB prevailing wages (covered employees) to verify that contractors or subcontractors are paying the appropriate wage rates. As provided in 29 CFR 5.6(a)(6), all interviews must be conducted in confidence.

(b) The funding recipient must conduct interviews with a representative group of covered employees within two weeks of each contractor or subcontractor's submission of its initial weekly payroll data and two weeks prior to the estimated completion date for the contract or subcontract. Funding recipients must conduct more frequent interviews if the initial interviews or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. Funding recipients shall immediately conduct necessary interviews in response to an alleged violation of the prevailing wage requirements. All interviews shall be conducted in confidence.

(c) The funding recipient shall periodically conduct spot checks of a representative sample of weekly payroll data to verify that contractors or subcontractors are paying the appropriate wage rates. The funding recipient shall establish and follow a spot check schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, the funding recipient must spot check payroll data within two weeks of each contractor or subcontractor's submission of its initial payroll data and two weeks prior to the completion date the contract or subcontract. Funding recipients must conduct more frequent spot checks if the initial spot check or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB . In addition, during the examinations the funding recipient shall verify evidence of fringe benefit plans and payments there under by contractors and subcontractors who claim credit for fringe benefit contributions.

(d) The funding recipient shall periodically review contractors and subcontractors use of apprentices and trainees to verify registration and certification with respect to apprenticeship and training programs approved by either the U.S Department of Labor or a state, as appropriate, and that contractors and subcontractors are not using disproportionate numbers of, laborers, trainees and apprentices. These reviews shall be conducted in accordance with the schedules for spot checks and interviews described in Item 5(b) and (c) above.

(e) Funding recipients must immediately report potential violations of the DB prevailing wage requirements to the EPA DB contact listed above and to the appropriate DOL Wage and Hour District Office listed at http://www.dol.gov/esa/contacts/whd/america2.htm.

Davis-Bacon Act Requirements

Funding Recipient Requirements (updated 9/13/2024)

If the funding recipient encounters a unique situation at a site that presents uncertainties regarding Davis Bacon (DB) applicability, the funding recipient must discuss the situation with the MDNR before authorizing work on that site.

The funding recipients shall obtain the wage determination for the locality in which a covered activity subject to DB will take place prior to issuing requests for bids, proposals, quotes or other methods for soliciting contracts (solicitation) for activities subject to DB. These wage determinations shall be incorporated into solicitations and any subsequent contracts. The funding recipients may obtain wage determinations at https://sam.gov/content/wage-determinations.

While the solicitation remains open, the funding recipient shall monitor www.SAM.gov on a regular basis to ensure that the wage determination contained in the solicitation remains current. For contracts entered into pursuant to sealed bidding procedures, a revised wage determination issued at least 10 calendar days before the opening of bids is effective with respect to the solicitation and contract. If a revised wage determination is issued less than 10 calendar days before the opening of bids, it is effective with respect to the solicitation and contract unless the MDNR finds that there is not a reasonable time still available before bid opening to notify bidders of the revision and a report of the finding is inserted in the contract file. No such report is required if the revision is issued after bid opening.

If the funding recipient does not award the contract within 90 days of the closure of the solicitation, any modifications or supersedes the DOL makes to the wage determination contained in the solicitation shall be effective unless the MDNR, at the request of the funding recipient, obtains an extension of the 90 day period from DOL pursuant to 29 CFR 1.6(c)(3)(iv). The funding recipient shall monitor www.SAM.gov on a regular basis if it does not award the contract within 90 days of closure of the solicitation to ensure that wage determinations contained in the solicitation remain current.

If the funding recipient carries out an activity subject to DB by issuing a task order, work assignment or similar instrument to an existing contractor (ordering instrument) rather than by publishing a solicitation, the funding recipient shall insert the appropriate DOL wage determination from www.SAM.gov into the ordering instrument.

Funding recipients shall review all subcontracts subject to DB entered into by prime contractors to verify that the prime contractor has required its subcontractors to include the applicable wage determinations.

As provided in 29 CFR 1.6(f), DOL may issue a revised wage determination applicable to a funding recipient's contract after the award of a contract or the issuance of an ordering instrument if DOL determines that the funding recipient has failed to incorporate a wage determination or has used a wage determination that clearly does not apply to the contract or ordering instrument. If this occurs, the funding recipient shall either terminate the contract or

ordering instrument and issue a revised solicitation or ordering instrument or incorporate DOL's wage determination retroactive to the beginning of the contract or ordering instrument by change order. The funding recipient's contractor must be compensated for any increases in wages resulting from the use of DOL's revised wage determination.

The funding recipient(s) shall insert in full in any contract in excess of $2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a public building or public work, or building or work financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in § 5.1, the following clauses:

1) The funding recipient shall periodically interview a sufficient number of employees entitled to DB prevailing wages (covered employees) to verify that contractors or subcontractors are paying the appropriate wage rates. As provided in 29 CFR 5.6(a)(6), all interviews must be conducted in confidence. The funding recipient must use Standard Form 1445 or equivalent documentation to memorialize the interviews. Copies of the SF 1445 are available from EPA on request.

2) The funding recipient shall establish and follow an interview schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, the funding recipient must conduct interviews with a representative group of covered employees within two weeks of each contractor or subcontractor's submission of its initial weekly payroll data and two weeks prior to the estimated completion date for the contract or subcontract. The funding recipients must conduct more frequent interviews if the initial interviews or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. The funding recipients shall immediately conduct necessary interviews in response to an alleged violation of the prevailing wage requirements. All interviews shall be conducted in confidence.

3) The funding recipient shall periodically conduct spot checks of a representative sample of weekly payroll data to verify that contractors or subcontractors are paying the appropriate wage rates. The funding recipient shall establish and follow a spot check schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, the funding recipient must spot check payroll data within two weeks of each contractor or subcontractor's submission of its initial payroll data and two weeks prior to the completion date the contract or subcontract. The funding recipients must conduct more frequent spot checks if the initial spot check or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. In addition, during the examinations the funding recipient shall verify evidence of fringe

benefit plans and payments there under by contractors and subcontractors who claim credit for fringe benefit contributions.

The funding recipient shall periodically review contractors and subcontractors use of apprentices and trainees to verify registration and certification with respect to apprenticeship and training programs approved by either the U.S Department of Labor or a state, as appropriate, and that contractors and subcontractors are not using disproportionate numbers of, laborers, trainees and apprentices. These reviews shall be conducted in accordance with the schedules for spot checks and interviews described in Item 5(b) and (c) above.

The contractor shall submit weekly, for each week in which any contract work is performed, a copy of all payrolls to the funding recipient, that is, the entity that receives the grant or loan from the MDNR. As to each payroll copy received, the funding recipient shall provide written confirmation in a form satisfactory to the MDNR indicating whether or not the project is in compliance with the requirements of 29 CFR 5.5(a)(1) based on the most recent payroll copies for the specified week.

As a general rule, the wage determination incorporated into a bid solicitation and related contract award establishes the minimum wage rates and fringe benefits which must be paid for the entire term of the contract. In the following circumstances, the contracting agency must incorporate the most recent revision of the wage determination(s) into an ongoing contract.

Out-of-scope changes: Where a contract is changed to include additional, substantial construction, alteration, and/or repair work not within the scope of the work of the original contract, the most recent wage determination revision must be incorporated into the contract, to be effective at the date of the change in the contract;

Additional time periods (e.g., options): If the contractor is required to perform work for an additional time period not originally obligated, including where an option to extend the term of the contract is exercised, the most recent wage determination revision must be incorporated into the contract, to be effective at the date of the contract extension or exercise of the option;

IDIQs, etc.: For contracts calling for construction, alteration, and/or repair work over a period of time that is not tied to the completion of any particular project (e.g., IDIQs, Multiple Award Schedules), the most recent revision of a wage determination must be incorporated into the umbrella contract on an annual basis at the anniversary date of the contract's award.

The funding recipients must immediately report potential violations of the DB prevailing wage requirements to the EPA DB contact listed above and to the appropriate DOL Wage and Hour District Office listed at https://www.dol.gov/esa/contacts/whd/america2.htm.

Attachment 1

Missouri DBE Requirements

MISSOURI STATE REVOLVING FUND

Procedures for Implementation

Minority Business Enterprise/Women's Business Enterprise

Each bidder/offeror must fully comply with the requirements, terms, conditions of 40 CFR Part 33 and DNR's regulations to award a fair share of subagreements to minority and women's business enterprises. The bidder/offeror commits itself to taking affirmative steps and complying with the Six Good Faith Efforts contained herein. Bidders/offerors will take affirmative steps prior to submission of bids/proposals.

Affirmative Steps

1. When feasible, segmenting total work requirements to permit maximum minority business and women business enterprises (MBE/WBE) participation.

2. Assuring that MBEs and WBEs are solicited whenever they are potential sources of goods or services. This step may include:

    a. Sending letters or making other personal contacts with MBEs and WBEs (e.g. those whose names appear on lists prepared by the Missouri Office of Administration, the Missouri Department of Transportation, or the funding recipients and other MBEs and WBEs known to the bidder/offeror.) MBEs and WBEs should be contacted when other potential subcontractors are contacted, within reasonable time (fifteen days) prior to bid submission or closing date for receipt of initial offers. Those letters or other contacts should communicate the following:

        i. Specific description of the work to be subcontracted;

        ii. How and where to obtain a copy of plans and specifications or other detailed information needed to prepare a detailed price quotation;

        iii. Date the quotation is due to the bidder/offeror;

        iv. Name, address, and phone number of the person in the bidder/offeror's firm whom the prospective MBE/WBE subcontractor should contact for additional information.

    b. Sending letters or making other personal contacts with local, state, federal and private agencies and DBE associations relevant to the project. Such contacts should provide the same information provided in the direct contacts to DBE firms.

3. Where feasible, establishing delivery schedules which will encourage participation by MBEs and WBEs.

Determination of Compliance

It is to be noted that bidders/offerors must demonstrate compliance with DBE requirements in order to be deemed responsible. Demonstration of compliance shall include, but is not limited to, the following information:

1. Names, addresses and phone numbers of MBEs/WBEs expected to perform work;

2. Work to be performed by the MBEs and WBEs;

3. Aggregate dollar amount of work to be performed by MBEs and WBEs, showing aggregate to MBEs and aggregate to WBEs separately;

4. Description of contacts to MBE and WBE organizations, agencies and associations which serve MBEs/WBEs, including names of organizations, agencies and associations and dates of contacts;

5. Description of contacts to MBEs and WBEs, including number of contacts, fields, (i.e. equipment or material supplier, excavators, transport services, electrical subcontractors, plumbers, etc.) and dates of contacts.

The Six Good Faith Efforts, and Minority and Women's Business Enterprise Utilization Worksheet shall be included in the specifications.

All bidders/offerors should complete the Minority and Women's Business Enterprise Utilization Worksheet and submit to the funding recipient prior to contract award.

Additional information on DBE requirements can be found at https://www.epa.gov/osbp/dbe_team.htm

Lists of Certified Disadvantaged Business Enterprises – To help comply with the Six Good Faith Efforts, please visit the following web sites to access existing lists of certified DBEs:

Small Business Administration https://www.sba.gov/search?query=dynamic+small+business+search

Missouri Department of Transportation https://www.modot.mo.gov/ecr/index.htm

Office of Equal Opportunity https://oeo.mo.gov/

The contractor shall not discriminate on the basis of race, color, nation origin or sex in the performance of this contract. The contractor shall carry out applicable requirements of 40 CFR Part 33 in the award and administration of contracts awarded under EPA financial assistance agreements. Failure by the contractor to carry out these requirements is a material breach of this contract which may result in the termination of this contract or other legally available remedies.

(Funding recipients may establish alternative methods of compliance equivalent to or more stringent than the above.)

"Six Good Faith Efforts"

The Six Good Faith Efforts are required methods to be used by all Loan and Grant recipients to ensure that all disadvantaged business enterprises (DBEs) have the opportunity to compete for procurements funded by EPA financial assistance dollars.

The prime contractor must pay its subcontractor for satisfactory performance no more than 30 days from the prime contractor's receipt of payment from the recipient.

A recipient must be notified in writing by its prime contractor prior to any termination of a DBE subcontractor for convenience by the prime contractor.

If a DBE subcontractor fails to complete work under its subcontract for any reason, the recipient must require the prime contractor to employ the six good faith efforts described below if soliciting a replacement subcontractor.

A recipient must require its prime contractor to employ the six good faith efforts even if the prime contractor has achieved its Fair Share Goals. The current Fair Share Goals are 10% for Minority Business Enterprises and 5% for Women Business Enterprises in accordance with 40 CFR, Part 33, Subpart D.

The Six Good Faith Efforts are:

1. Ensure DBEs are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities. For Indian Tribal, State and Local Government recipients, this will include placing DBEs on solicitation lists and soliciting them whenever they are potential sources.

2. Make information on forthcoming opportunities available to DBEs and arrange time frames for contracts and establish delivery schedules, where requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive process. This includes, whenever possible, posting solicitations for bids or proposals for a minimum of 30 calendar days before bid or proposal closing date.

3. Consider in the contracting process whether firms competing for large contracts could subcontract with DBEs. For Indian Tribal, State and Local Government recipients, this will include dividing total requirements when economically feasible into smaller tasks or quantities to permit maximum participation by DBEs in the competitive process.

4. Encourage contracting with a consortium of DBEs when a contract is too large for one of these firms to handle individually.

5. Use the services and assistance of the SBA and the Minority Business development Agency of the Department of Commerce.

6. If the prime contractor awards subcontracts, require the prime contractor to take the above steps.

MISSOURI STATE REVOLVING FUND
DISADVANTAGED BUSINESS ENTERPRISE
(MINORITY AND WOMEN'S BUSINESS ENTERPRISE)
UTILIZATION WORKSHEET

Funding Recipient _____
Project No.: _____

Contractor/Engineer: _____
Contract Name: _____
Contract Contact Person: _____
Contractor MBE/WBE: Yes ☐ No
OA / MODOT / EPA Certification No.: _____
Address: _____
Telephone No.: _____ Email Address _____
Amount of Contract _____ Total Contract MBE% _____ WBE % _____

1. MBE _____Subcontractor _____
   WBE _____Address _____
   Contact Person _____Telephone No. _____
   Email Address: _____
   OA MBE/WBE Certification Number _____
   MODOT MBE/WBE Certification (Yes) _____ (No) _____
   Amount of Subcontract _____
   Scope of Work _____
   _____
   _____

2. MBE _____Subcontractor _____
   WBE _____Address _____
   Contact Person _____Telephone No. _____
   Email Address: _____
   OA MBE/WBE Certification Number _____
   MODOT MBE/WBE Certification (Yes) _____ (No) _____
   Amount of Subcontract _____
   Scope of Work _____
   _____
   _____

3. MBE _____Subcontractor _____
WBE _____Address _____
Contact Person _____Telephone No. _____
Email Address: _____
OA MBE/WBE Certification Number _____
MODOT MBE/WBE Certification (Yes) _____ (No) _____
Amount of Subcontract _____
Scope of Work _____
_____
_____

4. MBE _____Subcontractor _____
WBE _____Address _____
Contact Person _____Telephone No. _____
Email Address: _____
OA MBE/WBE Certification Number _____
MODOT MBE/WBE Certification (Yes) _____ (No) _____
Amount of Subcontract _____
Scope of Work _____
_____
_____

5. MBE _____Subcontractor _____
WBE _____Address _____
Contact Person _____Telephone No. _____
Email Address: _____
OA MBE/WBE Certification Number _____
MODOT MBE/WBE Certification (Yes) _____ (No) _____
Amount of Subcontract _____
Scope of Work _____
_____
_____

6. MBE _____Subcontractor _____
WBE _____Address _____
Contact Person _____Telephone No. _____
Email Address: _____
OA MBE/WBE Certification Number _____
MODOT MBE/WBE Certification (Yes) _____ (No) _____
Amount of Subcontract _____
Scope of Work _____
_____
_____

Comments: _____
_____
_____
_____
_____
_____

Prepared By: _____

Telephone Number: _____

Date: _____

SECTION 01000 – GENERAL PROJECT REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. This section covers the general project requirements for all projects.

B. The work to be performed under these Contract Documents shall be consistent with Section 0700-General Conditions in the construction, installation, and completion of all work required in connection with the Todd Creek Facility Plan Update Project, in Kansas City, Platte County, Missouri.

1.02 RELATED SECTIONS

A. Section 00700 – General Conditions.

B. Section 00800 – Supplementary Conditions.

C. Section 01015 – Specific Project Requirements.

D. Section 01020 – Record Documents.

E. Section 01300 – Submittals.

F. Section 01329 - Safety Plan

G. Section 01353 – Selective Alterations and Demolition

H. Section 01566 – Cleanup Operations.

I. Section 01570 – Temporary Erosion Control.

J. Section 01580 – Project Signs.

K. Section 01581 – Public Communications.

1.03 SECTION 31 20 50 – SITE PREPARATION AND EARTHWORK. CODES AND STANDARDS

A. By reference, as applicable for the Work being performed.

1.04 SUBMITTALS

A. Submit as specified in Section 01300 – Submittals.

B. Project Communications:

1. Progress Meeting Minutes.

C. Other:

1. Description and location of offsite storage arrangements.
2. Construction Site Plan.
3. Safety Representative.

1.05 QUALITY ASSURANCE

A. The Contractor or Design-Builder is responsible for the quality assurance and quality control of the Work.

1.06 MATERIALS SELECTION AND ACQUISITION

A. The Contractor or Design-Builder shall not use materials or equipment removed from existing premises, except as specifically permitted by the Contract Documents. All products shall be new, never used before, unless otherwise specified.

B. Provide interchangeable components of the same manufacturer, for similar removable components, such as: T-bolts, glands, gaskets, manhole rings and covers, nuts, wiring, slip rings, conduit, bolts, seals, etc.

1.07 CONSTRUCTION SITE PLAN

A. The Contractor shall submit a site plan showing the locations and dimensions of temporary facilities which include, but are not limited to, the following layouts and details:
   1. Equipment and material storage area on City property and bonded warehouses).
   2. Access and traffic routes.
   3. Indicate if a supplemental or off-site staging area is being utilized.
   4. Show locations of safety and construction fencing, job site trailer, construction entrances, trash dumpsters, temporary sanitary facilities and parking areas for project personnel.
   5. Indicate locations of concrete washout facilities.

1.08 EASEMENTS AND RIGHTS-OF-WAY

A. The City will furnish the Site in accordance with Section 00700 - General Conditions. The Contractor or Design-Builder shall confine construction operations to the immediate vicinity of the Site shown in the Contract Documents and shall use due care in placing construction tools, equipment, excavated materials, construction materials and supplies to cause the least possible damage to public and private property and least possible interference with public traffic.

B. On Private Property:
   1. The permanent easements are as noted in the Contract Documents. No additional temporary construction easements have been obtained, unless otherwise indicated in the Contract Documents. The Contractor or Design-Builder shall set stakes to mark the boundaries of construction easements across each private property. The stakes shall be protected and maintained until completion of the Work. After cleanup has been completed in accordance with Section 01566 – Cleanup Operations, the Contractor or Design-Builder shall remove all construction stakes.
   2. The Contractor or Design-Builder shall not enter any private property outside the designated construction easement boundaries without written permission from the owner of the property and notification to the RPR
   3. Should it become necessary to use or occupy the land beyond the limits of the Site (as defined by Section 00700 – General Conditions), the Contractor or Design-Builder shall obtain a written agreement with each affected property owner and tenant. Each agreement shall clearly outline the terms for which the Contractor or Design-Builder may utilize the property and shall be fully executed by the Contractor or Design-Builder, the property owner and the tenant (when applicable).
   4. Whenever the easement is occupied by crops which will be damaged by construction operations, the Contractor or Design-Builder shall notify the property owner sufficiently in advance so that the crops may be removed before the Work is started. The Contractor is responsible for all damage to crops outside the easement and shall make satisfactory settlement for the damage directly with the property owner.
   5. Where the Work impacts fields that are leveled for irrigation or terraced, the Contractor shall relevel irrigated fields and replace all terraces to their original or better condition and to the satisfaction of the property owner.

C. State Highways:

1. All work within MoDOT right-of-way shall be in conformance with MoDOT regulations. The permit must be secured before any construction is started within MoDOT right-of-way.

1.09 LINES AND GRADES

A. All Work shall be done to the lines, grades and elevations indicated in the Contract Documents.
B. Basic horizontal and vertical control points are provided in the Contract Documents. All additional survey, layout and measurement work shall be performed by the Contractor or Design-Builder as a part of the Work.
C. The Contractor or Design-Builder shall provide an experienced surveyor, competent assistants and all instruments, tools, stakes and other materials required to complete the survey, layout and measurement work.
D. The Contractor or Design-Builder shall provide qualified personnel, materials and equipment (tools, stakes and other materials) as may be required for the following tasks needed in the Work:
   1. Establish or designate control points.
   2. Establish construction easement boundaries.
   3. Verify survey.
   4. Verify layout shown on the Contract Documents.
   5. Verify and document work performed by the Contractor or Design-Builder.

   These efforts shall be included in the Contractor or Design-Builder's bid price and performed at no additional cost to the City.
E. The Contractor or Design-Builder shall remove and reconstruct, at no additional cost to the City, any Work that was improperly installed or improperly located.
F. See Section 01020 – Record Documents, paragraph SURVEY REQUIREMENTS for additional requirements.

1.10 CONNECTIONS TO EXISTING FACILITIES

A. Unless otherwise specified or indicated in the drawings, the Contractor or Design-Builder shall make all necessary connections to existing facilities. This includes, but is not limited to, structures, drain lines, water utilities, sewer utilities, gas utilities, communications utilities and electric utilities. In each case, the Contractor or Design-Builder shall receive permission from the City or the owning utility prior to undertaking a connection or disconnection. The Contractor or Design-Builder shall protect facilities against deleterious substances and damage.
B. Connections to existing facilities that are in service shall be thoroughly planned in advance. See 01140, 01140.01, and 01140.02. All required equipment, material and labor shall be on hand at the time of undertaking the connections.

1.11 UNFAVORABLE CONSTRUCTION CONDITIONS.

A. During unfavorable weather, wet ground, or other unsuitable construction conditions, the Contractor shall confine operations to Work that will not be adversely affected by such conditions.
B. No portion of the Work shall be constructed under conditions that would adversely affect the quality or efficiency thereof, unless special means or precautions are taken by the Contractor or Design-Builder to perform the Work in a manner acceptable to the City.

1.12 UNDERGROUND FACILITIES AND ASSOCIATED RESTORATION

A. As provided in Section 00700, paragraph 4.04 of the General Conditions, the Contractor shall perform all cutting and patching required for the Work and as may be necessary in connection with locating all underground facilities, installation of Work, uncovering Work for inspection or for the correction of defective Work.
B. The Contractor or Design-Builder shall perform all cutting and patching required for and in connection with the Work, including but not limited to the following:
   1. Removal of improperly timed Work.
   2. Removal of samples of installed materials for testing.
   3. Alteration of existing facilities.
   4. Installation of new Work.
C. The Contractor or Design-Builder shall provide all shoring, bracing, supports and protective devices necessary to safeguard all Work and existing facilities during cutting and patching operations. The Contractor or Design-Builder shall not undertake any cutting or demolition that may affect the structural stability of the Work or existing facilities without City's approval.
D. Materials shall be cut and removed as required to complete the Work. Materials shall be removed in a careful manner, with no damage to adjacent facilities or materials. The Contractor or Design-Builder shall remove all excavated materials from the site that cannot be incorporated in the Work.
E. All Work and existing facilities affected by cutting operations shall be restored with new materials, or with salvaged materials acceptable to City, to obtain a finished installation with strength, appearance and functional capacity required to match the existing area. If necessary, entire surfaces shall be patched and refinished.
F. The Contractor or Design-Builder, at no extra cost to the City, shall replace all surface features damaged, removed or so designated to be replaced.
G. Contractor or Design-Builder shall at no cost provide photographic documentation of all exposed work after excavation prior to additional underground work and prior to backfill. Photos shall be taken from as many angles as possible.

1.13 ENVIRONMENTAL PROTECTION

A. Laws and Regulations:
   1. The Contractor or Design-Builder shall conform to all laws and regulations as required by Section 00700 – General Conditions, Article 6 – Contractor or Design-Builder's Responsibilities.
B. Storm Water Runoff:
   1. Storm Water Pollution Prevention Plan (SWPPP): As required by Section 00700 – General Conditions, Article 6 – Contractor or Design-Builder's Responsibilities.
   2. Erosion Sediment Control: See Paragraph 1.25.
   3. The Contractor or Design-Builder shall prevent the pollution of drains and watercourses by sanitary wastes, sediment, debris and other substances resulting from construction activities. See paragraph 1.38.
   4. Dewatering: As required by Section 31 20 50 – Site Preparation and Earthwork..
   5. Concrete Washout Facilities: As required by Section 01566 – Cleanup Operations.
C. Air Pollution:
   1. Burning: No open burning will be permitted.
   2. Dust Control: See paragraph 1.37.

D. Other Construction Activities:
   1. Disposal of Demolition Material: As required by Section 01352 – Selective Alterations and Demolition.
   2. Disposal of Debris: Section 31 20 50 – Site Preparation and Earthwork. Protection of Wetlands: As shown on the Drawings or Section 01140 Work Restrictions
   3. Floodplains: As shown on the Drawings or Section 01140 Work Restrictions
   4. Cleanup and Site Maintenance: As required by Section 01566 – Cleanup Operations.

1.14 LICENSES, PERMITS, AND CERTIFICATES

A. Requirements for licenses, permits and certificates are provided in Section 00700 – General Conditions, paragraph 6.09.
B. Permitting exceptions (if any) are noted in Section 00800 – Supplementary Conditions.

1.15 APPLICABLE CODES

A. Standard specifications of the Kansas City, Missouri Department of Public Works are, by reference, hereby made a part of this contract specifications

1.16 REFERENCE STANDARDS

A. See Section 00700 – General Conditions, paragraph 3.02 for references to standards and specifications of technical societies.

1.17 PRECONSTRUCTION CONFERENCE

A. A Preconstruction Conference will be held in accordance with Article 2 of the General Conditions. The conference will be held at a mutually agreed time and location. The conference shall be attended by:
   1. Contractor or Design-Builder and the project superintendent(s).
   2. Design Professional(s) (Engineer of Record) and Owner's Advisor if applicable
   3. Resident Project Representative(s).
   4. City's Representative
   5. Other City Staff (Engineering, Operations, etc.…)

B. Other participants as requested by the Contractor, Design-Builder, or City; such as the following:
   1. Principal Subcontractors such as Systems Integrator, Electrical, shoring, Mechanical, concrete etc.
   2. Representative of principal suppliers and manufacturers as appropriate.
   3. Utility Company representatives.
   4. Affected Property Owners and other stakeholders
   5. Governmental representatives as appropriate.
   6. The Contractor or Design-Builder shall bring to the conference the Preliminary Schedules described in Article 2 of the General Conditions (Preliminary Project Schedule, Preliminary Schedule of Values, Preliminary Schedule of Shop Drawings and Samples), major outages, OCCPs, suggested communication routes, a draft risk register, and list of project goals.
C. The purpose of the conference is to designate responsible personnel and to establish a working relationship. Matters requiring coordination will be discussed and

procedures for handling such matters established. The agenda shall include, but not limited to, the following:

1. Contractor or Design-Builder's Preliminary Schedules.
2. Document Management
3. Timing the Monthly Schedule Update
4. Processing Applications for Payment.
5. Commissioning Plan including the Commissioning Manager
6. Maintaining record documents
7. electronic data requirements including Electronic O&M manuals and BIM (if applicable)
8. Critical Work sequences
9. Field decisions and Change Orders.
10. Use of premises, field office, material storage areas, security, housekeeping, and City's needs.
11. Major equipment deliveries and priorities.
12. Contractor or Design-Builder's assignment for Safety Representative.
13. Discussion of the Safety Plan (See Section 01329 –Safety Plan)
14. Expectations and the Contractor or Design-Builder's plan for Environmental Protection.

D. Contractor or Design-Builder will preside at the conference, will arrange for keeping the minutes and will distribute draft minutes to all persons in attendance within one business day.

1.18 PROGRESS MEETINGS

A. The Contractor or Design-Builder shall schedule and hold progress meetings weekly unless mutual agreed upon, and, at other times as requested by the City or as needed by the progress of the Work. The duration of the weekly meetings will mutually agree upon by the City and Contractor or Design-Builder. The Contractor or Design-Builder, City, Design Professional, and all Subcontractors active on the Site shall be represented at each meeting. The Contractor or Design-Builder may, at their discretion, request attendance of their suppliers, manufacturers or other utilities.
B. The Contractor or Design-Builder shall preside at the meeting. Meeting minutes shall be prepared and distributed by the Contractor or Design-Builder after review by the City or Design Professional. The purpose of the meetings will be to review the progress of the Work, maintain coordination of efforts, discuss changes in scheduling and resolve problems which may have developed on the project.
C. Draft meeting minutes will be distributed within one business day.

1.19 SAFETY REPRESENTIVE

A. In accordance with Section 00700 – General Conditions, Article 6 – Contractor or Design-Builder's Responsibilities, the Contractor or Design-Builder shall submit the name and complete contact information for the person designated as the Safety Representative for the Project.
B. In accordance with Section 01300 – Submittals, this information shall be submitted prior to the Preconstruction Conference.
C. If the Safety Representative changes during the Project, the Contractor or Design-Builder shall designate a new person to fulfill the role and submit their name and complete contact information.

1.20 SAEFTY PLAN

A. See Section 01329 – Safety Plan.

1.21 SITE ADMINISTRATION

A. The Contractor or Design-Builder is responsible for all areas of the site used by their personnel and all Subcontractors in the performance of the Work. The Contractor will exert full control over the actions of all employees and other persons with respect to the use and preservation of property and existing facilities, except such controls as may be specifically reserved to Owner or others. The Contractor or Design-Builder has the right to exclude from the site all persons who have no purpose related to the Work or its inspection and may require all persons on the site to observe the same regulations as their personnel.

1.22 CLEAN-UP

A. The Contractor or Design-Builder shall conduct cleanup operations in accordance with Section 01566 – Project Cleanup.

1.23 SUBSTANTIAL COMPLETION WALKTHROUGH

A. See Section -00700 – General Condition Article 14.04.
B. Walkthrough will also include City Employees from the operating division as designed by their Division Manager.

1.24 FINAL ACCEPTANCE

A. Final Acceptance of the Work shall be in accordance with Section 00700 – General Conditions, Article 14.

1.25 EROSION AND SEDIMENT CONTROL

A. Work associated with erosion and sedimentation control shall be done in accordance with Section 01570 – Temporary Erosion and Sediment Control.

1.26 STREET LIGHTS AND SITE LIGHTING

A. Relocation or restoration of streetlights and Site lighting due to construction interference shall be included in the Contractor or Design-Builder's Bid Price. No separate measurement and payment will be made. The Contractor or Design-Builder shall notify and coordinate street light relocations with the Public Works Department:

Street Lights Division
Phone: (816) 513-9500.

1.27 PROJECT SIGNS

A. Work associated with Project signs shall be done in accordance with Section 01580 – Project Signs.

1.28 RESTORATION

A. The Contractor or Design-Builder shall replace all surface material and shall restore all paving, curbs, gutters, sidewalks, driveways, shrubbery, fences, sod, walls, floors, roofs, piping, conduit, cable trays, HVAC equipment, architecture features, drains, gravel, coating systems, fences, furniture, tiling, fixtures, masonry, structural supports, doors, windows, skylights and all other features disturbed to a condition of

equal to or better than before the work began, furnishing all material, labor and equipment incidental thereto.

1.29 WATER

A. The City will furnish, without charge, all water necessary for the Work (i.e., filling, flushing, testing and disinfecting completed water lines). The Contractor or Design-Builder shall make arrangements with the City for all water used.
B. Use of the City's water facilities shall be at the direction of the Water Services Department so that water is not wasted and service to customers is not impaired.
C. Any water furnished by the City must be obtained from an existing City main.
D. The Contractor or Design-Builder shall use a Reduced Pressure Zone (R.P.Z.) Backflow Preventer and meter when connected to the City's water system.
E. Until such time that City can establish potable water services to the Site, Contractor or Design-Builder will be responsible for obtaining and transporting water to the Site.
F. When utilizing public hydrants, The Contractor or Design-Builder shall contact the Kansas City Fire Department (KCFD) at (816) 513-4645 to purchase a hydrant meter permit. After securing a hydrant meter permit from KCFD, the Contractor or Design-Builder shall present the permit to the Consumer Services desk located at Water Services Department headquarters, 4800 E. 63rd Street, KCMO. The Contractor or Design-Builder shall apply for and pay Consumer Services the refundable security deposit. If approved, the Contractor or Design-Builder shall contact the Water Services Backflow Department at (816) 513-4797 to schedule the installation of the R.P.Z./Meter (hydrant meter). The Contractor or Design-Builder shall provide the location of the hydrant where the R.P.Z./Meter is to be installed. The Contractor or Design-Builder shall contact the Backflow Department to have the R.P.Z./Meter moved or returned to Water Services. Jetting and Vacuum trucks with approved backflow prevention devices or air gap separation are not required to utilize a R.P.Z. backflow preventer; however, a meter to track water usage shall be used at all times. The Jetter/Vac Contractor or Design-Builder shall contact the Water Services Backflow Department for issuance of the meter and pay the associated refundable security deposit. In all cases, the Contractor or Design-Builder is solely responsible for any and all damage to the equipment issued by the Water Services Backflow Department. The cost to repair the damage or the cost of complete replacement of the unit shall be deducted from the security deposit.
G. When utilizing hydrants on City projects after the facility's water meter, Contractor or Design-Builder shall utilize an RPZ/Meter that is pre-approved by the City. The location and duration for the connection must be submitted 15 days prior to the proposed connection. Any unapproved connections will be grounds for removal from the Site(s) by the connecting Contractor or Subcontractor.
H. All costs for labor, material, equipment and services needed to obtain water for construction purposes shall be included in the Bid. No separate measurement or payment will be made to make connections.

1.30 OPERATION OF EXISTING VALVES

A. The Contractor or Design-Builder shall not operate any valves on the City's system outside the fence line without direct supervision from a Water Services Department representative.
B. OCCP may allow for the contractor to operate valves and equipment.

C. If the Contractor or Design-Builder needs valves operated, the request shall be made at least five (5) days in advance to Water Services for such operation, also giving notice to any affected customers/properties in accordance with the notification requirements outlined in Section 01581 – Public Communications.
D. All fire hydrants and water valves shall be kept free from obstruction and available for use at all times.

1.31 BARRICADES AND LIGHTS

A. All streets, roads, highways, facility roads, and other public thoroughfares which are closed to traffic shall be protected by effective barricades and acceptable warning signs. Barricades shall be located per the approved traffic control plan and associated permit. RPR will approve the barricades for facility roads.
B. All trenches and other excavations shall be covered and shall have suitable barricades, signs and lights to provide adequate protection to the public and City Staff. Obstructions such as material piles and equipment shall be provided with similar warning signs and lights in roads.
C. All barricades and obstructions shall be illuminated with warning lights from sunset to sunrise in the public right of way. Material storage and execution of the Work on or alongside public streets and highways shall cause the minimum obstruction and inconvenience to the traveling public.
D. All barricades, signs, lights and other protective devices shall be installed and maintained in conformity with applicable statutory requirements and as required by the authority having jurisdiction; such as, Work within railroad right-of-way, highway right-of-way, etc.

1.32 EXISTING FENCING

A. All existing fences affected by the Work shall be maintained by the Contractor or Design-Builder until completion of the Work. Fences which interfere with construction operations shall not be relocated or dismantled until written permission is obtained from the owner of the fence including the City and the period the fence may be left relocated or dismantled has been agreed upon.
B. Where fences must be maintained across the construction easement or plant site, adequate gates or City approved access shall be installed. Facility Gates and Gates outside facilities shall be kept closed and locked at all times when not in use. Within Facilities, operations staff will determine what gates will need to be closed and locked.

1.33 SAFETY FENCING

A. Provide fencing along the construction site at all open excavations and tunnels to control access if the excavation or tunnel can otherwise be accessed by the public.
B. Temporary safety fencing must be a high visibility orange colored, high density polyethylene grid or approved equal, a minimum of 48 inches high and maximum mesh size of 2 inches, supported and tightly secured to steel posts located on maximum 10-foot centers, constructed at the approved location.
C. Remove the fence from the work site upon completion of the Work.

1.34 PROTECTION OF PUBLIC AND PRIVATE PROPERTY

A. The Contractor or Design-Builder shall protect, shore, brace, support, and maintain all underground pipes, conduits, drains and other underground construction uncovered or otherwise affected by the construction operations.

B. All pavement, surfacing, driveways, curbs, gutters, sidewalks, buildings, utility poles, guy wires, fences, and all other features and structures affected by construction operations, together with all sod and shrubs in yards, parkways, medians and green spaces, shall be restored to their original condition, whether within or outside the right-of-way or easement. All replacements shall be made with new materials.

1.35 DAMAGE TO EXISTING PROPERTY

A. The Contractor or Design-Builder is solely responsible for any damage to existing features, structures, Work, materials, or equipment because of their operations and shall repair or replace any damaged features, structures, Work, materials, or equipment to the satisfaction of the City and at no additional cost to the City.
B. The Contractor or Design-Builder shall protect all existing structures and property from damage and shall provide bracing, shoring, or other work necessary for such protection.
C. The Contractor or Design-Builder is responsible for all damage to streets, roads, curbs, sidewalks, highways, shoulders, ditches, embankments, culverts, bridges, or other public or private property, which may be caused by transporting equipment, materials, or personnel to or from the Work. The Contractor or Design-Builder shall make satisfactory and acceptable arrangements with the agency having jurisdiction over the damaged property concerning its repair or replacement.

1.36 NOISE CONTROL

A. The Contractor or Design-Builder shall conduct construction operations as described herein and in compliance with the City of Kansas City, Missouri Code of Ordinances, Chapter 46 – NOISE CONTROL.
B. The Contractor or Design-Builder shall take all reasonable measures to avoid unnecessary noise. Such measures shall be appropriate for the normal ambient sound levels in the area during working hours. All construction machinery and vehicles shall be equipped with practical sound-muffling devices and operated in a manner to cause the least noise, consistent with the efficient performance of the Work.
C. During construction activities on or adjacent to occupied buildings and when appropriate, the Contractor or Design-Builder shall erect screens or barriers effective in reducing noise in the building and shall conduct their operations to avoid unnecessary noise which might interfere with the activities of the building occupants.
D. Contractor or Design-Builder shall insure no facilities will have noise levels that prevent a full shift at the facility per OSHA safety standards.
E. All work including, but not limited to, excavation, demolition, alteration, or repair being performed in or adjacent to a residential area other than between the hours of 7:00 a.m. and 6:00 p.m. on weekdays, except in the case of urgent necessity in the interest of public safety, shall require written permission from the Water Services Department of the City of Kansas City, Missouri.

1.37 DUST CONTROL

A. The Contractor or Design-Builder shall control dust in accordance with Section 01566 – Cleanup Operations, paragraph DUST CONTROL. The Contractor or Design-Builder shall take all reasonable measures to prevent unnecessary dust. Earth surfaces subject to dusting shall be kept moist with water or by the approved application of an approved chemical suppressant. When practicable, dusty materials in piles or in transit shall be covered to prevent blowing.

B. Buildings or operating facilities which may be affected adversely by dust shall be adequately protected from dust. Existing or new machinery, motors, instrument panels, or similar equipment shall be protected by suitable dust screens. Proper ventilation shall be included with dust screens.

1.38 POLLUTION CONTROL

A. The Contractor or Design-Builder shall prevent the pollution of drains (Combined Sewer, plant piping, Storm Sewer), and watercourses by sanitary wastes, sediment, debris or other substances resulting from the construction activities. No sanitary wastes will be permitted to enter any drain or watercourse other than sanitary sewers. No sediment, debris, or other substance will be permitted to enter sanitary sewers and all reasonable measures will be taken to prevent such materials from entering any drain or watercourse.

1.39 SECURITY

A. The Contractor or Design-Builder is solely responsible for security and protection of the site. This includes protecting all Work, materials, equipment, existing facilities and all temporary facilities against theft, vandals and access by unauthorized persons.

B. No claim shall be made against the City by reason of an act of an employee or trespasser. The Contractor or Design-Builder shall make good on all damage and theft of property resulting from the Contractor or Design-Builder's failure to provide adequate security measures including City Property. After trespass or theft, the City may direct the Contractor or Design-Builder to provide additional site security at no cost including but not limited to security cameras, on site security, and night security.

1.40 PARKING

A. The Contractor or Design-Builder shall provide and maintain suitable parking areas for the use of all City personnel, construction workers and others performing work or furnishing services in connection with the Project. Suitable parking is required to avoid the need for parking personal vehicles where they may interfere with traffic, City's operations, or construction activities. Location of the parking within Facilities should be mutually agreed up by the operating division manager and the Contactor or Design-Builder. Operating Division Manager may change parking areas as need to maintain operations

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01015 – SPECIFIC PROJECT REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. This section covers the modification of specifications for this Project. Any specification that is modified for this Project is listed in Part 3 of this Section by Division. If the Division or specification is not included in this Section, then the Project specification in the Division remains intact.

1.02 SPECIFICATION MODIFICATIONS

A. In the event Section 01015 – Specific Project Requirements conflicts with other project specifications of Divisions 01 through 06; the requirements of this Section shall govern.

1.03 RELATED SECTIONS

A. Section 01000 – General Project Requirements.
B. Section 01500 – Temporary Facilities.
C. Section 01580 – Project Signs.

1.04 QUALITY ASSURANCE

A. The Contractor is responsible for the quality assurance and quality control of the Work.

1.05 INFORMATION PROVIDED BY THE CITY

A. As provided in the Contract Documents.

1.06 MATERIALS FURNISHED BY THE CITY

A. The City will provide the following equipment or materials to be used for the Project. All materials required to complete the Work in accordance with the Contract Documents shall be furnished, installed, and paid for by the Contractor.
    1. No equipment or materials will be provided by the City.

PART 2 – PRODUCTS

Not Used.

PART 3 – EXECUTION

3.01 DIVISION 1 – GENERAL REQUIREMENTS, SPECIFICATION MODIFICATIONS

A. Division 1 – General Requirements is modified as follows:

B. Section 01500 – Temporary Facilities

1. Office: In accordance with paragraph 3.01 OFFICE, the Contractor will not be allowed to use an assigned vehicle in lieu of a stationary office.

2. Field Office for Resident Project Representative: In accordance with paragraph 3.02 FIELD OFFICE FOR RESIDENT PROJECT REPRESENTATIVE, the Contractor shall provide a separate field office for Engineer's Resident Project Representative on the Site.
   a. 150-square-foot minimum, with minimum dimension of 8 feet.
   b. Secure entrance doors - one set of keys.
   c. Windows with blinds and operable sash and insect screens.
   d. Lockable storage closet.
   e. Resilient floor covering.
   f. Furnishings:
      i. One standard size desk with three drawers, swivel desk chair with arms.
      ii. One four foot by eight foot (4'x 8') conference table.
      iii. One plan rack to hold a minimum of six (6) racks of Drawings.
      iv. One standard four-drawer legal-size metal filing cabinet with lock and key.
      v. Six linear feet of bookshelves, 10-inch minimum depth.
      vi. Minimum of six office chairs.
      vii. One waste basket per desk and table.
      viii. One tack board, 36" x 30"
   g. Services:
      i. Lighting: 50 foot-candles (538 lux) at desktop height. Exterior lighting at entrance door.
      ii. Heating and air conditioning.
      iii. Electrical Service: Minimum of two circuits, 110V, 60 hertz. Minimum of four 110V duplex convenience outlets.
      iv. Outdoor toilet facilities with toiletries.
      v. Weekly cleaning service for trailer/office and toilet facilities.
      vi. Electric water cooler.
      vii. 30 Mbps minimum internet service.

3. Field Office for Resident Project Representative: In accordance with paragraph 3.02 FIELD OFFICE FOR CITY, provide a separate field office for City's Resident Project Representative on the Site with the following minimum requirements:
   a. 150-square-foot minimum, with minimum dimension of 8 feet.
   b. Secure entrance doors - one set of keys.
   c. Windows with blinds and operable sash and insect screens.
   d. Lockable storage closet.
   e. Resilient floor covering.

f. Furnishings:
   ix. One standard size desk with three drawers, swivel desk chair with arms.
   x. One four foot by eight foot (4'x 8') conference table.
   xi. One plan rack to hold a minimum of six (6) racks of Drawings.
   xii. One standard four-drawer legal-size metal filing cabinet with lock and key.
   xiii. Six linear feet of bookshelves, 10-inch minimum depth.
   xiv. Minimum of six office chairs.
   xv. One waste basket per desk and table.
   xvi. One tack board, 36" x 30"

g. Services:
   viii. Lighting: 50 foot-candles (538 lux) at desktop height. Exterior lighting at entrance door.
   ix. Heating and air conditioning.
   x. Electrical Service: Minimum of two circuits, 110V, 60 hertz. Minimum of four 110V duplex convenience outlets.
   xi. Outdoor toilet facilities with toiletries.
   xii. Weekly cleaning service for trailer/office and toilet facilities.
   xiii. Electric water cooler.
   xiv. Ninja CREAMi (or approved equal); Coffee Cream color.
   xv. 30 Mbps minimum internet service.

D. Section 01580 – Project Signs

1. Printers: The following is a list of local businesses who have provided printing services for City project signs. Printing location shall be coordinated with the City/Design Professional.

   a. Almar Printing
   7735 Wornall Road
   Kansas City, MO 64114
   Phone: (816) 523-4566

   b. Custom Color
   14320 W. 101st Terrace
   Lenexa, KS 66215
   Phone: (913) 730-3100

   c. KC Blueprint Company
   1804 Swift St.
   North Kansas City, Missouri 64116
   816-513-1048 Print Center
   816-527-0900 Home Office

   d. Office Max

e. City Hall Basement Print Center
414 E. 12th Street
Kansas City, MO 64106
Phone: (816) 513-1048

2. Number of Project Signs to be provided: two (2)

END OF SECTION

SECTION 01810 – PROJECT DESIGN CRITERIA

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:
    1. Criteria for use in selection of equipment and appurtenances specified in subsequent Sections of these Specifications, or on the Drawings.
    2. Criteria for design of tanks and other equipment fabricated off site and shipped to the Work site for installation.
    3. Criteria for use in design of anchors for connecting process, mechanical and electrical equipment, and appurtenances to supporting structures.
B. The criteria included in this Section are general criteria that apply throughout the Work unless more restrictive or more stringent criteria are indicated on the Drawings or in technical Specifications. See Drawings and Specifications for additional criteria relevant to specific locations, materials and equipment.

1.02 REFERENCES

A. American Society of Civil Engineers (ASCE):
    1. 1. 7-10 - Minimum Design Loads for Buildings and Other Structures (ASCE 7).
B. ASHRAE, Incorporated (ASHRAE).
C. International Code Council (ICC):
    1. International Plumbing Code (IPC).
D. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA):
    1. Seismic Restraint Manual: Guidelines for Mechanical Systems, 4th edition.

1.03 SUBMITTALS

A. Design of supports and anchorage for structures:
    1. Shop drawings and calculations:
        a. Complete shop drawings and calculations.
        b. Calculations shall be signed and sealed by an engineer licensed in the State of Missouri.
    2. Seismic design calculations:
B. Where seismic design calculations are specified in this Specification, such requirements will be waived for structures or equipment determined to be in Seismic Design Categories A or B.
C. Wind design calculations: Where wind design calculations are specified in this Specification, such requirements will be waived for structures or equipment located inside other structures.

1.04 PROJECT DESIGN CRITERIA – SITE INFORMATION

A. Location:
    1. Address: 14001 Interurban Road, Kansas City, MO 64163
    2. Site coordinates (approximate): 39deg 20min 50sec N, 94deg 40min 10sec W
B. Elevation:

1. Operating elevation for equipment: Approximately 800 to 855 feet above mean sea level for Influent Pumping. Approximately 845 to 870 feet above mean sea level for remaining facilities.

1.05 PROJECT DESIGN CRITERIA – REGULATORY REQUIREMENTS

A. Code requirements of authorities having jurisdiction over the project are included in Section 01410 - Regulatory Requirements.

1.06 PROJECT DESIGN CRITERIA – OPERATING ENVIRONMENT

A. Equipment and materials for the Work shall be suitable for performance in a wastewater treatment plant environment, and under conditions specified in the following paragraphs.
    1. See technical specifications for each type of equipment for additional requirements.
B. Climate data for site:
    1. Energy Code Climate Zone: 4A (IECC 2021).
    2. Local data:
        a. Location: Kansas City, Missouri, Kansas City International Airport.
            (1) Data coordinates: Latitude 39.30 N; Longitude 94.71 W.
        b. Prevailing winds: 12 miles per hour.
        c. Temperatures - Outdoor: As specified in Table 1:

Table 1: Design Temperatures - Outdoor	
Condition	**Criteria**
Winter	2.4 degrees Fahrenheit dry-bulb at ASHRAE 99.6 percent.
Summer	92.7 degrees Fahrenheit dry-bulb / 76.1 degrees Fahrenheit mean coincident wet-bulb at ASHRAE 99.6 percent.

        d. Temperatures - Indoor: As specified in Table 2

Table 2: Design Temperatures - Indoor		
	Summer (degrees Fahrenheit)	**Winter (degrees Fahrenheit)**
Process and process equipment areas:		
• Unless otherwise noted.	10 degrees above ambient	55
• Blower and Pump Rooms.	104	55

• Corridors.	10 degrees above ambient	55
• Electrical, Control, and Mechanical (HVAC equipment) rooms.	85	55
Non-process areas:		
• Offices, conference rooms, vestibules, kitchen, restrooms. • Control room, wet analysis room. • PLC, instrument shop, instrument storage, electrical/com room.	75	70
• Admin storage.	80	65
• Mechanical (HVAC equipment) rooms.	85	55
• Conditioned Parts Storage Room.	75	70
• Maintenance shop.	104	55

3. Outdoor conditions - other:
    a. Humidity: 43.4 to 83.5 percent (NOAA 2002).
    b. Freeze-thaw conditions: 90-100 frost days per year.
4. Indoor conditions - other:
    a. Moisture conditions: As defined in individual equipment sections.

C. Rainfall design criteria:
1. Reference: 2015 IPC.
    a. 3.6 inches per hour (100-year, 1-hour storm).

1.07 PROJECT DESIGN CRITERIA - STRUCTURAL

A. GENERAL. Buildings, non-structural components and non-building structures shall be designed in accordance with this section. In the event of conflict with requirements in other sections, the more stringent criteria shall be followed.

B. DESIGN CRITERIA. Buildings, non-structural components including anchorage of such items, shall be designed in accordance with the following criteria in PART 3.

General Design Data:

Building code and references	IBC 2012, ASCE 7-10 "Minimum Design Loads for Buildings and Other Structures", AISC 360 "Specification for Structural Steel Buildings", AISC 341 "Seismic Provisions for Structural Steel Buildings"	
Site elevation, above mean sea level	734	ft
Design flood elevation, DFE	743.33	ft
(500 yr)		
Design groundwater elevation (Ref Geotechnical Soil Report)	717	ft

Wind Design Data:

Basic factored wind speed, V, Risk Category III	120	mph
Exposure category	C	
Importance factor (wind loads), I	N/A	
Building enclosure classification	Enclosed	

Snow Design Data:

Ground snow load, P_g	20	psf
Importance factor (snow loads), I	1.1	
Exposure factor (C_e)	0.9	
Thermal factor (C_t)	1.0	

Ice Design Data:

Nominal ice thickness, t	1.0	in
Concurrent wind speed, V_c	40	mph
Importance factor (ice loads – ice thickness), I_i	1.25	
Importance factor (ice loads – concurrent wind), I_w	1.0	

Seismic Design Data for Non-structural Components:

Design short period spectral response acceleration, S_{DS}	0.135g

Component importance factor, I_P	If/As indicated in the Non-Structural Components PART 3
Seismic Design Category	B

C. WIND ANCHORAGE. Equipment that is to be located outdoors shall have anchor bolts designed for the effects of wind forces, as determined in accordance with ASCE 7, Chapter 6. Shop drawings shall include full anchor bolt details and shall be sealed by a professional engineer licensed in the state of the project. Calculations shall be furnished when requested by Engineer.

D. SEISMIC DESIGN.

a. General. Structural systems shall provide continuous load paths, with adequate strength and stiffness to transfer all seismic forces from the point of application to the point of final resistance.

b. Pre-Engineered Buildings. As Per Architectural Drawings

c. Non-Structural Components. Non-structural components are architectural, mechanical, and electrical items that are permanently attached to and supported by a structure but are not part of the structural system, as indicated in Chapter 13 of ASCE 7, and in the Non-Structural Components Description PART 3.

The Non-Structural Components Description PART 3 identifies the components that require some level of seismic design. The requirements of this paragraph are applicable only to the items listed in the Non-Structural Components Description PART 3.

All components, and the anchorage of those components to the main structure, shall be shown on construction documents prepared and sealed by a registered design professional that is licensed in the state of the project. The construction documents shall be submitted in accordance with the Submittal Procedures section. Structural calculations shall be submitted when requested by Engineer.

Design of non-structural components shall be in accordance with all applicable provisions of ASCE 7, Chapter 13. Non-structural components shall have sufficient strength and ductility to resist the specified seismic effects, and shall meet all of the design, proportioning, detailing, inspection, and quality assurance provisions of the specified building code and other referenced codes.

Non-structural components shall be attached so that seismic forces are transferred to the structural system. Curbs that support roof-mounted equipment shall be designed to transfer forces from the equipment into the main structural roof members. All structural attachments shall be bolted,

welded, or otherwise positively fastened. Frictional resistance due to gravity shall not be considered in evaluating the required resistance to seismic forces.

When the Non-Structural Components Description PART 3 indicates that seismic design of any component is required, the component shall be designed to be operable during and following a design level seismic event without collapsing, breaking away from supports, creating an ignition hazard, or releasing any contents.

"W_p" shall include the total operating weight of the component or system, including, but not limited to, any insulation, fluids, and concentrated loads such as valves, condensate traps, and similar components.

Seismic effects that shall be analyzed in the design of piping systems include the dynamic effects of the piping system, contents, and supports. The interaction between piping systems and the supporting structures, including other mechanical and electrical equipment, shall also be considered. Where pipe supports are to be designed by Contractor, as required by the Pipe Supports section, both the piping and support systems shall be designed to meet the applicable requirements of ASCE 7, Chapter 13.

Non-Building Structures. Not used.

PART 2 - PRODUCTS

2.01 GENERAL

A. Equipment and materials for the project shall be suitable for the following conditions:
    1. Wastewater treatment plant conditions.
    2. Site, environmental and structural loading conditions as specified in this Section.
    3. Specific conditions listed in the relevant sections of the Contract Documents for the equipment and products under consideration.
B. Anchoring and fastening: See the following Sections for materials and installation requirements:
    1. Section 03 20 00 - Concrete Reinforcement.
    2. Section 04 20 00 - Unit Masonry.
    3. Division 5 – Metals.

PART 3 – EXECUTION

3.01 GENERAL

A. Design in accordance with the requirements of the building code as specified in Section 01410 - Regulatory Requirements and the references and project-specific design criteria listed in this Section.
B. In the event of conflicts between design criteria, the more restrictive or severe shall govern.

3.02 DESIGN OF SUPPORTS AND ANCHORAGE FOR EQUIPMENT AND TANKS

A. General:
    1. Anchor using anchor bolts, anchor rods, bolts, or welded studs.

2. Anchor bolts used to resist seismic loads and wind forces shall have a standard hex bolt head.
    a. Do not use anchor bolts fabricated from rod stock with an L or J shape.
    b. Do not use post-installed anchors (including concrete anchors, sleeve anchors, flush shells, chemical anchors, powder actuated fasteners, or other types of anchor) unless indicated on the Drawings or accepted in writing by the Engineer.
3. Anchor bolt and fastener calculations:
    a. Design for ductile failure (anchor bolt yield).
    b. Anchor bolts and fasteners embedded cast into plastic concrete or installed into cured concrete:
        (1) Design based on a minimum specified 28-day concrete compressive strength of 4,000 pounds per square inch (f'c = 4000 psi).

B. Seismic loads:
1. Do not use friction to resist sliding resulting from seismic forces. Resist such forces only by direct application of loads to fasteners as bearing, shear, tension, or compression force(s).
2. Do not use more than 60 percent of the weight of the mechanical and electrical equipment for designing anchors for resisting overturning due to seismic forces.
3. For tanks and equipment with varying weight based on the volume of material contained, design anchorage to accommodate both filled and empty conditions.
    a. Do not use more than 60 percent of the weight of the tank for resisting overturning due to seismic forces.

C. Wind loads:
1. Design load combinations shall be as specified in ASCE 7.
2. For tanks and equipment with varying weight based on volume of material contained, evaluate anchorage considering both filled and empty conditions.

End of Section

SECTION 01019 – CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section. B. Related Sections include the following:

1. Section 00700 – General Conditions.
2. Section 01020 – Record Documents.
3. Section 01021 – Operation and Maintenance Data.
4. Section 01140 – Work Restrictions.
5. Section 01140.01 - Process and System Shutdown Constraints Schedule.
6. Section 01140.02 - Operation Change Control Plan Documents.
7. Section 01300 – Submittal.
8. Section 01320 – Construction Progress Documentation.
9. Section 01322 – Photographic Documentation
10. Section 01335 – Document Management.
11. Section 01340 – Building Information Modeling (BIM)
12. Section 01433 – Manufacturers' Field Services
13. Section 01664 – Training
14. Section 01757 – Commissioning

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Inspection procedures.
2. Submittals.
3. Final cleaning.

1.03 SUBMITTALS

A. All Substantial Completion documents shall be submitted at least 14 calendar days prior to Substantial Completion inspection request.

1. Specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
2. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases. 3. Prepare and submit Project Record Documents, final operation and maintenance manuals, Record Documents, damage or settlement surveys, property surveys, and similar final record information.
4. Submit specific warranties, workmanship bonds, maintenance service agreements, and similar documents in accordance with this Section.
5. Submit all manufacturers' certificates in accordance with Section 01433 Manufacturers' Field Services

6. Submit Final Original Equipment Manufacturer Operations & Maintenance (OEM O&M) Manuals for all equipment and materials furnished as part of the Work of the Project.
7. Prepare and submit draft Facility O&M Data and the draft Electronic O&M Manual in accordance with the requirements of this Section.
8. Submit draft as-built BIM developed in accordance with Section 01340 Building Information Modeling Requirements and updated to include as-built conditions.
9. Submit training materials and recordings of training sessions as described in Section 01757 Commissioning.
10. Submit approved Acceptance Test Plan developed in accordance with Section 01757 Commissioning and with this Section.
11. Deliver tools, spare parts, extra material, and maintenance products in accordance with Section 01600 Product Delivery Storage and Handling.
12. Submit changeover information related to Owner's use, operation, and maintenance.
13. Prepare and submit draft Project Record Documents prepared in accordance with Section 01700 Execution Requirements and submitted in accordance with the requirements of this Section.

B. All Final Completion documents shall be submitted at least 14 calendar days prior to Final Completion inspection request. Before requesting a final inspection to determine the date of Final Completion, complete the following:
    1. Submit a certified copy of the City's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by the City. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
    2. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
    3. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Final operations and maintenance manuals must be provided for the training sessions.
    4. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects. Surfaces which cannot be touched-up or repaired satisfactorily, shall be refinished or replaced.
    5. Submit changeover information related to Owner's use, operation, and maintenance.
    6. Submit final O&M Data, including the final electronic O&M in accordance with the requirements of this Section.
    7. Submit Final Building Information Model incorporating all as-built information in accordance with Section 01340 Building Information Modeling Requirements.
    8. A written request for final inspection for acceptance requirements.
    9. Submit a final Application for Payment according to Division1 Section "Payment Procedures."

1.04 WARRANTIES

A. Submit written warranties on request of Engineer for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.
B. Partial Use: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and used by Owner during construction period by separate agreement with Contractor or Design-Builder.

C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
    1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
    2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
    3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor or Design-Builder.
D. Provide additional copies of each warranty to include in operation and maintenance manuals.
E. Provide additional copies of each warranty as a separate pdf file.
F. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1.05 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining the date of Substantial Completion, the Contractor or Design-Builder shall comply with all conditions in Supplementary Conditions and complete the following. List items below that are incomplete in request.
    1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
    2. Deliver salvaged material and similar items in accordance with Section 01352 Selective Alterations and Demolition to location designated by the Owner. Label with manufacturer's name and model number where applicable.
    3. Complete Installation and Functional Testing of all equipment, systems and subsystems in accordance with Section 01757 Commissioning.
    4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems in accordance with Section 01757 Commissioning.
    5. Clean the project area of construction debris and other construction effects.
    6. Terminate and remove temporary facilities from the Project site, along with mockups, construction tools, and similar elements.
    7. Complete final cleaning requirements, including touchup painting.
    8. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
    9. Prepare and submit all required Submittals as specified herein.
B. Inspection: Submit a written request for Substantial Completion inspection. On receipt of request, the Engineer will either proceed with inspection or notify Contractor or Design-Builder of unfulfilled requirements. The Engineer will prepare the Certificate of Substantial Completion after inspection or will notify Contractor or Design-Builder of items, either on Contractor or Design-Builder's list or additional items identified by Engineer, that must be completed or corrected before certificate will be issued.
    1. Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

2. Results of completed inspection will form the basis of requirements for Substantial Completion.
3. The Contractor or Design-Builder shall pay for any re-inspection other than the first reinspection. The costs of all extra re-inspections, including the cost of the Owner's Representative and the Engineer will be deducted from the Contractor or Design-Builder's payments.
4. Following completion of all items above and all requirements for Substantial Completion included in the Supplemental Conditions 008000, the Owner will complete Form 01290.2 Certificate of Substantial Completion and distribute to the Contractor or Design-Builder.

1.06 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining the date of Final Completion, complete the following:
    1. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Final operations and maintenance manuals must be provided for the training sessions.
    2. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects. Surfaces which cannot be touched-up or repaired satisfactorily, shall be refinished or replaced.
    3. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects. Surfaces which cannot be touched-up or repaired satisfactorily, shall be refinished or replaced.
    4. Prepare and submit all required Submittals as specified herein.
B. A written request for final inspection for acceptance must be provided to the Engineer. Upon receipt of request, Engineer will either proceed with inspection or notify Contractor or Design-Builder of unfulfilled requirements. Engineer will prepare a final Certificate for Payment after inspection or will notify Contractor or Design-Builder of construction that must be completed or corrected before certificate will be issued.
    1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected. The Contractor or Design-Builder shall pay for any reinspection other than the first re-inspection. The costs of all extra re-inspections, including the cost of the Owner's Representative and the Design Professional deducted from the Contractor or Design-Builder's payments.
    2. Submit a final Application for Payment according to Division 1 Section "Payment Procedures."

1.07 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Contractor or Design-Builder shall prepare and submit three copies of punch list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor or Design-Builder that are outside the limits of construction. The Contractor or Design-Builder shall use the standard Water Services form for all items.
    1. Organize a list of spaces in sequential order,
    2. Organize items applying to each space by major element, including category equipment, and building systems.

3. Include the following information at the top of each page:
    a. Project Number
    b. Project name.
    c. Date.
    d. Name of Contractor or Design-Builder.
    e. Page number.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with the manufacturer's written instructions.
C. Complete the following cleaning operations before requesting inspection for certification of Final Completion for entire Project or for a portion of Project:
    1. Clean Project site and grounds, in areas disturbed by construction activities, of rubbish, waste material, litter, and other foreign substances.
    2. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    3. Remove tools, construction equipment, machinery, and surplus material from the Project site.
    4. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, and similar spaces.
    5. Sweep concrete floors broom clean in unoccupied spaces.
    6. Remove labels that are not permanent.
    7. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already shows evidence of repair or restoration.
D. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
    1. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
    2. Clean ducts and blowers if units were operated without filters during construction.
    3. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
    4. Leave Project clean and ready for use.
E. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the Project site and dispose of lawfully.

END OF SECTION

SECTION 01020 – RECORD DOCUMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Contractor shall maintain, in a safe place at the Site, one updated record copy of all Drawings, Standards and Specifications, Addenda, Shop Drawings, Requests for Interpretation (RFIs), Requests for Proposal (RFPs), Work Change Directives (WCDs), Change Orders, other written interpretations or clarifications of the contract documents, survey information (including approved cut sheets) and all other documents relevant to the Work.
B. All such documents shall be kept in order, good condition and shall be continuously updated to indicate all work installed and all changes made during construction.
C. No work shall be allowed in the absence of these record documents.
D. This document also outlines electronic data requirements and defines the survey requirements for the development of Field-Marked Drawings, As-Built Drawings and Conforming to Construction Drawings.

1.02 RELATED SECTIONS

A. Section 00700 – General Conditions.
B. Section 01019 – Closeout Procedures.
C. Section 01020 – Record Documents.
D. Section 01021 – Operation and Maintenance Data.
E. Section 01140 – Work Restrictions.
F. Section 01140.01 - Process and System Shutdown Constraints Schedule.
G. Section 01140.02 - Operation Change Control Plan Documents.
H. Section 01300 – Submittals.
I. Section 01320 – Construction Progress Documentation.
J. Section 01322 – Photogram Documentation.
K. Section 01335 – Document Management.
L. Section 01340 – Project BIM Coordination
M. Section 01664 – Training.
N. Section 01757 – Commissioning.

1.03 CODES AND STANDARDS

A. CAD Standards – KC Water CAD Standards.

1.04 DEFINITIONS

A. Drawings – As defined by Section 00700 – General Conditions.
B. Approved for Construction Drawings – Any drawing or sketch that has been issued to the Contractor or Design-Builder by the City for the purposes of constructing the Work. These include, but are not limited to, the following: Drawings, revisions to the Drawings, information issued as part of change orders and information issued as part of work change directives.
C. Field-Marked Drawings (Red Line Markups) – A copy of the Approved for Construction Drawings that is maintained and updated daily by the Contractor or Design-Builder during construction clearly detailing all work completed and depicting all changes made to the Work during construction.

D. As-Built Drawings – The completed Field-Marked Drawings that include the signed certification language from both the Contractor or Design-Builder and Surveyor.
E. Conforming to Construction Drawings – The Approved for Construction Drawings that have been revised to reflect the changes noted on the As-Built Drawings. For these drawings, the CAD files are updated, revision block is updated, and a new set of drawings is created.
F. Record Model – The building information model (BIM) that documents the work completed.
G. Record Drawings – All drawings used or developed as part of the Work. Record Drawings include, but are not limited to, the following: Approved for Construction Drawings, Field-Marked Drawings, As-Built Drawings and Conforming to Construction Drawings.
H. Record GIS – GIS files containing the site piping work completed in this project that has been created per KC Water Standards.
I. Record Documents – As defined by this Section and Section 00700 – General Conditions, Article 6 Contractor or Design-Builder's Responsibilities including but not limited to updated BIM, Electronic O&M Manual, OEM O&M, Record Photos, Final Submittals, SOPs, SIs, and any other specified submittals.

1.05 SUBMITTALS

A. Submit as specified in Section 01300 – Submittals.
B. Warranties and Bonds.
C. For each item of material or equipment furnished under the Contract.
D. Submittals include, but are not limited to, the following:
   1. Warranties as specified herein.
   2. As-Built Drawings.
   3. Conforming to Construction Drawings.
   4. Electronic Submittals:
   5. All electronic deliverables (drawings, coordinates table, etc.) shall be made through the approved document management system. See Section 01335 – Document Management.
   6. As-Built Drawings:
      a. One (1) hard copy on paper for review and approval.
      b. One (1) electronic copy in PDF format.
   7. All Record Documents including those listed in the referenced Sections:
      a. Submit Record documents in accordance with Section 00700 – General Conditions, Article 14 – Payments to the Contractor or Design-Builder and Completion.
      b. The following shall be submitted for Record Documents:
         i. One (1) hard copy on paper.
         ii. One (1) electronic copy in PDF format.
         iii. As specified in other sections.
         iv. Electronic (PDF) Documents:
         v. Documents shall be full scale.
         vi. Markups shall be noted in RED.
         vii. Minimum resolution shall be 600 dpi.

1.06 WARRANTY

A. Warranties and Bond are Record Documents.
B. CITY has the right to reject warranties.

C. CITY reserves the right to reject Work for the Project if the required warranties have not been provided.
D. Submit form of manufacturer's warranty prior to fabrication and shipment of the item from the manufacturer's facility.
E. Submit form of manufacturer's special warranty when specified.
F. Provide consolidated warranties and bonds within 15 calendar days of Substantial Completion.
G. Contents:
   1. Organize warranty and bond documents:
   2. Include Table of Contents organized by specification section number and the name of the product or work item.
   3. Include each required warranty and bond in proper form, with full information, are certified manufacturer as required, and are properly executed by Contractor, or subcontractor, supplier, or manufacturer.
   4. Provide name, address, phone number, and point of contact of manufacturer, supplier, and installer, as applicable.
H. Warranty submittal format:
   1. Submit two (2) hardcopies.
   2. Hardcopies shall be assembled in 3 D-side ring binders with durable cover.
   3. Identify each binder on the front and spine clearly labeling the following:
      a. Warranties and Bonds.
      b. Project Name or Title.
      c. Name, Address, and Telephone Number of the Contractor.
   4. Submit one (1) electronic copy in PDF format.
   5. The Record Documents shall be an integral part of the work guaranteed by the Contractor or Design-Builder's Performance and Maintenance Bond. If during the three-year maintenance period the City determines that further revisions or corrections are necessary to make the Record Documents accurate, the Contractor or Design-Builder shall make or cause the revisions or corrections to be made at no additional cost to the City.

1.07 QUALITY ASSURANCE

A. The Contractor or Design-Builder is responsible for the quality assurance and quality control of the Work.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION

3.01 SURVEY REQUIREMENTS

A. All field books, notes, videotapes and other data developed by the Contractor or Design-Builder in performing required surveys as part of the Work shall be available to the City for examination throughout the construction period. All such data shall be submitted to the City with the other documentation required for final acceptance of the Work.
B. General Requirements:
   1. The Contractor or Design-Builder shall provide survey grade information for the locations and elevations of the Work as described herein. Surveys shall be conducted by a Professional Land Surveyor, licensed in the State of Missouri.

2. Vertical Datum – All elevations shall be indicated in North American Vertical Datum of 1988 (NAVD 88) in feet and decimals of a foot.
3. Horizontal Control – Coordinates shall be referenced to the North American Datum of 1983 (NAD 83), State Plane Missouri West Zone FIPS 2403 US Feet coordinate system, Kansas City Metro Control. Statewide Missouri Geographical Reference System monuments, Project monuments and Certified Land corners shall be used as references to determine State Plane coordinates. All control monuments used in the survey work shall be listed with reference ties and shown on the Record Drawings.
4. Water Systems:
    a. Fire Hydrant Assemblies – Provide survey point (location and elevation) at the top of the operating nut for each fire hydrant.
    b. Fittings – Provide survey point (location and elevation) at the center of each fitting (i.e. bends, tees, valves, etc.). Survey shall be taken at the top of the fitting. Provide the elevation of finished grade or improvements at the top of the fitting.
    c. Pipe Profile – Provide survey points (location and elevation) at the center point of all piping at a maximum spacing of 50 feet. Survey shall be taken on the top of the pipe. At the same location, provide the elevation of finished grade.
    d. Valves, Valve Vaults, Meter pits and Other Structures – A survey is required to verify the location of all new valves, valve vaults, meter pits or other structures. The survey shall include, but is not limited to, the following:
    (i) Location of the Structure – Provide coordinates for the center of the access cover.
    (ii) Top elevation – Provide the top elevation of the structure at the center of the access cover.
5. Wastewater Systems:
    a. Location – Verify the "Locating Point" shown on the Approved for Construction Drawings or standard detail. Verify all coordinate data shown on the Approved for Construction Drawings. If no such information is provided, the Locating Point shall be the center of the manhole cover.
    b. Top Elevation. – Provide the elevation of the top of the structure at the Locating Point.
    c. Pipe Inverts – Provide the invert elevation and flow direction of all pipes that penetrate the structure (flowline in - FL IN) and exit the structure (flowline out - FL OUT).
    d. Manhole Invert – Provide the elevation of the invert at the center of the manhole if different than the pipe inverts.
6. Existing Manholes – A survey is required to verify the location of all existing manholes that are modified as part of the Work. The survey shall include, but is not limited to, the following:
    a. Location of the Structure – Verify the "Locating Point" shown on the Approved for Construction Drawings or standard detail. Verify all coordinate data shown on the Approved for Construction Drawings. If no such information is provided, the Location Point shall be the center of the manhole cover.
    b. Top Elevation – Provide the elevation of the top of the structure at the Locating Point.
    c. Pipe Inverts – Provide the invert elevation and flow direction of all pipes that penetrate the structure (flowline in - FL IN) and exit the structure (flowline out - FL OUT).
    d. Manhole Invert – Provide the elevation of the invert at the center of the manhole if different from the pipe inverts.
7. Storm Water and Green Infrastructure Systems

a. A survey is required to verify the location of all new Green Infrastructure, Storm Water Structures, Junction Boxes, Manholes, Inlets and all other related structures. The survey shall include, but is not limited to, the following:
b. Location of the Structure – Verify the Locating Point shown on the Approved for Construction Drawings or standard detail. Verify all coordinate data shown on the Approved for Construction Drawings. The locating point for curb inlets is center of inside face of inlet wall. If no other locating information is provided for other structures, the Locating Point shall be the center of the access cover.
c. Top Elevation – Provide the elevation of the top of the structure at the Locating Point.
d. Pipe Inverts – Provide the invert elevation and flow direction of all pipes that penetrate the structure (flowline in - FL IN) and exit the structure (flowline out - FL OUT).
e. Manhole or Structure Invert – Provide the elevation of the invert at the center of the manhole or structure if different than the pipe inverts.

8. Culvert - A survey is required to verify the location of new culverts. The survey shall include, but is not limited to, the following:
   a. Location – The Locating Points shall be the center line of each culvert barrel at the upstream and downstream end of each. The location of each culvert barrel is to be provided.
   b. Invert – Provide the upstream and downstream invert elevation of each culvert barrel.
9. Channels and Ditches:
   a. Profile – Provide survey points (location and elevation) at the upstream and downstream end of the channel and along the channel at a maximum 50-foot intervals and at all bends and changes in alignment.
   b. Survey points shall be taken at finished grade at the centerline, toes of side slopes or walls and top elevation of the high flow channel on both sides of the channel. If water is present in the channel or ditch, provide water surface elevation on both sides of the channel.
10. Detention Areas:
    a. For any surface feature designed to detain or retain storm water runoff (i.e., detention basins, rain gardens, bio-retention cells, etc.) an as-built survey of the feature is required.
    b. Enough survey points shall be taken to generate 1-foot contours of the detention or retention area and any containment berms.
    c. Provide survey points (location and elevation) for both ends of weirs, all weir high and low points (if top of weir is not level) and other flow control structures, inlets and outlets.
    d. Provide survey points (location and elevation) for both ends of weirs and all weir high and low points (if top of weir is not level) of the principal spillway structure.
11. Facility Site Assets:
    a. Site Assets shall be documented to the same level of detail as other assets (water, wastewater etc..).
    b. Assets include all buried infrastructure in the project including but not limited to ductbanks, conduit, chemical piping, casings, gravity sewers, process piping, etc.

3.02 FIELD-MARKED DRAWINGS

A. The Contractor or Design-Builder shall continuously maintain a set of Field-Marked Drawings which details all work completed and shows all changes or deviations made by the Contractor or Design-Builder from the Approved for Construction Drawings. Where the Approved for Construction Drawings are not detailed and allow for flexibility during construction, the Contractor or Design-Builder shall include the detailed information on how the Work was constructed. These adjustments shall include, but are not limited to, field adjustments and change orders.

B. Field-Marked Drawings shall be prepared using survey grade information to show the horizontal and vertical location of the Work after completion of construction. Connection details may be sketched using field run measurements.
C. Mark new information that is not shown on Drawings or Shop Drawings.
D. Include the following:
   a. Field changes of dimension and detail.
   b. Change Order modification. Note related Change Order numbers where applicable.
   c. RFI modification. Note related RFI numbers where applicable.
   d. Details not on original Drawings.
   e. Horizontal and vertical location of all underground utilities and all other concealed elements that would be difficult or costly to maintain the installed asset long term.
E. Precision of Measurement:
   a. Where survey measurements are not required (sketching connection details) – elevations, stationing, distances and measurements shall be expressed to the nearest 0.10 foot.
   b. All other Work requires survey information – elevations, station, distances and measurements shall be expressed to the nearest 0.01 foot.
   c. Field changes or additions shall be designated in RED. Hard copy and electronic (PDF) deliverables shall be provided in color.
   d. Information shall be clearly distinguishable on hard copy mark-ups and in the electronic files.
F. If the Contractor or Design-Builder observes inaccurate information pertaining to existing conditions, the correct information shall be noted in the Field-Marked Drawings.
G. The Contractor or Design-Builder shall submit 30%, 60% and 90% check prints with the corresponding percent complete of work. The check prints shall be submitted with the Application for Payment. Failure to provide the check prints shall cause the Application for Payment to be returned to the Contractor or Design-Builder.

3.03 AS-BUILT DRAWINGS

A. Upon completion of the Work and before the Application for Final Payment, the Contractor or Design-Builder shall prepare the As-Built Drawings by completing annotations to the Field-Marked Drawings and adding the required certification statements.
B. Surveyor's Certification:
   1. Each drawing shall be modified to include a certification statement and signature block as described below.
      a. Water Systems

         Each sheet of these Record Drawings and attached Survey Cut Sheets for the Work have been reviewed and approved by the Professional Land Surveyor whose seal is affixed to this Record. The horizontal control, coordinates and elevations shown on these Records are accurate and are based on the Missouri Coordinate System of 1983, West Zone and NAVD88 datum, with the date of adjustment. These Records have been revised, as required in Section 01000, 1.20 of the Standards and Specifications for Water Main Extensions and Relocations, under my personal supervision to show the true and accurate measurements of the work as it was actually constructed.

      b. Wastewater, Storm Water and Green Infrastructure Systems

         Each sheet of these Record Drawings, Record Models and attached Survey Cut Sheets for the Work have been reviewed and approved by the Professional Land Surveyor

whose seal is affixed to this Record. The horizontal control coordinates and elevations shown on these Records are accurate and are based on the Missouri Coordinate System of 1983, West Zone and NAVD88 Datum. These Records have been revised under my personal supervision to show the true and accurate measurements of the work as it was actually constructed.

2. Every sheet of the Field-Marked Drawings must be reviewed, signed and sealed by a Professional Land Surveyor, licensed in the State of Missouri and must include the following statement on the title block inside the box marked "for WSD use" and near the Surveyor's professional license seal.

C. Contractor's Certification:

1. Each drawing shall be modified to include a certification statement and signature block as described below:

Water Systems

I hereby certify that this Record correctly depicts the Work constructed as to size, material, horizontal location, vertical location and finished grade as shown on the approved construction drawings or their revision. The Work was done in accordance with these Records and the current version of the Standards and Specifications for Water Main Extensions and Relocations.

Contractor: _____ *Date:* _____

Name (print): _____ *Title:* _____

Signature: _____

Wastewater, Storm Water and Green Infrastructure Systems

I hereby certify that this Record correctly depicts the Work constructed as to size, material, horizontal location, vertical location, grade of installed piping systems and finished grade as shown on the approved construction drawings or their revision. The Work was done in accordance with these Records.

Contractor: _____ *Date:* _____

Name (print): _____ *Title:* _____

Signature: _____

a. The Contractor or Design-Builder shall provide certification that the Field-Marked Drawings reflect the conditions that were constructed.
b. The Contractor or Design-Builder shall review the Field-Marked Drawings and verify all information is accurate. The Contractor or Design-Builder shall verify that all changes to the Work have been documented. The Contractor or Design-Builder shall sign each sheet of the Record Drawings with the following certification(s):

D. Submittals – Submit As-Built Drawings in accordance with paragraph SUBMITTALS. As-Built and Conforming to Construction Drawings must be approved by the City before the Contractor or Design-Builder submits the Application for Final Payment.

1. Mark each document "AS-BUILT DRAWINGS" in neat, large print letters.

2. The cover sheet of the project shall be included. The cover sheet shall include all required As-Built certifications and shall clearly show that the drawings are AS-BUILT.

3.07 OTHER RECORD DOCUMENTS

A. As defined by Section 00700 – General Conditions, Article 6 – Contractor or Design-Builder's Responsibilities. Section 01021 – Operation and Maintenance Data, Section 01300 –Submittals, Section 01320 – Construction Progress Documentation, Section 01322 – Photographic Documentation, Section 01664 – Training, Section 01757 – Commissioning, etc…
B. GIS Data of Site Piping.
C. Coordinates Table – Provide a Microsoft Excel spreadsheet that contains of every asset installed or adjusted as part of the Work per KCMO's asset standard document.
D. Survey Cut Sheets.

END OF SECTION

SECTION 01021 – OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes administrative and procedural requirements for the preparation, submission, and City's Representative's review of Operation and Maintenance (O&M) Data.

1. The Contractor or Design-Builder shall furnish all labor, materials, equipment, and incidentals as necessary to comply with these requirements.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract; including General and Supplementary Conditions, all applicable Division 1 Sections, and all applicable Division Sections; apply to this Section.

B. Related Sections include the following:

1. Section 01019 – Closeout Procedures
2. Section 01020 – Record Documents
3. Section 01140 – Work Restrictions
4. Section 01140.01 - Process and System Shutdown Constraints Schedule
5. Section 01140.02 - Operation Change Control Plan Documents
6. Section 01020 – Record Documents
7. Section 01300 –Submittals
8. Section 01320 – Construction Progress Documentation
9. Section 01322 – Photogram Documentation
10. Section 01335 – Document Management
11. Section 01664 – Training
12. Section 01757 – Commissioning

1.03 REQUIRMENTS

A. Contractor shall prepare and provide data and materials, and provide instruction and services, as specified in this Section.

B. Compile product data and related information appropriate for Owner's maintenance and operation of products and systems furnished under this Contract. Include Information on all motors supplied with equipment.

C. Prepare O&M Data as specified in this Section and as referenced in other pertinent sections of the Specifications.

D. Instruct Owner's personnel in maintenance of products and in operation of equipment and systems, including electrical and instrumentation.

1.04 DEFINITIONS

A. O&M Data is including but not limited to:

1. Original Equipment Manufacturer Operation and Maintenance manuals.
2. Electronic O&M Manual for the entire project.
3. PLC, VFD, and SCADA Server Programs.

B. Preliminary Data: Initial and subsequent submissions for the City's Representative's review.

C. Final Data: City's Representative accepted data, submitted as specified herein.

D. Maintenance Operation: As used on Asset Maintenance Summary Form is defined to mean any routine operation required to ensure satisfactory performance and longevity of equipment. Examples of typical maintenance operations are lubrication, belt tensioning, adjustment of pump packing glands, and routine adjustments.

1.05 SUBMITTALS

A. Informational:

1. Data Outline: Submit two copies of a detailed outline of proposed organization and contents of Final Data prior to the preparation of the Preliminary Data.

2. Preliminary Data:
   a. Submit three copies for City's Representative's review including Relevant Standard Operation Procedures and Standard Instructions.
   b. If Data meets the condition of the Contract:
      (1) One copy will be returned to Contractor or Design-Builder.
      (2) One copy will be forwarded to Resident Project Representative.
      (3) One copy will be retained in City's Representative's file.
   c. If Data does not meet the condition of the Contract:
      (1) All copies will be returned to Contractor or Design-Builder with City's Representative's comments (on separate document) for revision.
      (2) City's Representatives comments will be retained in City's Representative's file.
      (3) Resubmit two copies revised in accordance with City's Representative's comments.

1.06 SEQUENCING AND SCHEDULING

A. Equipment and System Data:

1. Preliminary Data:
   a. Do not submit until Shop Drawings for equipment or system has been reviewed and approved by City's Representative.
   b. Submit prior to shipment.

2. Final Data: Submit instructional Manual Formatted data not less than 30 days prior to equipment or system field functional testing Submit Compilation Formatted and Electronic Media Formatted data prior to Substantial Completion of Project.

B. Materials and Finish Data:

1. Preliminary Data: Submit at least 15 days prior to request for final inspection.

2. Final Data: Submit within 10 calendar days after final inspection.

PART 2 - PRODUCTS

2.01 DATA FORMAT (for Original Equipment Manufacture Operations and Maintenance Manuals OEM O&Ms)

A. Prepare preliminary and final data in the form of an instructional manual. Prepare final data on electronic media and printed.

B. Instructional Manual Format:

1. Binder: Commercial quality, permanent, three ring or three post binder with durable plastic cover.
2. Size: 8 ½ inches by 11 inches minimum.
3. Cover: Identify manual with typed or printed title, "(relevant area) OPERATION AND MAINTENANCE MANUAL" and list.
   a. Project title.
   b. Designate applicable system, equipment, material, or finish.
   c. Identify the assets covered in this O&M Manual.
   d. Identify separate structure as applicable.
   e. Identify volume number if more than one volume.
   f. Identify of general subject matter covered in manual. Identity of equipment number and Specification section.
4. Spine:
   a. Project Title.
   b. Volume number (if more than one volume).
5. Title Page:
   a. Contractor name, address, and telephone number.
   b. Subcontractor, supplier, installer, or maintenance Contractor or Design-Builder's name, address, and telephone number, as appropriate.
      (1) Identify area of responsibility of each.
      (2) Provide name and telephone number of local source of supply of parts and replacement.
6. Table of Contents:
   a. Neatly typewritten and arranged in systematic order with consecutive page numbers.
   b. Identify each product by product name and other identifying numbers or symbols as set forth in Contract Documents.
7. Paper: 20 pound minimum, white for typed pages.
8. Text: Manufacturer's printed data, or neatly typewritten.
9. Three-hole punch data for binding and composition.
10. Material shall be suitable for reproduction, with quality equal to original. Photocopying of material will be acceptable, except for material containing photographs.

C. Data Compilation Format:

1. Compile all City's Representative's accepted preliminary O&M data into a hard copy, hard bound set.
2. Each set shall consist of the following:
   a. Binder: Commercial quality, permanent, three ring or three post binders with durable plastic covers.

b. Cover: Identify each volume with typed and printed title "OPERATION AND MAINTENANCE DATA, VOLUME NO. _____ OF _____", and list:
   (1) Project Title
   (2) Contractor's name, address, and telephone number.
   (3) If entire volume covers equipment or system provided by one supplier include the following:
      (a) Identity of general subject matter covered in manual.
      (b) Identity of equipment number and Specification section.

c. Provide each volume with title page and typed table of contents with consecutive page numbers. Place contents of entire set, identified by volume number, in each binder.

d. Table of contents neatly typewritten, arranged in a systematic order:
   (1) Include list of each product, indexed to content of each volume.
   (2) Designate system or equipment for which it is intended.
   (3) Identify each product by product name and other identifying numbers or symbols as set forth in Contract Documents.

e. Section Dividers:
   (1) Heavy, 80 pound cover weight, tabbed with numbered plastic index tabs.
   (2) Fly leaf:
      (a) For each separate product, or each piece of operating equipment, with typed description of product and major component parts of equipment.
      (b) List with each product:
         (i) Name, address, and telephone number of Sub-contractor, Supplier, Installer, and Maintenance Contractor or Design-Builder, as appropriate.
         (ii) Identify area of responsibility of each.
         (iii) Provide local source of supply for parts and replacement.

f. Assemble and bind material, as much as possible, in same order as specified in the Contract Documents.

D. Electronic Media Data:

1. Portable Document Format (PDF):
   a. After all preliminary data has been found to be acceptable to City's Representative, submit Operation and Maintenance data in PDF format on CD.
   b. Files to be exact duplicates of City's Representative's accepted preliminary data. Arrange by specification number, asset, and name.
   c. Files to be fully functional and viewable in most recent version of Adobe Acrobat.
   d. PDFs shall be bookmarked as appropriate with appropriate hyperlinks.
   e. All files shall be tagged per the City's Record File tagging system.

E. DATA FOR EQUIPMENT SYSTEMS (Original Equipment Manufacturer Operations and Maintenance Manuals OEM O&Ms):

1. Content for each Unit (or Common Units) and System:

2. Product Data:
   a. Include only those sheets that are pertinent to specific product.
   b. Clearly annotate each sheet to:
      (1) Identify specific product or part installed.
      (2) Identify data applicable to installation.

(3) Delete references to inapplicable information.

c. Function, normal operating characteristics, and limiting conditions.

d. Performance curves, engineering data, nameplate data, and tests.

e. Complete nomenclature and commercial number of replaceable parts.

f. Original manufacturer's parts list, illustrations, detailed assembly drawings showing each part with part numbers and sequentially numbered parts list, and diagrams required for maintenance.

g. Spare parts ordering instructions.

h. Where applicable, identify installed spares and other provisions for future work (e.g., reserved panel space, unused components, wiring, terminals).

3. As installed, color coded piping diagrams.

4. Charts of valve tag numbers, with the location and function of each valve.

5. Drawings: Supplement product data with drawings as necessary to clearly illustrate:

a. Format:

(1) Provide reinforced, punched, binder tab; bind in with text.

(2) Reduced to 8 ½ inches by 11 inches, or 11 inches by 17 inches folded to 8 ½ inches by 11 inches.

(3) Where reduction is impractical, fold and place in 8 ½ inch by 11 inch envelopes bound in text.

(4) Identify Specification section and product on drawings and envelopes.

b. Relations of component parts of equipment and systems.

c. Control and flow diagrams.

d. Coordinate drawings with Project record documents to assure correct illustration of completed installation.

6. Instructions and procedures: Within text, as required to supplement product data.

a. Format:

(1) Organize in consistent format under separate heading for each different procedure.

(2) Provide logical sequence of instructions for each procedure.

(3) Provide information sheet for Owner's personnel, including:

(a) Proper procedures in event of failure.

(b) Instances that might affect validity of guarantee or Bond.

b. Installation Instructions: Including alignment, adjusting, calibrating, and checking.

c. Operating Procedures:

(1) Startup, break-in, routine, and normal operating instructions.

(2) Test procedures and results of factory tests where required.

(3) Regulation, control, stopping, and emergency instructions.

(4) Description of operation sequence by control manufacturer.

(5) Shutdown instructions for both short and extended duration.

(6) Summer and winter operating instructions, as applicable.

(7) Safety precautions.

(8) Special operating instructions.

d. Maintenance and Overhaul Procedure:

(1) Routine maintenance.

(2) Guide to troubleshooting.

(3) Disassembly, removal, repair, reinstallation, and re-assembly.
(4) Recommended work orders for preventative maintenance.

7. Guarantee, Bond, and Service Agreement: In accordance with section 01019, "Closeout Procedures".

8. Standard Operating Procedures and Standard Instructions for each unit process in KCMO Water Services Format approved by the KCMO City's Representative and Utility and created by the engineer of record or an alternative acceptable to the KCMO City's Representative.

9. Assets covered in this document.

F. Content for each Electric or Electronic Item or System:

1. Description of Unit and Component Parts:
   a. Function, normal operating characteristics, and limiting conditions.
   b. Performance curves, engineering data, nameplate data, and tests.
   c. Complete nomenclature and commercial number of replaceable parts.
   d. Interconnection wiring diagrams, including control and lighting systems.
   e. Piping and Instrumentation Diagram of the unit.

2. Circuit Directories of Panelboards.

3. Electrical service.

4. Control requirements and interface.

5. Communication requirements and interfaces.

6. List of electrical relay settings, and control and alarm contact settings.

7. Electrical interconnection wiring diagram, including as applicable, single line, three line, schematic and internal wiring, tags per KCMO tagging standard and external interconnection wiring.

8. As installed control diagrams by control manufacturer.

9. Operating Procedures:
   a. Routine and normal operating instructions.
   b. Startup and shutdown sequences, normal, and emergency.
   c. Safety precautions.
   d. Special operating instructions.

10. Maintenance Procedures:
    a. Routine maintenance.
    b. Guide to troubleshooting.
    c. Adjustment and checking.
    d. List of relay settings, control, and alarm contact settings.
    e. Preventative Maintenance.

11. Manufacturer's printed operating and maintenance instructions.

12. List or original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

G. Maintenance Summary:

1. Complete individual Maintenance Summary for each applicable equipment item, respective unit or system, and for components or sub-units.

2. The Maintenance Summary form shall be updated to incorporate the final recommendations established through the Maintenance Workshops described in Section 01320 Construction Progress Documentation.

3. Format:
   a. Use Maintenance Summary Form bound with this section or electronic facsimile of such.
   b. Each Maintenance Summary may take as many pages as required.
   c. Use only 8 ½ inch by 11 inch size paper.
   d. Complete using typewritten or electronic printing.

4. Include detailed lubrication instructions and diagrams showing points to be greased or oiled; recommended type, grade, and temperature range of lubricants and frequency of lubrication.

5. Recommended Spare Parts:
   a. Data to be consistent with manufacturer's Bill of Materials/Parts List furnished in O&M manuals.
   b. "Unit" is the unit of measure for ordering the part.
   c. "Quantity" is the number of units recommended.
   d. "Unit Cost" is the current purchase price.

H. The type and quantity of spare parts provided shall be consistent with technical specifications.

2.02 DATA FOR MATERIALS AND FINISHES

A. Content for Architectural Products, Applied Materials, and Finishes:

1. Manufacturer's data, giving full information on products:
   a. Catalog number, size, and composition.
   b. Color and texture designations.
   c. Information required for reordering special manufactured products.
2. Instructions for Care and Maintenance:
   a. Manufacturer's recommendation for types of cleaning agents and methods.
   b. Cautions against cleaning agents and methods that are detrimental to product.
   c. Recommended schedule for cleaning and maintenance.

B. Content for Moisture and Weather Exposed Products:

1. Manufacturer's data, giving full information on products:
   a. Applicable standards.
   b. Chemical composition.
   c. Details of installation.
2. Instructions for inspection, maintenance, and repair.

2.03 COMPLETE ASSET/CMMS DATA:

1. Owner will provide a template for machine reading assets and maintenance activities into the Owner's Computerized Maintenance Management System (CMMS).

2. Access database template will be blank with fields for assets information such as asset additions, asset updates, asset retirements including a rough estimated value, maintenance activities for the assets, PID tags within the asset, and asset categorization.

3. Contractor or Design-Builder shall fill out the template documenting changes in the CMMS; insert asset additions including value, updates and retired assets including estimated value when taken out of service; work order updates; new PMs; PMs to be retired; non-destructive testing updates; and other asset fields. Assets shall be coordinated and categorized with the applicable CMMS takes for entry into Owner's CMMS and Financial Software.

2.04 PROGRAMS

A. PLC, VFD, and SCADA Programs: Provide current native format copies of all software programs used to control assets.

1. Files should be named per asset equipment IDs, systems, or sub systems as appropriate.

2.05 SUPPLEMENTS

A. The supplements listed below, following "End of Section", are part of this Specification.

1. Forms: Asset Maintenance Summary Form.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

ASSET MAINTENANCE SUMMARY FORM

PROJECT _____ CONTRACT NO _____

KCMO CMMS TAG _____

EQUIPMENT ITEM _____

MANUFACTURER _____

PID/TAG NUMBERS _____

WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS) _____

NAMEPLATE DATA (hp, voltage, speed, etc.) _____

MANUFACTURER'S LOCAL REPRESENTATIVE _____

Name _____ Telephone Number _____

Address _____

MAINTENANCE REQUIREMENTS

Maintenance Operation Comments	Frequency	Lubricant (if applicable)
List briefly each maintenance operation required and refer to specific information in manufacturer's standard maintenance manual, if applicable. (Reference to manufacturer's catalog or sales literature is not acceptable)	List required frequency of each maintenance operation	Refer by symbol to lubricant required

LUBRICANTS

Reference Symbol	Shell	Exxon Mobil	Chevron Texaco	BP Amoco	or Equal

RECOMMENDED SPARE PARTS FOR OWNER'S INVENTORY

Part Number	Description	Unit	Quantity	Unit Cost
Note: Identify parts provided by this contract with two asterisks				

SECTION 01110 – SUMMARY OF WORK

PART 1 GENERAL

1.01 LOCATION OF WORK

A. The work of this Contract is located at the property surrounding the coordinates below:

Latitude 39º 21’ 20.45” North
Longitude 94º 40’ 13.33” West

as well as at the existing Todd Creek WWTP at 7600 NW 144th Street, Kansas City, MO 64163.

1.02 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and construct the Todd Creek Facility Plan Update Project in its entirety as shown on the Drawings and as specified herein for a fully functioning system.

B. The Work includes, but is not necessarily limited to, the following:

1. Construction of a new 4.6 MGD Todd Creek Wastewater Treatment Plant, including:
   a. Gravity sewer and control structures to route flow to new facilities
   b. Coarse Screen channel and building
   c. Chemical feed equipment
   d. Influent pump station and electrical building
   e. Influent force main
   f. Headworks building
   g. Aerated granular sludge (AGS) basins and associated structures
   h. Blower building
   i. UV Disinfection Building
   j. Cascade aeration structure
   k. Solids Process building
   l. Effluent gravity line and outfall
   m. Administration Building
   n. Site civil improvements including roads, fencing, grading, stormwater management
   o. Site SCADA and cybersecurity
   p. Water line extension to provide potable water
   q. All related equipment, piping, valving and instrumentation

2. Abandonment of existing sludge holding cells in compliance with MDNR and KCMO regulations. Final grading and seeding in and adjacent to the holding cell footprint

3. Removal of existing bridge across Todd Creek and installation of erosion control systems in its place.

4. Demolition of the existing Todd Creek WWTP building, tanks, outfall, fencing and structures. Abandonment of existing buried structures and utilities. Backfill, final grading, and seeding of the existing WWTP footprint.

5. Training, startup and commissioning activities to place the new facilities into service.

a. This includes providing AGS seed sludge for AGS basins as a part of the startup and commissioning activities.

1.03 WORK SEQUENCE

A. Construction of new facilities and tie-in to existing sanitary sewer.

B. Startup and commissioning of new facilities.

C. Demolition of existing sludge holding cells

D. Removal of Todd Creek bridge

E. Demolition of existing Todd Creek WWTP

F. Regrade and seeding of demo and abandoned areas of existing facilities.

1.04 CONTRACTOR'S USE OF PREMISES

A. Contractor shall limit the use of the premises for his/her Work and for storage to allow for:

1. Work by other agencies.

2. Owner occupancy.

3. Public use.

B. Coordinate use of premises with Owner.

C. Contractor shall assume full responsibility for security of all his/her and his/her subcontractors materials and equipment stored on the site.

D. If directed by the Owner, move any stored items which interfere with operations of Owner or other contractors.

E. Obtain and pay for use of additional storage or work areas if needed to perform the Work.

1.05 OWNER OCCUPANCY

A. Owner will occupy premises during performance of the Work for the conduct of his/her normal operations. Coordinate all construction operations with Owner to minimize conflict and to facilitate Owner usage.

1.06 CONSTRUCTION COORDINATION

A. Activities by Others which may affect performance of the Work:

1. CITY will use an existing IDIQ contract for dewatering of all tanks and basins at the existing Todd Creek WWTP as well as cleaning out sludge from the existing sludge holding cells. Coordinate with CITY regarding schedule for interconnection work and demolition work.

B. Contractor shall coordinate with the Owner regarding scheduling and sequence of work.

END OF SECTION

SECTION 01140 – WORK RESTRICTIONS

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes: Requirements for sequencing and scheduling the Work affected by existing site and facility; work restrictions; and coordination between construction operations and plant operations.

1.02 SUBMITTALS

A. Baseline Schedule with OCCP tasks.
B. Operational Change Control Plan (OCCP) Form.
C. Progress Schedule with OCCP tasks.

1.03 GENERAL CONSTRAINTS ON SEQUENCE AND SCHEDULING OF WORK

A. Wastewater projects:
    1. The Todd Creek Wastewater Treatment Plant is the City's only means of treating sewage for the designated service area prior to discharging to the Missouri River. Impairing the operational capabilities of this treatment plant will result in serious environmental damage and monetary fines.
    2. Conduct Work in a manner that will not impair the operational capabilities of essential elements of the treatment process or reduce the capacity of the entire treatment plant below levels sufficient to treat the quality of raw wastewater to the water quality limitations specified in the discharge permit. 3. Conduct commissioning and process start-up activities as specified in Section 01757 - Commissioning in a manner that will not impair the operational capabilities of essential elements of the treatment process or reduce the capacity of the entire existing treatment plant below levels sufficient to treat the quality of raw wastewater to the water quality limitations specified in the discharge permit.
    3. The status of the new treatment plant shall be defined as "operational" when it is capable of treating the entire quantity of wastewater received at the Todd Creek WWTP to the water quality limits specified in the discharge permit.
B. Work sequence and constraints:
    1. Utilize description of critical events in work sequence in this Section as a guideline for scheduling and undertaking the Work.
    2. Work sequence and constraints presented do not include all items affecting completion of the Work, but are intended to describe critical events necessary to minimize disruption of the existing facilities and to ensure compliance with National Pollutant Discharge Elimination System (NPDES) permit requirements.
C. Instrumentation and controls process performance testing:
    1. After the Process Operational Period, test PCIS system as specified in Section 01757 - Commissioning.

1.04 SHUTDOWN AND CONSTRUCTION CONSTRAINTS

A. Normal working hours:
    1. Construction will take place during normal working hours as defined:
        a. 7AM to 6PM Monday through Friday.

b. Refer to 0700 General Conditions Section 6.03 for further restrictions.

B. Construction Operations and Safety Constraints
   1. In recognition of nearby property owners concerns with construction activities, the following restrictions shall be adhered to unless otherwise accepted by the Owner in writing:
      a. Vehicle access for the demolition of the existing plant shall be through NW 144th Street. Access shall not be permitted off of Todd Creek Road.
      b. Vehicle and motorized equipment on site shall include backup/reverse alarms that utilize a "white noise" system rather than the more typical "beeper" system. The system should be in compliance with OSHA requirements for this type of safety device.

C. General shutdown constraints:
   1. Execute the Work while the existing facility is in operation.
   2. Some activities may be accomplished without a shutdown.
   3. Apply to activities of construction regardless of process or work area.
   4. Activities that disrupt plant or utilities operations must comply with these shutdown constraints.
   5. Organize work to be completed in a minimum number of shutdowns.
   6. Provide thorough advanced planning, including having required equipment, materials, and labor on hand at time of shutdown.
   7. Notify the City at least 30 days in advance of any tasks that will require dewatering and cleaning to allow the City the appropriate amount of time to conduct the work.
   8. Where required to minimize treatment process interruptions while complying with specified sequencing constraints, provide temporary pumping, power, lighting, controls, instrumentation, and safety devices.
   9. Final determination of the permitting of shutdowns will be the sole judgment of the Owner.
   10. Owner maintains the ability to abort on the day of the scheduled shutdown or to hold at any hold point.

D. Unit process availability work limitations:
   1. Shutdowns and tie-ins or other activities that disrupt plant operations shall not occur if the following conditions exist unless approved by the OWNER in writing, or specified in 01140.01 Process and System Shutdown Constraints Schedule:
      a. Rainfall has occurred in the 2 days preceding the shutdown.
      b. Rainfall is forecast for more than 3 of the first 14 days of the shutdown period.

E. Shutdown activities:
   1. Scheduling:
      a. Perform between the hours of 10 p.m and 4 a.m. unless otherwise specified herein or as approved by Owner.
   2. Unplanned shutdowns due to emergencies are not defined in this Section.

F. Dewatering of existing process and disposal of residue:
   1. When the Owner has turned the process unit over to the Contractor for modification or temporary use, the Contractor is responsible for costs and procedures required to dewater and dispose of liquid, solids, etc. in the process unit unless the Owner has made prior arrangements.
      a. Drainage and disposal of process unit liquids, solids, etc. into another treatment process unit on the plant site may be allowed if approved in advance by the Engineer and Owner and is conducted in accordance with the Project requirements.

b. Costs for dewatering, disposal of solids and residuals, and preparation of surfaces for the Work are Contractor's responsibility.
    (1) Includes tipping fees for the removal and disposal of the grit/debris.
c. Dewatering of grit/debris to meet landfill requirements is the responsibility of the Contractor.
d. Contractor shall provide adequate time in schedules for draining and cleanup of basins and channels.

G. Refer to the Process and System Shutdown Constraints Schedule in Section 01140.01 for additional requirements.

1.05 OPERATIONAL CHANGE CONTROL PLAN (OCCP)

A. Refer to Section 01140.02 - Operational Change Control Plan (OCCP) Documents for additional requirements.
B. Submit Baseline Schedule, as specified in Section 01320 – Construction Progress Documentation.
C. No consideration will be given to claims of additional time and cost associated to preparing OCCPs required by the Owner and Engineer to complete this work in a manner that facilitates proper operation of the facility and compliance with effluent discharge criteria.
D. Where required to minimize treatment process interruptions while complying with specified sequencing constraints, provide temporary pumping, power, lighting, controls, instrumentation, and safety devices.
E. OCCPs are required whenever an existing asset or a new asset that could affect treatment or conveyance are modified including but not limited to set points and operational modes.

1.06 COMPLIANCE WITH NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT

A. The existing facility is operating under the terms of a NPDES permit issued by the State of Missouri. This permit specifies the water quality limits that the plant must meet prior to discharge of effluent. A copy of the existing permit (Missouri State Operating Permit No. MO-0024961) is on file for review at the Administration Building at the Todd Creek WWTP. The facility includes a biological process that may require extended periods of acclimation after a shutdown or other impact before it can reasonably be expected to perform as intended. Contractor will include adequate acclimation time as a part of any construction activity.
B. Perform work in a manner that will not prevent the existing facility from achieving the finished water quality requirements established by regulations.
C. Bear the cost of penalties imposed on the Owner for discharge violations caused by actions of the Contractor.

1.07 REQUIREMENTS FOR OPERATION OF PLANT AND MAINTAINING CONTINUOUS OPERATION OF EXISTING FACILITIES

A. Facilities or conditions required to keep the existing plant operational include, but are not limited to, the following:
    1. Influent gravity sewer
    2. Influent screening and pumping
    3. Blowers
    4. Aeration basins and clarifiers

5. RAS/WAS pump station
6. UV disinfection system
7. Existing outfall

B. Contractor shall protect existing grating with steel traffic plate or other Engineer approved means when moving equipment or supplies over grating.
C. Maximum allowable superimposed live load on any existing grating or walkway shall be 50 psf. If higher loads are proposed, provide detailed calculations demonstrating adequacy of grating or walkway system for higher loads. The calculations shall be sealed and signed by a registered professional engineer and submitted to the Engineer for review and acceptance.

1.08 OPERATION AND MAINTENANCE ACCESS

A. Provide safe, continuous access to process control equipment for plant operations personnel.

1.09 COORDINATION OF THE WORK

A. Maintain overall coordination of the Work.
B. Obtain construction schedules from subcontractors and suppliers and assume responsibility for correctness.
C. Incorporate schedules from subcontractors and suppliers into Progress Schedule to plan for and comply with sequencing constraints.

1.10 WORK BY OTHERS

A. Where proper execution of the Work depends upon work by others, inspect and promptly report discrepancies and defects.

1.11 UTILITIES

A. Provide advance notice to request and utilize services of the Missouri One Call System (www.mo1call.com or 1-800-344-7483 (DIG-RITE)) for location and marking of underground utilities operated by utility agencies other than the Owner.
B. Maintain electrical, telephone, water, gas, sanitary facilities, and other utilities within existing facilities in service. Provide temporary utilities when necessary.
C. New yard utilities were designed using existing facility drawings.
    1. Field verification of utilities locations was not performed during design.
    2. Services crossed or located nearby new yard utilities may require relocation and possible shutdowns.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 PROCESS AND SYSTEM SHUTDOWN CONSTRAINTS SCHEDULE

A. Refer to the Process and System Shutdown Constraints Schedule in Section 01140.01 for constraints on process and system shutdowns.
B. Requests for variance from any part of this schedule must be approved in writing by the OWNER.
C. The planned date of shutdown as listed on the Operational Change Control Plan (OCCP) form shall be considered the start date for the shutdown and used for calculating the actual shutdown duration, unless approved in writing by the OWNER. In the event that the OWNER can shut down a system or

process prior to the planned date of shutdown and the CONTRACTOR agrees to commence work at that earlier date, the date that the CONTRACTOR commences work on the associated process or system shall be considered the start date for the shutdown and for calculating the actual shutdown duration.

D. These constraints are intended to supplement the demolition, modification, tie-in, and construction activities and constraints described in Article 1.12 of this Section.

End of Section

01140.01 - PROCESS AND SYSTEM SHUTDOWN CONSTRAINTS SCHEDULE

PART 1 GENERAL

1.01 SUMMARY

A. Section includes: Information on the shutdown constraints for each of the major processes.

1.02 DEFINITIONS

A. Maximum Shutdown Duration: The maximum allowable time in calendar days (unless otherwise noted) that a process and its associated piping, valves, channels, gates, etc. may be removed from service to perform the required work on that process.

B. Minimum Time Between Shutdowns: The minimum amount of time in calendar days (unless otherwise noted) between consecutive shutdowns of a process and its associated piping, valves, channels, gates, etc. 3.

C. Maximum Number of Shutdowns: The maximum number of times that a process and its associated piping, valves, channels, gates, etc. may be removed from service to perform the required work on that process. In cases where only one (1) shutdown is allowed, a value has been listed in the "Minimum Time Between Shutdowns" column to provide guidance if additional shutdowns are determined to be required.

D. Seasonal Shutdown Constraint: The approximate time period during which a process shall remain in service and no work shall be performed on that process.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 PROCESS AND SYSTEM SHUTDOWN CONSTRAINTS SCHEDULE

A. The Process and System Shutdown Constraints Schedule is presented on the following pages.

B. Requests for variance from any part of this schedule must be approved in writing by the OWNER.

C. The planned date of shutdown as listed on the Operational Change Control Plan (OCCP) form shall be considered the start date for the shutdown and used for calculating the actual shutdown duration, unless approved in writing by the OWNER. In the event that the OWNER can shut down a system or process prior to the planned date of shutdown and the CONTRACTOR agrees to commence work at that earlier date, the date that the CONTRACTOR commences work on the associated process or system shall be considered the start date for the shutdown and for calculating the actual shutdown duration.

D. These constraints are intended to supplement the demolition, modification, tie-in, and construction activities and constraints described in Section 01140 - Work Restrictions.

PROCESS AND SYSTEM SHUTDOWN CONSTRAINTS SCHEDULE					
Phase 1 of Work Sequence	**Maximum Shutdown Duration**	**Minimum Time Between Shutdowns**	**Maximum Number of Shutdowns**	**Seasonal Shutdown Constraints**	**Notes**
Tie-In to existing gravity sewer	As necessary	As necessary	2	NA	Bypass pumping may be required. Refer to 33 01 30.19

General Notes:

(1) NC = No Constraints

(2) NA = Not Applicable

Notes:

(1) Shutdown of this process, system, or equipment is restricted to between the hours of 10 p.m. and 4 a.m.

(2) Shutdown of this process, system, or equipment shall not occur at the same time as other items having this note.

(3) Shutdowns and tie-ins or other activities that disrupt plant operations shall not occur if the following conditions exist:

a) Rainfall has occurred in the 2 days preceding the shutdown

b) Rainfall is forecast for more than 3 of the first 14 days of the shutdown period.

END OF SECTION

KC WATER

WASTEWATER TREATMENT DIVISION
7300 Hawthorne Road • Kansas City, MO 64120
P: 816-513-7200 • F: 816-513-7271 • www.kcwater.us

Operational Change Control Plan (OCCP) Version 8

OCCP Number & Title (The OCCP number will be provided by the Division OCCP Coordinator)

OCCPs ARE REQUIRED TWO WEEKS IN ADVANCE OF THE ANTICIPATED WORK

This version is being provided as a Word document to enable editing within the document.

Do not delete any sections. Note if a section is not applicable to the proposed work.

Instructions are provided at the beginning of each section. READ THESE CAREFULLY. Provide the information requested. The submitted document is to include this title page.

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1. Date	
2. Version (use modifier starting with A at end of OCCP number when document changes substantially)	
3. OCCP Number	
4. Facility Name/ Facility ID	
5. Project Execution Start Date	

6. Description of Works (provide a brief summary of the work to be performed)

7. Key Plan information (hold points are those points at which work will be halted and operations returned to usual and customary conditions and is not a description of the work to be performed)

Description of Hold Point 1	
Description of Hold Point 2	
Description of Hold Point 3	
Description of Hold Point 4	
Description of Hold Point 5	
Description of Hold Point 6	
Description of Hold Point 7	
Description of Hold Point 8	

8. **Significant Dates** **(this section keys around the OCCP development to include a meeting with WTD staff to define operational collaboration)**

Project is scheduled to start no earlier than (insert date here)	
Action	**Date**
OCCP Initial Development no later than:	
OCCP Final no later than:	
OCCP Coordination Meeting no later than:	
Other as needed:	
Other as needed:	

9. **Project Milestones/Execution Steps** **(define the major work steps and attach a schedule for the work if so developed specifically for this OCCP project)**

Step	**Action and Date (may include start date + X if start is unknown at the time of OCCP development**

Step	Action and Date (may include start date + X if start is unknown at the time of OCCP development

10. Works to be completed prior start of OCCP (this will result from the initial OCCP meeting)

Operational Condition	Contingency Action

11. Contingency Actions (these actions result from plans in the event of adverse project impacts)

Mode of Failure/Incident	Contingency Action

12. Job Hazard Analysis (define any hazards to be encountered that are not usual and customary)

Hazard	Mitigation

13. Affected monitoring points and impact

a. **Usual sample locations affected by this operation** (this will result from the initial OCCP meeting)

Description of Element	How is it Affected

b. **Special location(s) established for this operation** (this will result from the initial OCCP meeting)

Description of Location	Describe Revised Procedure

c. **Treatment Process Affected** **(define which process will be impacted and how any alternate or interim operation will be implemented)**

Process Description	Describe Alternate or Interim Operation

d. Alarm Modifications

Alarm name	Alarm Value	Replacement	How Does it Operate?

e. Environmental Spill Risks

Description of Spill Risks	Mitigating Controls

14. Wastewater Quality Impacts

Description of Impact	How It Will Be Managed

15. External Stakeholders To Be Notified (these include neighboring residential and businesses)

Individual or Entity	Name and Phone Number

16. Contractor OCCP Development and Sign Off (these include the prime and any subs performing the work and to ensure all contractor teams are aware of the work plan)

Name and Title	Signature

17. WWTD OCCP Final Authorization and Approval (to include the WTD chain of command from the CPO to the Division Manager and a senior representative from each contractor team)

Name	Title	Signature	Date

SECTION 01210 - ALLOWANCES

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Listing of allowance items:
      a. Related responsibilities of Contractor and procedures.

1.02 ALLOWANCE AMOUNTS

A. Include following amounts in Contract Price:
   1. Evergy Primary Circuit Buildout: $4,250,000.
   2. Unforeseen Site Conditions and Hazardous Materials Disposal: $250,000.
   3. Administration Building Furniture: $500,000.

1.03 COSTS INCLUDED AND EXCLUDED IN ALLOWANCES

A. Costs included in allowances for furnishing products only:
   1. Net cost of product.
   2. Delivery and unloading at site.
   3. Applicable taxes and fees.

B. Costs included in Contract Price, but not included in allowances for furnishing products only:
   1. Handling at site, including uncrating and storage.
   2. Protection from elements, theft, and damage.
   3. Labor, installation, testing, and finishing.
   4. Other expenses required to complete installation.
   5. Overhead and profit.

C. Costs included in allowances for furnishing and installing products:
   1. Net cost of product.
   2. Delivery and unloading at site.
   3. Applicable taxes.
   4. Handling at site, including uncrating and storage.
   5. Protection from elements and from damage.
   6. Labor, installation, testing, and finishing.
   7. Other expenses required to complete installation.

1.04 DUTIES OF CONTRACTOR IN PROVIDING PRODUCTS BY ALLOWANCE

A. Advise Engineer at least 60 days in advance of purchase date necessary to avoid impacts to Progress Schedule.

B. Obtain proposals from suppliers, including:
   1. Quantity.
   2. Complete description of product and services provided under allowance.
   3. Unit cost.
   4. Total amount of purchase.
   5. Taxes and delivery charges.

C. On notification of selection, enter into purchase agreement with designated supplier.

D. Arrange for delivery and unloading.

E. Install products in accordance with Contract Documents.

1.05 ADJUSTMENT OF COSTS

A. When actual cost is more or less than amount of allowance, Contract Price will be adjusted by Change Order.

1.06 ALLOWANCES

A. Evergy Utility Installation. The scope of work associated with EVERGY is as follows:
   1. Provide and install all overhead power poles and cable and buried power cables and conduits, from the property line to the electrical transformers and provide and install all medium-voltage, three-phase, pad mounted transformers, power metering units, and all associated primary cable and terminations. The transformers will be installed by Evergy on Contractor installed transformer pads on the at grade. Evergy shall also perform all primary terminations to the transformers. The Contractor shall be responsible for construction of all conduit and cable for secondary terminations and shall perform all terminations not otherwise performed by Evergy. Prior to installing the transformers, Evergy will inspect the pads and conduit system installed by the Contractor. The cost of the power poles, primary cables, transformers, meters, and terminations shall be reimbursed directly to Evergy by the Contractor through the allowance.
   2. The Contractor shall be responsible for coordinating and scheduling the delivery and installation of the power poles, primary cables, conduit, and transformers by Evergy, including but not limited to obtaining delivery schedules for equipment from Evergy and incorporating these schedules into the overall project schedule described in the Construction Progress Documentation section.
   3. Owner shall provide the easement required for the installation of the overhead and buried power lines at the site.
   4. Requirements and responsibilities for providing primary conductors, CT's, meter connections, and transformers shall be as listed within these specifications and as indicated on the Contract Drawings.

B. Unforeseen Site Conditions and Hazardous Materials
   1. If, during the progress of the Work, previously unidentified Hazardous Environmental Conditions are identified, Contractor shall stop work in the affected area and immediately notify the Owner and Engineer in accordance with the

requirements in the General Conditions. At the Owner's discretion, the Owner may instruct the Contractor to engage an abatement Subcontractor qualified to perform abatement of the suspected Hazardous Environmental Condition identified, to verify the materials and, if necessary, encapsulate, enclose, or remove and dispose of all ACM, Metal Bearing Protective
Coatings, Paints, and Linings, Contaminated Environmental Media, and/or other Hazardous Substances in accordance with current regulations of the Environmental Protection Agency and the U. S. Department of Labor - Occupational Safety and Health Administration, the applicable state regulating agency, and any local government agency. Payment for such work will be made by the Hazardous Material Disposal Allowance contained within the Bid Form or by Change Order.

2. The Contractor shall use a State of Missouri licensed abatement subcontractor to perform the Work. An independent third party that is accredited by the State of Missouri shall perform any monitoring and clearance. The independent third party shall be onsite during the Work associated with encapsulating, enclosing, or removing and disposing of all ACM, Metal Bearing Protective Coatings, Paints, and Linings, Contaminated Environmental Media, and/or other Hazardous Substance.

C. Administration Building Furniture

1. Includes, furniture, bookshelves, chairs, tables etc. for the project's Administration Building, exclusive of built-in cabinets and countertops shown and specified in the contract documents.

2. Also includes whiteboards, signage, and non-consumable supplies needed in the Administration Building where not otherwise specified in the contract documents.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

ALLOWANCE AUTHORIZATION

Project/Contract Numbers: 81000927/1698

Project Title: Todd Creek Expansion & Major Upgrades

To: _____ Authorization Number: _____
_____ From: _____
Re: _____ Date: _____
_____ Contract For: _____

You are authorized to perform the following item(s) of work and to adjust the Allowance Sum accordingly:

This is NOT a CHANGE ORDER and does NOT INCREASE OR DECREASE the CONTRACT AMOUNT.

Original Allowance	$_____
Allowance Expenditures prior to this Authorization	$_____
Allowance Balance prior to this Authorization	$_____
Allowance will be [❑ increased] [❑ decreased] by this Authorization	$_____
New Allowance Balance	$_____

APPROVAL RECOMMENDED

_____
Design Professional Date

_____
Construction Manager Date

CITY APPROVAL

_____
City's Representative Date

CONTRACTOR ACCEPTANCE

_____
Contractor Date

❑ Attachments:

Distribution:
- ❑ City
- ❑ Contractor
- ❑ Construction Manager
- ❑ Design Professional
- ❑ Consultant
- ❑ Other

CITY OF FOUNTAINS
HEART OF THE NATION
KANSAS CITY
MISSOURI

APPLICATION FOR PAYMENT

Project Number 81000927

Project Title Todd Creek WWTP Expansion & Major Upgrade

Final Payment[5] ☐

CONTRACTOR

Address

Application Number[2]:
Date:
Ordinance/Resolution Number:
Effective:
PO Number
Vendor Number

Application for Work Accomplished from _____ to _____

Original Contract Price		[1]			$	-
Net by Change Orders___through___				[2]	$	-
Current Contract Price (1+2)				[3]	$	-
Completed Work		[4]				
Disputed Amounts[3]	[-]	[4a]	$ -			
Stored Material[4]		[5]	$ -			
Disputed Amounts[3]	[-]	[5a]	$ -			
Total Completed and Stored to Date (4+5)				[6]	$	-
Previous Payments		[7]				
Previous Retainage		[8]				
Total Previous Applications (7+8)				[9]	$	-
Amount This Application (6-9)				[10]	$	-
Less Retainage This Application (5%)				[-] [11]	$	-
Release of Retainage				[12]	$	-
Total Due This Application (10-11+12)				[13]	$	-
Liquidated Damages						
Completion of Work		[14]	$ -	[-]	$	-
Prevailing Wage[7]		[15]	$ -	[-]	$	-
MBE/WBE Program[7]		[16]	$ -	[-]	$	-
Workforce Program[7]		[17]	$ -	[-]	$	-
Total Amount Due Contractor (13 - 14 through 17)				[18]	$	-

Accompanying Documentation: [1, 2, 3, 4, 5, & 6] and any other information as necessary.

NOTE: Initial all figures on this Application and on the Schedule of Values that are changed to correct errors or conform to the amount recommended. Attach explanation of changes that have been made.

CONTRACTOR's Certification:

The undersigned CONTRACTOR certifies that (a) all previous progress payments received from OWNER on account of Work done under this Contract have been applied on account to discharge CONTRACTOR's legitimate obligations incurred in connection with Work covered by all prior Applications for Payment; (b) at time of payment, title of all Work, materials and equipment incorporated into said Work or otherwise listed in or covered by this Application for Payment will pass to OWNER free and clear of all Liens, security interests and encumbrances (except such as are covered by a Bond acceptable to OWNER indemnifying OWNER against any such Lien, security interest or encumbrance); and (c) all Work covered by this Application for Payment is in accordance with the Contract Documents and not defective; and (d) all manufactured goods or commodities used or supplied for this Project are in compliance with Kansas City's Buy America ordinance.

_____ By _____ _____

Contractor | Authorized Representative (Print) | Signature

Date_____

State of)
)SS
County of)

Subscribed and Sworn to before me this _____ day of _____, _____ .

My commission expires:

_____ Notary Public: _____

DESIGN PROFESSIONAL's Recommendation of Payment:

In accordance with the Contract Documents, based on on-Site observations and the data comprising this application, the DESIGN PROFESSIONAL recommends to the OWNER that to the best of the DESIGN PROFESSIONAL's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the CONTRACTOR is entitled to payment of the Amount above listed in this application.

Name of firm (Print)	DESIGN PROFESSIONAL (Print)	(Signature)

Date: _____

Construction/Program Manager's Recommendation of Payment: (if applicable)

In accordance with the Contract Documents, based on on-Site observations and the data comprising this application, the Construction/Program Manager recommends to the OWNER that to the best of the Construction/Program Manager's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the CONTRACTOR is entitled to payment of the Amount above listed in this application.

Construction/Program Manager firm (Print)	Authorized Representative (Print)	(Signature)

Date: _____

City's Representative's Agreement with Recommendation of Payment

City's Representative(print)	(Signature)	(Date)

City's Approval

The amount previously recommended is approved for payment.

Director or Designee (Print)	(Signature)	(Date)

[1]See General Conditions Article 14.02 A and B

[2]Proof of tax compliance if 1st payment and if Contract amount exceeds $150,000.00

[3]Schedule of Values–Denote any amounts currently disputed in this application. Attach additional dispute documentation if required.

[4]If requesting payment for stored materials, see General Conditions Article 14.02 A.1

[5]If final payment, current proof of tax compliance if Contract is longer than 1 year and amount exceeds $150,000.00.

[6] Per General Conditions Sec. 14.02 attach a copy of the most recent 00485.01 M/WBE Monthly Utilization Report, 00485.02 Project Workforce Monthly Report and 00485.03 Company-Wide Workforce Monthly Report CONTRACTOR has submitted to the City's Human Relations Department

[7]Applicable only if final payment

REMINDER: CONTRACTOR is responsible for meeting or exceeding the the D/M/WBE participation amounts in its Contractor Utilization Plan (CUP) as amended by any previously approved Request for Modification/Substitution. Any Change Orders or amendements modifying the amount CONTRACTOR is to be compensated will have correspondingly impacted the amount of compensation due D/M/WBEs for purposes of meeting or exceeding the Bidder/Proposer participation. CONTRACTOR is again reminded to consider the effect of any Change Order or amendment, and to submit a Request for Modification/Substitution if appropriate.

Distribution: Owner, Contractor, Construction Manager, Project Manager, Design Professional

SCHEDULE OF VALUES

Project Number 81000927

Project Title Todd Creek WWTP Expansion & Major Upgrades

HRD APPROVED CUP		
MBE	**WBE**	**DBE**
$0.00	$0.00	$0.00
%	**%**	**%**

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
SPEC SECTION	UNIT PRICE CONTRACTS			DESCRIPTION OF WORK UNIT ITEM DESCRIPTION	$ UNIT PRICE	NO. OF UNITS	$ TOTAL OR LUMP SUM	UNITS COMPLETE	$ COMPLETED WORK	$ STORED MATERIAL	$ TOTAL COMPLETED AND STORED TO DATE		TOTALS TO DATE			% AT BOTTOM	$ TOTAL PREVIOUS APPLICATIONS	$ AMOUNT THIS APPLICATION L-R
	UNIT ITEM NO.	UNIT	ESTIMATED QUANTITY								$ J+K	% J/H	$ MBE	$ WBE	$ DBE			
																P/L		
																O/L		
																N/L		

CITY OF FOUNTAINS
HEART OF THE NATION
KANSAS CITY
MISSOURI

SUBCONTRACTORS AND MAJOR MATERIAL SUPPLIERS LIST

Project Number 81000927
Project Title Todd Creek WWTP Expansion & Major Upgrades

From Contractor _____ To _____ Date _____

Spec. No.	Section Title	4	Firm, Address (Check box if Supplier)	Phone, FAX and e-mail	Contact

❑ Attachments:

Signed by: _____ Date _____

Distribution: ❑ Owner ❑ Contractor ❑ Construction Manager ❑ Design Professional ❑ Consultant ❑ Other

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

DAILY LABOR FORCE REPORT

Project Number 81000927 Day _____ Date _____
Project Title Todd Creek WWTP Expansion & Major Upgrades
Contractor _____
Subcontractor _____

Weather: (Indicate if weather prevented work and why) _____
_____
_____

Shift: (circle) 5–8 hr Days 4–10 hr Days Other _____

* This report *MUST be completed and turned in* for EACH DAY until FINAL COMPLETION.

Worker's Full Legal Name	**Occupational Title or Classification Group & Skill**	**Hours Worked & Time (i.e. 10AM – 4PM)**	**Race & Gender**

I CERTIFY THAT ALL OF THE INFORMATION PROVIDED ABOVE IS TRUE AND COMPLETE.
Contractor/Subcontractor Representative:

Complete Name: (print) _____ Title: (print) _____

Signature: _____ Page ____ of ____

Distribution: ❑ City Department ❑ Contractor ❑ Subcontractor ❑ Other

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

CERTIFICATE OF SUBSTANTIAL COMPLETION

Project Number 81000927

Project Title Todd Creek Facility Plan Update

CONTRACT FOR: _____

CONTRACTOR: _____

DATE OF ISSUANCE: _____

PROJECT OR DESIGNATED PORTION SHALL INCLUDE:

The Work performed under this Contract has been reviewed and found, to the Design Professional's and/or Construction Manager's best knowledge, information and belief, to be substantially complete. Substantial Completion is the state in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so the Owner can occupy or utilize the Work for its intended use. The date of Substantial Completion of Project or portion thereof designated above is hereby established as _____ which is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below:

A list of items to be completed or corrected is attached hereto. The failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

CONSTRUCTION MANAGER	BY	DATE
DESIGN PROFESSIONAL	BY	DATE

The Contractor will complete or correct the Work on the list of items attached hereto within _____ days from the above date of Substantial Completion.

CONSTRUCTION MANAGER	BY	DATE
DESIGN PROFESSIONAL	BY	DATE

The Owner accepts the Work or designated portion thereof as substantially complete and will assume full possession thereof at _____ (time) on _____(date).

OWNER'S REPRESENTATIVE	BY	DATE

Distribution:
- ❑ Owner
- ❑ Contractor
- ❑ Construction Manager
- ❑ Design Professional
- ❑ Consultant _____
- ❑ Other _____

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

PUNCH LIST

Project Number 81000927

Project Title Todd Creek WWTP Expansion & Major Upgrades

CONTRACTOR _____

From _____ Site Visit Date _____

The following items require the attention of the CONTRACTOR for completion or correction. This list may not be all-inclusive, and the failure to include any items on this list does not alter the responsibility of the CONTRACTOR to complete all Work in accordance with the Contract Documents.

Item No.	Location (Area)	Description	Correction/ Completion Date	Verification Check

❑ Attachments

Signed by: Date:

DESIGN PROFESSIONAL (Firm/In House)

Distribution:
- ❑ OWNER
- ❑ CONTRACTOR
- ❑ DESIGN PROFESSIONAL
- ❑ Consultant _____
- ❑ Other _____

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

CONTRACTOR AFFIDAVIT FOR FINAL PAYMENT

Project Number 81000927

Project Title Todd Creek WWTP Expansion & Major Upgrades

STATE OF _____)
)SS
COUNTY OF _____)

The Undersigned, _____ of lawful
(Name)
age, being first duly sworn, states under oath as follows:

1. I am the _____ of _____who is the general
(Title) (CONTRACTOR)
CONTRACTOR for the CITY on Project No. _____ and Project Title _____.

2. All payrolls, material bills, use of equipment and other indebtedness connected with the Work for this Project have been paid and all Claims of whatever nature have been satisfied, as required by the Contract.

3 (✓) ____Prevailing wage does not apply; or

(✓) ____All provisions and requirements set forth in Chapter 290, Section 290.210 through and including 290.340, Missouri Revised Statutes, pertaining to the payment of wages to workmen employed on public works projects have been fully satisfied and there has been no exception to the full and complete compliance with these provisions and requirements and the Annual Wage Order contained in the Contract in carrying out the Contract and Work. CONTRACTOR has fully complied with the requirements of the prevailing wage law as required in the Contract and has attached affidavits from all Subcontractors on this Project, regardless of tier, affirming compliance with the prevailing wage law as stipulated in the Contract.

4. I hereby certify that (a) at project completion and pursuant to contractor's final request for payment, contractor achieved (_____%) Minority Business Enterprise (MBE) participation and (_____%) Women Business Enterprise (WBE) participation on this contract, and (b) listed herein are the names of all certified M/WBE subcontractors, regardless of tier, with whom I, or my subcontractors contracted.

1. Name of MBE/WBE Firm _____
Address _____
_____
Telephone Number (_____) _____
IRS Number _____
Area/Scope*of Work _____
Subcontract Final Amount _____

2. Name of MBE/WBE Firm _____
Address _____
_____
Telephone Number (_____) _____
IRS Number _____
Area/Scope*of Work_____
Subcontract Final Amount _____

List additional subcontractors, if any, on a similar form and attach to the bid.

Supplier** Final Amount: _____

*Reference to specification sections or bid item number.

(✓) ____ Met or exceeded the Contract utilization goals; or
(✓) ____ Failed to meet the Contract utilization goals (attach waiver, substitution or modification); or
(✓) ____ No goals applied to this Project.

5. CONTRACTOR certifies that each Subcontractor has received full payment for its respective work in connection with the Contract.

6. If applicable, I hereby certify that (a) at project completion and pursuant to contractor's final request for payment, contractor achieved, company-wide, at least ten percent (10%) minority workforce participation and two percent (2%) women workforce participation and (2) a true and accurate copy of my final project workforce monthly report (HRD Form 00485.02 and final company-wide workforce monthly report (HRD Form 00485.03) are attached. **NOTE: This paragraph is only applicable if you completed a construction contract that was estimated by the City, prior to solicitation, as requiring more than 800 construction labor hours and costing in excess of $324,000.01. If applicable you MUST attach copies of your final monthly workforce reports.**

7. This affidavit is made in behalf of the CONTRACTOR for the purpose of securing from Kansas City, Missouri, the certification of completion of the Project and receiving payment therefore.

8. If the Contract amount exceeded $150,000, CONTRACTOR has submitted proof of compliance with the City tax ordinances administered by the City's Commissioner of Revenue and has on file proof of tax compliance from all Subcontractors. If the Contract term exceeded one (1) year, CONTRACTOR has provided proof of compliance with the City tax ordinances administered by the City's Commissioner of Revenue prior to receiving final payment and has on file proof of tax compliance from all Subcontractors prior to the Subcontractor receiving final payment from CONTRACTOR.

CONTRACTOR_____

By _____
(Authorized Signature)

Title _____

On this _____ day of _____, _____, before me

appeared _____, to me personally known to be the

_____of the_____,

and who executed the foregoing instrument and acknowledged that (s)he executed the same on behalf of

_____ as its free act and deed.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal on the day and year first above written.

My commission expires:

_____ _____
Notary Public

CITY OF FOUNTAINS
HEART OF THE NATION
KANSAS CITY
MISSOURI

SUBCONTRACTOR AFFIDAVIT FOR FINAL PAYMENT

Project Number 81000927

Project Title Todd Creek WWTP Expansion & Major Upgrades

STATE OF MISSOURI)

) ss:

COUNTY OF _____)

After being duly sworn the person whose name and signature appears below hereby states under penalty of perjury that:

1. I am the duly authorized officer of the business indicated below (hereinafter Subcontractor) and I make this affidavit on behalf of Subcontractor in accordance with the requirements set forth in Section 290.290, RSMo. Subcontractor has completed all of the Work required under the terms and conditions of a subcontract as follows:

Subcontract with: _____, Contractor

Work Performed: _____

Total Dollar Amount of Subcontract and all Change Orders: $_____

City Certified ☐MBE ☐ WBE ☐ DBE ☐ NA
List certifications: _____

2. Subcontractor fully complied with the provisions and requirements of the Missouri Prevailing Wage Law set forth in Sections 290.210, RSMo through 290.340, RSMo.

Business Entity Type:
(___) Missouri Corporation
(___) Foreign Corporation
(___) Fictitious Name Corporation
(___) Sole Proprietor
(___) Limited Liability Company
(___) Partnership
(___) Joint Venture
(___) Other (Specify)

Subcontractor's Legal Name and Address

_____

_____
Phone No. _____
Fax: _____
E:mail:_____
Federal ID No._____

I hereby certify that I have the authority to execute this affidavit on behalf of Subcontractor.

By: _____ _____
(Signature) (Print Name)

_____ _____
(Title) (Date)

NOTARY

Subscribed and sworn to before me this _____ day of _____, 20_____.

My Commission Expires:_____ By_____

_____ _____
Print Name Title

SECTION 01300 – SUBMITTALS

PART 1 - GENERAL

1.01 SUMMARY

A. This section provides for the submittals required by the City prior to the start of work and, as required, for the duration of the Work.

B. All submittals shall be clearly identified by reference to a specification section and/or detail drawing. Submittals shall be clear and legible and shall include sufficient presentation of the data.

C. No portion of the work requiring a shop drawing, product data or sample shall be started nor shall any materials be fabricated or installed prior to the completion of the submittal process described herein. Fabrication performed, purchased materials or on-site construction accomplished prior to completing the submittal process as defined herein shall be at the Contractor or Design-Builder's sole risk. The City shall not be liable for any expense or delay to complete the submittal process.

1.02 RELATED SECTIONS

A. Section 00700 – General Requirements:
   1. Article 2, paragraph 2.07.B.1 – Preliminary Project Schedule.
   2. Article 2, paragraph 2.07.B.2 – Preliminary Schedule of Shop Drawings.
   3. Article 2, paragraph 2.07.B.3 – Preliminary Schedule of Values.
   4. Article 6, paragraph 6.04 – Progress Schedule.
   5. Article 6, paragraph 6.05 – Recovery Schedule.
   6. Article 6, paragraph 6.06 – Substitute and "Or-Equal" Items.
   7. Article 6, paragraph 6.15 – Safety Representative.
   8. Article 6, paragraph 6.18 – Shop Drawings and Samples.

B. Section 01019 – Closeout Procedures

C. Section 01020 – Record Documents

D. Section 01021 – Operation and Maintenance Data

E. Section 01140 – Work Restrictions

F. Section 01140.01 - Process and System Shutdown Constraints Schedule

G. Section 01140.02 - Operation Change Control Plan Documents

H. Section 01020 – Record Documents

I. Section 01320 – Construction Progress Documentation

J. Section 01322 – Photogram Documentation

K. Section 01019 – Closeout Procedures

L. Section 01664 - Training

M. Section 01757 – Commissioning

N. Section 01335 – Document Management

1.03 GENERAL INFORMATION

A. Definitions:
   1. Shop Drawings, product data and Samples are technical Submittals prepared by the Contractor or Design-Builder, Subcontractor, manufacturer or Supplier and submitted by Contractor or Design-Builder to the City for review and comment as a basis of the use of Equipment and Materials proposed for incorporation in the Work or needed to describe installation, operation, maintenance or technical properties, as specified in each Division of the Specifications:

(a) Shop Drawings include custom-prepared data of all types including drawings, diagrams, performance curves, material schedules, templates, instructions and similar information.
(b) Product data includes standard printed information on materials, products and systems; not custom-prepared for this Project, other than the designation of selections from available choices.
(c) Samples include both fabricated and physical examples of materials, products and Work; both as complete units and as smaller portions of units of Work; either for limited visual inspection or (where indicated) for more detailed testing and analysis. Mock-ups are a special form of Samples which are too large to be handled in the specified manner for transmittal of Sample Submittals.
(d) Spare parts: Describe spare parts necessary for the Owner's use in facility operation and maintenance; identify the type and quantity but include the actual characteristics of the spare parts in Product as part of the specification of the product.
(e) Tools: Tools are generally defined as items such as special wrenches, gauges, circuit setters, and other similar devices required for the proper operation or maintenance of a system that would not normally be in the Owner's tool kit.

2. Informational Submittals are those technical reports, administrative Submittals, certificates and guarantees not defined as Shop Drawings, product data or Samples:
(a) Technical reports include laboratory reports, tests, technical procedures, technical records and Contractor or Design-Builder's design analysis.
(b) Administrative Submittals are those nontechnical Submittals required by the Contract Documents or deemed necessary for administrative records. These Submittals include maintenance agreements, bonds, project photographs, physical work records, statements of applicability, copies of industry standards, project record data, schedules, security/protection/safety data and similar type Submittals.
(c) Certificates and guarantees are those Submittals on Equipment and Materials where a written certificate or guarantee from the manufacturer or Supplier is required in the Contract Documents.
(d) Manufacturer's Instructions: Instructions, stipulations, directions, and recommendations issued in printed form by the manufacturer of a product addressing handling, installation, erection, and application of the product; manufacturers' instructions are not prepared especially for the Work.

B. Quality Requirements:
1. The Contractor or Design-Builder shall submit Shop Drawings and Samples in accordance with Section 00700.
2. Submittals such as Shop Drawings and product data shall be of suitable quality for legibility and reproduction purposes. Every line, character and letter shall be clearly legible. Drawings shall be useable for further reproduction to yield legible hard copies.
3. All submittals by subcontractors shall be sent directly to the Contractor or Design-Builder for checking. The Contractor or Design-Builder shall be responsible for their submission at the proper time to prevent delays.
4. The Contractor or Design-Builder shall check all subcontractors' submittals regarding measurements, sizes, materials and details to determine and verify that they meet the requirements of the Contract Documents. Submittals found to be inaccurate or otherwise in error shall be returned to the subcontractors for correction before submission to the City.
5. Certificates of Compliance – Where indicated in these specifications, each submittal shall include a certificate of compliance prepared by the manufacturer or Supplier of the submitted data, certifying that the item covered complies with Contract Documents. The

certificate of compliance shall be a separate document and shall include identification of all deviations, if any, from the Contract Documents.

C. Submittal Completeness:
   1. The Contractor or Design-Builder shall accept full responsibility for the completeness of each submission. When an item consists of components from several sources, the Contractor or Design-Builder's initial submittal on the item shall include all components.
   2. Submittals shall be complete with respect to dimensions, design criteria, materials of construction and other information specified to enable the City or Designee to review the information effectively.
   3. Where standard drawings are furnished which cover several variations of the general class of Equipment, each drawing shall be annotated to indicate exactly which parts of the drawing apply to the Equipment being furnished. Use hatch marks to indicate variations that do not apply to the Submittal. The use of "highlighting markers" will not be an acceptable means of annotating Submittals. Annotation shall also include proper identification of the Submittal permanently attached to the drawing.
   4. Reproductions or copies of Contract Drawings or portions thereof will not be accepted as complete fabrication or erection drawings. The Contractor or Design-Builder may use a reproduction of Contract Drawings for erection drawings to indicate information on erection or to identify detail drawing references. Whenever the Drawings are revised to show this additional Contractor or Design-Builder information, the Design Professional's title block shall be replaced with Contractor or Design-Builder's title block and the Design Professional's professional seal shall be removed from the drawing. The Contractor or Design-Builder shall revise these erection drawings, as needed, for subsequent Design Professional revisions to the Contract Drawings.

D. Form of Submittals:
   1. Submittals and other Project documents shall be transmitted in electronic format and non-electronic format as specified.
   2. Contractor or Design-Builder shall provide a submittal registry prior to the pre-con meeting that is suitable for upload to the City's Document Management program.
   3. Electronic Format:
      (a) Transmit Submittals and Project documents utilizing:
         (i) Adobe ".pdf" files created directly from native electronic format or City-approved equal file type and format.
         (ii) Electronic submittal ".pdf" files are not to be combined files or collections of files/drawings. Each drawing document must stand alone.
         (iii) Each file will be right reading and oriented the same for all consecutive resubmissions.
         (iv) For any given Submittal, the filename and format shall be consistent for initial submission and subsequent revisions of the same. Use consistent naming convention throughout. Reference to revision or dates shall not be included in a filename.
         (v) Files greater than 5 pages shall have table of contents with bookmarks for each section. The Sections shall have easily understood names.
         (vi) Submittals not meeting the above criteria are subject to rejection.
      (b) Provide Project Record Documents, equipment instruction books and operating and maintenance manuals and any other documents, as required, in a file type and format approved by City.
   4. Non-electronic Format:
      (a) Selected Submittals may be provided in paper (hard copy), as well, only with advance approval of the City and using procedures specified herein.

(b) Equipment instruction books and operating manuals shall be provided in hardcopies in addition to the specified electronic format.

E. Transmittal of Submittals:
1. Submittal register shall be uploaded prior the transmission of the first submittal.
2. All submittals, regardless of origin, shall be stamped with the approval of the Contractor or Design-Builder and identified with the name and number of this Contract, Contractor's or Design-Builder's name, references to applicable specification paragraphs and Contract Drawings and version of the submittal. Submittals can be named for their specification if the submittals cover the full scope of work in said specification.
3. Each submittal shall indicate the intended use of the item in the Work. When catalog pages are submitted, applicable items shall be clearly identified and inapplicable data crossed out. The current revision, issue number and date shall be indicated on all drawings and other descriptive data. The Contractor or Design-Builder's stamp of approval is a representation to the City and Design Professional that the Contractor or Design-Builder accepts full responsibility for determining and verifying all quantities, dimensions, field construction criteria, materials, catalog numbers and similar data, and the Contractor or Design-Builder has reviewed and coordinated each submittal with the requirements of the Work and the Contract Documents.
4. Electronic Submittals – The Contractor or Design-Builder shall utilize the City's document management system as specified in Section 01335- Document Management for managing, tracking and storing documents associated with the Project. If an internet-based document management system is to be used, additional requirements are provided in Section 01335- Document Management. The Contractor or Design-Builder shall comply with the file protocols and procedures for the document management system.
5. Approved submittals shall be tagged per City's metadata tagging standard and provided to the City as part of the Electronic O&M Manual.

F. Submittals Required for the Preconstruction Conference:
1. Following are the minimum required submittals to be provided by the Contractor or Design-Builder at the pre-construction conference:
(a) General Requirements:
(i) Preliminary Project Schedule including Submittals.
(ii) Preliminary Schedule of Values.
(iii) Preliminary Submittal Registry.
(iv) Listing of Subcontractors.
(v) Project Sign Request.
(vi) List of Major Equipment utilized.
(vii) Safety Representative.
(b) Document Management can be found in Section 01335 – Document Management.

G. In order to allow expedited review, submittals on the sections or topics below are required to have a pre-submittal meeting:
1. AGS Processing Equipment
2. Commissioning Schedule
3. Switchgear and Transformer
4. Motor Control Centers
5. Variable Frequency Motor Controllers
6. PLC Programming and Reports
7. Testing and Balancing Reports

1.04 SHOP DRAWINGS AND SAMPLES

A. Shop Drawings:

1. Shop Drawings and engineering data covering all equipment and fabricated and building materials which will become a permanent part of the Work under this Contract shall be submitted to the City or Designee for review as specified herein. The data shall include drawings, descriptive information, sufficient detail to show the kind, size, arrangement and operation of component materials and devices; the external connections, anchorages and supports required; performance characteristics; and dimensions needed for installation and correlation with other materials and equipment.
2. All deviations from the Contract Documents shall be identified on each submittal and shall be tabulated in the Contractor or Design-Builder's letter of transmittal. Such submittals shall, as pertinent to the deviation, indicate essential details of all changes proposed by the Contractor or Design-Builder (including modifications to other facilities that may be a result of the deviation) and all required piping and wiring diagrams.

B. Product Data:
1. Product data as specified in individual Sections, include, but are not necessarily limited to, standard prepared data for manufactured products (sometimes referred to as catalog data), such as the manufacturer's product specification and installation instructions, availability of colors and patterns, manufacturer's printed statements of compliances and applicability, roughing-in diagrams and templates, catalog cuts, product photographs, standard wiring diagrams, printed performance curves and operational-range diagrams, production or quality control inspection and test reports and certifications, mill reports, product operating and maintenance instructions and recommended spare-parts listing and printed product warranties, as applicable to the Work.
2. If applicable, submittals for equipment shall include a listing of all installations where identical or similar equipment has been installed and been in operations for a period of at least one year.
3. Certificates are statements printed on the manufacturer's or supplier's letterhead and signed by responsible officials of manufacturer of product, system or material. Certifications shall provide a clear statement that the product, system or material meets the specified requirements of Contract Documents. All certificates shall be dated after the Effective Date of the contract and shall clearly indicate the project name and project number.

C. Samples:
1. Samples specified in individual Sections, include, but are not necessarily limited to, physical examples of the work such as sections of manufactured or fabricated work, small cuts or containers of materials, complete units of repetitively used products, color/texture/pattern swatches and range sets, specimens for coordination of visual effect, graphic symbols and units of work to be used by the City or Designee for independent inspection and testing, as applicable to the Work.

D. Instruction Books and Operating and Manuals:
1. Per Section 01021 – Operation Maintenance Data

E. Record Documents
1. Per Section 01019 Closeout Procedures, 01021 Operation Maintenance Data, 01020 Record Documents, 01322 Photographic Documentation

F. Survey Data
1. All field books, notes, videotapes, and other data developed by Contractor in performing surveys required as part of the Work shall be available to City for examination throughout the construction period.
2. All such data shall be submitted to City with the other documentation required for final acceptance of the Work.

1.05 SCHEDULES

A. 01320 - Construction Progress Documentation

1.06 COMMISSIONING SUBMITTALS

A. Section 01757 Commissioning

1.07 CONSTRUCTION PROGRESS PHOTOGRAPHS AND VIDEOS

A. Section 01320 Construction Progress Documentation
B. Photos and Videos documenting assets that will not be visible during the substantial completion walkthrough shall have their record photos taken prior to be obscured by backfill, equipment installation, gypsum board installation, etc… Record photos shall have metadata tags per KC Water standards.

1.08 WARRANTY and BONDS and CLOSEOUT SUBMITTALS

A. Section 011019 Closeout Procedures, Section 00800 Supplementary Conditions, and 00700 General Conditions

1.09 SCHEDULE OF VALUES

A. The CONTRACTOR shall prepare and submit to the DESIGN PROFESSIONAL for approval by the preconstruction conference, a Schedule of Values for and covering the Lump Sum Price Bid as shown in the Proposal. The Schedule of Values shall show the estimated total number of construction units for each kind of work and the value of each unit.
B. Each price listed shall include all overhead, other costs, CONTRACTOR's profit and the total estimated value of the items of work listed in the Schedule of Values shall equal the Contract Lump Sum Price covered by the estimate. Overhead and profit are not to be listed as separate items.
C. An unbalanced schedule of values providing for overpayment of CONTRACTOR on items of Work which would be performed first will not be approved. The Schedule of Values shall be revised and resubmitted until acceptable to the DESIGN PROFESSIONAL & OWNER. Final acceptance by DESIGN PROFESSIONAL shall indicate only consent to the Schedule of Values as a basis for preparation of applications for progress payments and shall not constitute an agreement as to the value of each indicated item.

1.10 CITY OR DESIGNEE'S REVIEW OF DRAWINGS AND DATA

A. The City or Designee's review of drawings and data submitted by Contractor or Design-Builder will cover only general compliance with the Construction Contract Documents. The City or Designee's review does not indicate a thorough review of all dimensions, quantities and details of the material, equipment, device or item shown. The City or Designee's review shall not relieve Contractor or Design-Builder of Contractor or Design-Builder's responsibility for errors, omissions or deviations in the drawings and data, nor of sole responsibility for compliance with the Construction Contract Documents.
B. The City or Designee's submittal review period shall be 21 consecutive calendar days in length and shall commence on the first calendar day immediately following the date of arrival of the submittal or resubmittal in the City or Designee's office. The time required to mail the submittal or resubmittal back to Contractor or Design-Builder shall not be considered a part of the submittal review period.
C. Contractor or Design-Builder may request an expedited review of a limited number of submittals. The City may elect to require a workshop to facilitate this expedited review. A maximum of one 1-hour workshop per week will be allowed.

D. Submittals shall be returned to the Contractor or Design-Builder under one of the following assignments:
   1. "Approved" is assigned when there are no notations or comments on the submittal. When returned, the Contractor or Design-Builder may release the equipment and/or material for manufacture.
   2. "Approved as Noted" is assigned when a confirmation of the notations and comments is not required by the Contractor or Design-Builder. The Contractor or Design-Builder may release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product.
   3. "Revise and Resubmit" is assigned when the submittal does not meet the intent of the Construction Contract Documents. The Contractor or Design-Builder must resubmit the document revised to bring the submittal into compliance with Contract Documents. "Revise and Resubmit" is also assigned when notations and comments are extensive enough to require a resubmittal of the package.
   4. "Rejected" is assigned when the submittal does not meet the intent of the Construction Contract Documents. The Contractor or Design-Builder must resubmit the entire package revised to bring the submittal into compliance with Contract Documents. It may be necessary to resubmit using a different manufacturer/vendor to meet the Construction Contract Documents. "Rejected" is also assigned when the notations and comments are extensive enough to require a resubmittal of the package.
   5. "For Record Only" is assigned when the submittal is provided as a courtesy to the City or as a contractual requirement by the Design-Builder or Contractor. Design-Builder or Contractor has no further action required. Submittal is for supplementary information only; pamphlets, general information sheets, catalog cuts, standard sheets, test reports, manufacturer's or supplier's letters included with submittal data, unmarked catalog data, bulletins and similar data, all of which are useful to Owner in design, operation, or maintenance, but which by their nature does not constitute a basis for determining that items represented thereby conform with the design concept or comply with the intent of the Contract Documents. It is not subject to Owner's review and acceptance, and is being filed for Record Copy purposes only. This is generally used in acknowledging receipt of means and methods of construction work plans, filed conformance test reports, health and safety plans, or structural design by the Design-Builder's or Contractor Engineer of Record, etc.

E. If the Contractor or Design-Builder considers any correction indicated on the shop drawings to constitute a change to the Contract Documents, the Contractor or Design-Builder shall give written notice thereof to the City or Designee at least seven working days prior to release for manufacture.

F. Resubmittal of Drawings and Data:
   1. The Contractor or Design-Builder shall accept full responsibility for the completeness of each resubmittal. The Contractor or Design-Builder shall verify that all corrected data and additional information previously requested by the City or Designee are provided on the resubmittal. When corrected copies are resubmitted, the Contractor or Design-Builder shall in writing direct specific attention to all revisions and shall list separately any revisions made other than those called for by the City or Designee on previous submissions.
   2. Requirements specified for initial submittals shall also apply to resubmittals. Resubmittals shall bear the number of the first submittal followed by a letter (A, B, etc.) to indicate the sequence of the resubmittal.
   3. Resubmittals shall be made within twenty-one (21) days of the date of the letter returning the submittal to be modified or corrected; unless, within 14 days, the Contractor or

Design-Builder submits an acceptable request for an extension of the stipulated period, listing the reasons the resubmittal cannot be completed within the specified time.

4. Any need for more than two resubmissions or any other delay in obtaining the City or Designee's review of submittals, will not entitle the Contractor or Design-Builder to an extension of the Contract Times, unless: the delay of the Work is directly caused by a change in the Work authorized by a Change Order or by failure of the City or Designee to review the submittals within the submittal review period specified herein. A limited number of equipment submittals are anticipated to require additional coordination and will not be limited to two resubmittals. This equipment is:

   (a) Motor Control Centers

   (b) Switchboards

   (c) Control Panels

   (d) Programmable Logic Controllers

   (e) Aerobic Granular Sludge Treatment System

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used

END OF SECTION

SECTION 01320 – PROJECT MANAGEMENT AND CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the construction process beginning with the Notice of Intent to Contract and continuing through completion of the Work performed and Construction Contract close out.

B. The Contractor or Design-Builder shall furnish all labor, materials, equipment and incidentals as necessary to comply with these requirements including but not limited to the following and as required herein:

1. Preliminary Project Schedule.
2. Project Baseline Schedule.
3. Progress Schedule.
4. Recovery Schedules.
5. Submittals Schedule.
6. Daily Labor Force reports.
7. Material location reports.
8. Field condition reports.
9. Special reports.
10. Commissioning
11. Training
12. O&M Data
13. Electronic O&M Manuals
14. Testing
15. Acceptance Testing
16. Photographic Documentation.

1.02 RELATED SECTIONS

A. Drawings and general provisions of the Contract; including General and Supplementary Conditions, all applicable Division 01 Sections, and all applicable Division Sections; apply to this Section.

B. Section 00700 – General Requirements:

1. Article 2, paragraph 2.07.B.1 – Preliminary Project Schedule.
2. Article 2, paragraph 2.07.B.2 – Preliminary Schedule of Shop Drawings.
3. Article 2, paragraph 2.08.A – Acceptable Schedule.
4. Article 2, paragraph 2.08.B – Project Baseline Schedule.
5. Article 6, paragraph 6.04 – Progress Schedule.
6. Article 6, paragraph 6.05 – Recovery Schedule.

C. Section 01000 – General Project Requirements.

D. Section 01020 – Record Documents

E. Section 01021 – Operation and Maintenance Data

F. Section 01140.01 - Process and System Shutdown Constraints Schedule

G. Section 01140.02 - Operation Change Control Plan Documents

H. Section 01140 – Work Restrictions

I. Section 01019 – Closeout Procedures

J. Section 01664 - Training

K. Section 01757 – Commissioning
L. Section 01322 – Photographic Documentation.

1.03 CODES AND STANDARDS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.
B. American Association of Cost Engineers (AACE):
   1. Comply with recommended practices.

1.04 SUBMITTALS

A. Scheduler Qualifications – For firms and persons preparing schedules, submit qualifications as required by Table 1 to demonstrate their capabilities and experience. Include lists of completed projects with the following information:
   1. Project name.
   2. Project location.
   3. Name and address of engineer, architect or Contractor or Design-Builder for which schedules were prepared.
   4. Name and address of client.
   5. Project Duration at Bid & Project Duration.
   6. Other information and pertinent.
B. Preliminary Schedule of Shop Drawings (Submittals) – Arrange the following information in a tabular format or a format that is compatible with entry into the City's document management system:
   1. Scheduled date for each first submittal.
   2. Specification Section number and title.
   3. Submittal category (action or informational).
   4. Name of subcontractor.
   5. Description of the Work covered.
   6. If a Pre-Submittal Workshop is required
   7. If the Contractor or Design-Builder will request expedited review.
   8. Scheduled date for City's final approval.
C. Standard Schedule Format – Layout for all schedules and reports shall follow the standard format in the following order, activity ID, activity name, original duration, remaining duration, percent complete, start, finish, late start, late finish, total float, baseline variance, predecessor, successor, and resource ID.
D. Preliminary Project Schedule (Design-Build Only) – Submit in native electronic format and *PDF format. PDF sheet size shall sufficiently large enough to legibly show entire schedule for entire construction period.
   1. Include:
      (a) CPM Report
      (b) Native File
E. Baseline Project Schedule – Submit in native electronic format and *PDF format. PDF sheet size shall sufficiently large enough to legibly show entire schedule for entire construction period.
   1. Include:
      (a) CPM Report
      (b) Resource Loaded
      (c) Native File

F. Progress Schedules – Submit in native electronic format and *PDF format. PDF sheet size shall sufficiently large enough to legibly show entire schedule for entire construction period.
   1. Include:
      (a) CPM Report
      (b) Activity report
         (1) A list of all activities sorted by activity number and early start date, or actual start date, if known.
      (c) Logic Report
         (1) A list of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
      (d) Total Float Report
         (1) A list of all activities sorted in ascending order of total float.
      (e) Daily Labor Force Report
      (f) Material Location Report
      (g) Field Condition Report
      (h) City may request a cost and resource loaded schedule if the project has insufficient float or multiple overlapping critical paths.

G. Commissioning Schedule Section 01757 - Commissioning

H. Special Reports – Submit special reports within one day of an occurrence.

I. Daily Construction Reports – Submit at weekly intervals.

J. Four Week look ahead – Schedules provided at each progress meeting that indicate with work activities will be occurring over the next 4 weeks and what was accomplished the previous week.
   1. The activity designations used in the four week look ahead must be consistent with those used in the baseline schedule and the monthly schedule updates.

1.05 DEFINITIONS

A. Activity:
   1. A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
   2. Critical activities are activities on the critical path. They must start and finish on the planned start and finish times.
   3. Predecessor activity is an activity that must start or complete before a given activity can be started. No negative lag is allowed.
   4. Successor activity is an activity that can not start until the predecessor activity allows it. No negative lag is allowed.

B. Cost Loading: All WBS summary activities are cost loaded. The sum total of all cost loaded activities shall equal the total Contract Price of the Contract, including Owner-approved change orders. This shall be equivalent to the total of the Schedule of Values for the Project.

C. CPM (Critical Path Method) – A schedule network analysis technique used to determine the amount of scheduling flexibility (the amount of float) on various logical network paths in the project schedule network, and to determine the minimum total project duration. Start and finish dates are calculated by means of a forward pass, using a specified start date. Late start and finish dates are calculated by means of a backward pass, starting from a specified completion date, which sometimes is the project early finish date determined during the forward pass.

D. Critical Path – Generally, but not always, the sequence of schedule activities determining the duration of the project. Generally, it is the longest path through the project. However, a

critical path can end, as an example, on a schedule milestone that is in the middle of the schedule model and that has a finish-on-or-before imposed date schedule constraint.

E. Event – The starting or ending point of an activity.
F. Float – The measure of leeway in starting and completing an activity. Float time is not for the exclusive use or benefit of either City or Contractor or Design-Builder, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the following activity. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
G. Fragnet – A partial or fragmentary network that breaks down activities into smaller activities for greater detail.
H. Gantt Chart – A graphic display of schedule-related information. In the typical Gantt chart, schedule activities or work breakdown structure components are listed down the left side of the chart, dates are shown across the top and activity durations are shown as date-placed horizontal bars. Also known as a Bar chart.
I. Lag – An offset or delay from an activity to its successor. It is based on the calendar of the successor activity.
J. Major Area – A significant construction element.
K. Major Procurement – As discussed in Section 00700, paragraph 2.07.B.1, Major Procurement shall further defined as any materials that fall within the critical path and/or have a lead time of 30 days or greater.
L. Milestone – A key or critical point in time for reference or measurement.
M. Network Diagram – A graphic diagram of a network schedule, showing activities and activity relationships.
N. Schedule Level –

    Detailed Schedule by Task – This level of detail will support the short-term planning for the field, normally for those activities of less than 1-week duration. It is used for workforce supervisors to plan and coordinate work at the detail level. City must approve of any activities greater than 1 week duration.

O. WBS (Work Breakdown Structure) – A deliverable-oriented hierarchical decomposition of the work to be executed by the project team to accomplish the project objectives and create the required deliverables. It organizes and defines the total scope of the project. Each descending level represents an increasingly detailed definition of the project work. The WBS is decomposed into work packages. The deliverable orientation of the hierarchy includes both internal and external deliverables. See also Schedule Levels.
P. Work Package – A deliverable or project work component at the lowest level of each branch of the WBS. The work package includes the schedule activities and schedule milestones required to complete the work package deliverable or project work component.
Q. Resource Loading: WBS activities has the allocated resources necessary to complete the WBS.
R. Schedule of Monthly Payments – Estimated monthly progress payments based on Baseline Schedule and Schedule of Values for each Month for the duration of the project.
S. City Activity: an activity required by the project that will be performed by the City or their designee outside the contract.

1.06 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities including the scheduling and reporting of separate Contractor or Design-Builders performing construction activities related to project.

B. Coordinate Progress Schedules with the Schedule of Values, to estimate a Schedule of Monthly Payments, list of subcontractors, Preliminary Schedule of Shop Drawings and Samples, progress reports, Application for Payment, and other required schedules and reports.
C. Secure time commitments for performing critical elements of the Work from parties involved. Time commitments should be captured within the schedule.

1.07 TRAINING SCHEDULE:

A. Contractor Shall provide a draft list of training sessions arranged in chronological order along with the submittal Schedule
B. Contractor shall provide a draft list of training sessions arranged in chronological order along with the submittal schedule.

1.08 Contractor shall send an updated training schedule every 3 months, and Contractor shall indicate which training sessions are tentative or firmly scheduled. SCHEDULE LEVEL

A. If a Recovery Schedule is deemed necessary by the City in accordance with Section 00700 – General Conditions, it shall be developed as a cost and resource loaded schedule.

1.09 SCHEDULING SOFTWARE

A. Prepare schedules using the latest version of Primavera version P6 or higher or Microsoft Project.

1.10 PRELIMINARY SCHEDULE OF SHOP DRAWINGS AND SAMPLES

A. Preparation – Provide a schedule of submittals arranged in chronological order by date required by the construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery as set forth in the Contract Documents, when establishing dates.
B. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, the estimated Schedule of Monthly Payments, and Progress Schedules.
C. Include Shop Drawing and Sample Submittals required during the first 60 days of construction. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
D. At Contractor or Design-Builder's option, show submittals on the Preliminary Progress Schedule, instead of tabulating them separately.

1.11 SCHEDULE REQUIREMENTS

A. Requirements According to Schedule Level – Contractor or Design-Builder shall provide the following information.

Item	Requirement
Procedures	Comply with procedures contained the American Association of Cost Engineers (AACE) recommended practices.
Time Frame	Extend project schedule from date established for the Notice to Proceed to the date of Final Completion.
Contract Times	Contract Times shall not be changed unless specifically authorized by Change Order.

Item	Requirement
Activities	Treat separate major areas as a separate numbered activity for each principal element of the Work. (WBS)
Activity Duration	Define activities so none is longer than 7 days, unless specifically allowed by City
Milestones	Include milestones indicated in the Contract Documents in schedule, including, but not limited to, all zero duration events, the Notice to Proceed, Substantial Completion, and Final Completion.
Computer Software	Prepare schedules using the latest version of Primavera version P6 or higher or Microsoft Project.
Scheduler's Qualifications	Submit scheduler's qualifications for review and approval
Submittal Review Time	Include review and re-submittal times for review of Shop Drawings and Samples. Each item listed in the Preliminary Schedule of Shop Drawings and Samples shall be included in the schedule.
Procurement Activities	Include separate activities for the procurement process of long-lead and major items that require a cycle of more than 30 days or fall within the critical path. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
Startup and Testing Time	See Sections -01757 Commissioning, 01664 Training. Incorporate all these requirements with appropriate lead times into the project schedule.
Phasing	Arrange list of activities on schedule by phase.
Submittal Review Time	Include review and re-submittal times for review of Shop Drawings and Samples. Each item listed in the Preliminary Schedule of Shop Drawings and Samples shall be included in the schedule.
City Activities	Include a separate activity for each area of the Work performed by City and a separate activity for notifying the City if contractually required or requested.
Products Ordered in Advance	Include a separate activity for each product. Delivery dates indicated stipulate the earliest possible delivery date.
City-Furnished Products	Include a separate activity for each product. Delivery dates indicated stipulate the earliest possible delivery date.
Work Restrictions	Show the effect of the following items on the schedule: • Coordination with existing construction. • Limitations of continued occupancies. • Uninterruptible services. • Partial utilization before Substantial Completion. • Use of premises restrictions. • Provisions for future construction. • Seasonal variations. • Environmental control.
Work Stages	Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following: • Subcontract awards. • Submittals.

Item	Requirement
	• Purchases. • Fabrication. • Sample testing. • Deliveries. • Installation. • Tests and inspections. • Adjusting. • Curing. • Startup and placement into final use.
Area Separations	Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities: • Contractor Mobilization* • Procurement – Divided by Long Lead and Short Lead • Completion of civil work • Completion of structural work • Completion of HVAC work • Completion of architectural work • Completion of mechanical installation • Completion of electrical installation • Completion of I&C installation • Completion of I&C programing • • Partial Utilization • Substantial Completion* • Start of Acceptance Testing • End of Acceptance Testing • Achievement of Full Operations* • Punch List and Final Corrections* • Final Completion*
Contract Modifications	For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragments to demonstrate the effect of the proposed change on the overall project schedule.
Work under More than One Contract or Subcontract.	Include a separate activity for each contract or subcontract.
Detailed by Work Package	Include detailed information by each work package and display all activities to be accomplished by the workforce with durations of 7 or more calendar days
Detail by Task	Include detail by task to support the short-term planning for the field, normally for those activities of less than 1-week duration.

B. Cost Correlation:
   1. At the head of schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of the Work performed as of dates used for preparation of payment requests.

1.12 PRELIMINARY AND BASELINE PROJECT SCHEDULES

A. Indicate each significant construction activity separately. Identify each Monday of each week with a continuous vertical line. Outline significant construction activities for the first 60 days of construction. Include skeleton diagram for the remainder of the Work.
B. Preliminary Network Diagram – Outline significant construction activities for the project. To be submitted with the Preliminary Progress Schedule.
C. Cost Loaded
D. Baseline Schedule shall be resource loaded.

1.13 PROGRESS REPORTS AND SCHEDULES

A. General – Prepare Progress Schedules using a CPM network analysis diagram and be cost loaded.
B. CPM Schedule Preparation – Prepare a list of all activities required to complete the Work. Using the preliminary network diagram, prepare a skeleton network to identify probable critical paths:
    1. Activities – Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
        (a) Preparation and processing of submittals.
        (b) Purchase of materials.
        (c) Delivery of materials and equipment.
        (d) Fabrication.
        (e) Installation.
    2. Processing – Process data to produce output data or a computer-drawn, time scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
    3. Format – Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges:
        (a) Sub-networks on separate sheets are permissible for activities clearly off the critical path. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.
        (b) Establish procedures for monitoring and updating CPM schedule and for reporting progress monthly. Coordinate procedures with progress meeting and payment request dates.
        (c) Use "one calendar day" as the unit of time.
    4. Initial Issue of Schedule – Prepare initial network diagram from a list of straight "early start-total float" sort. Identify critical activities. Prepare tabulated reports showing the following:
        (a) Contractor or subcontractor and the Work or activity.
        (b) Description of activity.
        (c) Principle events of activity.
        (d) Immediate preceding and succeeding activities.
        (e) Early and late start dates.
        (f) Early and late 'finish dates.
        (g) Activity duration in days.
        (h) Total float or slack time.
        (i) Average size of workforce.
    5. Schedule Updating – Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

(a) Identification of activities that have changed added or deleted.
(b) Changes in logic ties.
(c) Changes in early and late start dates.
(d) Changes in early and late finish dates.
(e) Changes in activity durations in days.
(f) Changes in the critical path.
(g) Changes in total float or slack time.
(h) Changes in the Contract Time.

6. Value Summaries – Prepare two cumulative value lists, sorted by finish dates:
   (a) In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
   (b) In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
   (c) In subsequent issues of both lists, substitute actual finish dates for activities completed as of last date.
   (d) Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.
   (e) In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
   (f) Submit value summary printouts one week before each regularly scheduled progress meeting.

C. Reports:
1. Daily Labor Force Reports – Prepare a daily labor force report recording the following information concerning events at Project site:
   (a) List of subcontractors at Project site.
   (b) List of separate Contractor or Design-Builders at Project site.
   (c) List of all the Contractor or Design-Builder's and subcontractor's personnel showing hours worked in labor class at Project site.
2. Material Location Reports – At monthly intervals, prepare a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.
3. Field Condition Reports – Immediately on discovery of a difference between field conditions and the Contract Documents, prepare a detailed report. Submit electronically and directly to City with a request for information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

D. Special Reports:
1. General – Submit special reports within one day of an occurrence.
2. Reporting Unusual Events – When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events; persons participating; response by Contractor or Design-Builder’s personnel; evaluation of results or effects; and similar pertinent information. Advise City in advance when these events are known or predictable.

1.14 SCHEDULE OF VALUES

A. Requirements for Schedule of Values are specified in Article 2.1.3 of the General Conditions.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.01 PROGRESS SCHEDULES

A. Updates – At monthly intervals, update schedule to reflect actual construction progress and activities. Progress Schedule should be provided for review and approval prior to monthly pay request at a mutually agreed upon date each month to enable the City's review to be complete by the agreed upon monthly pay application date. Progress Schedules will be reviewed and discussed at regularly schedule progress meetings. Contractor or Design-Builder shall bring printed copies of CPM Schedule:
   1. Revise schedule immediately after an activity revision has been recognized or made at the direction by the City. Issue updated schedule concurrently with the report of each such progress meeting.
   2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
   3. As the Work progresses, indicate actual completion percentage for each activity.
   4. Post copies in Project meeting rooms and temporary field offices.

3.02 MEETINGS

A. Preconstruction Conference:
   1. Contractor or Design-Builder will schedule the Preconstruction Conference to occur before the start of general construction at a time convenient to Owner. Hold the conference at Project site or another convenient location. If Baseline Schedule is not ready for discussion at Preconstruction Conference, Owner and Contractor or Design- Builder may modify, for the purpose of discussion at the Conference, the Mobilization and Engineering Schedule for early construction activities with defined scope and budget.
      (a) Attendees: Authorized representatives of Owner, Owner's Advisor, Design Professional, Contractor or Design-Builder Key Personnel, major Subcontractors and others as appropriate shall attend the conference. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.
      (b) Agenda: Discuss items of significance that could affect progress, including the following:
         (1) Owner, Owner's Advisor, Design Professional, and Contractor or Design-Build team member contacts, roles, responsibilities, communication requirements.
         (2) Distribution of Contract Documents.
         (3) Submission of Owner-approved updated Subcontractors and Major Material Suppliers List, Schedule of Values, and Baseline Schedule if changed from Pre-Commencement Meeting
         (4) Schedules and Milestones.
         (5) Contractor or Design-Builder work zone and office trailer locations.
         (6) Procedures: Includes change management, document controls, schedule management, submittals management, and RFIs.

(7) Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and contract closeout procedures.
(8) Project Record Document Requirements.
(9) Review of startup requirements and procedures.
(10) Lockout/tagout procedures and requirements.
(11) Use of the premises.
(12) Contractor or Design-Builder and Owner will discuss additional areas for Contractor or Design- Builder access.
(13) Responsibility for temporary facilities and controls including designation of person responsible for traffic control in accordance with Section 01500 - Temporary Facilities, and 01700 Traffic Control
(14) Standard vehicle traffic onsite.
(15) Parking availability.
(16) Equipment deliveries and priorities.
(17) OCCPs.
(18) Project site safety requirements (safety vests, OSHA), and first aid.
(19) Plant/site Security/Access Procedures.
(20) Progress cleaning.
(21) Meetings.
(22) Working hours.

(c) Minutes: Contractor or Design-Builder shall record minutes and distribute electronic copies within 1 business days after meeting to participants, with copies to Contractor or Design-Builder, Owner, and those affected by decisions made.

2. Prior to Preconstruction Conference, Contractor or Design-Builder shall have submitted the following deliverables for discussion at meeting:
   (a) Proposed Baseline Schedule.
   (b) Mobilization and Engineering Schedule (modified as discussed above).
   (c) Photo and Video Documentation Plan.
   (d) Construction Safety Plan.
   (e) List of Operational Change Control Plans lasting longer than one week.
   (f) Quality Management Plan.
   (g) Qualifications of Scheduler, Photographer, and any others as required by Specifications.
   (h) And any other deliverables required by Specifications.

B. Monthly Progress Meetings:
   1. Contractor or Design-Builder will schedule and administer formal progress meetings throughout progress of the Work at maximum monthly intervals with the first meeting scheduled approximately 30 calendar days after the Preconstruction Conference.
   2. Contractor or Design-Builder will make arrangements for meetings, prepare agenda with copies for participants, and preside at meetings.
   3. Contractor or Design-Builder shall provide printed copies of latest submitted progress schedules and Schedule Update.
   4. Attendance Required: Owner, Owner's Advisor, Design Professional, Contractor or Design-Builder's Project Manager, Contractor or Design-Builder's Construction Manager (if different than the Project Manager), as appropriate to agenda topics for each meeting.
   5. Agenda shall be reoccurring and approved by Owner. Topics shall include:
      (a) Review minutes of previous meetings.
      (b) Review of Work progress and future Work.

(c) Review of safety record/events.
(d) Risk register/log.
(e) Change orders.
(f) Quality control.
(g) Pay application.
(h) Schedule reports.
(i) Discuss Stored Material for which the Contractor or Design-Builder will be requesting payment.
(j) Commissioning.

6. Minutes: Contractor or Design-Builder will record changes for update and distribute electronic copies within 7 calendar days after meeting to participants and file on Owner's document management system.

C. Weekly Coordination Meetings:
1. Upon start of construction, Contractor or Design-Builder will schedule and administer meetings throughout progress of the Work at maximum weekly intervals.
2. Contractor or Design-Builder will make arrangements for meetings, prepare agenda with copies for participants, and preside at meetings.
3. Attendance Required: Owner, Owner's Advisor, Design Professional, Contractor or Design-Builder's Project Manager, Contractor or Design-Builder's Construction Manager (if different than the Project Manager), Commissioning Manager, superintendents, major subcontractors and suppliers as appropriate to agenda topics for each meeting.
4. Agenda:
(a) Review of Work progress.
(b) Field observations, problems, and decisions.
(c) Identification of problems delaying planned progress, hazards and risks.
(d) Review of critical submittals.
(e) Deviations in the previous week's 4-Week Schedule.
(f) Review of critical RFIs, change documents, issues and action items.
(g) Review of upcoming OCCPs within 3-week window.
(h) Review of offsite fabrication and delivery schedules.
(i) Maintenance of Baseline Schedule.
(j) Corrective measures to regain projected schedules.
(k) Review 5-Week Schedule and planned progress during succeeding work period.
(l) Schedule Update, if required in accordance with Paragraph 3.02.
(m) Coordination of projected progress.
(n) Maintenance of quality and work standards.
(o) Effect of proposed changes on Baseline Schedule and coordination.
(p) Any requests for stored materials payment
(q) Other business relating to Work.
5. Contractor or Design-Builder will record minutes and distribute electronic copies within 1 calendar day after meeting to participants and those affected by decisions made.

D. Daily Coordination Meeting: Upon start of construction, Contractor or Design-Builder shall hold daily informal meetings with the Owner to discuss planned daily activities by the Contractor or Design-Build team and Owner staff. Owner may elect to merge this meeting with the Division's regular morning meetings.

E. OCCP Coordination Meetings:
1. Contractor or Design-Builder shall schedule and coordinate with Owner one-week prior to implementation of approved OCCP.
2. Agenda:

(a) Review Approved OCCP.
(b) Review safety requirements and preparations.
(c) Review contingency plans.
(d) Confirm resource availability for execution of OCCP.

3. Contractor or Design-Builder may request and coordinate additional meetings with Owner as necessary to facilitate completion and approval of draft OCCPs. Owner will make reasonable effort to accommodate Contractor or Design-Builder but prefers minimum one week notice.

F. Pre-Installation Conferences:
1. Conduct a Pre-Installation Conference at Project site before each construction activity that requires coordination with other construction or moving heavy equipment within reach of the railroad. Work around railroads shall be coordinated in accordance with Section OR-01500 - Temporary Facilities.
2. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Owner of scheduled meeting dates.
3. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
(a) Contract Documents.
(b) Options.
(c) Related Change Orders.
(d) Purchases.
(e) Deliveries.
(f) Submittals.
(g) Possible conflicts.
(h) Compatibility problems.
(i) Time schedules.
(j) Weather limitations.
(k) Manufacturer's written recommendations.
(l) Warranty requirements.
(m) Compatibility of materials.
(n) Acceptability of substrates.
(o) Temporary facilities and controls.
(p) OCCPs.
(q) Space and access limitations.
(r) Regulations of authorities having jurisdiction.
(s) Testing and inspecting requirements.
(t) Required performance results.
(u) Protection of construction and personnel.
4. Record significant conference discussions, agreements, and disagreements.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

G. Expedited Submittal Review Meetings: To expedite the submittal process and accelerate the delivery schedule for equipment with long delivery lead times, expedited submittal review meetings may will need to be held for equipment identified by the Contractor or Design-Builder. Contractor or Design-Builder shall identify such meetings on Baseline Construction Schedule and coordinate the meetings as needed.

H. Required Submittal Review Meetings: Work in the following Specifications shall require a workshop prior to submittals in order to streamline the review process.
   (a) Section 23 05 93 Testing Adjusting and Balancing for HVAC
   (b) Section 262413 Switchboards
   (c) Section 262419 Motor Control Centers
   (d) Section 262923 Variable-Frequency Motor Controllers
   (e) Section 465360 Granular Sludge Biological Treatment System
   (f) Section 406196 Process Control Software Programming and Reports

I. Other Meetings as Required:
   1. Maintenance Workshop(s):
      (a) Purpose: Develop the work orders for new and modified assets with the Owner. Contractor or Design-Builder shall review Original Equipment Manufacturer (OEM) O&M manual maintenance recommendations with Owner. Maintenance activities (Preventive & Predictive) will be divided between operations and maintenance. The updated round sheets for the site(s) will be reviewed for deficiencies. Contractor or Design-Builder shall facilitate a discussion of which OEM recommended maintenance activities have value after the warranty period. If necessary, the Contractor or Design-Builder and Owner will develop additional maintenance activities not recommended by the OEM with a particular focus on predictive maintenance activities such as vibration testing, lubricant testing, and IR testing to support the Owner's reliability centered maintenance program. Maintenance activity frequency will also be discussed. Lubrication for assets will be discussed with a focus on minimizing new lubricants that will need to be stocked.
      (b) Scheduling: Meetings shall occur after OEM manuals have submitted and approved.
   2. Sequence of Operations Meeting(s):
      (a) Schedule: During design, after draft sequence of operations are completed.
      (b) Purpose: Walk Owner's operations staff and engineering staff through the proposed sequences of operation to control equipment and processes and solicit comments and refinements.
   3. Facility Data Workshop:
      (a) Purpose: Any points communicated to a PLC and not SCADA will be discussed. Alarm set point and priority will be reviewed and developed. Historian settings for each point will also be developed or reviewed.
      (b) Scheduling: After draft sequence of operations is completed and finalized PIDs.
   4. O&M Data Meeting
      (a) 90 days prior to Substantial Completion, a meeting will be held to discuss the steps to prepare the O&M Data for transmittal to the City.
   5. Spare Parts Coordination Meeting
   6. Commissioning meetings as required in Section 01757 - Commissioning.

END OF SECTION

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

DAILY FIELD OBSERVATION REPORT

Project Number 81000927

Project Title Todd Creek WWTP Expansion & Major Upgrades

Contractor _____

Report Number _____ Date _____ Time _____

Weather			Site Conditions		Day	
❑ Clear	❑ Snow	❑ Warm	❑ Clear	❑ Dusty	❑ Monday	❑ Thursday
❑ Overcast	❑ Foggy	❑ Hot	❑ Muddy	❑ _____	❑ Tuesday	❑ Friday
❑ Rain	❑ Cold	❑ Temperature Range _____			❑ Wednesday	❑ _____

Persons Contacted:

Work Observed:

Items Discussed:

Materials Delivered:

Requested Revisions or Interpretations:

Nonconforming Work Reported This Date To Contractor:

Remarks:

❑ Attachments

Signed by: Date:

Distribution:
- ❑ Owner
- ❑ Contractor
- ❑ Construction Manager
- ❑ Design Professional
- ❑ Consultant _____
- ❑ Other _____

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

PERIODIC FIELD OBSERVATION REPORT

Project Number 81000927

Project Title Todd Creek WWTP Expansion & Major Upgrades

Contractor _____

Report Number _____ Date _____ Time _____

Weather			Site Conditions		Day	
❑ Clear	❑ Snow	❑ Warm	❑ Clear	❑ Dusty	❑ Monday	❑ Thursday
❑ Overcast	❑ Foggy	❑ Hot	❑ Muddy	❑ _____	❑ Tuesday	❑ Friday
❑ Rain	❑ Cold	❑ Temperature Range _____			❑ Wednesday	❑ _____

Persons Contacted:

Work Observed:

Items Discussed:

Remarks:

❑ Attachments

Signed by: Date:

Distribution:
- ❑ Owner
- ❑ Contractor
- ❑ Construction Manager
- ❑ Design Professional
- ❑ Consultant _____
- ❑ Other _____

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

WEEKLY REPORT OF WORKING DAYS

Project Number 81000927

Project Title Todd Creek WWTP Expansion & Major Upgrades

Contractor _____

Report Number _____ Week Ending: _____

DATE:	WORKING DAY	REMARKS

TOTAL THIS WEEK	PREVIOUSLY	TOTAL TO DATE	WORKING DAYS IN CONTRACT	REMAINING OR OVERTIME

Signed by OWNER'S REPRESENTATIVE Date:

Signed by CONTRACTOR Date:

Distribution: ❑ OWNER ❑ CONTRACTOR ❑ Construction Manager ❑ Design Professional ❑ Consultant ❑ Other

SECTION 01322 – PHOTOGRAPHIC AND VIDEO DOCUMENTATION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section outlines the requirements for photographic and video documentation. The Contractor is solely responsible for the development of an overall plan to fully document Site conditions and the progress of the Work.

B. The Contractor shall hire a professional photographer to provide the services and deliverables described herein.

C. This section does not include work associated with internal closed-circuit television (CCTV) inspections of sewer gravity pipes. See Section 02686 – CCTV Inspection of Sewer Mains.

1.02 SPECIFICATION MODIFICATIONS

A. It is understood that throughout this section these Specifications may be modified by appropriate items in Section 01015 – Specific Project Requirements or as otherwise indicated in the contract documents.

1.03 RELATED SECTIONS

A. Section 00700 – General Conditions.

B. Section 01015 – Specific Project Requirements.

C. Section 01300 – Submittals.

D. Section 01320 – Construction Progress Documentation.

E. Section 01335 – Document Management.

F. Section 02686 – CCTV Inspection of Sewer Mains.

1.04 DEFINITIONS

A. Pre-Construction Video: A video taken to document Site conditions prior to the start of construction.

B. Pre-Construction Photographs: Photographs taken to document Site conditions prior to the start of construction. All Pre-Construction Photographs shall be digital, indexed on an interactive map and shown on a View Location Map.

C. Construction Progress Photographs: Digital photographs taken to document the progress of construction.

D. Construction Activity Photographs: Digital photographs taken to document specific construction activities.

E. Post-Construction Photographs: Digital photographs taken after final restoration to document the finished condition of the Site.

F. Affidavit of Authenticity: The photographer's signed and notarized affidavit, attesting to the production of the original photographs, videos and their authenticity.

1.05 SUBMITTALS

A. Submit as specified in Section 01300 – Submittals.

B. Other required Submittals:

1. Photographer's Qualifications: Submit for review and approval the qualification information demonstrating the photographer meets the requirements of paragraph 1.06 of this Section.
2. Phasing Plan: If applicable, submit for review and approval a phasing plan for Pre-Construction Photographs and Videos.

3. Pre-Construction Photographs: Submit for review and approval digital pre-construction photographs with an interactive index map, Photograph Navigation System (see paragraph 2.05 of this Section) and affidavit of authenticity.
4. Pre-Construction Video: Submit for review and approval a pre-construction video with a Video Navigation System (see paragraph 2.05 of this Section) and affidavit of authenticity (see paragraph 1.04 of this Section).
5. Construction Progress Photographs: On a monthly basis, submit digital construction photographs, interactive index map and affidavit of authenticity.
6. Construction Activity Photographs: On a monthly basis, submit digital activity photographs (if different than progress photographs), interactive index map and affidavit of authenticity.
7. Post-Construction Photographs/Video: Submit for review and approval digital post-construction photographs or video, interactive index map and affidavit of authenticity.

1.06 QUALITY ASSURANCE

A. The Contractor is responsible for the quality assurance and quality control of the Work.
B. General Quality: Photographs and video shall be clear and of sufficient quality to show relevant detail. They shall not be blurred, taken in shadow or too far away to provide conclusive information. The City may require that the photographs or video be retaken should the quality be insufficient. Costs for such re-takes are the Contractor's sole responsibility and shall be done at no extra cost to the City.
C. Qualifications of Photographer: The Contractor shall engage the services of a professional photographer with a minimum of 3 years of experience in construction photography to document the conditions of the project site. Upon request, samples of the photographer's prior work and/or references shall be submitted.
D. Affidavit of Authenticity: The Contractor shall provide the photographer's signed and notarized affidavit, attesting to the production of the original photographs, videos and their authenticity. An affidavit of authenticity shall be provided with each submittal/deliverable.

1.07 MINIMUM REQUIREMENTS

A. The section specifies several different sets of photographic and video documentation requirements. The extent of documentation will depend upon the size and type of the project. The following table summarizes the basic documentation requirements.

Table 1. Summary of Requirements

Set of Documentation	Mandatory	As Required by Section 01015
Pre-Construction Video		✓
Haul Route Video		✓
Pre-Construction Photographs	✓	
Interactive Index Map		✓
Construction Progress/Activity Photographs		✓
Post-Construction Photographs/Video		✓

1.08 OWNERSHIP

A. The photographs and videos shall become the sole property of the City.

1.09 SCHEDULES

A. Schedule of Values: Photographic/Video documentation shall be listed as one line item in the Schedule of Values.
B. Construction Progress Documentation: Each set of photographs or videos shall be listed in the Preliminary Project Schedule as a discrete activity. See Section 01320 – Construction Progress Documentation.

1.10 PHASING

A. Based on the nature and scope of the Work, the Contractor may phase the Pre-Construction Photographs and Video. If phasing is to be implemented, the following shall apply:
   1. The Contractor shall submit a Phasing Plan that identifies each area of the Work.
   2. For each phase, Pre-Construction Photographs and Videos shall be taken within 21 days of the start of construction activities unless otherwise approved in writing by the City/Design Professional.
B. Under no circumstances shall construction begin in any area until the Pre-Construction Photographs and/or Video have been submitted and approved by the City/Design Professional.

PART 2 - PRODUCTS

2.01 PHOTOGRAPH QUALITY

A. Photographic images shall be captured in digital format, with a minimum of 10-megapixel resolution and taken without JPG compression.
B. Each photograph shall include a date/time stamp in the image, showing when the image was taken.

2.02 VIDEO QUALITY

A. All video recordings shall be captured in full 1080-dpi Hi-Definition digital format, without compression or file-reduction whether applied in-camera or after capture during editing.
B. The original video segments shall be retained in the format captured in camera (such as MP4 or MTS for Canon HD Video) without compression or modification that would reduce resolution or quality. The video shall include a date/time stamp in the image, showing when the image was taken. Video shall include verbal description and narrative of what is being captured.

2.03 METADATA

A. Digital files for photographs and videos shall, at a minimum, contain the following metadata:
   1. Project Name.
   2. Date and Time Taken.
   3. All other metadata inherently provided by the camera/video equipment.

2.04 MEDIA LOG

A. The Contractor shall maintain a media log (photographs and videos) for the project. The log shall include, but is not limited to, the following information for each photograph and/or video:
   1. Project Name.
   2. Project Number.
   3. Contract Number.
   4. Name of City and Department.

5. Name of Contractor.
6. Name of Design Professional.
7. Photograph file name (the specific format should be tied to the project name). Photograph file name shall be unique to each digital file and shall be embedded in the digital image in a manner that is permanent and clearly legible when the file is opened.
8. Include a date designator in file names.
9. Date the photograph was taken.
10. The name of the photographer who took the photograph.

2.05 PHOTOGRAPH AND VIDEO NAVIGATION SYSTEM

A. If specified in Section 01015 – Specific Project Requirements, the Contractor shall provide an electronic photographic and video navigation system (navigation system) for searching and viewing recorded imagery.

B. Interactive Index Map: The navigation system shall indicate the general location of each area photographed or video recorded using icons and other suitable mark-ups on the actual construction drawings in PDF-format.

C. The navigation system shall utilize standard PDF-reader software (such as Adobe Reader, Acrobat, or Bluebeam Vu) or other software that shall be included with the deliverables. Icons shall be individually hyperlinked to the respective photograph, video, affidavit of authenticity and media log file for immediate playback in Windows Media Player, VLC or other players.

D. The navigation system shall include the following:
1. Project Name.
2. Project Number.
3. Contract Number.
4. Name of City.
5. Name of Contractor.
6. Name of Design Professional.
7. Ranges of dates for which the photographs or videos were taken.
8. The name of the photographer.
9. Affidavit of Authenticity.
10. Media Log.
11. Photographs.
12. Videos.

E. A navigation system shall be provided for each set of photographs and videos taken.

PART 3 - EXECUTION

3.01 PRIOR TO PHOTOGRAPHIC AND VIDEO DOCUMENTATION

A. Construction Limits: Prior to the Pre-Construction Photographs and Video, the Contractor shall flag or mark the construction limits and excavation areas for identification, and project centerlines shall be physically marked with survey stakes and/or high visibility paint (including station numbers).

B. Mark Utilities: Prior to the Pre-Construction Photographs or Video, the Contractor shall notify utilities and have them marked so that utility locations are documented.

C. Coordinate with City: For any work that requires a representative of the City to be present, the Contractor shall provide the City a minimum of 2 days' notice.

3.02 PRE-CONSTRUCTION VIDEO

A. If specified in Section 01015 – Specific Project Requirements, the Contractor shall provide a pre-construction video.

B. Scope: Prior to the start of construction, the Contractor shall prepare a color video recording with audio of all the areas to be affected by construction. All pre-construction video recordings shall have sufficient detail to reveal the condition (including defects and damage) of all existing features, such as pavement, driveways, culverts, inlets, sidewalks, landscaping, vegetation, creek banks, trees, structures, foundations and other such items along the construction route and in the immediate adjacent areas, which might be affected by the construction operations. In addition, the videographer shall move beyond the construction zone as needed to ensure documentation of features and areas that may not be adequately recorded from the centerline rotations. Videos shall be taken on both sides of the street when construction is in or along a roadway (use this approach along drainage channels and in other similar situations).

C. Schedule: Taken after utilities have been marked and prior to the placement of materials or equipment on the Site. Videos shall be submitted to the City for review and approval. Under no circumstances shall construction begin until the pre-construction video has been submitted and approved.

D. The pre-construction video recording shall be done in the presence of a representative of the City.

E. The Contractor shall document all pre-existing site conditions/elements of the Site, the same as listed for the Pre-construction Photographs.

F. The video documentation shall provide a clear and continuous view of the project showing all visible utilities and features within the limits of construction.

G. To preclude the possibility of tampering or editing in any manner, all video recordings shall, by electronic means, generate and display continuously and simultaneously on the screen or in the video file metadata properties digital information to include the date and time of recording. The time information shall consist of hours, minutes and seconds, separated by colons (i.e., 10:35:18).

H. The audio/video recording shall consist of one video and one audio track which shall be recorded simultaneously. All tracks shall consist of the original live recordings and thus shall not be copies of other audio or video recordings.

I. The audio track shall contain the narrative commentary. Ample descriptive narrative shall be recorded simultaneously during all recordings. Narration shall include clearly audible comments that will deliver station number and/or street address, locations, direction of view and rotation.

J. Typical video segments should not exceed 10 minutes in length.

K. Rotations of 360-degrees shall be at the beginning and end of each video segment and at each 100 foot increment throughout the video.

L. The rate of speed in the general direction of travel of the conveyance used during recording shall be controlled to provide a usable image. On average, the rate of forward travel during videotaping shall not be less than fifteen minutes for every 1000 linear feet of pipeline route or street centerline; slower rates shall be utilized in residential/commercial areas.

M. Panning rate, zoom-in rate and zoom-out rate shall be controlled sufficiently such that playback will provide clarity of the object viewed.

N. All recording shall be done during times of good visibility. No recording shall be done during periods of precipitation unless authorized by the City.

3.03 HAUL ROUTE VIDEO

A. If specified in Section 01015 – Specific Project Requirements, the Contractor shall provide pre-construction video documentation of all haul routes associated with the Project.
B. Haul route videos shall be made at the time of the Pre-Construction Photographs.
C. Haul Route Videos shall meet the requirements of the paragraph PRE-CONSTRUCTION VIDEO as well as the following:
    1. Haul routes shall be recorded during daylight hours and during good weather conditions.
    2. Video equipment may be mounted on a vehicle. The speed of the vehicle while recording shall not be more than 5 miles per hour (mph). If traffic or safety concerns prohibit driving 5 mph then the video shall be taken while walking the route.
    3. No audio/narrative commentary is required for the haul route video.

3.04 PRE-CONSTRUCTION PHOTOGRAPHS

A. The Contractor shall provide pre-construction photographs as specified in this Section and as specified in Section 01015 – Specific Project Requirements.
B. Scope: The purpose for pre-construction photo documentation is to record existing conditions, damage and features on or adjacent to the project site. The principal reason for obtaining photographs is so that items such as cracked curbs, broken pavement, sidewalks, plugged culverts, driveway conditions, lawn conditions and other existing conditions located in the Project Site may be clearly shown and documented. This will to some degree mitigate the possibility of post-construction restoration issues with property owners in the Project area.
C. Schedule: Take photographs after utilities have been marked, prior to placement of materials or equipment on the Site and prior to the start of construction activities in an area. Photographs shall be submitted to the City for review and approval. Under no circumstances shall construction begin until the pre-construction photographs have been submitted and approved.
D. Pre-construction photographs shall be taken at sufficient intervals to be able to carefully document the pre-construction conditions of the Site and in no case more than 50-foot intervals along the street, right-of-way, drainage easement and water/wastewater line route before commencement of the Work.
E. In addition, select photographs shall be taken as needed along the construction limits, and of adjacent properties, to ensure documentation of features and areas that may not be adequately recorded in the centerline rotations. Photographs shall be taken along both sides of the street when construction is in or along a roadway.
F. Overlapping composition techniques shall be employed to ensure maximum photographic coverage.
G. Pre-construction photographs shall be taken after the utility locations have been marked.
H. Pre-construction photographs shall be taken with a representative of the City present unless otherwise authorized by the City.
I. All Pre-Construction Photographs shall have sufficient detail to reveal the condition (including defects and damage) of all existing features, such as pavement, driveways, culverts, inlets, sidewalks, landscaping, vegetation, creek banks, trees, structures, foundations and other such items along the construction route, and adjacent areas which might be affected by the construction operations. An identifier such as house or business address/signs, property numbers, mail boxes, landscaping, etc… shall be included when practical in each view for ease of identification.
J. At a minimum, pre-construction photographs must be taken of the following views:
    1. The entire street right of way and limits of construction; whichever is greater.
    2. The entire easement width and length (both permanent and temporary).

3. All curb lines (both sides of street) – all pre-existing curb damage not called for replacement within the Work and shall include major cracks.
4. All driveways, steps, and curbs and curb ramps (both sides of street).
5. Fence and gate conditions.
6. Trees, ornamental shrubs, plantings/planter boxes and evidence of irrigation features.
7. Other privately or publicly owned features or facilities that might be disturbed by the construction.
8. Views of structures, both inside and adjacent to the project site and easements in areas where the Contractor will be working within five (5) feet of said structure.
9. Prominent utility features, such as: guy wires, poles, signs, valves, fire hydrants, meters, pull boxes, etc.
10. Streams and stream banks within the limits of construction.
11. At the discretion of the Contractor, photograph offsite roadways that will be subjected to heavy usage such as for haul routes or delivery of heavy components or equipment. Refer to Paragraph HAUL ROAD VIDEO for additional requirements.
12. Other significant or prominent features to protect the City and the Contractor following construction (e.g. close-up photographs of pre-existing broken curbs, cracked/failed pavement, damaged adjacent retaining walls, etc.).
13. Views of structures, both inside and adjacent to the ROW/easement in areas where the Contractor will be working within five (5) feet of said structure.
14. Other views as requested by the City.

3.05 CONSTRUCTION PROGRESS PHOTOGRAPHS

A. If specified in Section 01015 – Specific Project Requirements, the Contractor shall provide Construction Progress Photographs.
B. Scope: The Contractor shall provide construction progress photographs to depict the progress of the work. The Contractor shall be responsible for photographs of the Site to show the existing and general progress of the Work. The City will advise as to which views are of interest.
C. Schedule: Photographs shall be taken at the time of the Pre-construction Photographs, a minimum of once per month throughout the duration of the Project, and at the time of the Post Construction Photographs. Construction Progress Photographs are to be submitted each month with the Contractor's Application for Payment. Applications for Payment was not be considered acceptable until the photographs are provided.
D. This set of photographs will be taken as close as possible to the same locations and views of the pre-construction photography.

3.06 CONSTRUCTION ACTIVITY PHOTOGRAPHS

A. If specified in Section 01015 – Specific Project Requirements, the Contractor shall provide Construction Activity Photographs.
B. Scope: The Contractor shall provide photographs taken to document Site conditions and specific construction activities throughout the duration of the Project.
C. Schedule: Photographs shall be taken two times per month (every two weeks) for the duration of the Project.
D. Construction Activity Photographs are to be submitted each month with the Contractor's Application for Payment.
E. Photographs shall be taken to depict the work accomplished during the month. These photographs are to include, but are not limited to, the following:
    1. Work not yet covered up.
    2. When mechanical, electrical, plumbing or building inspections are scheduled.

3. The beginning of installation of major items of equipment.
4. After installation of major items of equipment.
5. Other significant construction activities.
6. As directed by the City.

3.07 POST-CONSTRUCTION PHOTOGRAPHS

A. If specified in Section 01015 – Specific Project Requirements, the Contractor shall provide Post-Construction Photographs.

B. Scope: The Contractor shall provide Post-Construction Photographs of the project area that documents the final restoration and construction improvements. Post-Construction photographs shall show the general condition of the construction zone (recording finished landscape and other restoration, plus construction improvements), and other areas that may have been affected by construction activities.

C. Schedule
   1. Photographs shall be taken after completion of the Substantial Completion punch list when the project is complete, the Site is restored to the satisfaction of the City, and before submission of the Application for Final Payment.
   2. Post-construction photographs shall be taken after all items have been address from the Substantial Completion inspection, after cleanup and site restoration, and before application for final payment.

D. Post-Construction Photographs are to be submitted with the Contractor's Application for Final Payment.

E. The Contractor shall coordinate the schedule of the post-construction photographs with the City's Project Manager and shall provide at least 5 days written notice to allow the City's Representative to be present when the photographs are taken.

3.08 POST-CONSTRUCTION VIDEO

A. If specified in Section 01015 – Specific Project Requirements, the Contractor shall provide a Post-Construction Video.

B. Scope: The Contractor shall prepare a color video recording with audio of all the areas affected by construction. All Post-Construction video recordings shall have sufficient detail to reveal the final, restored condition of all existing features, such as pavement, driveways, culverts, inlets, sidewalks, landscaping, vegetation, creek banks, trees, structures, foundations, and other such items along the construction route, and in the immediate adjacent areas, which might have been affected by the construction operations. In addition, videographer shall move beyond the construction zone as needed to insure documentation of features and areas that may not be adequately recorded from the centerline rotations. Videos shall be taken on both sides of the street when construction is in or along a roadway (use this approach along drainage channels and in other similar situations).

C. Schedule: The post-construction video shall be taken in conjunction with the post-construction photographs.

D. Post-construction videos are to be submitted with the Contractor's Application for Final Payment.

E. Unless otherwise authorized by the City, the post-construction video recording shall be done with a representative of the City present.

F. The Contractor shall document all post-construction site conditions/elements of the Site as listed for the post-construction Photographs.

G. The video documentation shall provide a clear and continuous view of the project alignment showing all visible utilities and features within the limits of construction.

H. To preclude the possibility of tampering or editing in any manner, all video recordings shall, by electronic means, generate and display continuously and simultaneously on the screen digital information to include the date and time of recording. The time information shall consist of hours, minutes and seconds, separated by colons (i.e., 10:35:18).
I. The audio video recording shall consist of one video and one audio track which shall be recorded simultaneously. All tracks shall consist of original live recordings and thus shall not be copies of other audio and video recordings.
J. The audio track shall contain the narrative commentary. Ample descriptive narrative shall be recorded simultaneously during all recordings. Narration shall include clearly audible comments that will deliver station number and/or street address locations, direction of view and rotation.
K. Typical video segments should not exceed 10 minutes in length.

3.09 DELIVERABLES

A. Refer to Section 01015 – Specific Project Requirements for additional deliverables required for the Project.
B. Delivery of the documentation record shall be made as soon as is practical after the images are recorded. Deliverables include original photographs in JPG format, photographs converted to pdf format, interactive map index and navigation system.
C. Electronic Storage Devices: Submit the navigation system on a non-returnable USB compatible flash drive. Submittals shall conform to the following:
    1. Submit with the monthly invoice two sets of digital photographs and/or videos. Each set shall be contained on a separate electronic storage device.
    2. Each set shall be cumulative of all photographs and/or videos taken to date.
    3. Affidavit(s) of Authenticity shall be included in a digital format.
D. Document Management System: Unless otherwise noted in Section 01015 – Specific Project Requirements, all deliverables shall be provided in an electronic format using the specified document management system and in accordance with paragraph 1.05 of this Section.

END OF SECTION

SECTION 01329 – SAFETY PLAN

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the development and maintenance of a Construction Safety Plan.

1.02 REFERENCES

A. National Fire Protection Association (NFPA):
    1. 70E - Standard for Electrical Safety in the Workplace.
B. Occupational Safety and Health Administration (OSHA).
C. Section 01300 Submittal Procedures.

1.03 CONSTRUCTION SAFETY PLAN

A. Detail the Methods and Procedures to comply with NFPA 70E, Federal, and Local Health and Safety Laws, Rules and Requirements for the duration of the Contract Times. Include reference to and comply with latest Owner safety policies. Include the following:
    1. Identification of the Certified or Licensed Safety Consultant (Safety Officer) who will prepare, initiate, maintain and supervise safety programs, and procedures.
    2. Procedures for providing workers with an awareness of safety and health hazards expected to be encountered over the course of construction.
    3. Safety equipment appropriate to the safety and health hazards expected to be encountered during construction including hydrogen sulfide (H2S), asbestos, and lead. Include warning devices, barricades, safety equipment in public right-of-way and protected areas, safety equipment used in multi-level structures, and personal protective equipment (PPE) as required by NFPA 70E.
    4. Methods for minimizing employees' exposure to safety and health hazards expected during construction including entrance to tanks, such as digesters, and confined spaces used in the operation of the treatment plant and demolition.
    5. Procedures for reporting safety or health hazards.
    6. Procedures to follow to correct a recognized safety and health hazard.
    7. Procedures for investigation of accidents, injuries, illnesses, and unusual events that have occurred at the construction site.
    8. Periodic and scheduled inspections of general work areas and specific workstations.
    9. Training for employees and workers at the jobsite.
    10. Methods of communication of safe working conditions, work practices and required personal protection equipment.
    11. Provision of a site-specific emergency action and evacuation plan during normal operations as well as when site access is blocked by trains.
B. Submit draft Safety Plan to Owner in accordance to Section 01300 Submittal Procedures for review prior to the Pre-Construction Meeting. The Safety Plan shall be a discussion topic on the agenda for the Pre-Construction Meeting. Following the Pre-Construction Meeting, Design-Builder shall submit final Safety Plan for Owner review within two weeks.
C. Design-Builder Assume assumes sole responsibility for every aspect of Health and Safety on the jobsite, including the health and safety of subcontractors, suppliers, and other persons on the jobsite:

1. Forward available information and reports to the Safety Consultant Officer who shall make the necessary recommendations concerning worker health and safety at the jobsite.
2. Employ additional health and safety measures specified by the Safety Consultant Officer, as necessary, for workers in accordance with OSHA guidelines.

D. Timely Transmit to Owner and Engineer copies of reports and other documents related to accidents or injuries encountered during construction in accordance with Section 01300 Submittal Procedures.

E. Smoking
1. There is no smoking allowed in buildings or within 50 feet of Digesters and NFPA classified areas and envelopes.
2. No smoking will be allowed in facilities once they are closed in.
3. No smoking will be permitted anywhere on the site following delivery of chemicals.
4. Smoking is only allowed in Owner designated areas.
5. Design-Builder shall provide signage identifying designated smoking areas, and when any changes to the designated areas are made.
6. Design-Builder will be responsible for cleaning up cigarette butts.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

End of Section

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

TRANSMITTAL LETTER

Project Number 81000927

Project Title Todd Creek WWTP Expansion & Major Upgrades

Date _____

TO: _____ Re: _____

ATTN: _____

We are sending you ❑ Attached ❑ Under separate cover via _____ the following items:
❑ Shop Drawings ❑ Prints ❑ Drawings ❑ Samples ❑ Specifications
❑ Copy of Letter ❑ Change Order ❑ _____

Copies	Date	No.	Description

These are transmitted as checked below:

❑ For Approval ❑ Approved as Submitted ❑ Resubmit _____ Copies for Approval
❑ For Your Use ❑ Approved as Noted ❑ Submit _____ Copies for Distribution
❑ As Requested ❑ Returned for Corrections ❑ Return _____ Corrected Prints
❑ For Review and Comment ❑ _____

Remarks: _____

By: _____

Distribution:
❑ Owner
❑ Contractor
❑ Construction Manager
❑ Design Professional
❑ Consultant
❑ Other

SECTION 01335 –DOCUMENT MANAGEMENT

PART 1 - GENERAL

1.01 SUMMARY

A. An internet-based coordination and document management systems (DMS), e-builder (Trimble) & B2G, will be used for the Project. This system will be used to manage project documentation among the City (and/or Designee) , Contractor (or Design-Builder) and Engineer of Record. The Contractor or Design-Builder shall utilize the document management system for all project related correspondence and documentation.

B. The DMS will be utilized to create, track and organize project documentation (City's Representative will provide the exceptions), including, but not limited to, the following:
   1. Schedules.
   2. Applications for Payment.
   3. Meeting minutes with action items.
   4. Project correspondence.
   5. Shop Drawing and Sample(s) Submittals.
   6. Transmittals.
   7. Change Management:
      (a) General Contractor Requests for Interpretation.
      (b) Proposal Requests.
      (c) Work Change Directives. (Storage only)
      (d) Change Orders.
   8. Reporting:
      (a) Certified Payroll Report. (B2G)
      (b) Subcontractors and Major Material Suppliers List. (B2G)
      (c) Daily Labor Force Reports. (B2G)
      (d) Daily Inspection Reports.
      (e) Photographs and Video.
      (f) Certificate of Achievement of Full Operation.
      (g) Contractor Affidavit for Final Payment.
      (h) Subcontractor Affidavit for Final Payment.
      (i) Punch Lists.
   9. Notifications:
      (a) Correction of Defective Work.
      (b) Notification of Non-Compliant Work.

1.02 RELATED SECTIONS

A. Section 00700 – General Conditions.
B. Section 01015 – Specific Project Requirements.
C. Section 01300 – Submittals.

1.03 COORDINATION MEETING

A. Prior to the pre-construction conference, the City will facilitate a meeting with the Contractor or Design-Builder to review requirements for project coordination, document control and use of the DMS. The meeting should be scheduled to allow

the Contractor or Design-Builder time to submit the initial project correspondence, other requirements and preliminary schedules in accordance with Section 00700-General Conditions.

B. At this meeting, the City will present the procedures to be used for document management for the Project.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01340 - PROJECT BIM COORDINATION

PART 1 - GENERAL

1.01 SUMMARY OF WORK

A. This section covers Building Information Modeling (BIM) enabled projects.

1.02 Related Sections

A. 01000 – General Requirements
B. 01019 – Closeout Procedures
C. 01615 – Equipment Identification & Tagging
D. 01340.A - Attributes
E. Kansas City Water Services Department Design Standards – CAD Drawing Standards

1.03 CODES AND SECTIONS

A. Not Applicable

1.04 DEFINITIONS

A. General Definitions
    1. BIM – Building Information Model
    2. Design Phase – The overall design is broken into separate stages. Each phase is a certain level of development.
    3. LIDAR - This is an acronym for Light Detection and Ranging. This method measures distances using laser light and measuring the reflection with a sensor. This is also called 3-D Laser Scanning.
    4. Modeled Object – An equipment asset created in BIM. Modeled objects are tagged using a parent-child-grandchild data structure with CMMS tag level 6 is the parent, CMMS tag level 7 is the child, CMMS tag level 8 is the grandchild. The grandchild inherits data from the child and the child inherits data from the parent.
    5. Overlay – Placing an object over the surface of another of another object thus allowing the object to be visible on drawings or other deliverables by viewer.
    6. Point Cloud - A set of data points in space used for capturing existing conditions of any site.
    7. Relative File Path – a defined location relative to BIM's current directory
    8. Site Types
        a. Brownfield – Project locations with hazardous materials at in existing in-use facilities by City.
        b. Grayfield - Project locations with existing in-use facilities by City.
        c. Greenfield – Project locations with no in-use facilities by City.
    9. Standard Component – Any valve, pipe, duct, fitting, cable, cable tray, conduit, wiring, or structural member where aforementioned component is dimensionally defined in a Design Standard.
    10. State Plane Coordinate System – U.S. Coordinate system used by each U.S. state and has between one to six zones depending on size and shape.
B. Software Definitions

1. Software Packages
    a. Autodesk Construction Cloud – Cloud-based platform that shows the latest published Revit 3D models for design collaboration between Owner and Contractors.
    b. CMMS – Computerized Maintenance Management System used for operation and maintenance of facility assets. CITY's current CMMS is Hansen Infor™.
    c. Revit – Autodesk software used for Building design, Foundation design, Structural design, and MEP design.
2. CMMS
    a. CMMS Parameters – Fields within Autodesk Revit associated with identifying and describing an asset or equipment item. These fields allow for the creation of unique identifiers for each piece of equipment, and allowing for synching with CITY's CMMS. Refer to Section 013124.A – BIM Attributes.
    b. CMMS Synching – Process that integrates the BIM model with CMMS.
3. CMMS Facility Key – Unique identifier used in City's asset management system. The asset management system relies on this unique identifier to incorporate all information collected into the asset management system. This may hereinafter also be referred to as the Comp Key.
4. Dynamic – Any item, field, attribute, or other component which receives an active input from a source other than by a manual user.
5. Parameter – Fields with populated values in BIM modeling software. In Autodesk Revit, these are commonly referred to as family parameters.
6. Publish – The process of pushing any model changes into cloud-based BIM software for the purpose of coordination between interdisciplinary and inter-organizational teams
7. Static – Any item, field, attribute, or other component which requires manual edit to change its value.

1.05 BIM INFORMATION PROVIDED BY OWNER

A. Existing
    1. Existing survey information, GIS data, 2D drawing documents, and existing BIM models will be shared with BIM responsible person(s).
    2. Non-available information will be determined prior to commencing any site visits. If needed, non-available information will be collected while on site and incorporated into the BIM model. Site visits may also identify any additional information needed for completion of Work and needed to be included in the BIM model.
    3. CITY encourages the use of LIDAR for documenting conditions due to increased efficiency over other methods.
    4. CITY will provide CMMS Facility Key information for existing assets in CMMS.

B. Equipment and Component Specifications
    1. All final submittals from Suppliers shall be provided to DP for integration into the BIM model.
C. BIM Parameters

1.06 RECORD BIM DATA

A. General: Transmit published BIM and all related files for CITY's reference during normal working hours. Any construction-related needs will be deferred to construction drawings for interpretation by DP.
B. At the end of the project, Record BIM Data shall be incorporated to include but not limited to: 3D representation of Work, all data parameters completed and all linked information in relative file paths.
C. Data Parameters
    1. BIM and its data shall be conformed to construction records prior to BIM turnover.
    2. For BIM facility asset parameters, fill out all data parameters as defined in 013124.A – Attribute Standard including relative hyperlinks per the file structure for all information the DPs/Contractors have.
    3. Any hyperlink will direct the user to the designated file location.
    4. Transmittals required by DP must be included in the CITY's Record Submittal Zip File. All files stored in Windows 10 shall have tag metadata that includes CMMS Level 1 through CMMS Level 8 asset information.
    5. The folder containing the designated file locations will appear as shown in Figure 01.

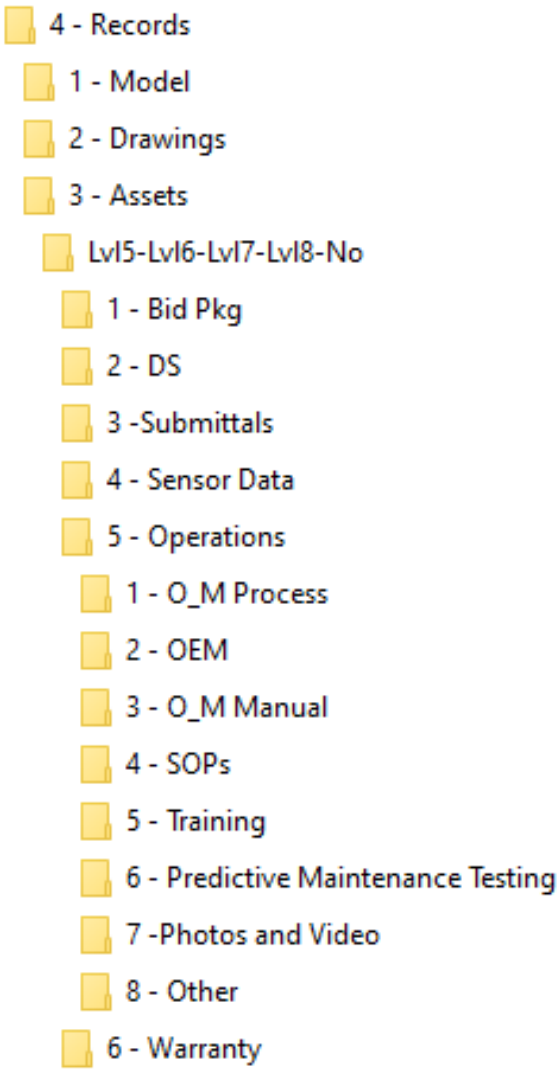


Figure 01: Record Submittal Zip File Structure

D. Submission
   1. BIM model must be cross-checked against field records and is free of conflicting data.
   2. Each BIM parameter with a link to a file shall be confirmed to work using relative file paths. Relative file paths will be used when during turnover of the Revit model and equipment documentation. Refer to CITY's Attribute Standard and CITY zip submittal.
   3. Naming of BIM files must be coordinated with CITY's representative prior to submission at Closeout. At CITY's discretion, the file names will change at request by CITY.
   4. Give particular attention to information on equipment components that cannot be readily identified in the field and recorded later.

E. For requirements regarding closeout procedures, refer to Section 01019.

PART 2 - PRODUCTS
Not used.

PART 3 - EXECUTION
Not used.

END OF SECTION

Equipment Parameters

CMMS Parameters			
ID Attribute	Attribute Description	Example Data	Comment
01 - CMMSDept	CMMS Department (Lvl. 1)	WSD	Text
02 - CMMSDiv	CMMS Division (Lvl. 2)	Wastewater	Text
03 - CMMSSec	CMMS Section (Lvl. 3)	Treatment	Text
04 - CMMSFacilityKey	CMMS Facility Key	(Assigned by KCWater)	Text
05 - CMMSAddressNumber	CMMS Address Number		Number
06 - CMMSAddressPreDir	CMMSAddressPreDir		Text
07 - CMMSAddressStreet	CMMS Address Street		Text
08 - CMMSAddressSuffix	CMMS Address Suffix		Text
09 - CMMSAddressPostDir	CMMS Address PostDir		Text
10 - CMMSAddressSubdesignation	CMMS Address Subdesignation		Text
11 - CMMSAddressCity	CMMS Address City		Text
12 - CMMSAddressState	CMMS Address State		Text
13 - CMMSAddressZIP	CMMS Address ZIP		Number
14 - CMMSSubArea	CMMS Sub-Area (Lvl. 4)	PXXX	Text
15 - CMMSProc	CMMS Process/Function (Lvl. 5)		Text
16 - CMMSSubProc	CMMS Systems (Lvl. 6)		Text
17 - CMMSEquip	CMMS Equipment (Lvl. 7)		Text
18 - CMMSComp	CMMS Component (Lvl. 8)		Text
19 - CMMSNumb	CMMS Number		Number
20 - CMMSDescription	CMMS Description		Text

Facility Asset Parameters			
Design Attribute	Attribute Description	Example Data	Comment
01 - ProjectNumber	Project Number	XXXXXXXXX	Text
02 - BidPkgNumber	Bid Package Number	P-XXXXX	Text
03 - ProvidedBy	Provided By	Contractor	Text
04 - InstalledBy	Installed By	Contractor	Text
05 - LocalRep	Local Representative	Contractor	Text
06 - Manufacturer	Manufacturer	XXXXX	Text
07 - Model	Model	XXXXX	Text
08 - SN	Serial Number	XXXXX	Text
09 - InstallationDate	Installation Date	XXXX.XX.XX	Text
10 - CommissionDate	Commission Date	XXXX.XX.XX	Text
11 - DecommissionDate	Decommission Date	XXXX.XX.XX	Text
12 - WarrantyStartDate	Warranty Start Date	XXXX.XX.XX	Text
13 - WarrantyEndDate	Warranty End Date	XXXX.XX.XX	Text
14 - BidPkg	Bid Package	..\3 - Equipment\(Lvl6).(Lvl7).(Lvl8).No\1 - Bid Pkg	URL
15 - DS	Equipment Datasheet	..\3 - Equipment\(Lvl6).(Lvl7).(Lvl8).No\2 - DS	URL

16 - Submittals	Submittals	..\3 - Equipment\(Lvl6).(Lvl7).(Lvl8).No\3 - Submittals	URL
17 - O_MProcess	Operation & Maintenance Process	..\3 - Equipment\(Lvl6).(Lvl7).(Lvl8).No\5 - Submittals\1 - O_M Process	URL
~~18 - OEMs~~	~~Original Equipment Manufatureres~~	~~..\3 - Equipment\(Lvl6).(Lvl7).(Lvl8).No\5 - Submittals\2 - OEMS~~	~~URL~~
19 - O_Mmanual	Operation & Maintenance Manual	..\3 - Equipment\(Lvl6).(Lvl7).(Lvl8).No\5 - Submittals\3 - O_M Manual	URL
20 - SOPs	Standard Operating Procedures	..\3 - Equipment\(Lvl6).(Lvl7).(Lvl8).No\5 - Submittals\4 - SOPs	URL
21 - Training	Training	..\3 - Equipment\(Lvl6).(Lvl7).(Lvl8).No\5 - Submittals\5 - Training	URL
22 - Other	Other	..\3 - Equipment\(Lvl6).(Lvl7).(Lvl8).No\5 - Submittals\7 -Others	URL
23 - PredictiveMaintTesting	Predicitive Maintenance Testing	..\3 - Equipment\(Lvl6).(Lvl7).(Lvl8).No\5 - Submittals\6 - Predictive Maintenance Testing	URL
24 - PhotosAndVideos	Photos and Videos	..\3 - Equipment\(Lvl6).(Lvl7).(Lvl8).No\5 - Submittals\7 - Photos and Videos	URL
25 - PredictiveMaintLog	Predicitive Maintenance Log	https:\\www.xxxx.com	URL - (Hyperlink to CMMS log)
26 - PreventativeMaintenanceLog	Preventative Maintenance Log	https:\\www.xxxx.com	URL - (Hyperlink to CMMS log)
27 - CorrectiveMaintenanceLog	Corrective Maintenance Log	https:\\www.xxxx.com	URL - (Hyperlink to CMMS log)
28 - GEN	General Notes	..\2 - Drawings\1 - General Notes\Filename.pdf	URL - (To Location of General notes sheet applicable to Equip.)
29 - PID	PID Drawing	..\2 - Drawings\2 - PIDs\Filename.pdf	URL - (To Location of P&ID where Equip. can be found on it)
30 - PL	Plan Drawing	..\2 - Drawings\3 - Plans\Filename.pdf	URL - (To Location of Plan Dwg where Equip. can be found on it)
31 - ELP	Enlarged Plan Drawing	..\2 - Drawings\4 - Enlarged Plans\Filename.pdf	URL - (To Location of Plan Dwg where Equip. can be found on it)
32 - EL	Elevation Drawing	..\2 - Drawings\5 - Elevations\Filename.pdf	URL - (To Location of Elevation Dwg where Equip. can be found on it)
33 - PRO	Profile Drawing	..\2 - Drawings\6 - Profiles\Filename.pdf	URL - (To Location of Profile Dwg where Equip. can be found on it)
34 - SEC	Section Drawing	..\2 - Drawings\7 - Sections\Filename.pdf	URL - (To Location of Section Dwg where Equip. can be found on it)
35 - DET	Detail Drawing	..\2 - Drawings\8 - Details\Filename.pdf	URL - (To Location of Detail Dwg where Equip. can be found on it)

SECTION 01352 – SELECTIVE ALTERATIONS AND DEMOLITION

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:
    1. Cutting or modifying existing or new work.
    2. Partial demolition of structures.

1.02 REFERENCES

A. American National Standards Institute (ANSI):
    1. A10.6 - Safety and Health Program Requirements for Demolition Operations.
B. International Concrete Repair Institute (ICRI):
    1. Guideline No. 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.
    2. Guideline No. 310.3R - Guide for the Preparation of Concrete Surfaces for Repair Using Hydro Demolition Methods.

1.03 RELATED SECTIONS

A. Section 00700 – General Conditions.
B. Section 00800 – Supplementary Conditions.
C. Section 01020 – Record Documents.
D. Section 01140 – Work Restrictions.
E. Section 01300 – Submittals.
F. Section 01329 – Safety Plan.
G. Section 01354 – Hazardous Material Procedures.
H. Section 01566 – Cleanup Operations.
I. Section 01580 – Project Signs.
J. Section 31 20 50 – Site Preparation and Earthwork.

1.04 DEFINITIONS

A. Chipping hammer: A hand-operated electrical or pneumatic demolition device for removal of hardened concrete or masonry materials having a weight of less than 15 pounds and an impact frequency of greater than 2,000 blows/minute.
B. Concrete breaker: A hand-operated electrical or pneumatic demolition device for removal of hardened concrete or masonry materials having a weight greater or impact frequency less than the limits defined for a chipping hammer.
C. Coring equipment: Non-impact rotary drill with diamond cutting edges.
D. Heavy abrasive blast: Cleaning procedure by which various abrasives materials, or steel shot, are forcibly propelled by high pressure against a surface to remove loose material and produce a concrete surface roughened to ICRI Surface Profile CSP-7, or higher, as specified in ICRI 301.3R.
E. Salvage materials: Materials removed from existing facility.

1.05 DESCRIPTION OF WORK

A. The work includes partial demolition, cutting, and modifying of existing facilities, utilities, and/or structures.
B. These facilities may be occupied and/or operational. Satisfactory completion of the work will require that the Contractor plan activities carefully to work around unavoidable obstacles and to maintain overall stability of structures and structural elements. It will further require restoration of existing facilities, utilities, and structures that are to remain in place and that are damaged by demolition or removal operations.

1.06 SUBMITTALS

A. General:
    1. Submit as specified in Section 01300 - Submittals.
B. Shop drawings include:
    1. Demolition Plan outlining the proposed sequence of events and procedures to be utilized for any demolition activities required as part of the Work. This plan shall include a plan for proper notification of Owner and other affected parties relative to the respective Work.
    2. The location of all embedded items shall be documented using diagrams and/or other media that clearly show dimensions and locations of existing structural elements, existing embedded items, and any new embedded items and their relationship to each other.
C. Submittals for information only:
    1. Permits and notices authorizing demolition.
    2. Certificates of severance of utility services.
    3. Permit for transport and disposal of debris.
D. Quality assurance submittals:
    1. Qualifications of non-destructive testing agency/agencies.
E. Project record documents.
F. Drawings and/or other media documenting locations of service lines and capped utilities.

1.07 QUALITY ASSURANCE

A. Qualifications:
    1. Assign relocation, removal, cutting, coring, and patching to trades and workers qualified to perform the Work in a manner that causes the least damage and that provides means of returning surfaces to an appearance at least equal to that of the surrounding areas unaffected by the Work.
    2. Non-destructive testing agencies shall have experience performing non-destructive testing for location of steel reinforcement in existing concrete under conditions that are similar to that required for this Work.

1.08 SEQUENCING

A. Perform Work in sequences and within times specified in Section 01140 - Work Restrictions.
B. If the facility or utility to be modified cannot be removed from service, perform the Work while the facility is in operation using procedures and equipment that do not jeopardize operation or materially reduce the efficiency of that facility.
C. Coordinate the Work with operation of the facility:

1. Do not begin alterations of designated portions of the Work until specific permission for activities in each area has been granted by Owner in writing.
2. Engineer will coordinate the planned procedure with facility manager.
3. Complete Work as quickly and with as little delay as possible.

D. Operational functions of the facility that are required to be performed to facilitate the Work will be performed by facility personnel only.
E. Owner will cooperate in every way practicable to assist in expediting the Work.
F. When necessary for the proper operation or maintenance of portions of the facility, reschedule operations so the Work will not conflict with required operations or maintenance.

1.09 REGULATORY REQUIREMENTS

A. Dispose of debris in accordance with governing regulatory agencies.
B. Comply with applicable air pollution control regulations.
C. Obtain permits for building demolition, transportation of debris to disposal site and dust control.

1.10 PREPARATION

A. Non-destructive evaluation of existing concrete and masonry:
    1. Prior to cutting, drilling, coring, and/or any other procedure that penetrates existing concrete [or masonry], retain and pay for the services of a qualified non-destructive testing agency to perform investigations to determine the location of existing steel reinforcement, plumbing, conduit, and/or other embedment's in the concrete.
    2. Submit documentation of the investigations to the Engineer for review and approval as specified in Section 01300 - Submittals before any work involving penetration of existing concrete is initiated.
B. Obtain permission from adjacent property owners, including railroads, when outriggers, swinging cranes, and other equipment may have to traverse or extend into adjacent property.

1.11 PROJECT CONDITIONS

A. Do not interfere with use of adjacent structures and elements of the facility not subject to the Work described in this Section. Maintain free and safe passage to and from such facilities or adequate barriers to prevent unsafe passage.
B. Provide, erect, and maintain barricades, lighting, guardrails, and protective devices as required to protect building occupants, general public, workers, and adjoining property:
    1. Do not close or obstruct roadways without permits.
    2. Conduct operations with minimum interference to public or private roadways.
C. Prevent movement, settlement, or collapse of structures adjacent services, sidewalks, driveways and trees:
    1. Provide and place bracing or shoring.
    2. Cease operations and notify Engineer immediately when safety of structures appears to be endangered. Take precautions to properly support structure. Do not resume operations until safety is restored.
    3. Assume liability for movement, settlement, or collapse.
    4. Promptly repair damage.
D. Provide and arrange for capping and plugging utility services. Disconnect and stub off.
    1. Notify affected utility company in advance and obtain approval before starting demolition.

2. Place markers to indicate location of disconnected services.

E. Unknown conditions:
    1. The drawings may not represent all conditions at the site and adjoining areas. Compare actual conditions with drawings before commencement of Work.
    2. Existing utilities and drainage systems below grade are located on the Drawings based on information from existing documents and from surface facilities such as manholes, valve boxes, area drains, and other surface fixtures.
    3. If existing active services encountered are not indicated or otherwise made known to the Contractor and interfere with the permanent facilities under construction, notify the Engineer in writing, requesting instructions on their disposition. Take immediate steps to ensure that the service provided is not interrupted, and do not proceed with the Work until written instructions are received from the Engineer.

PART 2 - PRODUCTS

2.01 SALVAGE MATERIALS

A. No materials shall be designated for salvage.

PART 3 - EXECUTION

3.01 EXAMINATIONS

A. Prior to beginning selective demolition operations, perform a thorough inspection of the facility and site, and report to the Engineer defects and structural damage to, or deterioration of existing construction to remain.
B. Examine areas affected by the Work and verify the following conditions prior to commencing demolition:
    1. Disconnection of utilities as required.
    2. Utilities serving occupied or active portions of surrounding facilities will not be disturbed, except as otherwise indicated.
C. If unsatisfactory conditions exist, notify the Engineer, and do not begin demolition operations until such conditions have been corrected.

3.02 PREPARATION

A. General:
    1. Review Section 01354 – Hazardous Material Procedures, before beginning selective alterations and demolition work.
B. Protection:
    1. Erect weatherproof closures to protect the interior of facilities and elements or equipment that are not designed for exposure to the weather. Provide temporary heat, cooling, and humidity control as necessary to prevent damage to existing and new construction. Maintain existing exiting paths and/or provide new paths in compliance with Building Code requirements.
    2. Erect and maintain dustproof partitions as required to prevent spread of dust, to other parts of building. Maintain negative pressure in the area where the Work is being performed to

prevent the accidental spread of dust and to minimize the spread of fumes related to the Work.

3. Upon completion of Work, remove weatherproof closures and dustproof partitions, and repair damaged surfaces to match adjacent surfaces.
4. Provide and maintain protective devices to prevent injury from falling objects.
5. Locate guardrails in stairwells and around open shafts to protect workers. Post clearly visible warning signs.
6. Cause as little inconvenience to adjacent building areas as possible.
7. Protect landscaping, benchmarks, and existing construction to remain from damage or displacement.
8. Carefully remove designated materials and equipment to be salvaged by Owner or reinstalled.
9. Store and protect materials and equipment to be reinstalled.

C. Layout:

1. The limits of selective demolition are indicated on the Drawings. Confine demolition operations within the limits indicated on the Drawings.
2. Lay out demolition and removal work at the site and coordinate with related Work for which demolition and removal is required. Clearly mark the extent of structural elements to be removed on the actual surfaces that will be removed.
3. Arrange for Engineer's inspection of the lay out extents.
4. Do not begin demolition/removal operations until the lay out markings have been reviewed by the Engineer.

3.03 DEMOLITION

A. General:

1. Perform demolition work in accordance with ANSI A10.6.
2. Demolish designated portions of structures and appurtenances in orderly and careful manner in accordance with the Selective Demolition Plan.
3. Conduct demolition and removal work in a manner that will minimize dust and flying particles.
    a. Use water or dust palliative when necessary to prevent airborne dust.
    b. Provide and maintain hoses and connections to water main or hydrant.
4. Demolish concrete and masonry in small sections. Perform demolition with small tools as much as possible. Blasting with explosive charges is not permitted.
5. Sawcut concrete to establish the edges of demolition, wherever possible.
    a. Do not use a concrete breaker within 6 inches of reinforcing or structural metals that are designated to remain.
    b. At edges that are not sawcut, remove the final 6 inches of material with a chipping hammer as defined herein. At surfaces where material is removed with a chipping hammer, follow with a heavy abrasive blast to remove all loose material and microcracking.
    c. Alternate techniques to remove concrete may be used if acceptable to the Engineer; however, techniques other than those deemed by ICRI Guideline No. 310.2R to provide a low risk of introducing microcracking will require a subsequent procedure to remove loose material.
    d. Provide final surface preparation for concrete repairs as specified in Division 3 specifications.

6. At locations indicated on the Drawings that the existing reinforcing is to be preserved, remove concrete using methods that do not damage the reinforcing. Use one of the following techniques:
    a. Hydro demolition techniques as outlined in ICRI Guideline No. 310.3R.
    b. Chipping hammer, as defined herein, followed by heavy abrasive blast to remove all loose material and microcracking at remaining surfaces impacted by the chipping hammer.
    c. Alternate methods may be used, only if acceptable to the Engineer.
    d. For all methods, provide a small, completed area for Engineer's review and acceptance. If the proposed method, in the opinion of the Engineer, damages the reinforcing, revise the removal method to remove the concrete with a less aggressive technique to protect the reinforcing.
7. Remove materials carefully, to the extent indicated and as required.
    a. Provide neat and orderly junctions between existing and new materials.
    b. Use methods that terminate surfaces in straight lines at natural points of division.
8. Do not remove anything beyond the limits of Work indicated without prior written authorization of the Engineer. If in doubt about whether to remove an item, obtain written authorization of the Engineer prior to proceeding.
9. Perform work to provide the least interference and most protection to existing facilities to remain.
10. Assume possession of demolished materials, unless otherwise indicated on the Drawings or specified.
    a. Remove demolished materials from site at least weekly and dispose of in accordance with Laws and Regulations.
11. Do not burn materials on site.

B. Sizing of openings in existing concrete or masonry:
1. Make openings large enough to permit final alignment of pipe and fittings without deflections, but without oversizing.
2. Allow adequate space for packing around pipes and conduit to ensure watertightness.
3. If the Engineer deems the opening to be insufficient in size to accomplish these criteria, remove additional material using the procedures outlined in this Section.

C. Cutting openings in existing concrete or masonry:
1. Do not allow saw cuts to extend beyond limits of openings.
2. Create openings by the following method or other means acceptable to the Engineer that prevents over-cutting of member at corners:
    a. Core-drill through slab or wall at corners, being careful not to damage materials beyond the area to be removed.
    b. Saw cut completely through the member, between the core holes at the corners.
    c. As an alternate to sawcutting through the member, score the edges of the opening with a saw to a 1-inch depth on both surfaces (when accessible).
        (1) Remove concrete or masonry to within 6 inches of material to remain with a concrete breaker.
        (2) Remove the remaining material with a chipping hammer.
    d. Remove the remaining material at the corners left by the core-drilling with a chipping hammer.

3. Prevent debris from falling into adjacent tanks or channels in service or from damaging existing equipment and other facilities.

D. Pump out buried tanks. Remove tanks and service piping from site.
E. Immediately upon discovery, remove and dispose of contaminated, vermin-infested, or dangerous materials using safe means that will not endanger health of workers and public.
F. Remove trees and shrubs within marked areas; clear undergrowth and dead plant material as specified in Section –31 20 50 – Site Preparation and Earthwork.
G. Backfill open pits and holes caused by demolition as specified in Section 31 20 50 – Site Preparation and Earthwork.
H. Rough grade areas affected by demolition.
I. Remove demolished materials, tools, and equipment upon completion of demolition.

3.04 RESTORATION

A. General:
    1. Repair damage caused by demolition to conditions equal to those that existed prior to beginning of demolition.
        a. Patch and replace portions of existing finished surfaces that are damaged, lifted, and discolored with matching material. Refinish patched portion surfaces in a manner which produces uniform color and texture to entire surface.
        b. When existing finish cannot be matched, refinish entire surface to nearest change of plane where angle of change exceeds 45 degrees.
    2. The cost of repairs shall be at the Contractor's expense, and no increase in the Contract Price.
    3. When new construction abuts or finishes flush with existing construction, make smooth transitions. Match finish of existing construction.
    4. Where partitions are removed, patch floors, walls, and ceilings with finish materials that match existing materials.
    5. Where removal of partitions results in adjacent spaces becoming one, rework floors, walls, and ceilings to provide smooth planes without breaks, steps, or bulkheads.
    6. Where changes of plane exceed 2 inches, request instructions for making transition.
    7. Trim and refinish existing doors as necessary to clear new floors.
    8. Match patched construction with adjacent construction in texture and appearance so that patch or transition is invisible at 5-foot distance.
    9. When finished surfaces are cut so that smooth transition is impossible, terminate existing surface in neat manner along straight line at natural line of division and provide appropriate trim.
B. Restore existing concrete reinforcement as follows:
    1. Where existing reinforcement is to be incorporated into the new Work, protect, clean, and extend into new concrete.
    2. Where existing reinforcement is not to be retained, cut off as follows:
        a. At the removal line where new concrete joins existing concrete, cut reinforcement flush with concrete surface.
        b. Where concrete surface at the removal line will become the finished surface, cut reinforcement 2 inches below the surface, paint ends with epoxy, and patch holes with dry pack mortar.

C. Restore areas affected by removal of existing equipment, equipment pads and bases, piping, supports, electrical panels, electric devices, and conduits such that little or no evidence of the previous installation remains:
    1. Fill areas in existing floors, walls, and ceilings from removed piping, conduit, and fasteners with non-shrink grout and finish smooth.
    2. Remove concrete bases for equipment and supports by:
        a. Saw cutting clean, straight lines with a depth equal to the concrete cover over reinforcement minus 1/2 inch below finished surface.
            (1) Do not cut existing reinforcement on floors.
        b. Chip concrete within scored lines and cut exposed reinforcing steel and anchor bolts.
        c. Patch with non-shrink grout to match adjacent grade and finish.
    3. Terminate abandoned piping and conduits with blind flanges, caps, or plugs.

3.05 FIELD QUALITY CONTROL

A. Do not proceed with demolition without Engineer's inspection of lay out.
B. Do not deviate from the submitted demolition plan without notifying the Engineer prior to Work.

End of Section

SECTION 01354 – HAZARDOUS MATERIAL PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes procedures required when encountering hazardous materials, including asbestos and lead-based paint (LBP), at the Work site.

1.02 REFERENCES

A. Occupational Safety and Health Administration (OSHA) United States Code of Federal Regulations (CFR) including, but not limited to:
    1. Title 29 - Labor:
        a. 1910 – Occupational Safety and Health Standards
            (1) 1910.1025 – Lead
            (2) 1910.1001 – Asbestos
            (3) 1910.1200 – Hazard Communication
        b. 1926 – Safety and Health Regulations for Construction
            (1) 1926.62 – Lead
            (2) 1926.1101 – Asbestos
            (3) 1926.65 – Hazardous waste operations and emergency response (HAZWOPER)
            (4) 1926.59 – Hazard Communication
B. United States Environmental Protection Agency (USEPA) including, but not limited to:
    1. Title 40 - Protection of Environment:
        a. Part 61, Subpart M – National Emission Standard for Asbestos
        b. Part 261 - Identification and Listing of Hazardous Waste
        c. Part 763 – Asbestos
C. Missouri Department of Natural Resources (MDNR):
    1. Revised Statutes of Missouri Title XL Additional Executive Departments
        a. Chapter 643 – Air Conservation
            (1) 225 – 265 – Asbestos Abatement and Asbestos Removal
D. Society for Protective Coatings (SSPC):
    1. SSPC Guide 6 (SSPC-6) – Guide for Containing Surface Preparation Debris Generated During Paint Removal Operations
    2. SSPC Guide 7 (SSPC-7) – Guide to Disposal of Lead-Contaminated Surface Preparation Debris
E. Existing KCMO WSD Reports (available upon request from WSD Project Manager):
    1. Asbestos Assessment, Todd Creek Wastewater Treatment Plant, 7600 NW 144th Street, Kansas City, MO 64163, March 31, 2023.

1.03 RELATED SECTIONS

A. Section 00700 – General Conditions.
B. Section 00800 – Supplementary Conditions.
C. Section 01020 – Record Documents.
D. Section 01140 – Work Restrictions.
E. Section 01300 – Submittals.
F. Section 01329 – Safety Plan.
G. Section 01565 – Asbestos Abatement.
H. Section 01566 – Cleanup Operations.
I. Section 01580 – Project Signs.

1.04 SUBMITTALS

A. Hazardous Materials Management Plan (HMMP):
    1. The HMMP will be submitted at least 10 days prior to the commencement of the Work and is the CONTRACTOR's comprehensive plan for the management of hazards encountered during the work, and should include:
        a. Information about the CONTRACTOR's designated Certified Industrial Hygienist (CIH) per Part 1.05 of this Section and SECTION 01565.
        b. Spill management procedures in the event of asbestos, lead or any other hazardous materials release.
        c. Intended methods of hazardous materials removal, containment, and disposal, including description of engineering controls, personal protective equipment (PPE), and compliance monitoring.
        d. Schedule and sequence of work for all hazardous materials work.
        e. A copy of the Site-Specific Hazard Communication Plan in accordance with 29 CFR 1910.1200.
        f. Copies of licenses, certifications, fit test records, medical surveillance records and notifications to handle and control hazardous materials, as applicable.
B. Submit laboratory reports, as applicable.
C. Refer to SECTION 01565 – ASBESTOS ABATEMENT for additional requirements.

1.05 DEFINITIONS

A. Asbestos-Containing Material (ACM): Mill tailings or any waste that contains commercial asbestos and is generated by a source subject to the provisions of this subpart. This term includes filters from control devices, friable asbestos waste material, and bags or other similar packaging contaminated with commercial asbestos. As applied to demolition and renovation operations, this term also includes regulated asbestos-containing material waste and materials contaminated with asbestos including disposable equipment and clothing.
B. Adequately Wet: Sufficiently mix or penetrate with liquid to prevent the release of particulates. If visible emissions are observed coming from asbestos-containing material (ACM), then that material has not been adequately wetted. However, the absence of visible emissions is not sufficient evidence of being adequately wetted.
C. Competent Person: A trained worker capable of identifying existing and predictable asbestos hazards, perform exposure assessment and monitoring, is qualified to train other workers, and has the authority to take immediate corrective action to eliminate a hazardous exposure.

D. Friable ACM (FACM): Any material containing more than 1 percent asbestos, that when dry, can be crumbled, pulverized, or reduced to powder by hand pressure.
E. Hazardous materials are those defined by 40 CFR 261 and State-specific codes.
F. Lead: As defined by 29 CFR 1926.62, lead means metallic lead, all inorganic lead compounds, and organic lead soaps. Excluded from this definition are all other organic lead compounds.
G. Non-friable ACM (NACM): Any material containing more than 1 percent asbestos, that when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.
    1. Category I NACM: Asbestos-containing packings, gaskets, resilient floor covering, and asphalt roofing products containing more than 1 percent asbestos.
    2. Category II NACM: Any material, excluding Category I NACM, containing more than 1 percent asbestos that, when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.
H. Regulated ACM (RACM): Any material that contains (a) FACM, (b) Category I non-NACM that has become friable, (c) Category I NACM that will be or has been subjected to sanding, grinding, cutting, or abrading, or (d) Category II NACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material over the course of demolition or renovation operations. Category II NACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder in the course of work.

1.06 HAZARDOUS MATERIALS PROCEDURES

A. When hazardous materials are encountered that were identified by existing reports prepared for WSD:
    1. Prepare and initiate implementation of the HMMP, as detailed in Part 1.04 of this Section.
    2. Complete notifications to Federal, State and local agencies as required by applicable Laws and Regulations within the times stipulated by such Laws and Regulations.
    3. CONTRACTOR will designate a CIH, as required per Part 1.04 of this Section, to issue pertinent instructions and recommendations for protection of workers and other affected persons' health and safety.
    4. Identify and contact subcontractors and licensed personnel qualified to undertake storage, removal, transportation, disposal, and other remedial work required by, and in accordance with, applicable laws and regulations.
B. When hazardous materials are encountered that were not identified by existing reports prepared for WSD:
    1. Prepare and initiate implementation of the HMMP as detailed in Part 1.04 of this Section.
    2. Notify immediately OWNER, ENGINEER, and other affected parties.
    3. Complete notifications to Federal, State and local agencies as required by applicable Laws and Regulations within the times stipulated by such Laws and Regulations.
    4. CONTRACTOR will designate a CIH, as required per Part 1.04 of this Section, to issue pertinent instructions and recommendations for protection of workers and other affected persons' health and safety.
    5. Identify and contact subcontractors and licensed personnel qualified to undertake storage, removal, transportation, disposal, and other remedial work required by, and in accordance with, applicable laws and regulations.
C. Forward to OWNER copies of reports, permits, receipts, and other documentation related to remedial work.
D. CONTRACTOR will assume responsibility for worker health and safety, including health and safety of subcontractors and their workers.

1. Provide training to workers on recognition, reporting, and safety and health procedures required when hazardous materials are encountered, as relevant to the Work.

E. File requests for adjustments to Contract Times and Contract Price due to the finding of previously unidentified hazardous materials at the Work site in accordance with Contract Documents.
    1. CONTRACTOR and subcontractors will minimize delays by continuing performance of the Work in areas not affected by hazardous materials operations.

1.07 LEAD-BASED PAINT REMOVAL AND DISPOSAL

A. Includes existing paint on the interior and/or exterior surfaces, as outlined in the LBP Survey Report for WSD per SSPC specifications, which may contain lead in concentrations which will require implementation of hazardous material compliance procedures as legislated by CFR Title 29 and Title 40.

B. CONTRACTOR and/or its' subcontractors will collect samples of suspected LBP using the methods and frequencies prescribed by CFR Title 29 and Title 40 from the structures identified herein and have samples tested by a certified testing laboratory to determine lead content in samples.
    1. Collect a sufficient number of paint samples to provide adequate information regarding lead content in paint on the interior and/or exterior surfaces outlined in the LBP Survey Report for WSD per SSPC specifications.
    2. Ensure that samples contain the total thickness of the paint to the substrate, where removed.
    3. Ensure that each sample contains a sufficient quantity of paint to facilitate proper and adequate analyses by testing laboratory.
    4. Ensure that samples are adequately identified with location from which it was removed.

C. Laboratory testing will be completed in accordance with applicable testing standards by a National Lead Laboratory Accreditation Program (NLLAP)–certified laboratory.
    1. Submit 10 copies of complete laboratory analyses of paint samples.

D. Prior to beginning the Work associated the removal, containment, and disposal of LBP and associated debris, prepare and submit to the OWNER 10 copies of the HMMP, as required by Part 1.04 of this Section. The HMMP will detail the following:
    1. Listing of LBP removal equipment to be used.
    2. Outline of procedures to be used to remove LBP.
    3. Data and specifications describing chemical stripping materials to be used, if applicable.
    4. Data and specifications describing abrasive blast materials and grit size to be used, if applicable.
    5. Description of planned LBP removal, hazardous waste debris containment, and hazardous waste disposal methods.
    6. Safety plan, consisting of a written plan of action covering operational requirements for safe removal of LBP, safe handling and containment of waste and debris generated by the operation, and safe disposal of hazardous waste and non-hazardous waste materials, complying with the most stringent requirements of the following:
        a. Equipment and material manufacturer's safety sheets.
        b. 29 CFR 1910.1025.
        c. 29 CFR 1926.62.
    7. Certifications of personnel to perform work.
    8. Selection of an appropriately permitted disposal facility.

E. Carry out LBP removal, containment, and disposal work in accordance with SSPC guidelines.

F. Assume responsibility for the proper implementation of the LBP removal method selected. When abrasive blast cleaning is selected to remove LBP, comply with all applicable Federal, State, and local air quality, pollution, and environmental control regulations for blast cleaning. When chemical stripping is selected to remove the LBP, adhere to the chemical manufacturer's recommendations for the application of the product, the removal of the paint, and the containment of the debris.
G. LBP removal work shall be performed by a Contractor having prior experience in the removal method selected and shall provide at least 5 references of similar projects completed, 3 of which must have been completed within the past 12 months, documenting their experience.
H. Utilize a minimum of Class 3 containment and ventilation system, as described in SSPC-6, during LBP removal and containment procedures, as required for the conditions.
I. Do not leave spent abrasive blast material, chemical stripping material, or LBP debris uncontained on the project site overnight.
J. Test each container of paint debris, spent blast cleaning abrasive, chemical stripping debris, and other waste material generated by the operation to determine the waste material hazardous waste classification, as required by 40 CFR 261 and the selected disposal facility.
K. Assume responsibility for the disposal of LBP waste and associated waste generated by the removal of the LBP and the preparation of the surfaces for recoating. Dispose in accordance with applicable Federal, State, local, and selected disposal facility requirements and regulations.
L. Accurately complete the Uniform Hazardous Waste Manifest included at the end of SSPC-7. Indicate on the Manifest that the OWNER is the hazardous waste generator and obtain the OWNER's USEPA identification number for use in completing the Manifest.

1.08 ASBESTOS MATERIALS

A. It is the specific intent of these Contract Documents to exclude from the Work any and all new products or materials containing asbestos. No products containing asbestos shall be incorporated in the Work.
B. Refer to the list of reports prepared for WSD, referenced in Part 1.2 of this Section, identifying locations which may have ACM. The reports also designate the condition of the ACM in each location as either friable or non-friable.
C. Asbestos abatement shall be executed as outlined in SECTION 01565 – ASBESTOS ABATEMENT of these Contract Documents.

PART 2 - PRODUCTS

PART 3 – EXECUTION

3.01 ASBESTOS MATERIALS

A. Notifications:
    1. CONTRACTOR shall notify OSHA 24 hours prior to performing ACM removal operations.
    2. CONTRACTOR will provide written notification to USEPA Regional Asbestos NESHAP contact at least 20 working days prior to the start of the Work per SECTION 01565.
    3. CONTRACTOR shall notify MDNR at least 10 working days prior to the start of performing ACM removal operations.
    4. CONTRACTOR shall notify OWNER 3 working days in advance of commencing asbestos material removal operations.
B. Work area:

1. CONTRACTOR will establish a regulated work area, using at a minimum, construction warning tape to establish limits of work area for the asbestos material removal.
2. On-site stockpiling or storage of ACM designated for disposal shall not be allowed.

C. Safety:
1. CONTRACTOR's safety plan will be provided as part of the HMMP (Part 1.02) and will detail requirements, as outlined in 29 CFR 1910.1001, 40 CFR 1926.1101 and 40 CFR 1926.65.

D. Worker qualifications:
1. Refer to SECTION 01565 – ASBESTOS ABATEMENT of these Contract Documents for qualifications for personnel performing asbestos abatement work.

E. Legal disposal:
1. Refer to SECTION 01565 – ASBESTOS ABATEMENT for asbestos disposal requirements.

End of Section

SECTION 01400 - QUALITY CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Quality assurance - control of installation.

B. Reference and standards.

1.2 RELATED SECTIONS

A. Section 01300 - Submittals: Submission of manufactures' instructions and certificates.

1.3 QUALITY ASSURANCE - CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform Work by persons qualified to produce required and specified quality.

1.4 REFERENCES AND STANDARDS

A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current on date for receiving bids, except where a specific date is established by code.

C. Obtain copies of standards where required by product specification sections.

D. Neither the contractual relationships, duties, nor responsibilities of the parties in Contract nor those of the Engineer shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that existing site conditions are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.

B. Examine and verify specific conditions described in the applicable individual specification sections.

3.2 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

End of Section.

SECTION 01410 - REGULATORY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes: Regulatory authorities and codes. Any costs associated with code compliance with the Kansas City, Missouri Codes Department or Platte County are the responsibility of the CONTRACTOR.

1.02 AUTHORITIES HAVING JURISDICTION

A. Building Department: City of Kansas City, Missouri.

B. Planning and Zoning, City of Kansas City, Missouri.

1.03 APPLICABLE CODES

A. International Code Council (ICC) – within Kansas City, Missouri.

1. Building code:
   a. International Building Code (IBC), 2018.
      1 With City of Kansas City, Missouri amendments
2. Electrical code:
   a. National Electrical Code, 2017.
      1 With City of Kansas City, Missouri Amendments
   b. National Fire Protection Association (NFPA), NFPA 70
      1 With City of Kansas City, Missouri amendments
3. Energy code:
   a. International Energy Conservation Code (IECC), 2021.
      1 With City of Kansas City, Missouri amendments
4. Fire code:
   a. International Fire Code (IFC), 2018.
5. Mechanical code:
   a. International Mechanical Code (IMC), 2018.
      1 With City of Kansas City, Missouri amendments
6. Plumbing code:
   a. International Plumbing Code (IPC), 2018.
      1 With City of Kansas City, Missouri amendments

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

SECTION 01433 - MANUFACTUERS' FIELD SERVICES

PART 1 – GENERAL

1.01 SUMMARY

A. This Section includes procedural requirements including field services for testing, startup, and training for the City of Kansas City Missouri.
B. The Contractor or Design-Builder shall furnish all labor, materials, equipment, and incidentals as necessary to comply with these requirements.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract; including General and Supplementary Conditions, all applicable Division 1 Sections, and all applicable Division Sections; apply to this Section.
B. Related Sections include the following:
    1. Divisions 02 through 46 Sections for specific requirements for any field services and startup instructions of applicable products in those Sections.
    2. Section 01300 – Submittals.
    3. Section 01664 – Training.
    4. Section 01757 – Commissioning.

1.03 DEFINITIONS

A. Work-day: One person's labor for 8 hours of work within the City and the Contractor or Design-Builder's working hours.
B. Systems Integrator: A contractor specializing in bringing together automation hardware and software subsystems into one system.

1.04 SUBMITTALS

A. Informational submittals:
    1. Training Schedule: Submit in accordance with requirements of this Specification not less than 30 days prior to start of equipment installation and revise as necessary for acceptance.
    2. Lesson plan: Submit, in accordance with requirements of this Specification, proposed lesson plan not less than 30 days prior to scheduled training and revise as necessary for acceptance. CONTRACTOR will submit plan for approval and for training credit by the Missouri Department of Natural Resources Operator Certification Program.

1.05 QUALIFICATIONS OF MANUFACTUERER'S REPRESENTATIVE

A. Authorized representative of the manufacturer, factory trained, and experienced in the technical applications, installation, operation, and maintenance of respective equipment, subsystems, or system, with full authority by the equipment manufacturer to issue the certifications required of the manufacturer. Additional qualifications may be specified in the individual specification section.
B. Representative subject to acceptance by the City's Representative. No substitute representatives will be allowed unless prior written approval by such has been given.

PART 2 - PRODUCTS (Not Used)

PART 3 – EXECUTION

3.01 FULFILLMENT OF SPECIFIED MINIMUM SERVICES

A. Furnish manufacturers' services, to meet requirements of this section and requirements of services described in individual technical specifications.
B. Comply with the requirements in Division 1 Section 01757– Commissioning and 01664-Training
C. Where time is necessary in excess of that stated in the Specifications for manufacturers' services, or when a minimum time is not specified, time required to perform specified services shall be considered incidental.
D. Contractor or Design-Builder shall schedule manufacturers' services to avoid conflict with other onsite testing in this project and other training of division personnel or manufacturers' onsite services.
E. Before scheduling services, determine the conditions necessary to allow successful testing have been met.
F. Only those days of service approved by the City's Representative will be credited to fulfill specified minimum services.
G. Contractor or Design-Builder shall coordinate manufacturer's field services with the systems integrator, so both are on-site during field services if desired by the City.
H. When specified in individual specification sections, manufacturer's onsite services shall include:

    1. Assistance during product (system, subsystem, or component) installation to include observation, guidance, instruction of Contractor or Design-Builder's assembly, erection, installation or application procedures.
    2. Inspection, checking, and adjustment as required for product (system, subsystem, or component) to function as warranted by manufacturer and necessary to furnish manufacturer's certificate of Proper Installation.
    3. Providing, on a daily basis, copies of manufacturers' representatives field notes and data to Owner.
    4. Revisiting the Site as required to correct problems and until installation and operation are acceptable to the Engineer of Record or City's Representative.
    5. Resolution of assembly or installation problems attributable to or associated with respective manufacturer's products and system.
    6. Assistance during functional and performance testing, commissioning, and system startup and evaluation.
    7. Training of Owner's personnel in the operation and maintenance of respective product as required.

3.02 MANUFACTURER'S CERTIFICATE OF COMPLIANCE

A. When so specified, a Manufacturer's Certificate of Compliance form, a copy of which is attached to this section, shall be completed in full, signed by an entity supplying the product, material, or service, and submitted prior to shipment of product or material or execution of the services.
B. City's Representative may permit use of certain materials or assemblies prior to sampling and testing if accompanied by accepted certification of compliance.

C. Such form shall certify proposed product, material, or service complies with that specified. Attach supporting reference data, affidavits, and certifications as appropriate.
D. May reflect recent or previous test results on material or product, if acceptable to the City's Representative.

3.03 MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

A. When so specified, a copy of the Manufacturer's Certificate of Proper Installation form shall be completed and signed by equipment manufacturer's representative.
B. This form shall certify signing party is a duly authorized representative of the manufacturer, is empowered by the manufacturer to inspect, approve, and operate their equipment, and is authorized to make recommendations required to ensure equipment is complete and operational.

3.04 TRAINING

A. Refer to Section 01664– Training for training requirements.

3.05 SUPPLEMENTS

A. Supplements listed below, following "End of Section", are part of this Specification.
    1. Manufacturer's Certificate of Compliance Form.
    2. Manufacturer's Certificate of Proper Installation Form.

End of Section

MANUFACTURER'S CERTIFICATE OF COMPLIANCE FORM

OWNER: _____ PROJECT, MATERIAL OR SERVICE SUBMITTED:

_____

PROJECT NAME: _____ PROJECT NO. _____

COMMENTS:

_____

_____

_____

_____

I hereby certify that the above referenced product, material, or service called for by the Contract for the named Project will be furnished in accordance with the applicable requirements. I further certify that the product, material, or service are of the quality specified and conform in all respects with the Contract requirements and are in the quantity shown.

Date of Execution _____ ,20 ____

Manufacturer: _____

Manufacturer's Authorized Representative (print) _____

Manufacturer's Authorized Representative (Signature) _____

MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION FORM

OWNER			EQPT SERIAL NO.	
EQPT TAG NO.			EQPT/SYSTEM	
PROJECT NO.			SPEC. SECTION	

I hereby certify that the above referenced equipment/system has been:

(Check Applicable)

☐ Installed in accordance with Manufacturer's recommendations.

☐ Inspected, checked, and adjusted.

☐ Serviced with proper initial lubricants.

☐ Electrical and mechanical connections meet quality and safety standards.

☐ All applicable safety equipment has been properly installed.

☐ Functional tests.

☐ System has been performance tested, and meets or exceeds specified performance requirements.

(When complete system of one manufacturer)

COMMENTS:

I, the undersigned Manufacturer's Representative, hereby certify that I am (i) a duly authorized representative of the manufacturer, (ii) empowered by the manufacturer to inspect, approve, and operate their equipment, and (iii) authorized to make recommendations required to ensure equipment furnished by the manufacturer is complete and operational, except as may be otherwise indicated herein. I further certify that all information contained herein is true and accurate.

Date of Execution _____ ,20 ____

Manufacturer: _____

Manufacturer's Authorized Representative (print) _____

Manufacturer's Authorized Representative (Signature) _____

SECTION 01500 – TEMPORARY FACILITIES

PART 1 - GENERAL

1.01 SUMMARY

A. This specification covers the requirements for temporary construction facilities required on all projects.

1.02 RELATED SECTIONS

A. Section 01000 – General Project Requirements.
B. Section 01300 – Submittals.

1.03 CODES AND STANDARDS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.
B. National Fire Protection Association:
   1. NFPA 10 - Standard for Portable Fire Extinguishers.
   2. NFPA 70 - National Electric Code.
   3. NFPA 241 - Standard for Safeguarding Construction, Alternation and Demolition Operations.

1.04 INFORMATION PROVIDED BY THE CITY

A. As provided in the Contract Documents.

1.05 SUBMITTALS

A. Submit as specified in Section 01300 – Submittals.

1.06 QUALITY ASSURANCE

A. The Contractor is responsible for the quality assurance and quality control of the Work.
B. Regulations – Comply with industry standards and applicable laws and regulations of authorities having jurisdiction, including but not limited to:
   1. Building Code requirements.
   2. Health and safety regulations.
   3. Utility company regulations.
   4. Police, Fire Department and rescue squad rules.
C. Standards:
   1. Comply with NFPA 10 and 241 and ANSI A10 Series standards “Temporary Electrical Facilities.”
   2. Comply with NEMA, NECA and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70.
D. Inspections – Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

PART 2 - PRODUCTS

Not used.

SECTION 01480 – WATER TIGHTNESS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes hydrostatic leakage testing for concrete water-containing structures.

1.02 REFERENCES

A. Section 03 30 00 – Concrete
B. Section 31 20 50 – Site Preparation and Earthwork

1.03 DEFINITIONS

A. Damp spots: Surfaces where visible moisture can be picked up by a dry hand.
B. Containment structure, lined: Liquid-containing structure with barrier coating or membrane applied to the inside surfaces to prevent leaking of contents to the outside.
C. Containment structure, unlined: Liquid containing structure where only the concrete structure itself is used to prevent leaking of contents to the outside.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination.
B. Pre-installation meetings.
C. Sequencing.
D. Scheduling.

1.05 SUBMITTALS

A. Shop drawings:
    1. Description and details of each evaporation/precipitation-measuring device anticipated for use during the test.
B. Tests and evaluation reports:
    1. Results of water leakage test for each structure and for each portion of a structure designated for testing.
C. Special procedure submittals:
    1. Testing plan for each structure, or portion thereof, required to be tested.
        a. Describe methods of obtaining water for testing and of releasing water for disposal, including provisions for dechlorination if required.
        b. Include plans showing locations where measurements will be made and locations of evaporation/precipitation-measuring device.
        c. Indicate plans for filling and draining structure(s).
        d. Include schedule showing duration of test for each structure or cell to be tested, date and time for start of each test, dates and times of observations and measurements during the test, dates and times for closeout of testing procedures, and date for submittal of final results.
    2. Proposed procedures and products for repair of leaks.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 GENERAL

A. Test structures and portions of structures listed in the following paragraphs for water leakage.
    1. Unless otherwise specified, the Contractor shall:
        a. Obtain all required permits for discharging testing water.
        b. Provide dechlorination of such water if required by the permits.
        c. Prepare and fill the structures.
        d. Provide access and equipment required for testing and for recording test results.
        e. Take measurements and make observations required for testing.
    2. At all times during testing, the Engineer shall have access to observe measurements by others or to make independent measurements.
B. Test the following concrete structures for water leakage:
    1. Influent Pump Station Wet Well
    2. Headworks Screening Channels.
    3. Grit Basin.
    4. Grit Basin Effluent Channel.
    5. Splitter Box between Headworks and AGS basins
    6. AGS basins
    7. UV channels
    8. TWAS basins
    9. WAS basins
C. Required preparation for testing is designated in this Section. Waiver of, or failure to complete preparations shall not change the testing criteria or approval criteria for the areas tested.
D. Retest structures and portions of structures until the evaluation criteria are satisfied.

3.02 TEST WATER SOURCE AND DISPOSAL

A. Water used for the first filling of the tank will be furnished by Owner.
    1. Contractor shall obtain water for leakage testing from:
        a. Disinfected effluent between April 1 and October 31.
        b. Secondary effluent between November 1 and March 31.
B. In the event that retesting is required, Contractor shall bear the cost of refilling the tank for subsequent tests.
C. After leakage testing is complete, Contractor shall dispose of water by discharging to Primary Treatment.

3.03 PREPARATION

A. For each structure to be tested, prepare and submit a plan showing schedule and sequence of activities, method of filling, and methods of disposing of test water.
B. Sequencing requirements:
    1. Complete construction of concrete structure and cure concrete to obtain minimum specified 28-day compressive strength as specified in Section 03 30 00 - Concrete.

a. Do not begin tests until all portions of structure are complete and have reached their minimum specified 28-day compressive strength.
b. Do not begin tests until at least 14 days have passed since completion of the last concrete placement.

2. Complete tests before:
   a. Covering any surface of the structure with materials that might mask the location of leaks or obscure damp concrete surfaces. Such coverings include, but are not limited to basin bottom grout, masonry veneer, stucco, plaster, and other coatings.
   b. Installation of equipment, unless otherwise approved by the Engineer.
   c. Backfilling structures to elevations above the limits indicated in the following paragraphs.
3. Liners and coatings:
   a. Field-coated or installed liners and coatings shall be applied in strict conformance to manufacturer's standards.
   b. Install liners that are mechanically locked to the concrete surface during placement of plastic concrete and before leakage testing.
      (1) Examine liners for pinholes, tears, and partially fused splices, complete all required liner integrity testing, and make required repairs before commencing leakage testing.
   c. Unless otherwise specified, do not install surface-applied protective or decorative coatings and linings until leakage tests have been completed.

C. Weather requirements:
1. Tests on structures with tops open to the atmosphere shall not be scheduled for periods when the 10-day weather forecast indicates a substantial change in weather patterns.
2. Measurements of water surface levels in the structure shall not be scheduled for periods when the weather forecast indicates a difference of more than 35 degrees Fahrenheit between the ambient temperature readings at the times of initial and final measurements.
3. Tests shall not be scheduled for periods when the 10-day weather forecast indicates that the water surface may freeze before the test is complete.

D. Groundwater requirements:
1. Bring groundwater to a level not higher than 3 feet below the bottom of the structure and maintain at that level for the duration of the test.

E. Clean interior of structure:
1. Remove dirt, contaminants, and construction debris.
2. Flush floors and sumps to provide clean surfaces.
3. Remove standing water that would interfere with examination of surfaces, cracks, or joints.

F. Observe the structure, or portions of the structure being tested, for potential leak locations.
1. Give particular attention to cracks, open joints, voids, and honeycombed and repaired surfaces.
2. Visually observe openings, fitting, and pipe penetrations in the structure at both faces, if possible.
3. Repair potential leak locations in accordance with these Specifications and as approved by the Engineer.
4. Backfill excavations to the top of the structure foundation. Do not place backfill against water-bearing walls or over footings unless approved in advance by the Engineer.
   a. If requesting backfilling of walls before testing, include a description of methods that will be used to detect leakage in the backfilled areas.

b. Engineer's approval of backfilling before testing shall not relieve Contractor of the responsibility to conduct leakage tests, to satisfy the leakage acceptance criteria for the structure, or to repair leaking portions of the structure, including those portions below or behind the backfill.

5. See Drawings and Section 31 20 50 - Site Preparation and Earthwork for requirements to provide wall stability before backfilling.

G. Inlets to/outlets from the structure:
   1. Inlets to and outlets from the structure shall be watertight.
      a. Include valves, sluice, and/or slide gate valves and temporary bulkheads as required.
      b. Inlets and outlets not required to be operable may be temporarily sealed before testing the compartments to which they open.
      c. Secure inlets used to fill the structure for testing to ensure that no water is entering or leaving the structure once it has been filled to the test level.
   2. Adjustments to measured leakage at inlets and outlets based on manufacturers or Contractor's estimates will not be allowed.
      a. Adjustments to measured leakage may be permitted by the Engineer, and, at their discretion, only when the Contractor makes specific measurements of leakage at each individual inlet and outlet using methods approved by the Engineer.

3.04 HYDROSTATIC LEAKAGE TEST FOR OPEN OR COVERED CONTAINMENT STRUCTURES

A. Isolate sections of water-holding structures that can be isolated in actual operation. Fill and test sections for leakage separately.
   1. Fill structures and sections of structures scheduled for testing to the normal operating water level indicated on the Hydraulic Profile indicated on the Drawings.
B. Initial rate for filling of structures shall not exceed 8 feet in 24 hours.
C. HST-100 testing includes 2 parts, "Qualitative Testing," and "Quantitative Testing," as described in the following paragraphs:
   1. HST-100, Part 1 - Qualitative Testing:
      a. During the first 24 hours after structures are filled, examine exposed concrete surfaces for damp spots or flowing water.
         (1) Make observations in early morning, at midday, and in late afternoon.
         (2) Continue observations through the duration of the Quantitative Testing period.
         (3) Pay particular attention to conditions at joints, honeycombed areas, cracks, and repaired portions of the structure.
      b. Evaluation criteria:
         (1) The structure shall be considered to have failed these Qualitative Testing requirements if any of the following conditions are observed.
            (a) Water droplets or moist areas on an outside surface that could only have originated inside the structure.
            (b) Water is flowing or seeping from joints, cracks, or surfaces.
               (i) Exception: Dampness or wetness on top of a footing, in the absence of flowing water, shall not be considered as failure to meet this criterion.
            (c) Moisture can be transferred to a dry hand from the outside surfaces of the filled area.

c. Repairs and retesting:
    (1) Where damp spots or flowing water as described in the preceding paragraphs are observed, mark locations, provide repairs, and retest the structure as specified in subsequent paragraphs.

2. HST-100 - Part 2: Quantitative Testing:
    a. If approved by the Engineer, Quantitative Testing may begin before repairs are made to areas failing Part 1 of this test; however:
        (1) Adjustments to volume loss calculations of Quantitative Testing based on observed leakage will not be permitted.
        (2) All defects identified for repair during Qualitative Testing shall be repaired to the satisfaction of the Engineer before approval of the structure.
    b. Report the results of Quantitative Testing on "Leakage Test Report" included as Figure A at the end of this Section, or similar form prepared by the Contractor and containing at least the information included in Figure A.
    c. Unlined concrete structures:
        (1) Fill to the designated water surface elevation. Maintain that level for at least 72 hours before recording initial water levels for leakage test.
        (2) Duration of test:
            (a) Theoretical time required to lower the water surface in the structure by 3/8 inch when leakage is occurring at the maximum allowable rate specified in subsequent paragraphs of this Section.
            (b) The duration ("D") of the test in days is determined by the following equation:

$$D = \frac{.375\ inches}{0.005\ in/in/day\ \times H\ ft\ \times 12\ in/ft}$$

$$Where\ H = Maximum\ Liquid\ Depth$$

                (i) Round results upward to the next full 24-hour period (day).
                (ii) Minimum duration of test: 24 hours (1 day).
                (iii) Maximum duration of test: 120 hours (5 days).
    d. Lined concrete structures and secondary containment areas:
        (1) Fill to the designated water surface elevation. Recording of water levels for leakage tests may begin as soon as the designated water surface level is reached and the water surface is calm. 2) Duration of test: 72 hours (3 days).
    e. Measurements: Water level:
        (1) Record water levels at 24-hour intervals for the full duration of the test period.
        (2) Measure water levels at not less than 2 locations on opposite ends of the structure, and preferably at 4 locations spaced equally around the structure. Mark locations on the structure and take measurements at the same locations throughout the duration of the test.
        (3) Measure, to an accuracy of 1/16 inch, the vertical distance to the water surface from a fixed point on the structure above.
    f. Measurements: Temperatures:

(1) As part of the first and last sets of level measurements, record water temperature at a depth of 18 inches below the water surface. Measure temperature at the same locations where level measurements are taken.
(2) Record ambient temperature at the time of each water level measurement.

g. Measurements: Evaporation and precipitation:
(1) Measure evaporation and precipitation by floating pans inside the structures during testing.
(a) For uncovered structures, measure both evaporation and precipitation.
(b) For covered structures that are well ventilated, measure evaporation.
(2) Measure using specially constructed clear containers:
(a) Provide clear plastic, calibrated, open-top containers not less than 18 inches in diameter and 18-inches deep.
(b) Partially fill containers with water and float inside the structure. Make provisions to hold containers in place at each measurement location, but away from structure walls and items passing overhead, such as beams or pipes.
(c) Measure initial depth of water in each device. Measure changes in water level in each device at the same time measurements of the water level inside the structure are taken.

h. Restart of test:
(1) The Engineer may order a restart of the test when, in the Engineer's opinion, measurements have become unreliable due to unusual precipitation or other factors.
(2) If measurements or observed leakage during the testing period indicate that the allowable leakage requirements will be exceeded, the test may be terminated before completion of the full test period. Take appropriate actions to correct problems before restarting the test.

i. Calculations of leakage test results:
(1) For each section of the structure tested, use water surface level records to calculate average loss of volume per 24-hour interval.
(a) For each 24-hour interval during the test, calculate the average of all measured drops in water level around the structure.
(b) Use the average drop thus determined to calculate an average loss of volume for each 24-hour interval.
(2) Adjustments to leakage calculations:
(a) For uncovered basins, calculations shall be corrected for precipitation added to the structure.
(b) Calculations may be corrected for evaporation and water temperature.

j. Evaluation criteria:
(1) Unless otherwise specified, the average loss of volume during any 24-hour interval shall not exceed the limits shown in Table A.

Table A - Loss of Volume Criteria for Leakage Tests	
Structure Type	**Maximum Loss of Water Volume**

• Structure fully lined prior to leakage test. • Secondary containment areas.	No measurable loss over 72-hour test period.
• Structure with monolithically placed membrane floor slab.	0.0125 percent of volume per 24-hour period.
• Concrete paved canals, drying beds, lagoons, and similar structures.	0.100 percent of volume per 24-hour period.
• Other containment structures.	0.050 percent of volume per 24-hour period.

k. Repairs and retesting:
   (1) Structures and portions of structures that have satisfied the qualitative requirements of HST-100, but have failed to satisfy the quantitative requirements of HST-100 may be immediately retested for volume loss.
      (a) If the structure fails the second test for volume loss, the structure shall be drained, and the Contractor shall observe the interior for probable areas of leakage.
      (b) The structure shall not be retested until repairs to the probable areas of leakage are complete.

3.05 REPAIRS FOR RETESTING

A. Locations showing damp spots or flowing water:
   1. Mark locations of visible leaks and damp spots.
   2. Drain structures for repair.
   3. Repair defects causing damp spots and flowing water using methods specified in Section 03 30 00 - Concrete and approved by the Engineer.
      a. Repair both interior and exterior surfaces and make structures watertight.
      b. Submit proposed repair products and procedures for Engineer's review.
      c. Refill structures for retesting.
   4. Repeat filling, observations, and repairs until no leaks or damp spots appear.
B. Structures for which loss of water volume loss exceeds the limits specified after adjustments for evaporation, and precipitation:
   1. Determine cause of volume loss.
   2. Drain structures of water.
   3. Repair defects causing loss of water volume using methods specified in Section 03 30 00 - Concrete and approved by the Engineer.
      a. Submit proposed repair products and procedures for Engineer's review.
   4. Refill water-holding structures.
   5. Repeat testing and repairs until volume loss does not exceed specified limits.

End of Section

FIGURE A

WATERTIGHTNESS TEST REPORT

PROJECT: _____ SUBMITTED BY:

STRUCTURE: _____ WITNESSED BY:

AREA: _____ TEST DATES:

TEST DURATION: TEST DURATION:

Surface area of structure tested: _____ (square feet)

Volume of structure tested: _____ (cubic feet)

Volume of structure tested: _____ (gallons)

Measured loss through gates, etc.: _____ (gallons / day)

Allowable loss of water volume: _____ (per day)

Allowable loss of water volume: _____ (% in 24 hours) Allowable

measured loss over test duration (inches): _____

Measured loss of water: _____ (gallons / day - From E below)

Measured loss of water volume (%): _____ (in 24 hours - From E below)

Water Temperature: Start of test: °F End of test: °F

			Water Surface Elevation (top of structure to top of water)				
			Location #1	Location #2	Location #3	Location #4	Initials**
Day	Date	Time	(inches)	(inches)	(inches)	(inches)	
1							
2							
3							
4							
5							
Changes in Level:							

A. Average change in level (feet): (Average of total charges for all locations)

B. Correction for precipitation:
(Measured from pan)

(Measured from pan)

C. Correction for evaporation:

D. Corrected change in level (CL):

E. Total days tested:

Average measured % water loss in 24 F. hours: = (CL) x (surface area) x 100 / (initial water volume) x (number of test days)

Notes and field observations□□

□□ Place date and initials at the beginning of each entry

PART 3 - EXECUTION

3.01 OFFICE

A. Stationary Office – If required in Section 01015 - Specific Project Requirements, the Contractor shall maintain a suitable stationery office at or near the Site during the performance of the Work.
B. The office shall serve as the headquarters of the Contractor's representative authorized to receive Contract Documents, instructions, other communication or articles associated with the Work.
C. Any communication given to the Contractor's representative or delivered to Contractor's office at the site of the Work shall be deemed to have been delivered to Contractor.
D. Copies of the Contract Documents shall be kept at the office and shall be available for use at all times.

3.02 FIELD OFFICE FOR RESIDENT PROJECT REPRESENTATIVE

A. See Section 01015 – Specific Project Requirements regarding the requirement of the Contractor to provide a field office for the Engineer's Resident Project Representative.

3.03 FIELD OFFICE FOR CITY

A. See Section 01015 – Specific Project Requirements regarding the requirement of the Contractor to provide a field office for a representative of the City.

3.04 TEMPORARY UTILITIES

A. Provide temporary utilities required for construction. Materials may be new or used, must be adequate for the required usage, not create unsafe conditions and not violate applicable codes and standards.
B. Power:
    1. All power for lighting, operations of the Contractor's plant/equipment or for any other use which may be required for proper completion of the Work shall be provided by the Contractor.
    2. Temporary heat and lighting shall be maintained until the Work is accepted.
C. Telephone/internet service:
    1. The Contractor shall make all necessary arrangements and pay all installation and monthly charges for telephone/internet service for the temporary office at the site and shall provide all required devices for such service.
D. Sanitary Facilities:
    1. The Contractor shall furnish temporary sanitary facilities at the site, as provided herein, for the needs of all construction workers and others performing work or furnishing services on the Project.
    2. Sanitary facilities shall be of reasonable capacity, properly maintained throughout the construction period and obscured from public view to the greatest practical extent. If toilets of the chemically treated type are used, at least one toilet will be furnished for every 20 persons. The Contractor shall enforce the use of such sanitary facilities by all personnel at the site.
    3. Ventilate the units to control odors and fumes and empty and clean them at least once a week or more often if required by the City. The doors shall be self-closing. Locate the facility behind the construction fence or out of the public view.

E. Water:
   1. The Contractor shall provide all potable water on site except for water used for leak-testing the water-holding basins constructed as part of the Work. Contractor shall be responsible for all permits, meters, and connection fees.

3.05 SECURITY

A. See Section 01000 – General Project Requirements – SECURITY regarding the requirements for security.

3.06 PARKING

A. See Section 01000 – General Project Requirements – PARKING regarding the requirements for parking.

END OF SECTION

SECTION 01565 - ASBESTOS ABATEMENT

PART 1 - GENERAL

1.01 SUMMARY

A. The Contractor shall provide the following:
    1. All labor, materials, and incidentals as necessary to comply with these requirements and to remove all ACM as specified.
    2. The equipment and safety provisions required for protecting workers while handling asbestos-containing material (ACM) except for respiratory protection.
    3. The disposal of Regulated Asbestos Containing Materials (RACM). Disposal includes packaging of RACM. Disposal may be accomplished either by land filling at an appropriately permitted facility or converting RACM to non-Asbestos waste.
    4. Obtaining permits, licenses, inspections, releases and similar documentation, as well as payments, statements and similar requirements known to the OWNER and associated with codes, regulations, and standards. Obtain all necessary permits for disposal of ACM at no additional cost to the OWNER.
B. The Contractor shall comply with specifications herein and adherence to work practices, procedures and requirements set forth in all applicable Federal, State and local regulation. Applicable codes, regulations and standards take precedence, when available.
C. The Contractor shall coordinate all activities with Kansas City Missouri Air Quality Division (Health Department) as necessary.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and all applicable Division Sections, apply to this section.
B. Asbestos Abatement Related Documents: None

1.03 SUBMITTALS

A. Submit the following to the OWNER for review before starting work.
    1. Certified Statement: Submit certified statement to be notarized-signed by an officer of the abatement contracting firm stating which exposure measurements, medical surveillance, and worker training records are being kept in conformance with 29 CFR 1926.
    2. Copy of the CONTRACTOR's or subcontractors current Missouri State Registration for Asbestos Contractors issued by the Missouri Department of Natural Resources (MDNR).
    3. Copy of State and/or local license for waste transport subcontractor.
    4. Name and address of landfill where RACM are to be disposed. CONTRACTOR to include contact person and contact's telephone number.
    5. Chain of Custody Form and Form of Waste Manifest proposed for use.
    6. Sample of disposal bag and any added labels to be used.
    7. Material Safety Data Sheet: Submit Material Safety Data Sheets, or equivalent, in accordance with the Occupational Safety and Health Administration (OSHA) Hazard Communication Standard (29 CFR 1910.1200) for the following:
        a. Surfactants
        b. Encapsulants
        c. Solvents

8. Surfactant: Submit product data, use instructions and recommendations from manufacturer of surfactant intended for use. Include data substantiating that material complies with requirements.

B. On a weekly basis, submit copies of all waste manifests and disposal tickets to OWNER.

C. Waste Shipment Record: Maintain a waste shipment record as required by the National Emission Standards for Hazardous Air Pollutants (NESHAP) regulation which indicates the waste generator, transporter, and disposal site; and describes the nature, size, type of container, and form of asbestos waste. Submit to OWNER within 30 days of departure from building.

D. Submit for the OWNERs records, copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence and records established in conjunction with compliance to standards and regulations bearing upon performance of the Work including:
   1. State and Local Regulations: Submit copies of codes and regulations applicable to the Work.
   2. Submit notices required by Federal, State and local regulations together with proof of timely transmittal to agency requiring the notice.
   3. Submit copies of current valid permits required by state and local regulations.
   4. Submit copies of all Federal, State and local licenses and permits necessary to carry out the Work.

1.04 CODES, REGULATIONS AND STANDARDS

A. Except to the extent that more explicit or more stringent requirements are written directly into the Contract Documents, all applicable Federal, State and local codes and regulations have the same force and effect (and are made a part of the Contract Documents by reference) as if copied directly into the Contract Documents, or as if published copies are bound herewith.

B. The CONTRACTOR shall assume full responsibility and liability for the compliance with all applicable Federal, State and local regulations pertaining to work practices, hauling, disposal, and protection of workers, visitors to the site, and persons occupying areas adjacent to the site. The CONTRACTOR is responsible for providing medical examinations and maintaining medical records of personnel as required by the applicable Federal, State and local regulations. The CONTRACTOR shall hold the OWNER and ENGINEER harmless for failure to comply with any applicable work, hauling, disposal, safety, health or other regulation on the part of the CONTRACTOR, the CONTRACTOR's employees, or subcontractors.

C. Federal Requirements that govern asbestos abatement work, and transportation and disposal of asbestos waste materials include but are not limited to the following:
   1. OSHA United States Code of Federal Regulations (CFR) including, but not limited to:
      a. Title 29 – Labor:
         (1) 1910 – Occupational Safety and Health Standards
            (a) 1910.1001 – Asbestos
            (b) 1910.132 – General Requirements
            (c) 1910.134 – Respiratory Protection
            (d) 1910.145 – Specifications for Accident Prevention Signs and Tags
            (e) 1910.146 – Permit-Required Confined Spaces
         (2) 1926 – Safety and Health Regulations for Construction
            (a) Part 1926.1101 – Asbestos
            (b) Part 1926.103 – Respiratory Protection
            (c) Part 1926.95-107 – Personal Protective and Life Saving Equipment

(d) 1926.33 – Access to Employee Exposure and Medical Records
(e) 1926.59 – Hazard Communication
(f) 1926.20-35 – General Safety and Health Provisions

b. Title 49 – Transportation:
(1) Part 171 – General Information, Regulations, and Definitions
(2) Part 172 – Hazardous Materials Table, Special Provisions, hazardous Materials Communications, Emergency Response Information, Training Requirements, and Security Plans
(3) Part 171-180 – General Awareness and Training Requirements for Handlers, Loaders and Drivers, and Editorial and Technical Revisions

2. United States Environmental Protection Agency (USEPA) including, but not limited to:
a. Title 40 – Protection of Environment:
(1) Part 763, Subpart G – Asbestos Worker Protection
(2) Part 763, Subpart E – Asbestos Hazard Emergency Response Act (AHERA)
(3) Part 763, Subpart E, Appendix C – Asbestos Model Accreditation Plan (MAP)
(4) Part 61, Subpart A – National Emission Standards for Hazardous Air Pollutants, General Provisions
(5) Part 61, Subpart M – National Emission Standards for Hazardous Air Pollutants, National Emission Standard for Asbestos

3. State Requirements which govern asbestos abatement work or transportation and disposal of asbestos waste materials include, but are not limited to:
a. Missouri State Law − Chapter 643, Air Conservation
b. Missouri Code of State Regulations (CSR) − 10 CSR 10-6, Air Quality Standards, Definitions, Sampling and Reference Methods and Air Pollution Control Regulations for Entire State of Missouri.

4. Abide by all local requirements which govern asbestos abatement work or hauling and disposal of asbestos waste materials.

1.05 NOTICES

A. USEPA
1. Postmark or Deliver Written Notification as required by USEPA NESHAP Asbestos Regulations (40 CFR 61, Subpart M) to the regional Asbestos NESHAP Contact at least 20 working days prior to beginning any work on asbestos containing materials (ACM). Send notification to the following address with a copy to WSD Project Manager:

Air Quality Program, Health Department
Suite 3000, 2400 Troost
Kansas City, Missouri 64108
(816) 983-4301

2. Include the following information in the notification sent to the Air Quality Program:
    a. Indication whether the notification is the original or revised notification.
    b. Name, address, and telephone number of Owner or operator.
    c. Name, address, and telephone number of Contractor.
    d. Type of Operation (demolition or renovation).
    e. Description of the facility or affected part of the facility being demolished or renovated, including the size (square feet, number of floors), age, present and prior use of the facility.
    f. Estimate of the approximate amount of RACM to be removed from the facility in terms of linear feet of pipe, and square feet of surface area for other facility components. Also estimate the approximate amount of Category I and Category II non-friable ACM (NACM) in the affected part of the facility that will not be removed before demolition.
    g. For facilities in which the amount of friable asbestos materials is less than 260 linear feet on pipes and less than 160 square feet or 35 cubic feet if the length and width could not be measured. On other facility components, explain techniques of estimation.
    h. Location and street address (including building number or name and floor or room number, if appropriate), city, county, and state of the facility being demolished or renovated.
    i. Scheduled starting and completion dates of asbestos removal work (or any other activity, such as site preparation that would break up, dislodge, or similarly disturb asbestos material) in a demolition or renovation; planned renovation operations involving individual nonscheduled operations shall only include the beginning and ending dates of the report period as described in paragraph (a)(4)(iii) of 40 CFR 61.145.
    j. Scheduled starting and completion dates of demolition or renovation.
    k. Nature of planned demolition or renovation and method(s) to be used, including demolition or renovation techniques to be used and description of affected facility components.
    l. Procedures to be used to comply with the requirements of NESHAP Asbestos Regulations (40 CFR 61 Subpart M).
    m. Name and location of the waste disposal site where the asbestos containing waste material will be deposited.
    n. A certification that at least one person trained as required by paragraph (c)(8) of 40 CFR 61.145 will supervise the stripping and removal described by this notification.
3. For emergency renovations described in paragraph (a)(4)(iv) of 40 CFR 61.145, the date and hour that the emergency occurred, a description of the sudden, unexpected event, and an explanation of how the event caused an unsafe condition, would cause equipment damage, or an unreasonable financial burden.
    a. Description of procedures to be followed in the event that the unexpected RACM is found or Category II NACM becomes crumbled, pulverized, or reduced to powder.
    b. Name, address, and telephone number of the waste transporter.

1.06 STATE AND LOCAL AGENCIES

A. Send written notification as required by State and local regulations prior to beginning any work on ACM.

1.07 PERMITS

A. All ACM is to be transported by an entity maintaining a current "Industrial waste hauler permit" specifically for ACM, as required for transporting of waste ACM to a disposal site.
B. CONTRACTOR is responsible for obtaining any demolition, building, renovation or other permits, and for paying application fees, if any, where required by State or Local jurisdictions.

1.08 LICENSES

A. Licenses: Maintain current licenses as required by applicable Federal, State and/or local jurisdictions for the removal, transporting, disposal or other regulated activity relative to the Work in this contract.

1.09 POSTING AND FILING OF REGULATIONS

A. Post all notices required by applicable federal, state and local regulations. Maintain two (2) copies of applicable federal, state and local regulations and standard. Maintain one copy of each at job site and one copy on file in Contractor's office.

1.10 WORKER TRAINING

A. AHERA Accreditation: All workers are to be accredited Abatement Workers as required by the USEPA MAP Asbestos Abatement Worker Training (40 CFR Part 763, Subpart E, Appendix C).
B. State and Local License: All workers are to be trained, certified and accredited as required by State of Missouri.
C. Training - Class I: Complete in accordance with 29 CFR 1926.1101. Provide training for all workers who will perform Class I operations that is the equivalent in curriculum, training method and length to the USEPA MAP asbestos abatement worker training (40 CFR Part 763, Subpart E, Appendix C).
D. Training - Class II Intact (Non-Friable): Provide training for workers who will be performing Class II work involving only the removal and/or disturbance of one generic category of building material, such as roofing materials, flooring materials, siding materials or cement asbestos panels, which includes at a minimum, the specific work practices and engineering controls which specifically relate to that category. Provide a course that includes "hands-on" training and takes at least 8 hours. Provide training that includes the elements set forth in 29 CFR 1926.1101(k) and the Compliance Directive CPL 2-2.63.
E. Training - Class II Non-Intact (Friable): Provide training for workers who will be performing Class II work on materials that are friable or will become friable during the work that is the equivalent in curriculum, training method and length to the USEPA MAP asbestos abatement worker training (40 CFR Part 763, Subpart E, Appendix C).
F. Competent Person: Competent Person for work on removal of ACM must be trained as required by OSHA regulation 29 CFR 1926.1101(k)(9) and 1926.32(f); and as set forth in the Compliance Directive CPL 2-2.63 Appendix D page D-22 to D-23.

PART 2 - PRODUCTS

2.01 PROTECTIVE CLOTHING

A. General. Provide and require the use of protective clothing, to include coveralls or similar whole-body clothing, head coverings, gloves, and foot coverings for any employee exposed to airborne concentrations of asbestos that exceed the total weight average (TWA) and/or excursion limit prescribed by 29 CFR 1926.1101 or for which a required negative exposure assessment is not produced, and for any employee performing Class I operations which involve the removal of over 25 linear or 10 square feet of thermal system insulation (TSI) or surfacing ACM or presumed ACM.
B. Coveralls: Provide disposable full-body coveralls and disposable head covers. Contractor will require that they be worn by all workers in the Work Area. Provide a sufficient number for all required changes, for all workers in the Work Area.
C. Additional Protective Clothing: Provide each worker with the protective clothing as required by Federal, State and local regulations, including but is not limited to, hardhats, cold weather gear, gloves, boots and goggles.
D. Disposable coveralls, head covers, and footwear covers shall be provided by the Contractor for the Owner, Engineer and other authorized representatives who may inspect the job site as needed.

2.02 MATERIALS

A. Provide 6-millimeter (mil) thick leak-tight polyethylene disposal bags with three labels showing the following text. **Peel and stick type labels are prohibited.**
    1. First Label: Provide in accordance with 29 CFR 1910.1200(f) of OSHA's Hazard Communication standard:
    "DANGER CONTAINS ASBESTOS FIBERS AVOID CREATING DUST CANCER AND LUNG DISEASE HAZARD BREATHING AIRBORNE FIBERS IS HAZARDOUS TO YOUR HEALTH".
    2. Second Label: Provide in accordance with U. S. Department of Transportation regulation on hazardous waste marking. 49 CFR parts 171 and 172. Hazardous Substances
    "RQ-ASBESTOS WASTE CLASS 9 NA2212-PG III".
    3. Third Label: Provide the name of the waste generator (Owner's name), the location from which the waste was generated and the names and addresses of the transporter. This label must be durable, able to repel dirt and moisture (e.g., permanent marker). Label must be placed directly on disposal bag(s) in a legible format.
B. Polyethylene Sheet: Provide flame resistant polyethylene film that conforms to requirements set forth by the National Fire Protection Association Standard 701, Small Scale Fire Test for Flame-resistant Textiles and Films. Provide largest size possible to minimize seams, 6-mil thick, frosted or black as indicated.
C. Duct Tape: Provide duct tape in 2-inch or 3-inch widths as indicated, with an adhesive which is formulated to stick firmly to sheet polyethylene.
D. Spray Cement: Provide spray adhesive in aerosol cans which is specifically formulated to stick firmly to sheet polyethylene.
E. Fiberboard Drums: Provide heavy duty leak tight fiberboard drums with tight sealing locking metal tops.
F. Paper board Boxes: Provide heavy duty corrugated paper board boxes coated with plastic or wax to retard deterioration from moisture. Provide in sizes that will easily fit in disposal bags.

PART 3 – EXECUTION

3.01 GENERAL

A. Worker Protection
    1. Provide worker protection as required by the most stringent OSHA and/or USEPA standards applicable to the Work. The following procedures are the minimum standards to be adhered to regardless of asbestos fiber count in the Work Area.
    2. Each time the Work Area is entered remove all personal clothes in designated Changing Room provided by Contractor, and put on new disposable coverall, new head cover, and a clean respirator. Proceed through shower room to equipment room and put on work boots.
    3. Warning Signs: Near the Work Area a sign complying with requirements of the USEPA NESHAP regulation (40 CFR Part 61) shall be visible in a manner and location that a person can read the following:
    "DANGER ASBESTOS CANCER AND LUNG DISEASE HAZARD AUTHORIZED PERSONNEL ONLY RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA".
B. Transportation and Disposal of RACM
    1. All waste is to be transported by a waste transportation contractor or subcontractor with all required licenses from all state and local authorities with jurisdiction.
    2. Mix all liquid ACM waste with a blendable material so that it forms a blendable (non-liquid) form and have the concurrence of the landfill operator prior to disposal.
    3. Load all adequately wetted RACM in disposal bags or leak-tight containers. All materials are to be contained in one of the following:
        a. Two 6-mil disposal bags; or
        b. Two 6-mil disposal bags and a fiberboard drum; or
        c. Sealed steel drum with no bag.
    4. Protect interior of truck or dumpster with critical and primary barriers, as required by authorities having jurisdiction.
    5. Carefully load containerized waste in fully enclosed dumpsters, trucks or other appropriate vehicles for transport. Exercise care before and during transport, to ensure that no unauthorized persons have access to the material.
    6. Warning Signs: During loading and unloading mark dumpsters, receptacles and vehicles with a sign to comply with requirements of the USEPA NESHAP regulation (40 CFR Part 61), in a visible location that reads:
    "DANGER ASBESTOS DUST HAZARD CANCER AND LUNG DISEASE HAZARD AUTHORIZED PERSONNEL ONLY"
    7. Do not store containerized materials outside of the Work Area. Take containers from the Work Area directly to a sealed truck or dumpster.
    8. Do not transport disposal bagged materials on open trucks. Label drums with same warning labels as bags. Uncontaminated drums may be reused. Treat used drums that have been contaminated as RACM and dispose of in accordance with this specification.
    9. Advise the landfill operator or processor, at least ten days in advance of transport, of the quantity of ACM to be delivered.
    10. At disposal site unload containerized waste:

a. At a disposal site, sealed plastic bags may be carefully unloaded from the truck. If bags are broken or damaged, return to work site for rebagging. Clean entire truck and contents using procedures set forth under Project Decontamination.

11. Retain receipts from landfill or processor for amount of ACM disposed.
12. At completion of hauling and disposal of each load, submit copy of waste manifest, chain of custody form, and landfill receipt to Owner.

3.02 SEQUENCING

A. Isolate air intakes
    1. Shut down air handling units that draw in fresh air from any area within 30 feet of the Work Area. Seal all air intakes with 6-mil plastic sheeting.
    2. Provide horizontal or vertical extension to relocate the opening of air intakes outside or above the Work Area.
B. Install critical barriers over all openings into building or equipment within 30 feet of the Work Area. Do not cover building surfaces. Erect temporary screens of reinforced plastic sheeting as required to prevent wind carrying products of work to any entries of the building or other occupied portions of the site.
C. Do not sand, abrade or grind asbestos containing materials.
D. Airborne Fiber Levels: Maintain airborne fiber levels as set forth herein.
E. Use Manual methods which do not render asbestos containing materials "non-intact." These include the use of spud, spade, flat-blade or slicing tools, such as axes, mattocks, pry bars, spud bars, crow bars, shovels, flat-blade knives, and utility knifes, to slice, cut, strip-off, shear-under, or pry up the material.
F. Remove ACM in an intact state to the extent feasible.
G. Perform all removal work on non-intact ACM using wet methods, or that which will be rendered non-intact during removal, unless wet methods are not feasible or will create safety hazards.
    1. For removal of ACM in outside conditions, preform all removal work on non-intact asbestos containing materials when outside temperatures are warm enough that the ACM is above the phase change (glass) point. Carryout removal of ACM in a manner that will minimize pulverizing, breaking or abrading of involved materials.
    2. Wet surface with amended water. Use sufficient water to completely wet surface but not cause ponding or running of water. Cut into sections able to fit in disposal boxes as applicable. Use rotary blade to cut. Do not saw or use powered rippers. Lift sections and place in disposal boxes as applicable. Use a high-efficiency particulate air (HEPA) vacuum or wet sweep into sweep shovels to pick up debris as applicable. Bag and dispose of as specified herein.
    3. For insulation, wet insulation with amended water sufficiently to enable it to be removed in a crumbly damp mass. Remove by scraping with hoes. Dispose of insulation as a non-asbestos waste.
H. When removing with a power cutter:
    1. Continuously mist the blade of the cutting machine during use unless the competent person determines that misting substantially decreases worker safety.

2. Collect dust and debris resulting from the cutting operation:
    a. Aggregate Surface: Collect all dust resulting from the cutting operation with a HEPA dust collector or by HEPA vacuuming along cut line.
    b. Smooth Surface: Collect all dust resulting from the cutting operation with a HEPA dust collector, by HEPA vacuuming along cut line, or by gently sweeping and then carefully and completely wiping up the wetted dust and debris left along the cut line.
3. Immediately bag dust and debris resulting from the cutting operation or place in covered containers.

I. Intact ACM shall be removed from Work Area as soon as it is practical, but no later than the end of the work shift.

J. ACM that is non-intact shall be removed from the Work Area as soon as it is practical, but in any event no later than at the end of the work shift. Non-intact ACM remaining in the Work Area will be kept wet, and placed in an impermeable waste bag, or wrapped in plastic sheeting.

3.03 DECONTAMINATION PROCEDURES

A. Require all workers to adhere to the following personal decontamination procedures at a minimum whenever they leave the Work Area:
    1. Type B or C Supplied Air or Powered Air-Purifying Respirators (PAPR):
        a. When exiting area, remove disposable coveralls, disposable head covers, and disposable footwear covers or boots in the equipment room.
        b. Still wearing respirators, proceed to showers. Showering is mandatory. Care must be taken to follow reasonable procedures in removing the respirator to avoid asbestos fibers while showering. The following procedure is required at a minimum:
            (1) Thoroughly wet body including hair and face. If using a PAPR hold blower unit above head to keep canisters dry.
            (2) With respirator still in place thoroughly wash body, hair, respirator face piece, and all parts of the respirator except the blower unit and battery pack on a PAPR. Pay particular attention to seal between face and respirator and under straps.
            (3) Take a deep breath, hold it and/or exhale slowly, completely wet hair, face, and respirator. While still holding breath, remove respirator and hold it away from face before starting to breath.
            (4) Carefully wash face piece of respirator inside and out.
        c. If using PAPR, shut down in the following sequence:
            (1) Cap inlets to filter cartridges, and then turn off blower unit (this sequence will help keep debris which has collected on the inlet side of filter from dislodging and contaminating the outside of the unit). Thoroughly wash blower unit and hoses. Carefully wash battery pack with wet rag. Be extremely cautious of getting water in battery pack as this will short out and destroy battery.
            (2) Shower completely with soap and water.
            (3) Rinse thoroughly.
            (4) Rinse shower room walls and floor prior to exit.
            (5) Proceed from shower to Changing Room and change into street clothes or into new disposable work items.

B. Remote Shower: The procedures above are to be used if the decontamination facility is used as a remote shower. If a worker cannot gain direct access to the Equipment Room, require that they enter Decontamination Unit and proceed directly through Shower Room to Equipment Room. Decontamination procedure is then completed as required above.

C. Within Work Area:

1. Require that workers NOT eat, drink, smoke, chew tobacco or gum, or apply cosmetics in the Work Area. To eat, chew, drink or smoke, workers shall follow the procedure described above, and then dress in street clothes before entering the non-Work Areas of the building.

End of Section

SECTION 01566 – CLEANUP OPERATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. The Contractor shall provide all material, labor and equipment necessary for cleanup operations. The Contractor shall maintain a neat and clean job site at all times.

1.02 RELATED SECTIONS

A. Section 00700 – General Conditions.
B. Section 01000 – General Project Requirements.
C. Section 01300 – Submittals.
D. Section 32 16 00 – Curbs, Gutters, Sidewalks, and Driveways.
E. Section 32 92 00.10 – Native Grasses.
F. Section 03 30 00 –Concrete.

1.03 CODES AND STANDARDS

A. Not used.

1.04 DEFINITIONS

A. Not used.

1.05 INFORMATION PROVIDED BY THE CITY

A. As provided in the Contract Documents.

1.06 SUBMITTALS

A. The Contractor shall submit as specified in Section 01300 – Submittals, if proposing alternate methods and facilities for concrete washout facilities. See paragraph 3.03.E. 3 in this Section.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 SITE MAINTENANCE

A. Cleanup operations shall be conducted in accordance with Section 00700 General Conditions, Article 6 – Contractor's Responsibilities.
B. Adequate cleanup shall be a condition for the processing of the Contractor's monthly progress payment applications.
C. The Contractor shall, at all times, keep the premises from accumulations of excavated materials, waste materials and other debris resulting from the Work. Site maintenance shall include, but is not limited to, the following:
    1. The Contractor shall sweep streets daily to maintain the Site in a neat and clean condition.
    2. Provide adequate trash receptacles on the Site and promptly empty when filled.
    3. Conduct periodic cleanup of the Site to avoid hazards, interference with traffic or operations at the Site.
    4. Keep construction materials such as pipe, forms and scaffolding neatly stacked.

5. Conduct immediate cleanup to protect the Work by removing splattered concrete, asphalt, oil, paint, corrosive liquids and cleaning solutions from all surfaces (linear construction) including walls, floors and metal surfaces (vertical construction) before the surfaces are marred.
6. Volatile wastes shall be properly stored in covered metal containers and removed from the Site daily.
7. Wastes shall not be buried on the site or disposed of into storm drains, sanitary sewers, streams or waterways. All wastes shall be removed from the site and disposed of in a manner complying with all local permits, ordinances and anti-pollution laws.
8. Overloading of trucks is prohibited to prevent spillages on all access and haul routes. The Contractor shall provide periodic inspection of traffic areas to enforce the requirements of this Section.
9. The Contractor shall prevent all excess material from washing into stream beds, storm water facilities, streets, culverts, etc.

D. All excavated material not incorporated into the Work shall be removed and disposed of by the Contractor so that the site will be left in equal or better condition than its original state.
E. Any deficiency in the quantity of material for filling depressions caused by settlement shall be supplied by the Contractor.
F. The Contractor shall remove all mobilized equipment, surplus materials, debris and temporary facilities from the site. The construction site shall be left in its original condition or better condition than before the Work commenced.
G. In addition, as directed by the City, the Contractor may be required to obtain a City approved release form, signed by the property owners affected by the Work.

3.02 DUST CONTROL

A. The Contractor shall take all reasonable measures to prevent unnecessary dust. Earth surfaces subject to dusting shall be kept moist with water or by the approved application of an approved chemical suppressant. When practical, dusty materials in piles or in transit shall be covered to prevent blowing.
B. The Contractor shall make provisions so that buildings or operating facilities that may be adversely affected by dust shall be adequately protected from dust. Existing or new machinery, motors, instrument panels or similar equipment shall be protected by suitable dust screens. Proper ventilation shall be included with dust screens.
C. Contractor shall maintain and keep all streets clean throughout the Work period. The Contractor shall perform street sweeping on a daily basis to remove dust and debris from paved areas within the Work site.

3.03 CONCRETE WORK

A. See Section 32 16 00 –Curbs, Gutters, Sidewalks, and Driveways for additional requirements.
B. See Section 03 30 00 –Concrete for additional requirements.
C. Three (3) working days after the placement of concrete, the Contractor shall conduct cleanup operations related to the completed concrete work as follows:
    1. Removal of forms, backfilling of the form excavation and debris removal from streets, sidewalks and parkway areas shall be accomplished within three (3) working days after the concrete placement. The backfilled areas within one foot of new concrete shall not be compacted until the concrete has cured a minimum of five (5) days.

2. Five (5) working days after the concrete is placed, the Contractor shall complete all joint caulking, pavement restoration, seeding and sodding. If construction is being performed during periods other than designated seeding and sodding seasons, all locations without turf cover shall be completed within ten (10) working days after the beginning of the next seeding and sodding season. Refer to Section 32 92 00.10 – Native Grasses for additional requirements.
3. If cleanup, backfilling, sodding, joint caulking or pavement restoration is not accomplished within the above limits, all tear-out and installation operations shall cease until these items are finished. Proceeding without these items being completed is at the sole discretion of the City.
4. All excavated material shall be removed and disposed of by the Contractor so that the grounds will be left in equal or better condition than its original state. Any deficiency in the quantity of material for filling depressions caused by settlement shall be supplied by the Contractor.
5. Surplus materials, equipment, tools, temporary facilities and structures shall be removed by the Contractor; all debris shall be hauled away by the Contractor and the construction site shall be left in equal or better condition than its original state. Payment of completed items on the Schedule of Values shall be subject to the completion of the cleanup operations.
6. Tear-out and installation shall not begin if unfavorable conditions for concrete placement are forecast for the next day.
7. All cleanup operations, as stated above, shall be completed five (5) working days after concrete placement.

D. Concrete Washout Facilities:
1. The Contractor shall provide facilities for concrete washout to collect and retain all the concrete washout water and solids in leak proof containers.
2. Lined wash pits or washout boxes are acceptable.
3. Alternate methods for washout facilities may be considered by the City. The Contractor shall submit for review and approval, per Section 01300 – Submittals, the alternate methods and facilities to be used.
4. The location of washout facilities shall be indicated on the Construction Site Plan (See Section 01000 – General Project Requirements, paragraph CONSTRUCTION SITE PLAN).
5. Concrete washout facilities shall be inspected daily and after heavy rains to check for leaks, identify any plastic linings or sidewalls that have been damaged by construction activities and determine whether they have been filled to over 75 percent capacity.
6. When the washout container is filled to over 75 percent of its capacity, the wash-water shall be vacuumed out or allowed to evaporate to avoid overflows. When the remaining cementitious solids have hardened, they shall be removed from the Site.
7. Damages to the washout container shall be repaired promptly.
8. Before heavy rains, the washout container's liquid level shall be lowered or the container shall be covered to avoid an overflow during the rain storm.
9. Washout facilities shall be removed from the Site upon completion of the Work and the area restored as specified herein.

END OF SECTION

SECTION 01570 - TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 – GENERAL

1.01 SUMMARY

A. The Contractor shall provide erosion and sediment control measures for all areas within and adjacent to the Project site. The Contractor shall assume that the work is to be done under the City's General Operating Permit (Permit No: MOR100006). The Contractor does not need to make separate application to the Missouri Department of Natural Resources (MDNR).

B. Specific erosion and sediment control measures are specified in APWA 5100 and Standard Erosion and Sediment Control (ESC) Drawings. These measures shall be implemented in order to control erosion and water pollution.

C. No separate payment shall be made for Erosion and Sediment Control. The Contractor shall include in the lump sum total bid price: all labor, material and equipment necessary to comply with this Section and all other Work indicated in the Contract Documents.

1.02 DESCRIPTION

A. The Contractor shall install and maintain temporary erosion and sediment control devices prior to commencing construction operations and continue through the construction period until such time as seeding and sodding has been completed and turf is established on all graded areas.

B. The Contractor shall prepare and implement a Stormwater Pollution Prevention Plan (SWPPP) utilizing the latest version of the City's SWPPP template to develop the plan. The plan must include a narrative of the types and appropriate uses of Best Management Practices (BMPs) for erosion and sediment control and stormwater management. The requirements of the SWPPP must be as stringent as those described in the City's General Operating Permit (No: MOR100006) and 10 CSR 20-6.200. Additionally, the SWPPP must comply with the City of Kansas City's MS4 permit.

C. Failure to control erosion and water pollution will result in the Contractor being noncompliant. Any noncompliance constitutes grounds for the following enforcement actions. The Contractor shall have 24 hours after receiving a notice of noncompliance from the City's representative (i.e. Project Manager, Design Professional, Inspector/ Representative of the City) to correct the problem. If weather conditions prevent the correction of BMPs within 7 calendar days, the reasons for the delay must be documented (including pictures) and there must be a narrative explaining why the work cannot be accomplished within the 7 day time period. The documentation must be filed with the regular inspection reports. The Contractor shall correct the problem as soon as weather conditions allow. If the Contractor fails to correct the problem after the time prescribed, the City will hire a remediation expert to fix the problem. In such an event, the Contractor shall be liable to the City for the remediation costs plus a 10 percent mark-up of the total contract price. If the Contractor continues to be noncompliant, the Director (or an authorized agent thereof) may issue a stop work order and delay any payment until control measures are properly functioning and any damage has been mitigated. In such an event, any delay to the Project schedule will result in liquidated damages assessed against the Contractor.

1.03 RELATED SECTIONS

A. Section 01000 – General Project Requirements.

B. Section 01300 – Submittals.

C. Section 31 20 50 – Site Preparation and Earthwork.

D. Section 32 92 00.10 – Native Grasses.

1.05 QUALITY ASSURANCE

A. The Contractor is responsible for the quality assurance and quality control of the Work. The Work shall be performed by a contractor with a proven record of performance for similar erosion and sedimentation control work.

1.06 INFORMATION PROVIDED BY THE CITY

A. As provided in the Contract Documents.

1.07 CONTRACTOR SUBMITTALS

A. The Contractor shall submit to the City/Design Professional for review and approval, in accordance with Section 01300 – Submittals, all specifications and data covering the proposed materials to be used for erosion and sedimentation control work.

B. The Contractor shall submit the following to the City/Design Professional for review and approval prior to the preconstruction conference:

1. The Contractor shall prepare a Stormwater Pollution Prevention Plan (SWPPP) for Projects that disturb one or more acres of land or disturb less than one acre when part of a larger Project which will disturb one or more acres over the life of the Project.
2. The SWPPP shall meet the requirements of this Section, applicable references on the plans, the City's adopted Erosion and Sediment Control Specifications (ESCS), and all sections of the APWA-KCMO specifications that reference erosion control requirements. The Contractor shall develop, implement, and adhere to the erosion control and stormwater pollution prevention plan based upon the City's guidelines and requirements.
3. No work can begin until the SWPPP is approved by the City/Design Professional.
4. The Contractor shall update and maintain the SWPPP as necessary to develop ongoing site-specific control measures until final acceptance of the Project.

PART 2 – PRODUCTS

A. Unless otherwise specified, acceptable products for Inlet Protection include the following:

1. Gutter Buddy, Dandy Curb® or approved equal.

PART 3 – EXECUTION

3.01 SAFETY

A. Perform all work in accordance with applicable Occupational Safety and Health Administration (OSHA) standards.

3.02 PERFORMANCE

A. City Projects are covered by a general NPDES permit maintained by the Water Services Department's Storm Water Division. The Permit imposes a number of obligations including, but not limited to, the following:

1. New Projects must be reported to the MDNR 90 days before the Project starts.
2. Each site must have and follow a written Storm Water Pollution Prevention Plan (SWPPP). Each site must be inspected weekly and following each rain event, for compliance with the SWPPP. Written inspection reports must be kept.

3. All personnel on site must be briefed on the requirements of the SWPPP.
4. A copy of the SWPPP must be on site at all times.
5. All deficient items shall be promptly corrected. In no case shall the correction period exceed two calendar days.
6. Quarterly reports must be filed by the City with MDNR identifying and giving the status and percent complete of each Project.
7. MDNR must be notified if hazardous substances or contaminated soil are discovered on site.

B. The Contractor shall follow the approved SWPPP, as well as all erosion control measures included in the Contract Documents and implement other BMP measures as directed by the City/Design Professional.

C. The Contractor shall prevent erosion during his operations until vegetation is re-established. The Contractor shall prepare erosion control plans and submit in writing to the City/Design Professional any proposed modifications to the plans. The proposed modifications shall describe materials that will be used and the tasks that will be performed to control runoff on the site.

D. Erosion control devices shall be in place before land is disturbed.

E. All earthen structures shall be seeded or sodded. See Section 32 92 00.10 – Native Grasses for additional requirements.

F. Vegetation shall be established to provide adequate protection or develop other suitable means.

G. Sediment trapping devices shall be installed in the proper location prior to grading.

H. The Contractor shall establish perimeter sediment trapping measures that function properly.

I. The Contractor shall prevent sediment from leaving the site and/or from damaging adjacent property.

J. The Contractor shall prevent and or remove mud on public roads or at intersections with public roads that is related to the Project work being completed.

K. The Contractor shall provide a temporary construction entrance to reduce/eliminate the transport of mud from the construction site onto public right of ways.

L. The Contractor shall provide dust control measures for any graveled areas or exposed soil areas. See Section 01000 – General Project Requirements, paragraph DUST CONTROL for additional requirements.

M. The Contractor shall temporarily or permanently stabilize all areas with exposed soil. See Section 32 92 00 – Seeding and Sodding for additional requirements.

N. The Contractor shall adequately stabilize all finished cut and fill slopes.

O. All on-site drainage channels and outlets shall be adequately stabilized.

P. Route stream around work areas.

Q. Repair stream channel damages per the Contract Documents.

R. Provide stabilization or a temporary stream channel crossing where needed.

3.03 INSTALLATION

A. Methods, materials and maintenance shall be the sole responsibility of the Contractor. The Contractor and the City/Design Professional shall conduct weekly onsite inspections using the “Erosion and Sediment Control Checklist” provided by the Water Services Department. Remove any onsite pollutant sources (debris piles with petroleum cans, chemical containers, fueling trucks/tanks or other possible sources of pollution). Upon notification of a weather forecast with a reasonable likelihood of rain, or at the direction of the

City/Design Professional, the Contractor shall construct temporary berms and install erosion control fencing as necessary to control the potential eroded sediment and prevent it from leaving the construction area. If the Contractor's construction operations are complete to the point where seeding or sodding is the major item at hand before final acceptance can be made, and seeding or sodding is out-of-season or disallowed by the City/Design Professional, the Contractor shall construct one of the following erosion control measures:

1. Incorporate the use of erosion control fencing immediately downstream of vulnerable areas that are susceptible to the formation of small streams. Maintain the erosion control devices until seeding or sodding season returns. Upon return of the sodding season, the area shall be re-graded to the lines and grades established in the Contract Drawings and sodded at the direction of the City/Design Professional. See Section 32 92 00.10 – Native Grasses for additional requirements.
2. Terrace the ground with graded berms and incorporate the use of both temporary slope drains (See ESCS Section 10.03.4.3 and Section 31 20 50 – Site Preparation and Earthwork for additional requirements) and erosion control fencing (as specified in this Section). Maintain the erosion control devices until seeding or sodding season returns. Upon return of the seeding or sodding season, the area shall be re-graded to the lines and grades established in the Contract Drawings and seeded/sodded at the direction of the City/Design Professional. See Section 32 92 00 – Seeding and Sodding for additional requirements.
3. Fertilize, place seed or sod, and irrigate as directed by APWA-KCMO 2400. Maintain the erosion control devices until seeding or sodding season returns. Upon return of the seeding or sodding season the Contractor shall re-establish the grade and replace all dead seed or sod at the direction of the City/Design Professional. See Section 32 92 00 – Seeding and Sodding for additional requirements.

B. Silt fence shall be installed, inspected and maintained in accordance with APWA ESC–10.

C. Berms shall be constructed in accordance to APWA ESC–29:

1. Berms are required if the silt fence is not installed or properly maintained.
2. Inspection shall be frequent and repair or replacement shall be made promptly as needed.
3. Remove sediment deposits as necessary to provide adequate storage volume for the next rain.
4. The Contractor shall remove berms when they have served their usefulness.
5. Sediment trapped by this practice shall be uniformly distributed on the source area prior to seeding or sodding.

D. The Rock Check Dam shall be constructed, inspected and maintained in accordance to APWA ESC–15.

E. Inlet Protection. Work covered under this item consists of installing a Gutter Buddy, Dandy Curb® or equal inlet protection system for inlets and median barrier inlets without grates. The purpose is to keep silt, sediment and construction debris out of the storm system:

1. The inlet protection system shall be a sewn fabric unit enclosing a porous structure in the form of a cylindrical tube placed in front of and extending beyond the inlet opening on both sides.
2. Place inlet protection unit on the street with aggregate pouch near the inlet it will be installed to protect.
3. For oil and sediment, place absorbent in the sock tube.

4. Center the unit against curb or median inlet opening so that the curb side of the unit creates a seal with the curb or median barrier and inlet structure. There will be approximately twelve (12) inches of the inlet protection unit overhanging on each side of the opening. If the unit is not installed in this manner, it will not function properly.
5. The Contractor shall remove all accumulated sediment and debris from in front of the unit and from the street surface in the vicinity of every installed unit after each rain event or as directed by the City/Design Professional. Dispose of the unit at an appropriate recycling or solid waste facility when the unit is no longer being used.
6. Oil and sediment. Remove and replace absorbent when near saturation.

3.04 MAINTENANCE AND REPAIR

A. The Contractor is responsible for maintaining all erosion and sediment control measures until acceptance of the Project by the City.
B. Erosion control measures showing evidence of overtopping, breaks or erosion shall be repaired or replaced with suitable materials.
C. All storm sewer inlets shall be regularly maintained so that sediment will not enter the system.
D. Repair and clean-out all control measures that are not functioning properly.
E. Remove temporary measures that are no longer needed.
F. Seeded or sodded areas requiring maintenance (fertilizer, re-sodding, re-seeding or additional mulch and watering) shall be promptly addressed. See Section 32 92 00.10 – Native Grasses for additional requirements.

3.05 WARRANTY

A. Seeding and sodding work shall have taken root and established satisfactory coverage before acceptance by the City. The Contractor shall maintain as described in paragraph 3.04 above and shall guarantee seeding and sodding for one (1) year after acceptance. The Contractor shall scarify, re-seed or re-sod, fertilize and mulch (seeded areas) any barren area greater than 1 square foot. See Section 32 92 00.10 Native Grasses for requirements on early acceptance.

END OF SECTION

SECTION 01580 – PROJECT SIGNS

PART 1 - GENERAL

1.01 SUMMARY

A. Contractor shall provide all material, labor and equipment necessary for the fabrication, printing and installation of Project signs.

B. This section covers project sign requirements for all Kansas City, Missouri - Water Services Department projects. Project sign requirements include the following:

1. Project identification sign description.
2. Project sign installation.
3. Maintenance and removal of Project sign.
4. Printing of signs.
5. Installation of signs.

1.02 SPECIFICATION MODIFICATIONS

A. It is understood that throughout this section these Specifications may be modified by appropriate items in Section 01015 – Specific Project Requirements or as otherwise indicated on the Drawings.

1.03 RELATED SECTIONS

A. Section 01015 – Specific Project Requirements.

B. Section 01300 – Submittals.

C. Section 01581 – Public Communications.

1.04 INFORMATION PROVIDED BY THE CITY

A. City shall provide the graphic design templates of the Project sign in an electronic format to be used in the printing process.

1.05 SUBMITTALS

A. Submit as specified in Section 01300 – Submittals.

B. Shop Drawings (not used).

C. Product Data (not used).

D. Samples.

E. Other:

1. Project Sign Locations – submit for review and approval a map of the Project area of marked up Drawings showing the location and orientation of each project sign.
2. Submit for review and approval notifications to homeowners and business adjacent to the location of the Project signs.
3. Re-use of Placards – if the Contractor has salvaged placards from previous projects, they may be re-used if in good condition, there are no changes to the information included on the sign and approved by the City. Submit color photographs that accurately show the condition of each placard to be re-used for review and approval.

PART 2 - PRODUCTS

2.01 PRINTERS

A. A list of printing companies that have previous experience with printing signs for the City are included in Section 01015 – Specific Project Requirements.

2.02 FRAME

A. Metal frame and hardware shall be in conformance with Water Services standard detail D-20142 – Installation Detail for Project Signs (see Figure 3).

2.03 PLACARDS

A. Upper Placard Size – 6 feet wide by 4 feet tall.
B. Lower Placard Size – 6 feet wide by 1 foot tall.
C. Material – Coroplast® corrugated plastic sheeting or approved equal.
D. Sheeting Thickness – ½ inch.
E. Sheeting Color – white.
F. Print Method – direct to Coroplast® with outdoor UV laminate coating.

2.04 PLACARD CONTENT

A. Construction Phase Upper Placard – for each Project sign the Contractor shall provide an upper placard which will be displayed through construction. An example of the Construction Phase Upper Placard is shown in Figure 1.
B. Post-Construction Phase Upper Placard – for each Project sign the Contractor shall provide an upper placard which will be displayed post construction. An example of the Construction Phase Upper Placard is shown in Figure 2.
C. Lower Placard – for each Project sign, the Contractor shall provide a lower placard. Examples of the Lower Placard are shown in Figures 1 and 2.
D. The City will provide digital files for all placards and graphic images.

2.05 NUMBER OF SIGNS TO BE PROVIDED

A. The number of project signs to be provided is defined in Section 01015 – Specific Project Requirements. Each Project sign includes the following:
    1. One (1) Construction Phase Upper Placard to be displayed during construction.
    2. One (1) Post-Construction Phase Upper Placard to be displayed after completion of the Work.
    3. One (1) Lower Placard to be displayed during construction and post-construction.
    4. Cost associated with printing of placards.
B. Frame as shown in Water Services standard detail D-20142 – Installation Detail for Project Signs (see Figure 3).

PART 3 - EXECUTION

3.01 INSTALATION AND PLACEMENT OF SIGNS

A. Installation – Project signs shall be fabricated and installed in accordance with Water Services standard detail D-20142 – Installation Detail for Project Signs (see Figure 3).

B. Location – Project signs shall be located within the Site as defined by Section 00700 General Conditions. Project signs shall be erected in a conspicuous place but shall not interfere with the vision of pedestrian or vehicular traffic such as to create a hazard. Signs shall be located in the public right of way or in an easement acquired for the Project. Locations of the signs shall be coordinated with the City prior to installation and submitted accordance with paragraph 1.05 SUBMITTALS.
C. Notifications – the Contractor shall notify any homeowners or businesses adjacent to the location of the signs at least three (3) days prior to erecting signs.
D. Project sign(s) shall be erected not less than two (2) days before the start of construction activities. No construction activities are allowed until the Project signs are erected.
E. Project signs shall remain in place for the duration of the Project and shall be maintained in a true, plumb and neat condition.

3.02 REPLACEMENT OF UPPER PLACARDS

A. Upon completion of the Work and at the direction by the City, the Contactor shall remove the Construction Phase Upper Placard (Figure 1) on all Project signs and replace them with the Post-Construction Upper Placard (Figure 2).
B. The Lower Placards are to remain in place.

3.03 REMOVAL OF PROJECT SIGNS

A. All Project signs shall be maintained for thirty (30) calendar days after completion of the Work or as otherwise directed by the City.
B. Contractor shall remove all Project signs and restore the area disturbed by construction activities.
C. Project signs shall be removed from the Project areas and will become property of the Contractor.
D. The Contractor may dispose of Project signs or salvage and reuse them on future City projects. The City will assess the condition of the signs and determine the appropriateness of reuse.
E. Within three (3) days of the removal of signs, Contractor shall provide the City written notice that all Project signs have been removed from the Site.

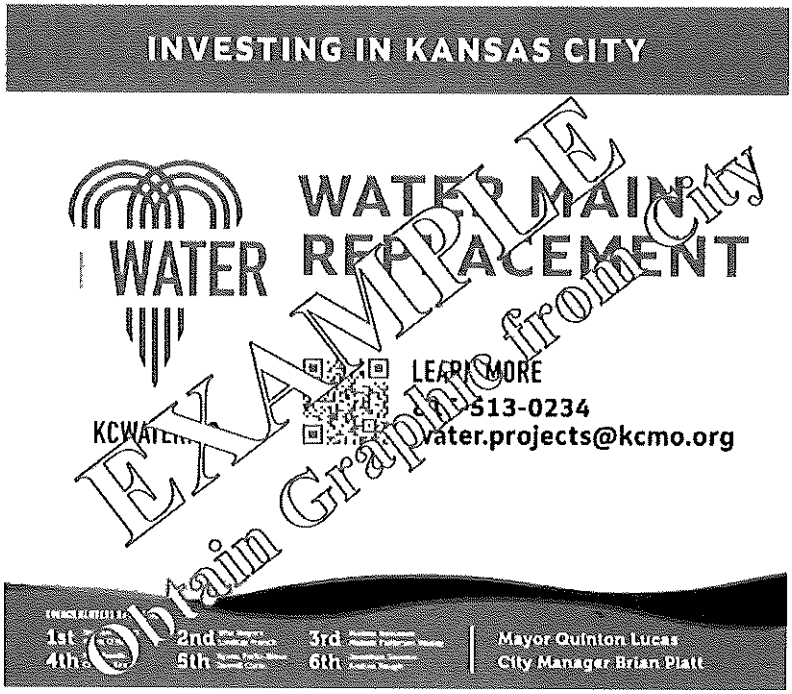


Figure 1: Construction phase upper and lower placard

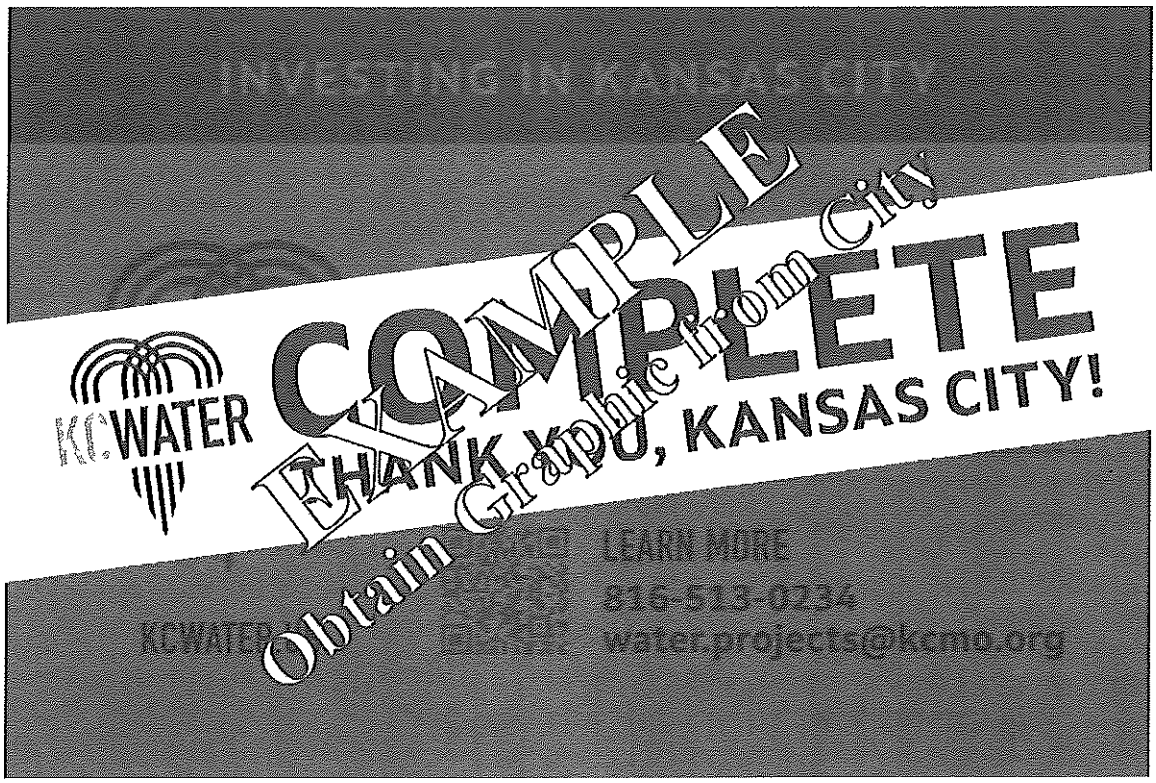


Figure 2 – Post Construction Placard

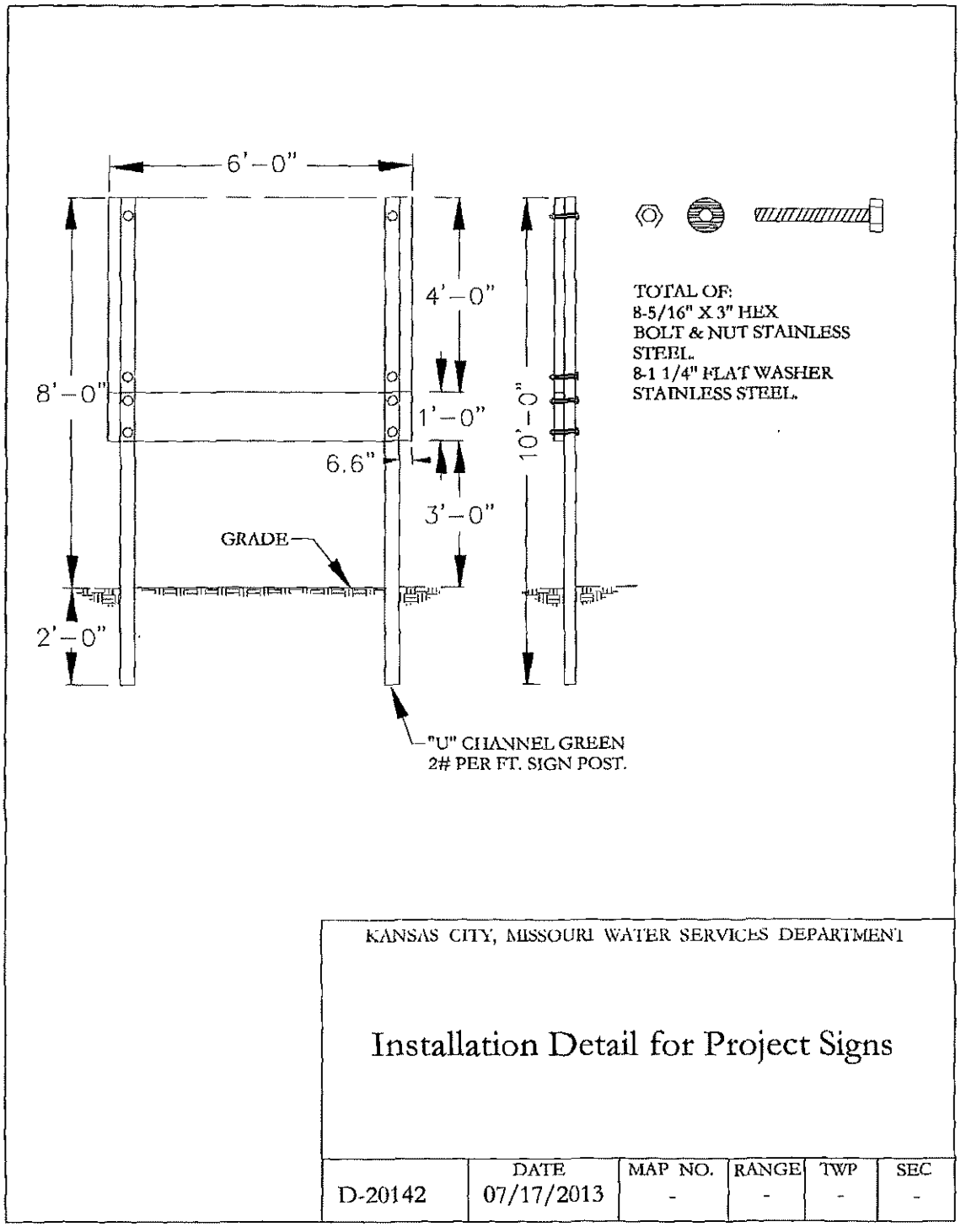


Figure 3 – Installation Detail for Project Signs

END OF SECTION

SECTION 01581 – PUBLIC COMMUNICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. This section covers communication procedures between the contractor and the public affected by construction activities.

B. Any time the contractor is acting on behalf of the City to perform work, the communications material between the contractor and the public shall adhere to these technical standards and is subject to review and approval by the City.

1.02 RELATED SECTIONS

A. Section 00700 – General Conditions:
   1. Article 6, paragraph 6.14 – Safety and Protection.

B. Section 01015 – Specific Project Requirements.

C. Section 01300 – Submittals.

1.03 DEFINITIONS

A. Affected Properties – homeowners, businesses, tenants or other entities whose everyday activities could be affected by the work.

1.04 INFORMATION PROVIDED BY THE CITY

A. The City will provide the contractor with an electronic file for mailing communications to affected property owners for the purpose of Project communications.

B. The City will provide the contractor with an electronic copy of approved communications templates to be distributed to affected properties.

1.05 SUBMITTALS

A. Submit as specified in Section 01300 – Submittals.

B. Notifications – Submit for review and approval all notification materials developed by the Contractor that are to be distributed to affected properties.

1.06 PUBLIC MEETINGS

A. Description – The contractor shall attend and participate in public meetings held for the project. The contractor's project manager shall attend and present project details. These details include, but are not limited to, the following:
   1. Project schedule.
   2. Project phasing.
   3. Disruptions to the neighborhood.
   4. Work hours.
   5. Temporary restoration efforts.
   6. Final restoration efforts.
   7. Field contact information.

B. The City will provide a location, date and time of the meeting and will facilitate the meeting.

C. See Section 01015 – Specific Project Requirements for additional meeting requirements.

1.07 DOOR HANGERS AND OTHER PRINTED COMMUNICATIONS

A. Description – Door hangers and other printed communications (fact sheets, post cards, signs, etc.) used throughout construction shall be distributed to inform homes and businesses of disruptions.

B. Templates – The City will provide templates for door hangers and other printed communications in an electronic format. See Figures 1 through 5 for an example door hanger.

C. Template Modification – The contractor may need to annotate the printed door hangers with project specific information. This effort may include describing the work and adding applicable date and time information for the benefit of the resident.

D. Review communications material – Review and approval of the communication materials by the City is required prior to the contractor's distribution of materials.

E. Printing and Reproduction – The contractor shall print door hangers, mailers and all other communication materials needed for the project.

F. Distribution List – The list of affected property owners will be provided by the City.

G. Mailing and Distribution – The contractor shall distribute the door hangers and other printed communications to the affected property owners. Door hangers are to be hand-delivered and not placed in the mailbox. All other printed communications will be delivered in a manner acceptable to the City.

H. Costs – All costs to develop, reproduce, deliver or mail notifications shall be included in the contractor's lump sum bid price.

1.08 NOTIFICATION OF UTILITIES

A. Notify utilities in accordance with Section 00700 – General Conditions, Article 6.

1.09 NOTICES TO PROPERTY OWNERS AND AUTHORITIES

A. As provided in Section 00700 - General Conditions, Article 6, the Contractor shall notify adjacent property owners and utilities when execution of the work may affect them.

B. Work Notice:
   1. General notice to affected property owners in advance of the work. Notice is required for any work within an easement. Notice shall be given for work within the City's right-of-way, outside of the street.
   2. Type of notification shall be a door hanger.

C. Denial of Access:
   1. Notice for when it is necessary to temporarily deny access to property, driveway, sidewalk or other facility.
   2. Type of notification shall be a door hanger.

D. Smoke Testing:
   1. Notice for when the Project involves smoke testing.
   2. Type of notification shall be a door hanger.

E. Utility Service Interruption:
   1. Notice for when any utility service connection must be interrupted.
   2. Type of notification shall be a door hanger.

F. Street Closures and Changes to Traffic Patterns:
   1. Notices to utilities and other concerned agencies prior to cutting or closing streets or other traffic areas or excavating near underground utilities or pole lines.
   2. Provide any additional notifications required by the traffic control permit.
   3. Type of notification will be written communication prepared and distributed by the Contractor.

G. Schedule – Notices shall be received by the affected properties no less than two (2) and no more than seven (7) calendar days prior to the work, denial of access, smoke testing, utility service interruption, street closures and changes to traffic patterns or other work that may require notification.

1.10 OTHER COMMUNICATIONS

A. See Section 01015 – Specific Project Requirements for additional communication requirements not specifically included herein or otherwise required by the Contract Documents.

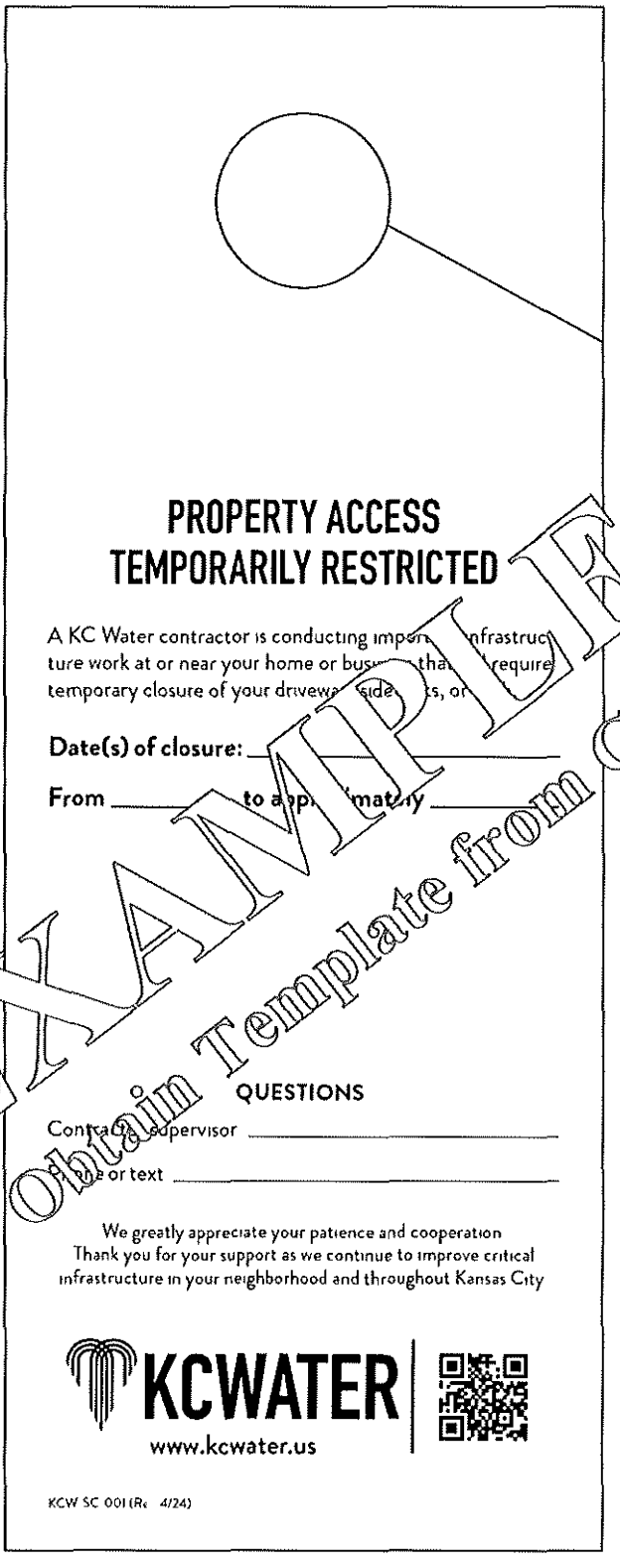
PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

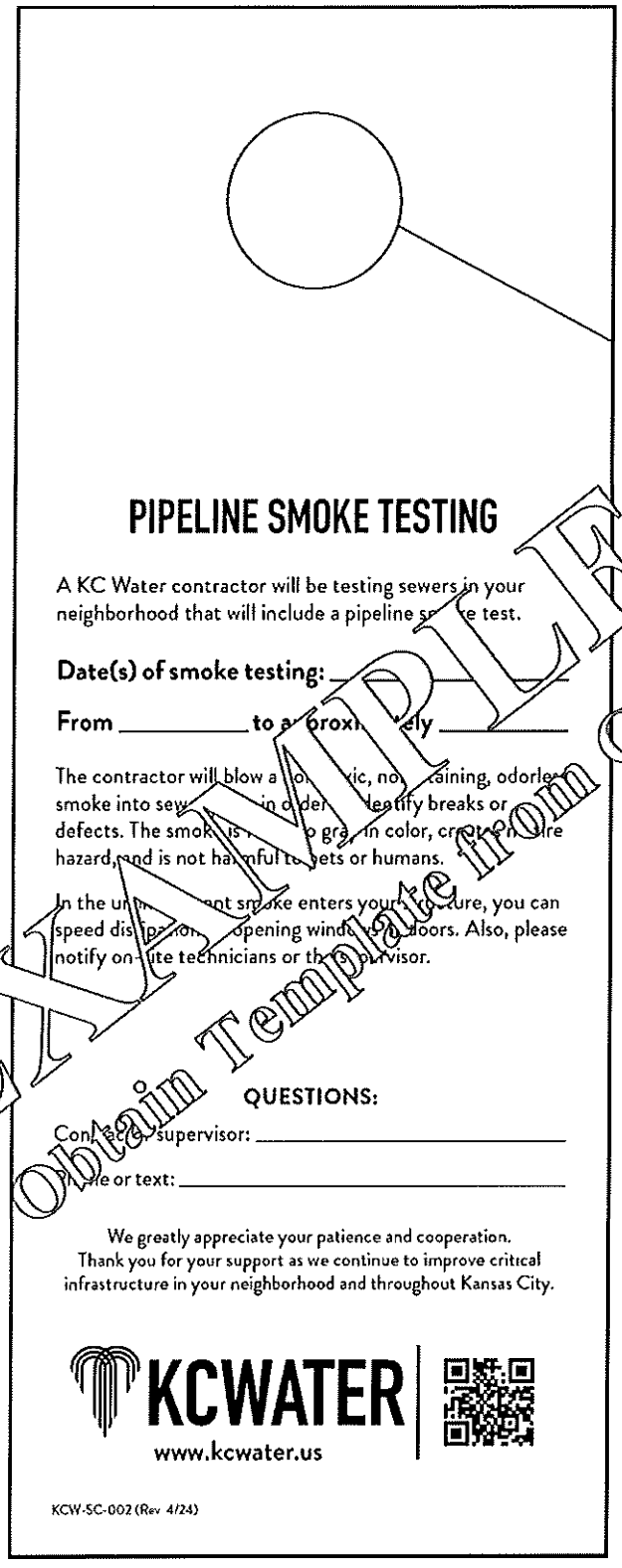
Not used.

See example templates on pages 4-9.



EXAMPLE
Obtain Template from City

Figure 1 – Restricted Access Door Hanger



PIPELINE SMOKE TESTING

A KC Water contractor will be testing sewers in your neighborhood that will include a pipeline sm e test.

Date(s) of smoke testing: _____

From _____ to a roxi ely _____

The contractor will blow a o ic, no aining, odorless smoke into sew in o der de tify breaks or defects. The smok is o gra in color, cr ot a fire hazard, and is not ha mful to pets or humans.

In the u ot smoke enters your st cture, you can speed dis pa ion opening windows doors. Also, please notify on- ite technicians or th supervisor.

QUESTIONS:

Con ac supervisor: _____

Pl e or text: _____

We greatly appreciate your patience and cooperation.
Thank you for your support as we continue to improve critical infrastructure in your neighborhood and throughout Kansas City.

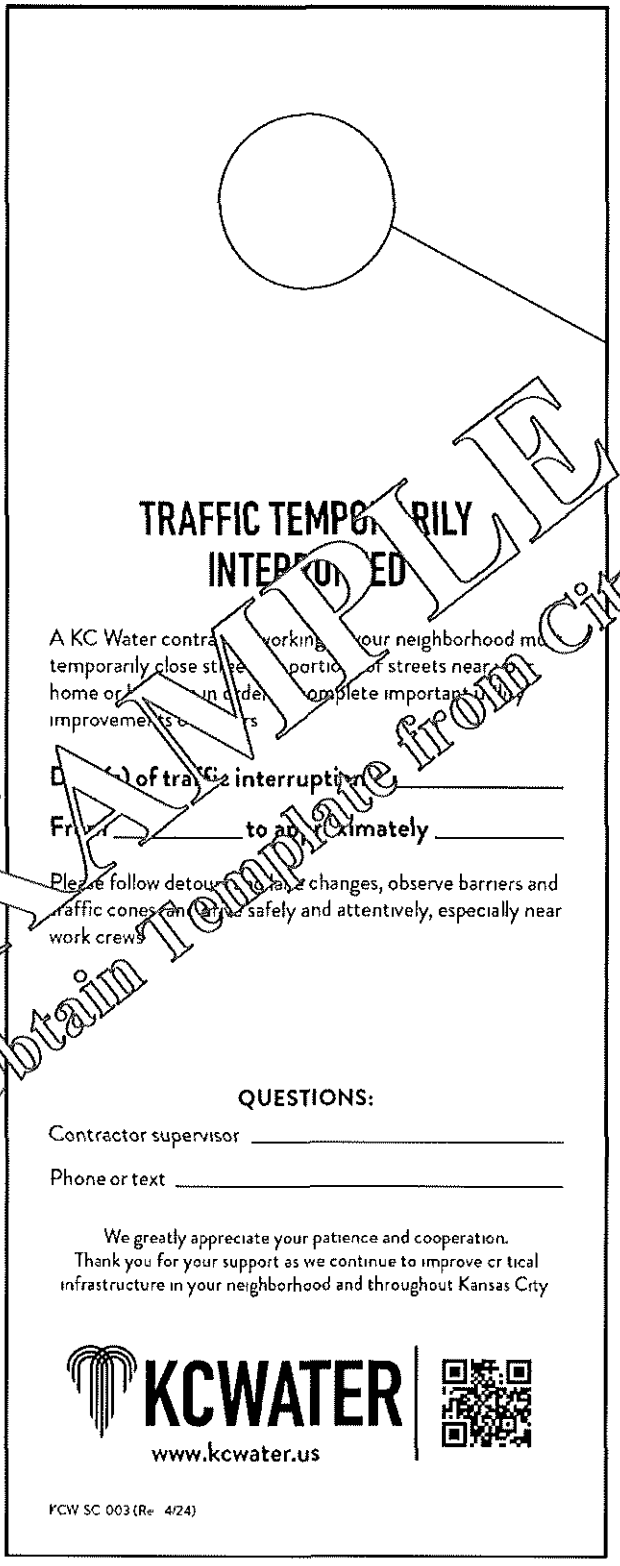
KCWATER

www.kcwater.us

KCW-SC-002 (Rev 4/24)

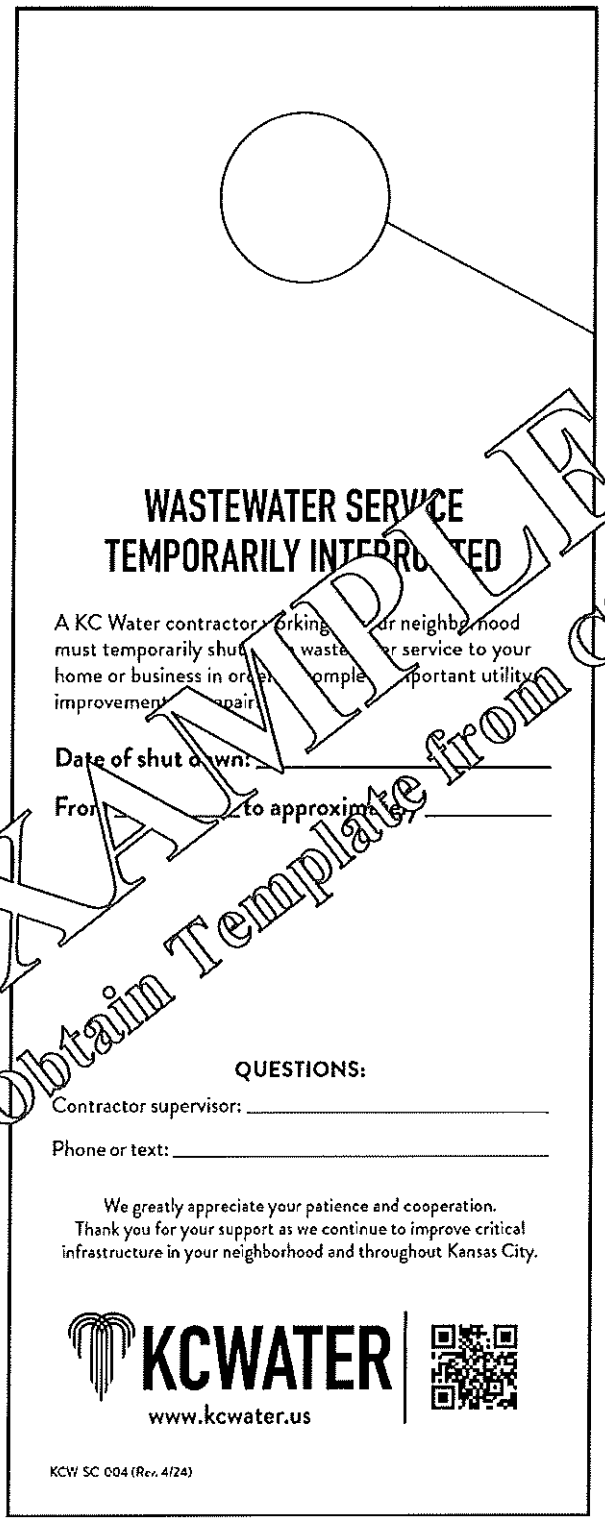
EXAMPLE
Obtain Template from City

Figure 2 – Smoke Testing Door Hanger



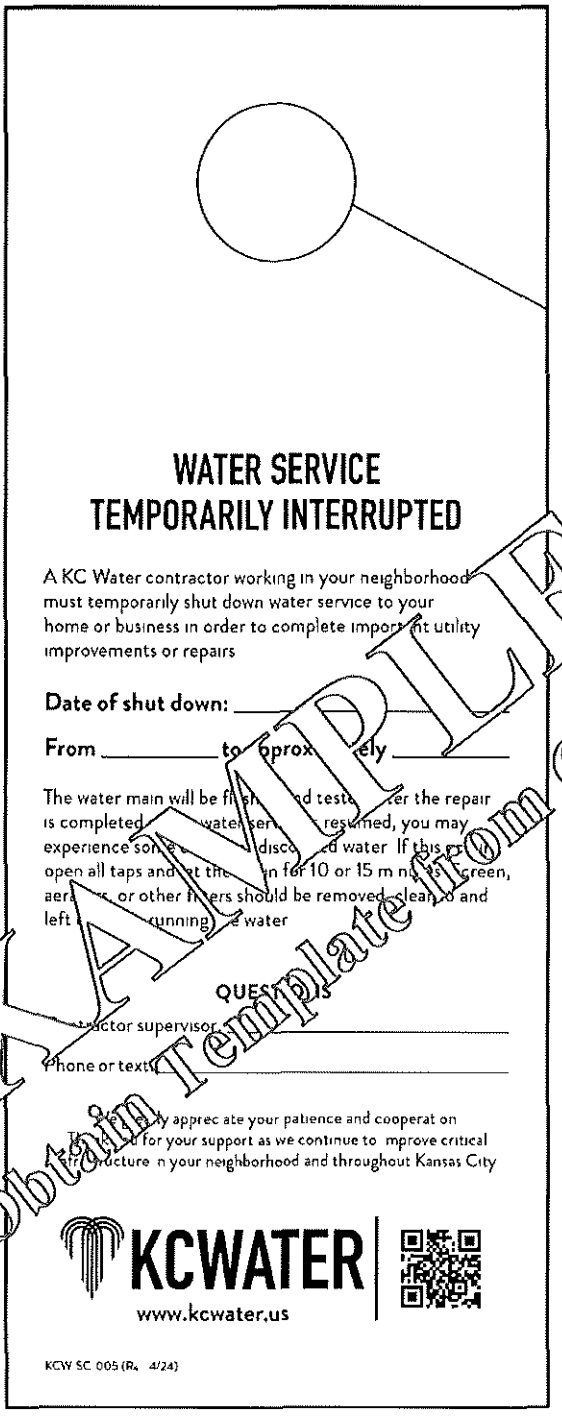
EXAMPLE
Obtain Template from City

Figure 3 -Traffic Interruption Door Hanger



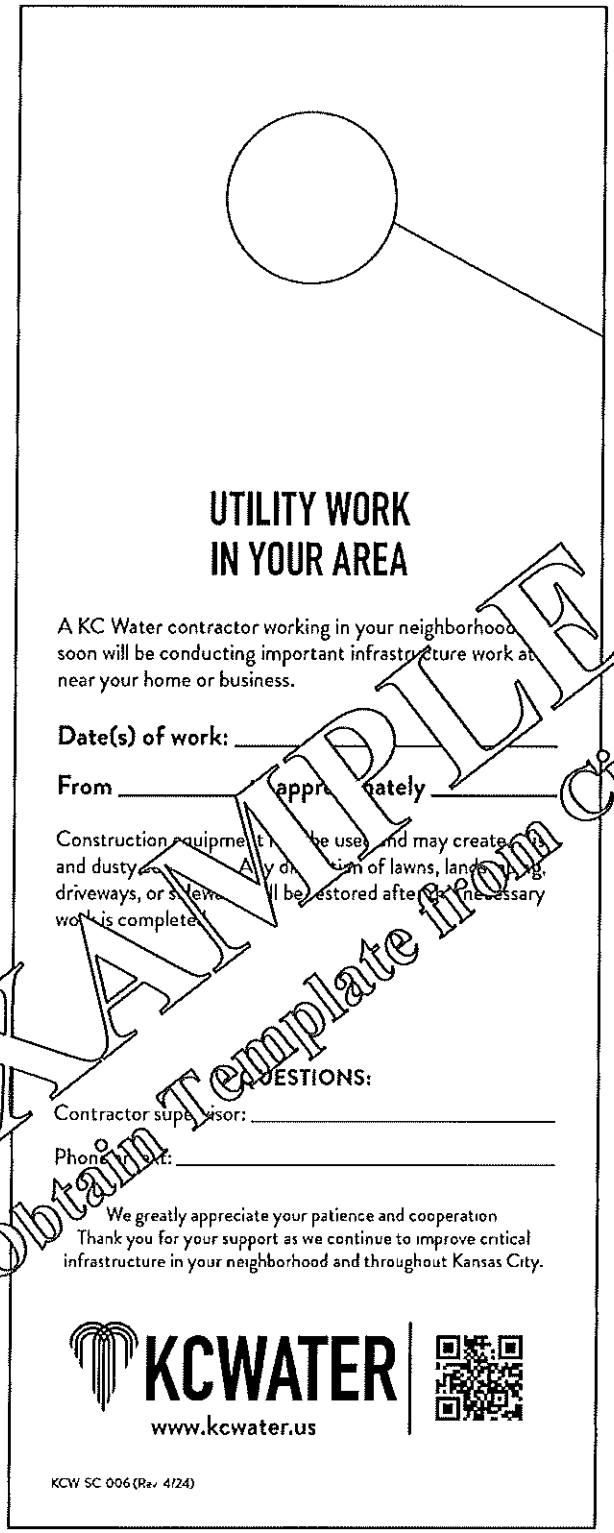
EXAMPLE
Obtain Template from City

Figure 4 – Wastewater Service Interruption Door Hanger



EXAMPLE
Obtain Template from City

Figure 5 – Water Service Interruption Door Hanger



EXAMPLE
Obtain Template from City

Figure 6 – Work Notice Door Hanger

END OF SECTION

SECTION 01600 – PRODUCT DELIVERY STORAGE AND HANDLING

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes: Product requirements; product selection; product options and substitutions; quality assurance; shipping, delivery, handling, and storage; and instructions for spare parts, maintenance products, and special tools.

1.02 REFERENCES

A. American National Standards Institute (ANSI).
B. NSF International (NSF):
    1. 61 - Drinking Water System Components - Health Effects.
    2. 372 - Drinking Water System Components – Lead Content.

1.03 RELATED SECTIONS

A. Section 01019 – Closeout Procedures.
B. Section 01300 – Submittals.
C. Section 01630 – Substitution Request Form.
D. Section 01757 – Commissioning.
E. Section 01783 – Operation and Maintenance Data.
F. Section 01810 – Project Design Criteria.
G. Section 09 90 00 – Protective Coatings.

1.04 DEFINITIONS

A. Products: Inclusive of raw materials, finished goods, equipment, systems, and shop fabrications.
B. Special tools: Tools that have been specifically made for use on a product for assembly, disassembly, repair, or maintenance.

1.05 SUBMITTALS

A. As specified in Section 01300 - Submittals.
B. Calculations/certifications in accordance with NSF 61 and 372 for materials in contact with drinking water.

1.06 GENERAL REQUIREMENTS

A. Comply with Specifications and referenced standards as minimum requirements.
B. Provide products by same manufacturer when products are of similar nature, unless otherwise specified.
C. Provide like parts of duplicate units that are interchangeable.
D. Provide equipment that has not been in service prior to delivery, except as required by tests.
E. When necessary, modify manufacturer's standard product to conform to specified requirements or requirements indicated on the Drawings.

1.07 SUBSTITUTIONS

A. Formal substitution request procedure:

1. Submit a written formal substitution request to Engineer for each proposed substitution within 30 days of effective date of Contract.
2. Engineer will return initial opinion and request for additional information within 30 days.
3. Engineer will notify Contractor in writing of decision to accept or reject the substitution request within 30 days of receiving required information.

B. Formal substitution request contents:
    1. Provide Substitution Request Form as specified in Section 01630 - Substitution Request Form.
    2. Manufacturer's literature including:
        a. Manufacturer's name and address.
        b. Product name.
        c. Product description.
        d. Reference standards.
        e. Certified performance and test data.
        f. Operation and maintenance data.
    3. Samples, if applicable.
    4. Shop drawings, if applicable.
    5. Reference projects where the product has been successfully used:
        a. Name and address of project.
        b. Year of installation.
        c. Year placed in operation.
        d. Name of product installed.
        e. Point of contact: Name and phone number.
    6. Itemized comparison of the proposed substitution with product specified including a list of significant variations:
        a. Design features.
        b. Design dimensions.
        c. Installation requirements.
        d. Operations and maintenance requirements.
    7. Define impacts:
        a. Impacts to construction schedule.
        b. Impacts to other contracts.
        c. Impacts to other work or products.
        d. Impact to Contract Sum:
            (1) Do not include costs under separate contracts.
            (2) Do not include Engineer's costs for redesign or revision of Contract Documents.
            (3) Required license fees or royalties.
        e. Availability of maintenance services and sources of replacement materials.
    8. Contractor represents the following:
        a. Contractor shall pay associated costs for the Engineer to evaluate the substitution.
        b. Contractor bears the burden of proof of the equivalency of the proposed substitution.
        c. Proposed substitution does not change the design intent and will have equal performance to the specified product.
        d. Proposed substitution is equal or superior to the specified product.

e. Contractor will provide the warranties or bonds that would be provided on the specified product on the proposed substitution, unless Owner requires a Special Warranty.
f. Contractor will coordinate installation of accepted substitution into the Work and will be responsible for the costs to make changes as required to the Work.
g. Contractor waives rights to claim additional costs caused by proposed substitution which may subsequently become apparent.

C. Substitutions will not be considered for acceptance under the following conditions:
1. No formal substitution request is made.
2. The substitution is simply implied or indicated on shop drawings or product data submittals.
3. The formal substitution request is submitted by a subcontractor or supplier.

D. Substitution requests submitted after the deadline will not be considered unless the following evidence is submitted to the Engineer:
1. Proof that the specified product is unavailable for reasons beyond the control of the Contractor.
a. Reasons may include manufacturing discontinued, bankruptcy, labor strikes, or acts of God.
b. Contractor placed or attempted to place orders for the specified products within 10 days after the effective date of the Agreement.
c. The formal substitution request is submitted to Engineer within 10 days of the Contractor discovering the specified product cannot be obtained.

E. Engineer's decision on a substitution requests will be final and binding.
1. Approved substitutions will be incorporated into the Contract Documents with a Change Order.
2. Requests for time extensions and additional costs based on submission of, approval of, or rejection of substitutions will not be allowed.

PART 2 – PRODUCTS

2.01 GENERAL

A. Material requirements:
1. Materials: Provide corrosion resistance suitable for project conditions as specified in Section 01810 - Project Design Criteria.
2. Dissimilar metals: Separate contacting surfaces with dielectric material.

B. Edge grinding:
1. Sharp projections of cut or sheared edges of ferrous metals which are not to be welded shall be ground to a radius required to ensure satisfactory paint adherence.

2.02 PRODUCTS IN CONTACT WITH DRINKING WATER

A. Materials in contact with drinking waters: In accordance with NSF 61 and NSF 372.
1. Certification by an independent ANSI accredited third party, including, but not limited to, NSF International, as being lead free.

2.03 PRODUCT SELECTION

A. When products are specified by standard or specification designations of technical societies, organizations, or associations only, provide products that meet or exceed reference standard and Specifications.
B. When products are specified with names of manufacturers but no model numbers or catalog designations, provide:
    1. Products by one of named manufacturers that meet or exceed Specifications.
    2. Engineer deemed "or equal" evidenced by an approved shop drawing or other written communication.
C. When products are specified with names of manufacturers and model numbers or catalog designations, provide:
    1. Products with model numbers or catalog designations by one of named manufacturers.
    2. Engineer deemed "or equal" evidenced by an approved shop drawing or other written communication.
D. When products are specified with names of manufacturers, but with brand or trade names, model numbers, or catalog designations by one manufacturer only, provide:
    1. Products specified by brand or trade name, model number, or catalog designation.
    2. Products by one of named manufacturers proven, in accordance with requirements for an "or equal", to meet or exceed quality, appearance and performance of specified brand or trade name, model number, or catalog designation.
    3. Engineer deemed "or equal" evidenced by an approved shop drawing or other written communication.
E. When Products are specified with only one manufacturer followed by "or Equal," provide:
    1. Products meeting or exceeding Specifications by specified manufacturer.
    2. Engineer deemed "or equal" evidenced by an approved shop drawing or other written communication.

2.04 SHIPMENT

A. Mandatory requirements prior to shipment of equipment:
    1. Engineer approved shop drawings.
    2. Engineer approved Manufacturer’s Certificate of Source Testing as specified in Section 01757 - Commissioning, when required by specifications.
    3. Draft operations and maintenance manuals, as specified in Section 01783 - Operation and Maintenance Data, when required by specifications.
B. Prepare products for shipment by:
    1. Tagging or marking products to agree with delivery schedule or shop drawings.
    2. Including complete packing lists and bills of material with each shipment.
    3. Packaging products to facilitate handling and protection against damage during transit, handling, and storage.
    4. Securely attach special instructions for proper field handling, storage, and installation to each piece of equipment before packaging and shipment.
C. Transport products by methods that avoid product damage.
D. Deliver products in undamaged condition in manufacturer's unopened containers or packaging.

2.05 SPARE PARTS, MAINTENANCE PRODUCTS, AND SPECIAL TOOLS

A. Provide spare parts and maintenance products as required by Specifications.
B. Provide one set of special tools required to install or service the equipment.

C. Box, tag, and clearly mark items.
D. Contractor is responsible for spare parts, maintenance products, and special tools until acceptance by Owner.
E. Store spare parts, maintenance products, and special tools in enclosed, weatherproof, and lighted facility during the construction period.
    1. Protect parts subject to deterioration, such as ferrous metal items and electrical components with appropriate lubricants, desiccants, or hermetic sealing.
F. Provide spare parts and special tools inventory list, see Appendix A:
    1. Equipment tag number.
    2. Equipment manufacturer.
    3. Subassembly component, if appropriate.
    4. Quantity.
    5. Storage location.
G. Store large items individually:
    1. Weight: Greater than 50 pounds.
    2. Size: Greater than 24 inches wide by 18 inches high by 36 inches long.
    3. Clearly labeled:
        a. Equipment tag number.
        b. Equipment manufacturer.
        c. Subassembly component, if appropriate.
H. Store in spare parts box smaller items:
    1. Weight: Less than 50 pounds.
    2. Size: Less than 24 inches wide by 18 inches high by 36 inches long.
    3. Clearly labeled:
        a. Equipment tag number.
        b. Equipment manufacturer.
        c. Subassembly component, if appropriate.
I. Spare parts and special tools box:
    1. Wooden box:
        a. Size: 24 inches wide by 18 inches high by 36 inches long.
    2. Hinged wooden cover:
        a. Strap type hinges.
        b. Locking hasp.
        c. Spare parts inventory list taped to underside of cover.
    3. Coating: As specified in Section 09 90 00 - Protective Coatings.
    4. Clearly labeled:
        a. The words “Spare Parts and/or Special Tools”.
        b. Equipment tag number.
        c. Equipment manufacturer.

PART 3 – EXECUTION

3.01 DELIVERY AND HANDLING

A. Handle equipment in accordance with manufacturer's instructions.
B. Provide equipment and personnel to handle products by methods to prevent soiling or damage.
C. Upon delivery, promptly inspect shipments:

1. Verify compliance with Contract Documents, correct quantities, and undamaged condition of products.
2. Acceptance of shipment does not constitute final acceptance of equipment.
3. Contractor shall maintain a log of all materials brought onto the jobsite and keep all packing slips. This information shall be made available at Owner's request.

3.02 STORAGE AND PROTECTION

A. Immediately store and protect products and materials until installed in Work.
B. Store products with seals and legible labels intact.
C. Maintain products within temperature and humidity ranges required or recommended by manufacturer.
D. Protect painted surfaces against impact, abrasion, discoloration, and other damage.
    1. Repaint damaged painted surfaces.
E. Exterior storage of fabricated products:
    1. Place on aboveground supports that allow for drainage.
    2. Cover products subject to deterioration with impervious sheet covering.
    3. Provide ventilation to prevent condensation under covering.
F. Store moisture sensitive products in watertight enclosures.
G. Furnish covered, weather-protected storage structures providing a clean, dry, noncorrosive environment for mechanical equipment, valves, architectural items, electrical and instrumentation equipment and special equipment to be incorporated into this project.
    1. Storage of equipment shall be in strict accordance with the "instructions for storage" of each equipment supplier and manufacturer including connection of heaters, placing of storage lubricants in equipment, etc.
    2. The Contractor shall furnish a copy of the manufacturer's instructions for storage to the Engineer prior to storage of all equipment and materials.
    3. Pumps, motors, electrical equipment, and all equipment with antifriction or sleeve bearings shall be stored in weathertight structures maintained at a temperature above 60°F. Electrical equipment, controls, and insulation shall be protected against moisture and water damage. All space heaters furnished in equipment shall be connected and operated continuously.
H. Unless otherwise instructed by or required by the equipment manufacturer:
    1. Equipment having moving parts, such as gears, bearings, and seals, shall be stored fully lubricated with oil, grease, etc.
    2. Equipment having moving parts shall be rotated a minimum of twice a month to ensure proper lubrication and to avoid metal to metal "welding".
I. Store loose granular materials on solid surfaces in well-drained area.
    1. Prevent materials mixing with foreign matter.
    2. Provide access for inspection.
J. Payment will not be made for equipment and materials improperly stored or stored without providing Engineer with the manufacturer's instructions for storage.
K. Provide an Equipment Log including, as a minimum, the equipment identification, date stored, date of inspection/maintenance, date removed from storage, copy of manufacturer's recommended storage guidelines, description of inspection/maintenance activities performed, and signature of party performing inspection/maintenance.

3.03 PROTECTION AFTER INSTALLATION

A. Provide substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations.
    1. Remove covering when no longer needed.
    2. Replace corroded, damaged, or deteriorated equipment and parts before acceptance of the project.
B. Update Equipment Log on a monthly basis with description of maintenance activities performed in accordance with the manufacturer's recommendation and industry standards and signature of party performing maintenance.
C. Upon installation of the equipment, Contractor shall, at the discretion of Engineer, start the equipment at one-half load for an adequate period of time to ensure that the equipment does not deteriorate from lack of use.
D. Unless otherwise instructed by or required by the equipment manufacturer, lubricants shall be changed upon completion of installation and as frequently as required thereafter during the period between installation and acceptance. New lubricants shall be put into the equipment by Contractor at the time of acceptance.

3.04 QUALITY ASSURANCE

A. Employ entities that meet or exceed specified qualifications to execute the Work.
B. Verify project conditions are satisfactory before executing subsequent portions of the Work.

3.05 COMMISSIONING

A. As specified in Section 01757 - Commissioning.

3.06 CLOSEOUT ACTIVITIES

A. Owner may request advanced delivery of spare parts, maintenance products, and special tools.
    1. Deduct the delivered items from the inventory list and provide transmittal documentation.
B. Immediately prior to the date of Substantial Completion, arrange to deliver spare parts, maintenance products, and special tools to Owner at a location on site chosen by the Owner.
    1. Provide itemized list of spare parts and special tools that matches the identification tag attached to each item.
    2. Owner and Engineer will review the inventory and the itemized list to confirm it is complete and in good condition prior to signing for acceptance.

3.07 ATTACHMENTS

A. Not Used

END OF SECTION

SECTION 01615 – EQUIPMENT IDENTIFICATION AND TAGGING

PART 1 - GENERAL

A. The following is a guide to the various types of tags used for KC Water (Wastewater Division) asset identification.

1.01 SUMMARY

B. This section describes tag structures KC Water uses to label an asset for different purposes. These tags include:
    1. CMMS tags (Asset IDs)
        a. These tags are used to identify assets in CITY's CMMS (Computerized Maintenance Management System.
        b. CMMS is primarily used for maintenance scheduling and financial tracking of assets.
        c. Not every asset will need an Asset ID, reference CITY's Tag Generator Spreadsheet for more details about which assets need this type of tag.
            (1) CMMS tags for all new assets will be created using the CITY's Tag Generator Spreadsheet.

    2. PLC Shortcuts
        a. Shortcuts are used in the OIT (Operator Interface Terminal)/HMI (Human Machine Interface) to establish a path from the HMI to the PLC.
        b. These tags are only used to identify/label PLCs.
        c. See CITY SCADA Standards for more details.

    3. P&ID Tags
        a. These tags are used to identify equipment and instruments on P&IDs (Process and Instrumentation Drawings).
        b. These tags are composed of a 3-5 digit equipment or instrument code followed by a 5 digit loop number.
        c. See CITY P&ID tagging standards for more details.

    4. PlantPax Tags
        a. PlantPax Tags are used in the PLC program as object names for all standard PlantPax objects.
        b. The tagging convention for these tags is based on ANSI/ISA Table 4.1 and also utilizes the loop numbers from the P&ID's
        c. See SCADA Standards for more details.

    5. NonPlantPax Tags
        a. NonPlantPax tags are used for objects that are not in the standard PlantPax library of objects. This might include objects that a vendor has created or possibly objects that a local integrator might need to create for specialty equipment that doesn't already have an object type in the standard PlantPax library.

    6. Other Tags/Names (See SCADA Standards for details)

a. HMI Application/Display Names.
b. OIT Application Names.
c. Thin/Thick Client Names.
d. ControlLogix PLC Program Filenames.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

End of Section

CITY OF FOUNTAINS
HEART OF THE NATION

KANSAS CITY
MISSOURI

SUBSTITUTION REQUEST

Project Number 81000927

Project Title Todd Creek WWTP Expansion & Major Upgrades

To: _____ Authorization Number: _____
_____ From: _____
Re: _____ Date: _____
_____ Contract For: _____

Specification Title: _____
Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____
Manufacturer: _____ Address: _____ Phone No. _____
Trade Name: _____ Model No. _____
Installer: _____ Address: _____ Phone No. _____
History: ❑ New Product ❑ 2-5 years old ❑ 5-10 years old ❑ More than 10 years old
Differences between proposed substitution and specified product: _____
_____
_____

❑ Point-by-point comparative data attached – REQUIRED

Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance, service, and availability of replacement parts, as applicable, are available.
- Proposed substitution will not affect or delay Progress Schedule, except as stated below.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances, except as stated below.
- Payment will be made for changes to building design, including architectural or engineering design, detailing, licenses, royalties, and construction costs caused by the requested substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be completed in all respects.

Reason for not providing specified item: _____
_____
_____
_____

Similar Installation:
Project: _____ Design Professional: _____
Address: _____ Owner: _____
_____ Date Installed: _____
Proposed substitution affects other parts of Work: ❑ No ❑ Yes; explain _____
_____
_____

Savings to Owner for accepting substitution: _____
Proposed substitution changes Contract Time: ❑ No ❑ Yes; add/deduct _____ days.

Supporting Data Attached:
❑ Product Data ❑ Drawings ❑ Tests ❑ Reports ❑ Samples ❑ _____
Attachments: _____

Submitted by: _____
Signature: _____
Firm: _____
Address: _____

Telephone: _____ Fax: _____ E-Mail: _____

Additional Comments: ❑ Contractor ❑ Subcontractor ❑ Supplier ❑ Manufacturer ❑ DP ❑ _____

DESIGN PROFESSIONAL'S REVIEW AND ACTION

- ❑ Substitution approved – Make submittals in accordance with Specification Section 01300.
- ❑ Substitution approved as noted – Make submittals in accordance with Specification Section 01300.
- ❑ Substitution rejected – Use specified materials.
- ❑ Substitution Request received too late – Use specified materials.

Signed by: _____ Date: _____

Distribution:
- ❑ Owner
- ❑ Design Professional
- ❑ Contractor
- ❑ Consultant
- ❑ Construction Manager
- ❑ Other

SECTION 01664 - TRAINING

PART 1 – GENERAL

1.01 DESCRIPTION

A. This section contains requirements for training the Owner's personnel by the Manufacturer's Representative in the proper operation and maintenance of the equipment and systems installed under this contract and other training required to operate the Works.
B. Training outcomes: Owner's operations, maintenance, and engineering staff have the information needed to safely operate, maintain, and repair the equipment/systems provided in the Contract Documents.

1.02 RELATED SECTIONS

A. Section 01300 – Submittals.
B. Section 01757 – Commissioning.
C. Section 01783 – Operation and Maintenance Data.

1.03 QUALITY ASSURANCE

A. Where indicated in the Equipment Schedule and as required by the detailed specifications, the Manufacturer's Representative shall provide on-the-job training of the Owner's personnel. The training sessions shall be conducted by qualified, experienced, factory trained representatives of the various equipment manufacturers familiar with operation and maintenance manual information specified in Section 01783 Operation and Maintenance Data. Commissioning Manager may perform other training sessions as approved by the Owner's Representative.
B. Trainers shall be knowledgeable in the equipment/system for which they are training. Trainer's qualifications shall be submitted in a form provided by the Owner and specifically demonstrating operational knowledge of the specific systems and components and treatment facility classroom and field training experience.

1.04 SUBMITTALS

A. The following information shall be submitted to the Engineer and Owner in accordance with the provisions of the Submittal Procedures section (Section 01300).
B. Lesson plans for each training session to be conducted by the manufacturer's representatives. Lessons plans shall be submitted 45 days prior to the scheduled training. In addition, training manuals, handouts, visual aids, and other reference materials shall be included.
C. Subject of each training session, instructor (s) and qualifications of individuals conducting the training, and tentative date and time of each training session. Owner has the right to request instructor substitution that are not appropriately qualified.
D. Training schedule including respective manufacturer, estimated dates for installation completion and estimated training dates will be incorporated into the project schedule in the commissioning section consistent with direction provided by the Owner's affected facility or division.
E. Submit other audio-visual aids utilized during each training course.
F. Provide two electronic copies and 3 hard copies organized in notebooks of the training course material 7 days prior to training.

PART 2 – PRODUCTS

2.01 GENERAL

A. Where specified, the Contractor's or Design-Builder's Commissioning Manager shall conduct training sessions for the Owner's personnel to instruct staff on the proper operation, care, and maintenance of the equipment and systems installed under this contract.
B. Training shall take place at the site of the work and under the conditions specified in the following paragraphs. Approved operation and maintenance manuals shall be available at least 30 days prior to the date schedule for the individual training session. Furnish a copy of each complete training package, to include operation and maintenance data for distribution to each trainee.
C. Commissioning Manager shall meet with Engineer and Owner's designated training Manager to develop a list of personnel to be trained and to establish expected training outcomes and objectives 120 days prior to commissioning of equipment/system and schedule the training.
D. Commissioning Manager shall conduct commissioning progress meetings throughout construction to plan, scope, coordinate, schedule future activities and resolve issues at least monthly. This meeting may be part of the weekly progress meetings.

2.02 LOCATION

A. Training sessions shall take place at the site of the work or at the Water Services Department offices as determined by the Owner.

2.03 LESSON PLANS

A. Lesson plans shall contain an outline of the material to be presented along with a description of the visual aids to be utilized during the sessions. Each plan shall contain time allocation for each subject and time spent on each form of training.
B. Lesson plans shall contain the following minimum information:
    1. Title and objectives
    2. Recommended attendees (i.e. managers, engineers, operators, maintenance)
    3. Course description, outline of course content, and estimated class duration.
    4. Format (i.e. lecture, self-study, demonstration, hands-on)
    5. Instruction materials and equipment requirements.
    6. Resumes of instructors providing training.
    7. Provide performance-based learning objectives.
    8. State learning objectives in terms of what the trainees will be able to do at the end of the lesson.
    9. Define student conditions of performance and criteria utilizing learning objectives for evaluating instructional success.
    10. Provide necessary information for submission to MDNR for approval of training hours in compliance with certified operator regulations for certificate renewal.
    11. Correspondence that a submission to MDNR for training hours has been completed and approved.
    12. Provide maintenance instruction lessons plans to include mechanical, HVAC, instrumentation, and electrical aspects.
    13. Equipment operation:
        a. Describe equipment process function and system theory.

b. Describe equipment fundamental operating principles and dynamics.
c. Identify equipment mechanical, electrical, and electronic components and features.
d. Identify support equipment associated with the operation of subject equipment.
e. Detail the relationship of each piece of equipment or component to the subsystems, systems, and process.
f. Cite hazards associated with the operations, exposure to chemicals associated with the component, or the waste stream handled by the component.
g. Specify appropriate safety precautions, equipment, and procedures to eliminate, reduce, or overcome hazards.

14. Detailed component description:
    a. Define preventative maintenance (PM) inspection procedures required on equipment in operation and identify troubleshooting and potential issues as a result of the troubleshooting,
    b. Identify predictive maintenance PdM that may be applicable (infrared analyses, oil evaluation, vibration analyses) to the component or system.
    c. Identify preventive maintenance tasks and frequencies and provide in a table.
    d. Identify each component function and describe in detail.
    e. Where applicable, group relative components into subsystems.
    f. Identify and describe in detail equipment safety features, permissives and controls interlocks.
15. Define and provide training on recommended systematic troubleshooting procedures as they relate to specific craft problems and provide component specific troubleshooting checklists as they relate to specific craft problems.
16. One complete set of originals of the lesson plans, training manuals, handouts, visual aids and reference materials shall be the property of the Owner and shall be suitable bound for proper organization and easy reproduction. The Contractor shall furnish up to forty (40) copies of necessary training manuals, handouts, visual aids, and reference materials at least one week prior to each training session. Specific quantities will be identified during progress or other meetings.

2.04 FORMAT AND CONTENT

A. Each training session shall be comprised of time spent both in the classroom and at the specific location of the subject equipment or system.
B. Instructors shall apply adult education best practices, emphasizing learner participation and activity.
C. Training delivery may include problem solving, question/answer, hands-on instruction, practice, evaluation/feedback tools, and lecture.
D. Visual aids must support training objectives.
E. Delivery time should be less than 30 percent of class time.
F. Delivery time is a minimum of 1 hours and a maximum of 2 hours.
G. Longer training sessions requires Owner approval.
H. Refreshment and breaks within the Owner's customary schedule or as predetermined in advance of the training delivery.
I. Estimated maximum class size will vary for class and field training sessions. This will be determined in advanced. Commissioning Manager and Owner will develop a headcount one (1) week prior to the class so the instructor can provide the correct number of aids and know the correct number of repeated sessions.

J. Training Modules:
    1. Provide a training module for each equipment category.
    2. Divide each training module's instructional content into discrete lesson plans with a division between operations and maintenance training if directed by the Owner's Representative.
K. Training Aids:
    1. Instructors are to utilize P&ID's and are encouraged to use audio-visual devices, models, charts, etc. to increase the transfer of knowledge.
    2. Instructors shall provide such equipment (televisions, video recorder/player, computer, projectors, screens, easels, etc.), models, charts, etc. for each class.
    3. Instructor is responsible for confirming with Engineer and Owner in advance of each class that the classroom will be appropriate for the types of audiovisual equipment to be utilized.
L. Familiarization:
    1. Review catalog, parts lists, drawings, etc. which have been previously provided for the plan files and operation and maintenance manuals.
    2. Check out the installation of the specific equipment items.
    3. Demonstrate the unit and indicate how all parts of the specifications are met.
    4. Answer questions.
M. Safety:
    1. Using material previously provided, review safety references.
    2. Discuss proper precautions around equipment.
N. Operation:
    1. Using material previously provided, review reference literature.
    2. Explain all models of operation (including emergency).
    3. Check out Owner's personnel on proper use of the equipment.
O. Preventive Maintenance:
    1. Using material previously provided, review preventative maintenance (PM) lists including:
        a. Reference material.
        b. Daily, weekly, monthly, quarterly, semiannual, and annual jobs.
    2. Demonstrate procedures to perform PM jobs.
    3. Show Owner's personnel what to look for as indicators of equipment problems.
    4. Facilitate discussion with Owner's personnel as to which PMs to continue after the warranty period.
P. Corrective Maintenance:
    1. List potential problems including troubleshooting recovery from adverse operating conditions.
    2. Identify, describe, instruct and provide via the transmittal process any special tools required for maintenance.
    3. Describe Recommended measuring instruments and procedures and provide instruction on interpreting alignment measurements as appropriate.
    4. Describe recommended procedures to check/test equipment following a corrective maintenance (CM) repair.
    5. Open equipment and demonstrate procedures, where practical.
Q. Parts:
    1. Show how to use previously provided parts list and properly identify parts to be ordered.
    2. Define and check spare parts on hand and identify minimum inventory levels.
R. Local Representatives:

1. Where to order parts: Name, address, telephone.
2. Service problems:
    a. Who to call.
    b. How to get emergency help.

S. Original Equipment Manufacturer (OEM) Operation and Maintenance (O&M) Manuals:
1. Review any other material submitted.
2. Update material as required.

2.05 VIDEO RECORDING

A. The Contractor shall retain the services of a commercial videotaping service to record each training session. If trainer is required to read a script during videotaping, the trainer will have one video recorded session without personnel and the remaining sessions with personnel will not be taped. After taping, the material may be edited and supplemented with professionally produced graphics to provide a permanent record. The Contractor shall advise all manufacturers providing training sessions that the material may be videotaped and shall make available to the Owner's videotaping contractor such utility services and accommodations as may be required to facilitate the production of the video tape record. Video recording shall be integrated into electronic O&M by the Design-Builder or Contractor.
B. Include classroom and field instruction with question and answering periods.
C. Owner approval required for producer of video materials.
D. Digital recording shall become the property of the Owner.
E. Audio quality should not degrade during the recording of the field sessions due to background noise, space, distance, or other factors. Trainer will verify that audio quality after the first training session.
F. Trainer shall record the first training session and verify it presents accurately.
G. Video files shall be a file format and delivery medium as directed and approved by Owner.
H. Electronic copies of the other training material shall be tagged per Owner Standards to be provided by the Owner by the Contractor or Design-Builder
I. Provide 2 complete sets of video materials fully indexed and catalogued with printed labels sating session content and dates recorded or an indexed video file to each segment of the training.
J. Contractor shall provide a written release from all claims to the recorded training material produced.

2.06 ATTENDANCE

A. Trainer shall keep an attendance log of all attendees.
B. Trainer shall have the trainees each sign an attendance form at the beginning and end of the training session.
C. These records shall be provided to the appropriate Division Manager in which the training is being provided.

2.07 TRAINING SCHEDULE

A. Draft Training Schedule for the entire project shall be submitted after the first item requiring training arriving on the site. When approved, the training schedule shall be integrated into the project schedule.
B. List specified equipment and systems that require training services and show:
1. Respective manufacturer
2. Estimated dates for installation completion

3. Estimated training dates

C. Training is a prerequisite for putting equipment into operation. Staged or partial training may be approved by the Owner's Representative.
D. Allow for separate training sessions for maintenance staff and operations staff. Owner will notify the trainer if it is desired to have separate sessions for maintenance and operations staff or have combined sessions.
E. Allow for multiple session for Operations training:
    1. Provide a minimum of three training sessions to accommodate different shifts. One will be for each shift: day, evening, and night on at least two days, or as determined appropriate to meet the Owner's requirements.
    2. Adjust schedule to ensure training of appropriate personnel as deemed necessary by Owner, and to allow full participation by manufacturers' representatives. Adjust schedule for interruptions in operability of equipment,
    3. Coordinate with section 01320 "Construction Progress Documentation," and Section 01757, "Commissioning."
F. Contractor shall provide a draft training schedule 30 days after the notice to proceed.
G. Schedule Owner's staff training within the constraints of their workloads. Those who will participate in this training have existing full-time work assignments, and training is an additional assigned work task, therefore, scheduling is imperative. Owner staff work schedules are variable for operations staff, as treatment facilities are typically operated on an around- the-clock basis.
H. Training sessions will be finalized two weeks prior to the training.
I. Training sessions that are rescheduled after a finalized date will be rescheduled at least two weeks out.
J. Commissioning Manager is responsible for preparing agendas and meeting minutes.

PART 3 – EXECUTION

3.01 TRAINING

A. Training shall be conducted in conjunction with the operational testing and commissioning periods. Classes shall be scheduled such that classroom sessions are interspersed with the instruction in logical sequence. The Contractor shall arrange to have the training conducted on consecutive days if approved by the Owner's Representative. Concurrent classes shall not be allowed.
B. Instructors shall apply adult education best practices, emphasizing learner participation and activity.
C. Unless otherwise agreed by the Owner, classes shall be repeated twice for a morning session, afternoon session, and a night session in order to have all three operations shifts trained. Adjust training schedule to ensure training of appropriate personnel deemed necessary by Owner, and to allow full participation by manufactures' representatives. Adjust schedule for interruptions in operability of equipment. Coordinate training efforts with Section 01320 Construction Progress Documentation and Section 01757 Commissioning.
D. Approved operation and maintenance manuals for the special equipment shall be provided to the Owner prior to the start of the training. Videotaping shall take place concurrently with the training sessions.
E. Pre-startup Training shall be coordinated with Owner's operating personnel and Manufacturers' representatives, and with submission of Operation and Maintenance manuals in accordance with Section 01783 Operation and Maintenance Data. Pre-startup Training shall be completed at least 14 calendar days prior to beginning of system startup.

F. Post-startup Training, if required in specifications, shall be furnished and coordinated with Owner's operating personnel by the respective manufacturers' representatives.
G. Trainees will keep training materials and documentation after the session.
H. Operations and maintenance manuals as specified in technical sections:
    1. Provide a minimum of 2 copies of final Engineer-approved operations and maintenance manuals as specified in Section 01783 - O&M Manuals for use during the classroom instruction.
    2. Owner reserves the right to delay training for a particular equipment item if the operations and maintenance manuals for that equipment are incomplete, inaccurate, or otherwise not in a format or stage of development for use by the Owner's staff.
    3. No contract extensions or extra costs will be allowed for training delays due to operations and maintenance manual submittal delays.
I. Provide Supplemental documentation handouts to support instruction.
J. The following services shall be provided for each item of equipment or system. Additional services shall be provided when specifically required in individual specification sections.
    1. As a minimum, classroom training for operations personnel will include:
        a. Use of electronic media and drawings.
        b. Discussion of the equipment's specific location in the plant and operational overview.
        c. Purpose and plant function of the equipment.
        d. A working knowledge of the operating theory of the equipment.
        e. Start-up, shutdown, normal operation, emergency operating procedures, including discussion on system integration and electrical interlocks, if any.
        f. Identify and discuss safety items and procedures.
        g. Routine preventive maintenance, including specific details on lubrication and maintenance of corrosion protection of the equipment and ancillary components.
        h. Operator detection, without test instruments, of specific trouble symptoms.
        i. Required equipment exercise procedures and intervals.
        j. Routine disassembly and assembly of equipment if applicable (as judged by the Owner on a case-by-case basis) for purposes such as operator inspection of equipment.
    2. As a minimum, hands-on equipment training for operations personnel will include:
        a. Identify location of equipment and review the purpose.
        b. Identifying piping and flow options.
        c. Identifying valves and their purpose.
        d. Identifying instrumentation:
            (1) Location of primary element.
            (2) Location of instrument readout.
            (3) Discuss purpose, basic operation, and information interpretation.
        e. Discuss, demonstrate, and perform standard operating procedures and round checks.
        f. Discuss and perform the preventive maintenance activities.
        g. Discuss and perform startup and shutdown procedures including alternative strategies.
        h. Perform the required equipment exercise procedures.
        i. Perform routine disassembly and assembly of equipment if applicable.
        j. Identify and review safety items and perform safety procedures, if feasible.

3. Classroom equipment training for the maintenance and repair personnel will include:
    a. Theory of operation.
    b. Description and function of equipment.
    c. Startup and shutdown procedures.
    d. Normal and major repair procedures.
    e. Equipment inspection and troubleshooting procedures including the use of applicable instruments and the "pass" and "no pass" instrument readings.
    f. Routine and long-term calibration procedures.
    g. Safety procedures.
    h. Preventive maintenance such as lubrication, normal maintenance such as belts, seals, and bearing replacement; and up to major repairs such as replacement of major equipment part (s) with the use of special tools, bridge cranes, welding jigs, etc.
4. Hands-on Equipment training for maintenance and repair personnel shall include:
    a. Locate and identify equipment components.
    b. Review the equipment function and theory of operation.
    c. Review normal repair procedures including corrective maintenance.
    d. Perform startup and shutdown procedures.
    e. Review and perform safety procedures.
    f. Perform Owner approved practice maintenance and repair job(s), including mechanical and electrical adjustments, calibration, and troubleshooting equipment problems.
5. Distribute Training Evaluation Form following each training session.
    a. Training Evaluation Form is included in Section 01757 –Commissioning.
    b. Return completed Training Evaluation Forms to Owner's designated training coordinator immediately after session is completed.
    c. Revise training sessions judged "Unsatisfactory" by a majority of attendees.
    d. Conduct training sessions again until a satisfactory rating is achieved at no additional cost to Owner.
6. Post Training Session
    a. Training Course Material: Due 14 days after class completion.
    b. Video Recording tagged and other materials tagged.
    c. Class Attendance Sheet and trainee acknowledgment that they were trained and able to run the equipment.
    d. Training Agenda, Lesson Plan, presentation, handouts
    e. Other audio-visual aids utilized during each training course.
    f. Provide material for all sessions of the class in a single transmittal.
    g. Format: 2 electronic copies and 3 hard copies organized in notebooks.

K. Closeout Documentation
1. Provide Training Documentation including submission to MDNR for operator training credit. Trainer will be required to submit any additional information required by MDNR.
2. Provide training certification and records of training acceptance by MDNR.

End of Section

SECTION 01757 - COMMISSIONING

PART 1 – GENERAL

1.01 SUMMARY

A. This Section includes the requirements for each Commissioning phase of the Project equipment/system and/or facility.

1.02 DEFINITIONS

A. Clean Water Facility Testing – Testing performed using potable or other "clean" water source to demonstrate that certain equipment/systems meet the manufacturer's requirements and requirements for project performance. Clean Water Facility Testing includes testing diffusers and/or mixers in water-holding tanks prior to filling tanks with process water.
B. Commissioning - The process of planning, testing, and process start-up of the installation for compliance with contract requirements and demonstrating, through documented verification, that the project has successfully met the Contractual requirements. It includes training the Owner's staff to operate the facility.
C. Commissioning Phases - The work activities of facility commissioning are grouped into the phases defined in the table below.

Commissioning		
Planning Phase	**Testing and Training Phase**	**Process Start-Up Phase**
Owner Training Plan and Schedule	Source Testing	Process Start-up
Commissioning Schedule	Owner Training	Process Operational Period
Subsystem Testing Plan	Installation Testing	Instrumentation and Controls Fine-Tuning
	Functional Testing	
	Closeout Documentation	

D. Component - A basic building block of equipment, subsystems, and systems that requires installation or functional testing but does not have electrical connection or internal electronics. (Examples: filter effluent piping and manual isolation valves).
E. Device - A basic building block of equipment, subsystems, and systems that requires installation or functional testing and does have electrical connections or internal electronics. (Examples: filter level transmitter or water pump pressure transmitter).
F. Equipment - An assembly of component(s) and devices(s) that requires installation or functional testing. (Examples: Pump, motor, VFD, Ozone Generator, UV Disinfection System, etc.).
G. Facility - A grouping of process areas, systems, subsystems, equipment, components, and devices (Examples: treatment plant, pump station, etc.).
H. Functional Testing - Testing performed on a completed subsystem to demonstrate that equipment/system meets manufacturers' calibration and adjustment requirements and other requirements as specified. Functional testing

includes operating equipment/system manually in local, manually in remote (or remote manual), and automatically in remote (in remote auto).

I. Installation Testing - Testing to demonstrate that subsystem component (piping, power, networks, devices, etc.) is ready and meets the project requirements in advance of functional testing. Installation testing also includes manufacturers' certification of installation and other requirements as specified to prepare equipment/system for Functional Testing. Also referred to as Field Acceptance Testing.

J. Instrumentation and Controls Fine-Tuning - Improving the performance of the Instrumentation Process Control system by operating for an extended time period.

K. Manufacturer's Certificate of Source Testing - When applicable, the form is used during Source Testing for the manufacturer to confirm that the applicable source tests have been performed and results conform to the Contract Documents. The form is provided at the end of this Section.

L. Manufacturer's Certificate of Installation and Functionality Compliance - The form is used during Installation Testing and Functional Testing. It is submitted at the end of Functional Testing to confirm that the equipment/system is installed in conformance with the Contract Documents and that it meets the Functional Testing requirements defined in the Contract Documents. The form is provided at the end of this Section.

M. Process Area - A grouping of systems, subsystems, equipment, components, and devices that divide a facility into functional areas. (Examples: Filter Process Area or Chemical Area).

N. Process Operational Period - A period of time after completion of the process start-up set aside for final Operational Testing to verify facility performance meets the Contract Document requirements. This period may specifically limit other construction activities.

O. Process Start-up Phase - Operating the facility to verify performance meets the Contract Document requirements.

P. Process Start-Up - Activities conducted after the testing and training phase that are necessary to place systems or process areas into operational service.

Q. Product - A system, subsystem or component.

R. Subsystem - A building block of systems made up from a grouping of components, devices, and equipment that perform a definable function. (Examples: Filter No. 1 Backwash Subsystem, Sedimentation Basin No. 1 Hoseless Sludge Removal Subsystem). Owner will define these items in coordination with Contractor.

S. System - A grouping of subsystems, equipment, components, and devices that perform a definable function. (Examples: Filter No. 1, Sedimentation Basin). Owner will define these items in coordination with Contractor.

1.03 COMMISSIONING MANAGER

A. Designate and provide a COMMISSIONING MANAGER for this project.

B. Submit summary of the COMMISSIONING MANAGER's qualifications within 30 days of NTP:
   1. Include description of previous experience as a COMMISSIONING MANAGER on similar projects for the designated COMMISSIONING MANAGER with a list of references including phone numbers for review and Owner approval.

C. COMMISSIONING MANAGER responsibilities include the following:
   1. Lead efforts relating to Commissioning.
   2. Be thoroughly familiar with commissioning requirements in the Contract Documents.
   3. Be regularly engaged and experienced in all aspects of commissioning.
   4. Provide technical instruction for commissioning.
   5. Provide primary interface with Engineer and Owner for efforts relating to Commissioning of Project facilities.
   6. Coordinate training efforts.

D. COMMISSIONING MANAGER on-site:
   1. Testing and Training Phase: Full-time.

2. Process Start-up Phase: Full-time.

E. Designate and provide COMMISSIONING MANAGER assistants, as needed.

1.04 SERVICES OF MANUFACTURER'S REPRESENTATIVES

A. Qualification of manufacturer's representative as specified in the Contract Documents technical sections include the following:
    1. Authorized representative of the manufacturer, factory trained and experienced in the technical applications, installation, operation, and maintenance of respective equipment/system with full authority by the equipment/system manufacturer to issue the certifications required of the manufacturer.
    2. Competent, experienced technical representative of equipment/system manufacturer for assembly, installation, testing guidance, and training.
    3. Additional qualifications may be specified in the individual sections.
    4. Submit qualifications of the manufacturer's representative no later than 30 days in advance of required observations.
    5. Representative subject to approval by Owner and Engineer.
    6. No substitute representatives will be allowed until written approval by Owner and Engineer has been obtained.
B. Completion of manufacturer on-site services: Engineer to confirm that required on-site services have been completed.
C. Manufacturer is responsible for determining the time required to perform the specified services.
    1. Minimum times specified in the Contract Documents are estimates.
    2. No additional costs associated with performing the required services will be approved.
    3. Manufacturer required to schedule services in accordance with the Contractor's project schedule up to and including making multiple trips to project site when there are separate milestones associated with installation of each occurrence of manufacturer's equipment.
D. Manufacturer's on-site services as specified in the Contract Documents include the following:
    1. Assistance during Commissioning Phase and Process Start-Up Phase.
    2. Provide daily copies of manufacturer's representatives field notes and data to Engineer.
    3. Services as specified in Section 01433 - Manufacturer's Field Services.
    4. Other requirements as specified in the Contract Documents.

1.05 PLANNING PHASE

A. Overview of Planning Phase:
    1. Define approach and timing for Commissioning.
B. Owner training plan and schedule:
    1. Complete as specified in Section 01664.
C. Commissioning Schedule:
    1. Commissioning overview:
        a. Comply with Commissioning Roles and Responsibilities Matrix specified at the end of this Section.
    2. Submittal due date:
        a. Submit Commissioning Schedule not less than 60 calendar days prior to planned initial commissioning of each subsystem or system.
    3. Schedule requirements:

a. Schedule durations and float for commissioning activities to ensure Work does not fall behind schedule due to complications or delays during commissioning.
b. Gantt chart detailing the work to take place in the period between 90 calendar days prior to planned initial commissioning of equipment and systems, and prior to the date of Substantial Completion, together with supporting narrative.
c. Provide detailed schedule of commissioning activities including durations and sequencing requirements.
    (1) Identify the following activities:
        (a) Testing and Training Phase:
            (i) Source Testing.
            (ii) Owner Training.
            (iii) Installation Testing.
            (iv) Functional Testing.
            (v) Clean Water Facility Testing.
            (vi) Closeout Documentation.
        (b) Process Start-Up Phase:
            (i) Process Start-Up.
            (ii) Process Operational Period.
            (iii) Instrumentation and Controls Fine-Tuning.
d. Schedule manufacturer's services to avoid conflict with other on-site testing or other manufacturers' on-site services.
e. Verify that conditions necessary to allow successful testing have been met before scheduling services.

D. Subsystem testing plans:
1. Provide separate testing plans for each individual subsystem and system that include the following:
    a. Approach to testing including procedures, schedule, and recirculation requirements.
    b. Test objective: Demonstrate subsystem meets the design requirements as specified in the technical sections.
    c. Test descriptions, forms, temporary systems (pumps, piping, etc.), shutdown requirements for existing systems, test forms, test logs, witness forms, and checklists to be used to control and document the required tests.
    d. Test forms: Include, but not limited to, the following information:
        (1) Tag and name of equipment/system to be tested.
        (2) Test date.
        (3) Names of persons conducting the test.
        (4) Names of persons witnessing the test, where applicable.
        (5) Test data.
        (6) Applicable project requirements.
        (7) Check offs for each completed test or test step.
        (8) Place for signature of person conducting tests and for the witnessing person, as applicable.
    e. Define start-up sequencing of unit processes:
        (1) Include testing of alarms, interlocks, permissives, control circuits, capacities, speeds, flows, pressures, vibrations, sound levels, and other parameters.
        (2) Provide detailed test procedures setting forth step-by-step descriptions of the procedures for systematic testing of equipment/system.

(3) Demonstrate proper rotation, alignment, speed, flow, pressure, vibration, sound level, adjustments, and calibration.
(a) Perform initial checks in the presence of and with the assistance of the manufacturer's representative.
(4) Demonstrate proper operation of each control loop function including mechanical, electrical, alarms, local and remote controls, instrumentation, and other equipment/system functions.
(a) Generate signals with test equipment/system to simulate operating conditions in each control mode.

2. Engineer approval of test plan is required prior to performing test.
   a. Revise and update test plans based on review comments, actual progress, or to accommodate changes in the sequence of activities.
   b. Submit test reports for each phase of testing for each equipment/system.
   c. Engineer approval of preceding test reports is required prior to start of next test.
   d. Tests will be rescheduled if test plan is not approved by the required deadline.
      (1) Contractor is responsible for any resulting delay.
      (2) See Section 01300 for review periods
3. Contractor is responsible to reproduce and distribute final test procedures.
   a. Provide 3 copies for Engineer.
4. Tests may commence only after Engineer has received approved test plan copies.
5. Submittals:
   a. Submit test plans not less than 90 calendar days prior to planned installation testing of subsystem or system.
   b. Completed Manufacturer's Certificate of Installation and Functionality Compliance.
   c. Test procedures and forms: Provide signed-off copy of test forms and test reports upon completion of the test.
   d. Test reports:
      (1) Submit preliminary copies within 1 day after testing completion.
      (2) Submit final copies and report within 14 days after testing completion.

1.06 TESTING AND TRAINING PHASE

A. Overview of Testing and Training Phase:
   1. General:
      a. Include specified Source Testing, Owner Training, Installation Testing, Functional Testing, Clean Water Facility Testing, and Closeout Documentation required by this Section and the technical sections.
   2. Contractor responsibilities:
      a. Furnish labor, power, chemicals, tools, equipment, instruments, and services required for and incidental to completing commissioning activities in accordance with the approved Commissioning Plans.
      b. Prior to testing, verify equipment protective devices and safety devices have been installed, calibrated, and tested.
      c. Acceptable tests: Demonstrate the equipment/system performance meets the requirements stated in the Contract Documents.

(1) When the equipment/system fails to meet the specified requirements, perform additional, more detailed, testing to determine the cause, correct, repair, or replace the causative components and repeat the testing that revealed the deficiency.

B. Source testing:
   1. Also referred to as factory testing or factory acceptance testing (FAT).
   2. Test components, devices, and equipment/system for proper performance at point of manufacture or assembly as specified in the technical sections.
   3. Notify the Engineer in writing when the equipment/system is ready for source inspection and testing.
   4. Source Test Plan:
      a. As specified in this Section and other technical sections.
      b. Source testing requirements as specified in technical sections.
         (1) Non-witnessed: Provide Manufacturer's Certificate of Source Testing.
         (2) Witnessed: 1 Owner's representative and 1 Engineer's representative present during testing, unless otherwise specified, and provide Manufacturer's Certificate of Source Testing.
      c. Prepared by Contractor as a result of discussions and planning emerging from regularly conducted commissioning meetings for source tests as specified in the Contract Documents.
      d. Provide the following items for each Source Test:
         (1) Purpose and goals of the test.
         (2) Identification of each item of equipment/system, including system designation, location, tag number, control loop identifier, etc.
         (3) Description of the pass/fail criteria that will be used.
         (4) Listing of pertinent reference documents (Contract Documents and industry standards or sections applicable to the testing).
         (5) Complete description, including drawings or photographs, of test stands and/or test apparatus.
         (6) Credentials of test personnel.
         (7) Descriptions of test equipment to be used, product information, and all appropriate calibration records for the test equipment.
         (8) Test set-up procedures.
         (9) Detailed step-by-step test procedures.
            (a) The level of detail shall be sufficient for any witness with a rudimentary technical aptitude to be able to follow the steps and develop confidence that the tests were being performed as planned.
            (b) All steps are significant, and all steps shall be included in the procedures.
         (10) Sample data logs and data recording forms.
         (11) Sample computations or analyses with the results in the same format as the final report to demonstrate how data collected will be used to generate final results.
            (a) Complete disclosure of the calculation methodologies.
            (b) Include a sample for each type of computation required for the test and analysis of the results.
         (12) Detailed outline of the Source Test report.
         (13) Sample test reports.
      e. Submit Source Test Plan and forms as specified in the technical sections.
         (1) Submit a copy of the Source Test Plan at least 21 days before any scheduled test date.
         (2) Engineer approval of Source Test Plan required prior to beginning source testing.

(3) Schedule the testing after approval of the test procedures submittal.

f. Indicate the desired dates for source inspection and testing.

(1) Notify the Engineer of the scheduled tests a minimum of 15 days before the date of the test.

5. Test results:
   a. Prepare and submit test results with collected data attached.
6. Owner is responsible for costs associated with Owner's representatives and Engineer's representative witnessing initial Source Tests.
   a. If Source Test is not ready when the witnesses arrive or if the Source Test fails, the witnesses will return home with Contractor responsible for costs associated with the trip including costs described below. Contractor is responsible for rescheduling the Source Test and witnesses' costs associated with the second trip including costs described below.
      (1) On-site time: 1 day at the site plus travel time each direction, unless specified otherwise.
      (2) Transportation costs:
         (a) Travel 1 day on commercial airline to site including air flight costs.
         (b) Travel 1 day on commercial airline from site including air flight costs.
         (c) Mid-size rental car or taxi services from hotel to and from the test site plus fuel, tolls, and airport parking at the departing airport.
         (d) International travel: Per-diem rates as established by the US Department of State for the specific location and dates of travel. Travel expenses may include the direct cost of securing passports, visas, language interpreters, document translators, communications, and internet access.
      (3) Hotel costs at a facility with an American Automobile Association 3 diamond rating or better for single occupancy room per person per day.
      (4) Meal allowance of $61 per person per day.
      (5) On-site time: 1 day at the site, unless specified otherwise.
      (6) Only actual costs will be documented and billed.
   b. Fees incurred such as airline reservation change fees, loss of fare due to purchase of nonrefundable tickets, hotel cancellation/rebooking fees, and similar expenses incurred as a result of OSS-requested changes to the inspection schedule after the initial notification shall be borne by the Contractor.
   c. Contractor is responsible for witnesses' costs associated with retests including costs described above.
7. Contractor is responsible for providing fuel, chemicals, and other consumables needed for Source Testing.

C. Owner training:
   1. Provide training as specified in Section 01664.

D. Installation Testing:
   1. Perform subsystem testing according to approved Subsystem Testing Plans.
   2. Initiate the Manufacturer's Certificate of Proper Installation for all equipment.
      a. Manufacturer's Certificate of Proper Installation form is included in this Section.
      b. Manufacturer's Certificate of Proper Installation certifies the equipment meets the following requirements:
         (1) Has been properly installed, adjusted, aligned, and lubricated.
         (2) Is free of any stresses imposed by connecting piping or anchor bolts.
         (3) Is able to be operated as necessary for Functional Testing.

c. Form shall be submitted after completion of Functional Testing, as specified in this Section.

3. Coordinate Installation Testing with restrictions and requirements as specified in Section 01140 - Work Restrictions.
4. Perform coating holiday testing as specified in Section 09 96 00 - High- Performance Coatings.
5. Perform pressure and leakage testing as specified in individual component Sections.
6. Perform mechanical equipment Installation Testing: As in individual equipment sections.
    a. Remove rust preventatives and oils applied to protect equipment during construction.
    b. Flush lubrication systems and dispose of flushing oils.
        (1) Recharge lubrication system with lubricant recommended by manufacturer.
    c. Flush fuel system and provide fuel for testing and start-up.
    d. Install and adjust packing, mechanical seals, O-rings, and other seals. Replace defective seals.
    e. Remove temporary supports, bracing, or other foreign objects installed to prevent damage during shipment, storage, and erection.
    f. Check rotating machinery for correct direction of rotation and for freedom of moving parts before connecting driver.
    g. Perform cold alignment and hot alignment to manufacturer's tolerances.
    h. Adjust V-belt tension and variable pitch sheaves.
    i. Inspect hand and motorized valves for proper adjustment.
        (1) Tighten packing glands to ensure no leakage but permit valve stems to rotate without galling.
        (2) Verify valve seats are positioned for proper flow direction.
    j. Tighten leaking flanges or replace flange gasket.
        (1) Inspect screwed joints for leakage.
    k. Install gratings, safety chains, handrails, shaft guards, and sidewalks prior to operational testing.
7. Electrical devices and subsystems Installation Testing: Refer to Division 26 specifications for electrical system testing and settings requirements.
8. Instrumentation devices and subsystems Installation Testing
9. Heating, ventilating, and air conditioning systems Installation Testing:
    a. Perform testing of heating, ventilating, and air conditioning equipment, balancing of distribution systems, and adjusting of ductwork accessories.
    b. Test hydronic systems, if required by technical sections.

E. Functional Testing:
    1. Perform subsystem testing according to approved Subsystem Testing Plan.
    2. Notify the Engineer 5 days prior to when the Work is ready for Functional Testing.
        a. Perform testing in the presence of the Engineer.
    3. Determine Functional Testing durations with Owner’s input.
        a. Durations will vary depending on the availability of water for testing.
        b. Target minimum Functional Test duration: 8 hours.
            (1) Identify equipment/system that cannot be tested for a minimum of 8 hours as specified in technical sections.
    4. Perform Functional Testing as specified in technical sections.
        a. Perform Functional Testing in addition to the other tests specified in the technical sections.
        b. Perform Functional Testing to demonstrate that the component equipment functions as an entire system in accordance with the design requirements.

c. Perform Functional Testing to demonstrate that the unit process has operated in a manner necessary to demonstrate equipment/system functions manually in local, manually in remote (or remote manual), and automatically in remote (in remote auto).
    (1) Perform testing with Contractor-provided water, either from Platte4 or non-potable water from existing Todd Creek WWTP.
d. Repair or replace parts that operate improperly and retest.
e. Submit testing results as specified in the technical sections to the Owner and Engineer for approval of Functional Testing results.

5. Provide completed Manufacturer's Certificate of Installation and Functionality Compliance forms for all equipment.
    a. Manufacturer's Certificate of Installation and Functionality Compliance form is included in this Section.
    b. Manufacturer's Certificate of Installation and Functionality Compliance certifies the equipment/system meets the following requirements:
        (1) Is suitable for satisfactory full-time operation under full-load conditions.
        (2) Operates within the allowable limits for vibration and noise.
        (3) Electrical and instrumentation requirements:
            (a) Electrical equipment, instrumentation, and control panels are properly installed, calibrated, and functioning.
            (b) Electrical Installation Testing is complete, and test results have been approved by the Engineer.
                (i) Noted deficiencies have been corrected.
                (ii) Relays, circuit breakers, and other protective devices are set.
            (c) Control logic for start-up, shutdown, sequencing, interlocks, control, and emergency shutdown has been tested and is properly functioning.
            (d) Motor control is calibrated and tested.

F. Closeout documentation:
1. Submittals:
    a. Provide records generated during Commissioning Phase of Project.
        (1) Required documents include but are not limited to:
            (a) Training documentation.
            (b) Manufacturer's Certificate of Source Testing.
            (c) Manufacturer's Certificate of Installation and Functionality Compliance.
            (d) Daily logs of equipment/system testing identifying tests conducted and outcome.
            (e) Test forms and documentation.
            (f) Functional Testing results.
            (g) Logs of time spent by manufacturer's representatives performing services on the job site.
            (h) Equipment lubrication records.
            (i) Electrical phase, voltage, and amperage measurements.
            (j) Insulation resistance measurements.
            (k) Bearing temperature measurements.
        (2) Data sheets of control loop testing including testing and calibration of instrumentation devices and setpoints. Format: 2 electronic copies and 3 hard copies organized in notebooks.
        (3) Due date: Within 14 calendar days of Substantial Completion.

1.07 PROCESS START-UP PHASE

A. Overview of Process Start-Up Phase:
    1. Operating the facility to verify performance meets the Contract Document requirements.
B. Process Start-Up:
    1. Perform process start-up in the presence of the Engineer.
    2. Pre-start-up activities:
        a. Commissioning Documentation and Data Review.
        b. Start-Up Go/No-Go Decision Criteria.
        c. Building and Fire Inspection Compliance Check.
        d. Process Start-Up Sequence Review.
            (1) Submit a Process Start-Up plan for review by Engineer not less than 90 calendar days prior to planned commencement of process start- up activities.
        e. Description of Temporary Testing Arrangement, if applicable.
        f. Final Process Start-Up Forms and Documentations.
        g. Final Operational Testing Plan.
    3. Control loop tuning.
        a. Perform control loop tuning during system testing with water to the extent possible.
    4. Process area start-ups.
        a. Process start-up individual process areas comprised of multiple interdependent systems where possible and beneficial to reduce complexity and risk of complete facility testing.
        b. Process area test flows may be limited by upstream and downstream process constraints (i.e., tank and basin volumes) and/or localized recirculation capabilities.
    5. Facility-wide process start-up.
        a. Upon approved completion of pre-start-up activities, perform entire facility process start-up.
            (1) Complete control loop tuning during this phase of process start-up.
            (2) Continue process start-up operations until facility meets or exceeds the Contract requirements.
        b. Process control systems testing:
            (1) Test complete system instrumentation, controls and PLC, HMI, and LOI programming for the facility.
        c. HVAC systems start-up and testing:
            (1) Test complete HVAC system for the facility.
            (2) Follow procedure described in Section 23 05 93
        d. Ancillary systems start-up and testing:
            (1) Test complete security system, phone system, fire alarm system, etc. for the facility.
        e. Remaining equipment/system tests:
            (1) Conduct remaining specified equipment/system performance tests that could not be performed during the Testing and Training Phase due to inter-system and/or treatment process dependencies.

1.08 PROCESS OPERATIONAL PERIOD:

A. Prior to beginning the Process Operational Period:

    1. Conformance with treatment standards is required prior to Operational Testing, if applicable.

a. Biological processes require time to build up the necessary population of organisms to meet treatment standards, as specified in Section 01140 - Work Restrictions. Refer to Section 46 53 60 for additional requirements on biological process startup, commissioning, and monitoring.

2. Correct any outstanding punch list items prior to the Operational Testing.

B. Duration: 30 calendar days minimum, or as specified elsewhere.

C. Engineer will be present for key process startup and commissioning activities unless such presence is expressly waived in writing.

D. Prove facility conformance with Contract Document requirements.

E. Contractor to provide:

1. Specified start-up materials and operating supplies.

2. Necessary craft of labor assistance, in the event of an emergency equipment failure requiring immediate attention (emergency is defined as a failure of function which precludes the further operation of a critical segment of or the whole of the Work) with a response time of not more than 4 hours from the time of notification.

3. Manufacturer's authorized representative to supervise placing equipment/systems in operation and provide guidance during Operational Testing per applicable section.

4. Necessary manufacturer's representatives and operating supplies for retesting systems that fail to pass the initial Operational Testing due to deficiencies in products of workmanship at no additional cost to the Owner.

5. List of 24-hour "on-call" representative supervisory persons who will monitor the Operational Testing and serve as liaison for the Engineer and Owner.

F. Owner will provide:

1. Operations personnel for duration of test.

G. Prior to date of Substantial Completion of Installation, the Contractor's COMMISSIONING MANAGER shall oversee Process Operational Period.

1. Owner staff will operate the completed Project construction.

2. Entire system shall continuously meet performance requirements as described in the technical specifications and shall operate without fault, failure, or defect for a continuous period.

3. Individual equipment/system failures that are corrected within 24 hours and do not prevent the entire project from continuously satisfying the established operational requirements shall not require the consecutive day test to be restarted unless the failure recurs.

4. Restart the consecutive test period for any of the following conditions:

a. Any failure of the complete Project construction to meet operational requirements.

b. When malfunctions or deficiencies cause shutdown or partial operation of the facility, or results in failure of the complete Project construction to meet operational requirements.

c. Any individual equipment/system failure that meets any of the following conditions:

(1) Requires more than 24 hours to correct.

(2) Recurs within the 24-hour correction period requiring further correction.

d. Immediately correct defects in material, workmanship, or equipment/system which became evident during Operational Testing.

1.09 INSTRUMENTATION AND CONTROLS FINE-TUNING

A. After the Process Operational Period, test PCIS system for additional 60 days.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

End of Section

MANUFACTURER'S CERTIFICATE OF SOURCE TESTING

OWNER_____ EQPT/SYSTEM_____
PROJECT NAME_____ EQPT TAG NO. _____
PROJECT NO._____ EQPT SERIAL NO. _____
SPECIFICATION NO. _____
SPECIFICATION TITLE _____

Comments: _____

_____

_____

_____

_____

I hereby certify Source Testing has been performed on the above-referenced equipment/system as defined in the Contract Documents, and results conform to the Contract Document requirements. Testing data is attached.

Date of Execution:_____, 20____

Manufacturer: _____

Manufacturer's Authorized Representative Name *(print)*: _____

_____
(Authorized Signature)

If applicable, Witness Name *(print)*: _____

_____
(Witness Signature)

MANUFACTURER'S CERTIFICATE OF INSTALLATION AND FUNCTIONALITY COMPLIANCE

OWNER_____ EQPT/SYSTEM_____
PROJECT NAME_____ EQPT TAG NO. _____
PROJECT NO._____ EQPT SERIAL NO. _____
SPECIFICATION NO. _____
SPECIFICATION TITLE _____

I hereby certify that the above-referenced equipment/system has been: (Check Applicable)

- ☐ Installed in accordance with manufacturer's recommendations.
- ☐ Inspected, checked, and adjusted.
- ☐ Serviced with proper initial lubricants.
- ☐ Electrical/instrumentation and mechanical connections meet quality and safety standards.
- ☐ All applicable safety equipment has been properly installed.
- ☐ Functionally tested.
- ☐ System has been performance tested and meets or exceeds specified performance requirements.

NOTES:
Attach test results with collected data and test report.

Attach written certification report prepared by and signed by the electrical and/or instrumentation subcontractor.

Comments: _____

_____

I, the undersigned manufacturer's representative, hereby certify that I am (i) a duly authorized representative of the manufacturer, (ii) empowered by the manufacturer to inspect, approve, and operate this equipment/system, and (iii) authorized to make recommendations required to ensure that the equipment/system furnished by the manufacturer is complete and operational, except as may be otherwise indicated herein. I further certify that all information contained herein is true and accurate.

Date:_____, 20 ____

Manufacturer: _____

Manufacturer's Authorized Representative Name *(print)*: _____

By Manufacturer's Authorized Representative: _____
(Authorized Signature)

COMMISSIONING

TRAINING EVALUATION FORM

EQUIPMENT/SYSTEM ITEM: _____

VENDOR/MANUFACTURER: _____

DATE: _____ NAME OF REPRESENTATIVE: _____

1.	Was representative prepared?	Acceptable	Unacceptable	or	N/A
2.	Was an overview description presented?	Acceptable	Unacceptable	or	N/A
3.	Were specific details presented for system components?	Acceptable	Unacceptable	or	N/A
4.	Were alarm and shutdown conditions clearly presented?	Acceptable	Unacceptable	or	N/A
5.	Were step-by-step procedures for starting, stopping, and troubleshooting presented?	Acceptable	Unacceptable	or	N/A
6.	Were routine/preventative maintenance items clearly identified?	Acceptable	Unacceptable	or	N/A
7.	Was the lubrication schedule (if any) discussed?	Acceptable	Unacceptable	or	N/A
8.	Was the representative able to answer all questions?	Acceptable	Unacceptable	or	N/A
9.	Did the representative agree to research and answer unanswered questions?	Acceptable	Unacceptable	or	N/A

10. Comments: _____

_____

_____

_____

11. Overall Rating: Satisfactory Unsatisfactory

Note:

Sessions judged “Unsatisfactory” by a majority of attendees shall be revised and conducted again until a satisfactory rating is achieved.

COMMISSIONING ROLES AND RESPONSIBILITIES MATRIX

NO.	TASK	OWNER	CONTRACTOR	ENGINEER
Testing and Training Phase				
Source Testing				
1	Source Testing	Witness	Lead	Witness, Review
Installation Testing				
2	Electrical Conductor Testing	No Action	Lead	Witness
3	Electrical Field Acceptance Tests	No Action	Lead	Witness
4	Instrument Field Calibration	No Action	Lead	Witness
5	Network Installation Testing	Witness	Lead	Witness
6	Loop Testing	Witness	Lead	Witness
7	Pressure Testing	No Action	Lead	Witness
8	Leak Testing	No Action	Lead	Witness
9	Holiday Testing	No Action	Lead	Witness
10	HVAC Testing	No Action	Lead	Witness
11	Motor Electrical Testing	No Action	Lead	Witness
Functional Testing				
12	Network Operational Testing	Witness	Lead	Review
13	Preliminary Run Testing Local/Manual Control	Witness	Lead	Review
14	PCIS Functional Demonstration Testing - Local/Auto Control Testing - Remote/Manual Contact Testing - Alarm Testing - Control Loop Testing	No Action	Lead	Review
15	Subsystem Start-Up and Testing	Witness	Lead	Review
16	Equipment/System Start-Up and Testing	Witness	Lead	Review
17	HVAC Start-Up and Testing	Witness	Lead	Review
18	Corrosion Control Start-Up and Testing	Witness	Lead	Review
19	Wide Area Network Communications Testing	Support	Lead	Witness
20	Manufacturer's Certificate of Installation and Functionality Compliance	No Action	Lead	Witness, Review
Clean Water Facility Testing				
21	Test Water Management Plan Finalization	Support	Lead	Review
22	Clean Water Facility Testing	Witness	Lead	Witness, Review
Process Start-Up Phase				
Process Start-Up				
23	Commissioning Documentation and Data Review	Review	Support	Lead
24	Start-Up Go/No-Go Decision Criteria	Lead	Support	Review
25	Building and Fire Inspection Compliance Check	No Action	Lead	Witness

NO.	TASK	OWNER	CONTRACTOR	ENGINEER
Testing and Training Phase				
26	HVAC Functionality Check	No Action	Lead	Witness
27	Start-Up Sequence Review	Support	Lead	Review
28	Temporary Testing Arrangement Finalization	Support	Lead	Support
29	Start-Up Forms Finalization	Support	Lead	Support
30	Operation Testing Plan Finalization	Review	Support	Lead
31	Test Water Management Plan Finalization	Support	Lead	Review
32	System Testing	Support	Lead	Witness
33	Control Loop Tuning	Support	Lead	Witness
34	Process Area Start-Ups	Support	Lead	Witness
35	Facility-Wide Start-Up	Support	Lead	Witness
36	Process Control Systems Testing	Support	Lead	Witness
38	HVAC Final Testing, Adjust, and Balancing	Witness	Lead	Witness, Review
Process Operational Period				
39	Operational Testing	Support	Lead	Witness, Review
40	Final Testing Reports	Support	Lead	Review
41	Water Quality Testing and Documentation	Support	Lead	Review
Instrumentation and Controls Reliability Phase				
Instrumentation and Controls Reliability Period				
42	As specified in Section 15950 - Testing, Calibration, and Commissioning			

Legend:
Lead: Primarily responsible for organization, coordination, and execution of task work product or result.
Support: Assist the lead with organization, coordination, and execution of task work product or result.
Witness: Observe and document completion of task work product or result.
Review: As necessary to accept task work product result.
No Action: Limited or no involvement.

SECTION 01810 – PROJECT DESIGN CRITERIA

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:
    1. Criteria for use in selection of equipment and appurtenances specified in subsequent Sections of these Specifications, or on the Drawings.
    2. Criteria for design of tanks and other equipment fabricated off site and shipped to the Work site for installation.
    3. Criteria for use in design of anchors for connecting process, mechanical and electrical equipment, and appurtenances to supporting structures.
B. The criteria included in this Section are general criteria that apply throughout the Work unless more restrictive or more stringent criteria are indicated on the Drawings or in technical Specifications. See Drawings and Specifications for additional criteria relevant to specific locations, materials and equipment.

1.02 REFERENCES

A. American Society of Civil Engineers (ASCE):
    1. 1. 7-10 - Minimum Design Loads for Buildings and Other Structures (ASCE 7).
B. ASHRAE, Incorporated (ASHRAE).
C. International Code Council (ICC):
    1. International Plumbing Code (IPC).
D. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA):
    1. Seismic Restraint Manual: Guidelines for Mechanical Systems, 4th edition.

1.03 SUBMITTALS

A. Design of supports and anchorage for structures:
    1. Shop drawings and calculations:
        a. Complete shop drawings and calculations.
        b. Calculations shall be signed and sealed by an engineer licensed in the State of Missouri.
    2. Seismic design calculations:
B. Where seismic design calculations are specified in this Specification, such requirements will be waived for structures or equipment determined to be in Seismic Design Categories A or B.
C. Wind design calculations: Where wind design calculations are specified in this Specification, such requirements will be waived for structures or equipment located inside other structures.

1.04 PROJECT DESIGN CRITERIA – SITE INFORMATION

A. Location:
    1. Address: 14001 Interurban Road, Kansas City, MO 64163
    2. Site coordinates (approximate): 39deg 20min 50sec N, 94deg 40min 10sec W
B. Elevation:

1. Operating elevation for equipment: Approximately 800 to 855 feet above mean sea level for Influent Pumping. Approximately 845 to 870 feet above mean sea level for remaining facilities.

1.05 PROJECT DESIGN CRITERIA – REGULATORY REQUIREMENTS

A. Code requirements of authorities having jurisdiction over the project are included in Section 01410 - Regulatory Requirements.

1.06 PROJECT DESIGN CRITERIA – OPERATING ENVIRONMENT

A. Equipment and materials for the Work shall be suitable for performance in a wastewater treatment plant environment, and under conditions specified in the following paragraphs.
    1. See technical specifications for each type of equipment for additional requirements.
B. Climate data for site:
    1. Energy Code Climate Zone: 4A (IECC 2021).
    2. Local data:
        a. Location: Kansas City, Missouri, Kansas City International Airport.
            (1) Data coordinates: Latitude 39.30 N; Longitude 94.71 W.
        b. Prevailing winds: 12 miles per hour.
        c. Temperatures - Outdoor: As specified in Table 1:

Table 1: Design Temperatures - Outdoor	
Condition	**Criteria**
Winter	2.4 degrees Fahrenheit dry-bulb at ASHRAE 99.6 percent.
Summer	92.7 degrees Fahrenheit dry-bulb / 76.1 degrees Fahrenheit mean coincident wet-bulb at ASHRAE 99.6 percent.

        d. Temperatures - Indoor: As specified in Table 2

Table 2: Design Temperatures - Indoor		
	Summer (degrees Fahrenheit)	**Winter (degrees Fahrenheit)**
Process and process equipment areas:		
• Unless otherwise noted.	10 degrees above ambient	55
• Blower and Pump Rooms.	104	55

• Corridors.	10 degrees above ambient	55
• Electrical, Control, and Mechanical (HVAC equipment) rooms.	85	55
Non-process areas:		
• Offices, conference rooms, vestibules, kitchen, restrooms. • Control room, wet analysis room. • PLC, instrument shop, instrument storage, electrical/com room.	75	70
• Admin storage.	80	65
• Mechanical (HVAC equipment) rooms.	85	55
• Conditioned Parts Storage Room.	75	70
• Maintenance shop.	104	55

3. Outdoor conditions - other:
    a. Humidity: 43.4 to 83.5 percent (NOAA 2002).
    b. Freeze-thaw conditions: 90-100 frost days per year.
4. Indoor conditions - other:
    a. Moisture conditions: As defined in individual equipment sections.

C. Rainfall design criteria:
1. Reference: 2015 IPC.
    a. 3.6 inches per hour (100-year, 1-hour storm).

1.07 PROJECT DESIGN CRITERIA - STRUCTURAL

A. GENERAL. Buildings, non-structural components and non-building structures shall be designed in accordance with this section. In the event of conflict with requirements in other sections, the more stringent criteria shall be followed.

B. DESIGN CRITERIA. Buildings, non-structural components including anchorage of such items, shall be designed in accordance with the following criteria in PART 3.

General Design Data:

Building code and references	IBC 2012, ASCE 7-10 "Minimum Design Loads for Buildings and Other Structures", AISC 360 "Specification for Structural Steel Buildings", AISC 341 "Seismic Provisions for Structural Steel Buildings"	
Site elevation, above mean sea level	734	ft
Design flood elevation, DFE	743.33	ft
(500 yr)		
Design groundwater elevation (Ref Geotechnical Soil Report)	717	ft

Wind Design Data:

Basic factored wind speed, V, Risk Category III	120	mph
Exposure category	C	
Importance factor (wind loads), I	N/A	
Building enclosure classification	Enclosed	

Snow Design Data:

Ground snow load, P_g	20	psf
Importance factor (snow loads), I	1.1	
Exposure factor (C_e)	0.9	
Thermal factor (C_t)	1.0	

Ice Design Data:

Nominal ice thickness, t	1.0	in
Concurrent wind speed, V_c	40	mph
Importance factor (ice loads – ice thickness), I_i	1.25	
Importance factor (ice loads – concurrent wind), I_w	1.0	

Seismic Design Data for Non-structural Components:

Design short period spectral response acceleration, S_{DS}	0.135g

Component importance factor, I_P	If/As indicated in the Non-Structural Components PART 3
Seismic Design Category	B

C. WIND ANCHORAGE. Equipment that is to be located outdoors shall have anchor bolts designed for the effects of wind forces, as determined in accordance with ASCE 7, Chapter 6. Shop drawings shall include full anchor bolt details and shall be sealed by a professional engineer licensed in the state of the project. Calculations shall be furnished when requested by Engineer.

D. SEISMIC DESIGN.

a. General. Structural systems shall provide continuous load paths, with adequate strength and stiffness to transfer all seismic forces from the point of application to the point of final resistance.

b. Pre-Engineered Buildings. As Per Architectural Drawings

c. Non-Structural Components. Non-structural components are architectural, mechanical, and electrical items that are permanently attached to and supported by a structure but are not part of the structural system, as indicated in Chapter 13 of ASCE 7, and in the Non-Structural Components Description PART 3.

The Non-Structural Components Description PART 3 identifies the components that require some level of seismic design. The requirements of this paragraph are applicable only to the items listed in the Non-Structural Components Description PART 3.

All components, and the anchorage of those components to the main structure, shall be shown on construction documents prepared and sealed by a registered design professional that is licensed in the state of the project. The construction documents shall be submitted in accordance with the Submittal Procedures section. Structural calculations shall be submitted when requested by Engineer.

Design of non-structural components shall be in accordance with all applicable provisions of ASCE 7, Chapter 13. Non-structural components shall have sufficient strength and ductility to resist the specified seismic effects, and shall meet all of the design, proportioning, detailing, inspection, and quality assurance provisions of the specified building code and other referenced codes.

Non-structural components shall be attached so that seismic forces are transferred to the structural system. Curbs that support roof-mounted equipment shall be designed to transfer forces from the equipment into the main structural roof members. All structural attachments shall be bolted,

welded, or otherwise positively fastened. Frictional resistance due to gravity shall not be considered in evaluating the required resistance to seismic forces.

When the Non-Structural Components Description PART 3 indicates that seismic design of any component is required, the component shall be designed to be operable during and following a design level seismic event without collapsing, breaking away from supports, creating an ignition hazard, or releasing any contents.

"W_p" shall include the total operating weight of the component or system, including, but not limited to, any insulation, fluids, and concentrated loads such as valves, condensate traps, and similar components.

Seismic effects that shall be analyzed in the design of piping systems include the dynamic effects of the piping system, contents, and supports. The interaction between piping systems and the supporting structures, including other mechanical and electrical equipment, shall also be considered. Where pipe supports are to be designed by Contractor, as required by the Pipe Supports section, both the piping and support systems shall be designed to meet the applicable requirements of ASCE 7, Chapter 13.

Non-Building Structures. Not used.

PART 2 - PRODUCTS

2.01 GENERAL

A. Equipment and materials for the project shall be suitable for the following conditions:
    1. Wastewater treatment plant conditions.
    2. Site, environmental and structural loading conditions as specified in this Section.
    3. Specific conditions listed in the relevant sections of the Contract Documents for the equipment and products under consideration.
B. Anchoring and fastening: See the following Sections for materials and installation requirements:
    1. Section 03 20 00 - Concrete Reinforcement.
    2. Section 04 20 00 - Unit Masonry.
    3. Division 5 – Metals.

PART 3 – EXECUTION

3.01 GENERAL

A. Design in accordance with the requirements of the building code as specified in Section 01410 - Regulatory Requirements and the references and project-specific design criteria listed in this Section.
B. In the event of conflicts between design criteria, the more restrictive or severe shall govern.

3.02 DESIGN OF SUPPORTS AND ANCHORAGE FOR EQUIPMENT AND TANKS

A. General:
    1. Anchor using anchor bolts, anchor rods, bolts, or welded studs.

2. Anchor bolts used to resist seismic loads and wind forces shall have a standard hex bolt head.
    a. Do not use anchor bolts fabricated from rod stock with an L or J shape.
    b. Do not use post-installed anchors (including concrete anchors, sleeve anchors, flush shells, chemical anchors, powder actuated fasteners, or other types of anchor) unless indicated on the Drawings or accepted in writing by the Engineer.
3. Anchor bolt and fastener calculations:
    a. Design for ductile failure (anchor bolt yield).
    b. Anchor bolts and fasteners embedded cast into plastic concrete or installed into cured concrete:
        (1) Design based on a minimum specified 28-day concrete compressive strength of 4,000 pounds per square inch (f'c = 4000 psi).

B. Seismic loads:
1. Do not use friction to resist sliding resulting from seismic forces. Resist such forces only by direct application of loads to fasteners as bearing, shear, tension, or compression force(s).
2. Do not use more than 60 percent of the weight of the mechanical and electrical equipment for designing anchors for resisting overturning due to seismic forces.
3. For tanks and equipment with varying weight based on the volume of material contained, design anchorage to accommodate both filled and empty conditions.
    a. Do not use more than 60 percent of the weight of the tank for resisting overturning due to seismic forces.

C. Wind loads:
1. Design load combinations shall be as specified in ASCE 7.
2. For tanks and equipment with varying weight based on volume of material contained, evaluate anchorage considering both filled and empty conditions.

End of Section

SECTION 01 43 39 - MOCKUPS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Integrated exterior mockups.
   2. Preconstruction laboratory mockups.
   3. Room mockups.

B. Related Requirements:
   1. Section 01400 - Quality Control for quality assurance requirements for aesthetic and workmanship mockups specified in other Sections.

1.02 DEFINITIONS

A. Integrated Exterior Mockups: Mockups of the exterior envelope constructed on-site as freestanding temporary built elements, consisting of multiple products, assemblies, and subassemblies.

B. Preconstruction Laboratory Mockups: Integrated exterior mockups constructed at testing facility to verify performance characteristics.

C. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes; doors; windows; millwork; casework; specialties; furnishings and equipment; and lighting as indicated.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Meet with Owner, Architect, testing and inspecting agency representative, and installers of major systems whose Work is included in integrated exterior mockups.
   2. Review coordination of equipment and furnishings provided by the Owner for room mockups.
   3. Review locations and extent of mockups.
   4. Review testing procedures to be performed on mockups.
   5. Review and finalize schedule for mockups, and verify availability of materials, personnel, equipment, and facilities needed to complete mockups and maintain schedule for the Work.

1.04 ACTION SUBMITTALS

A. Shop Drawings: For integrated exterior mockups.
   1. Include plans, elevations, sections, and mounting details.
   2. Indicate manufacturer and model number of individual components, subassemblies, and assemblies.
   3. Include site location drawing indicating orientation of mockup.
   4. Revise and resubmit Shop Drawings to reflect approved modifications in details and component interfaces resulting from changes made during testing procedures.

B. Delegated Design Submittal: For temporary structural supports for mockups not attached to building structure, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 QUALITY ASSURANCE

A. Build mockups to do the following:
   1. Verify selections made under Sample submittals.

2. Demonstrate aesthetic effects.
3. Demonstrate the qualities of products and workmanship.
4. Demonstrate acceptable coordination between components and systems.
5. Perform preconstruction testing, such as window air- and water-leakage testing.

B. Fabrication: Before fabricating or installing portions of the Work requiring mockups, build mockups for each form of construction and finish required. Use materials and installation methods as required for the Work.
1. Build mockups of size indicated.
2. Build mockups in location indicated or, if not indicated, as directed by Architect.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at the Project.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed unless otherwise indicated.

C. Notifications:
1. Notify Architect seven days in advance of the dates and times when mockups will be constructed.
2. Allow seven days for initial review and each re-review of each mockup.

D. Approval: Obtain Architect's approval of mockups before starting fabrication or construction of corresponding Work.
1. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.06 COORDINATION

A. Coordinate schedule for construction of mockups, so construction, testing, and review of mockups do not impact Project schedule.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01400-Quality Control to design support structure for free-standing mockups.

2.02 INTEGRATED EXTERIOR MOCKUPS

A. Construct integrated exterior mockups according to approved mockup Shop Drawings. Construct mockups to demonstrate constructability, coordination of trades, and sequencing of Work; and to ensure materials, components, subassemblies, assemblies, and interfaces integrate into a system complying with indicated performance and aesthetic requirements.

B. Design and construct foundation and superstructure to support free-standing integrated exterior mockups.

C. Build integrated exterior mockups using installers and construction methods that will be used in completed construction.

D. Use specified products that have been approved by Architect. Coordinate installation of materials and products specified in individual Specification Sections that include Work included in integrated exterior mockups.

E. The Work of integrated exterior mockups includes, but is not limited to, the following:
1. Precast architectural concrete.

2. Air and weather barriers.
3. Thermal insulation.
4. Through-wall flashing.
5. Flashing and sheet metal trim.
6. Joint sealants.
7. Metal wall panels.
8. Aluminum-framed entrances and storefront.
9. Glazing.
10. Hollow core roof structure.
11. Roof insulation
12. Standing seam metal roof panels
13. Fiberglass sandwich panels
14. Metal soffit panels
15. Concrete faced panels

F. Photographic Documentation: Document construction of integrated exterior mockups with photographs in accordance with Section 01322-Photographic Documentation. Provide photographs showing details of interface of different materials and assemblies.
   1. Document testing procedures, including water leakage and other deficiencies. Photograph modifications to component interfaces intended to correct deficiencies.

G. Provide and document modifications to construction details and interfaces between components and systems required to properly sequence the Work, or to pass performance testing requirements. Obtain Architect's approval for modifications.

H. Retain approved mockups constructed in place. Incorporate fully into the Work.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 43 39

SECTION 01 43 39 - MOCKUPS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Integrated exterior mockups.
   2. Preconstruction laboratory mockups.
   3. Room mockups.

B. Related Requirements:
   1. Section 01400 - Quality Control for quality assurance requirements for aesthetic and workmanship mockups specified in other Sections.

1.02 DEFINITIONS

A. Integrated Exterior Mockups: Mockups of the exterior envelope constructed on-site as freestanding temporary built elements, consisting of multiple products, assemblies, and subassemblies.

B. Preconstruction Laboratory Mockups: Integrated exterior mockups constructed at testing facility to verify performance characteristics.

C. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes; doors; windows; millwork; casework; specialties; furnishings and equipment; and lighting as indicated.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Meet with Owner, Architect, testing and inspecting agency representative, and installers of major systems whose Work is included in integrated exterior mockups.
   2. Review coordination of equipment and furnishings provided by the Owner for room mockups.
   3. Review locations and extent of mockups.
   4. Review testing procedures to be performed on mockups.
   5. Review and finalize schedule for mockups, and verify availability of materials, personnel, equipment, and facilities needed to complete mockups and maintain schedule for the Work.

1.04 ACTION SUBMITTALS

A. Shop Drawings: For integrated exterior mockups.
   1. Include plans, elevations, sections, and mounting details.
   2. Indicate manufacturer and model number of individual components, subassemblies, and assemblies.
   3. Include site location drawing indicating orientation of mockup.
   4. Revise and resubmit Shop Drawings to reflect approved modifications in details and component interfaces resulting from changes made during testing procedures.

B. Delegated Design Submittal: For temporary structural supports for mockups not attached to building structure, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 QUALITY ASSURANCE

A. Build mockups to do the following:
   1. Verify selections made under Sample submittals.

2. Demonstrate aesthetic effects.
3. Demonstrate the qualities of products and workmanship.
4. Demonstrate acceptable coordination between components and systems.
5. Perform preconstruction testing, such as window air- and water-leakage testing.

B. Fabrication: Before fabricating or installing portions of the Work requiring mockups, build mockups for each form of construction and finish required. Use materials and installation methods as required for the Work.
1. Build mockups of size indicated.
2. Build mockups in location indicated or, if not indicated, as directed by Architect.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at the Project.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed unless otherwise indicated.

C. Notifications:
1. Notify Architect seven days in advance of the dates and times when mockups will be constructed.
2. Allow seven days for initial review and each re-review of each mockup.

D. Approval: Obtain Architect's approval of mockups before starting fabrication or construction of corresponding Work.
1. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.06 COORDINATION

A. Coordinate schedule for construction of mockups, so construction, testing, and review of mockups do not impact Project schedule.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01400-Quality Control to design support structure for free-standing mockups.

2.02 INTEGRATED EXTERIOR MOCKUPS

A. Construct integrated exterior mockups according to approved mockup Shop Drawings. Construct mockups to demonstrate constructability, coordination of trades, and sequencing of Work; and to ensure materials, components, subassemblies, assemblies, and interfaces integrate into a system complying with indicated performance and aesthetic requirements.

B. Design and construct foundation and superstructure to support free-standing integrated exterior mockups.

C. Build integrated exterior mockups using installers and construction methods that will be used in completed construction.

D. Use specified products that have been approved by Architect. Coordinate installation of materials and products specified in individual Specification Sections that include Work included in integrated exterior mockups.

E. The Work of integrated exterior mockups includes, but is not limited to, the following:
1. Precast architectural concrete.

2. Air and weather barriers.
3. Thermal insulation.
4. Through-wall flashing.
5. Flashing and sheet metal trim.
6. Joint sealants.
7. Metal wall panels.
8. Aluminum-framed entrances and storefront.
9. Glazing.
10. Hollow core roof structure.
11. Roof insulation
12. Standing seam metal roof panels
13. Fiberglass sandwich panels
14. Metal soffit panels
15. Concrete faced panels

F. Photographic Documentation: Document construction of integrated exterior mockups with photographs in accordance with Section 01322-Photographic Documentation. Provide photographs showing details of interface of different materials and assemblies.
   1. Document testing procedures, including water leakage and other deficiencies. Photograph modifications to component interfaces intended to correct deficiencies.

G. Provide and document modifications to construction details and interfaces between components and systems required to properly sequence the Work, or to pass performance testing requirements. Obtain Architect's approval for modifications.

H. Retain approved mockups constructed in place. Incorporate fully into the Work.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 43 39

SECTION 02 41 00 - DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes the removal of existing construction to limits as indicated and specified herein. Demolition includes the complete or partial removal and disposal of materials of the following:
   1. Existing sludge holding basins.
   2. Fencing.
   3. Sidewalks.
   4. Roads.
   5. Bridges and box culverts.
   6. Piping, valves, manholes, vaults.
   7. Conduit, lights, electrical cable.
   8. Light switches, receptacles.
   9. Reinforced concrete panels, embankments, and ramps.
   10. Other items as indicated on Contract Drawings.

B. Related Work Specified Elsewhere:
   1. Site Preparation and Earthwork: SECTION 31 20 50.
   2. Clearing and Grubbing: SECTION 31 11 00.

1.02 REFERENCES:

A. American National Standards Institute (ANSI):
   1. A10.6 - Safety and Health Program Requirements for Demolition Operations.

B. Burns & McDonnell:
   1. Asbestos, Lead Paint, and Hazardous Materials Survey – Issued March 31, 2023.

C. Code of Federal Regulations (CFR):
   1. 40 CFR.273 - Standards for Universal Waste Management.

D. Occupational Safety and Health Administration (OSHA):
   1. 1910.1025 - Lead.
   2. 29 CFR 1926.62 - Lead.
   3. 29 CFR 1926.1101 - Asbestos.

E. Missouri Department of Natural Resources (MDNR):
   1. PUB2568 - Wastewater Treatment Plant Closure.
   2. Standard Conditions for NPDES Permits - Part III.
   3. 10 CSR 20-6.010.
   4. 10 CSR 20-6.015.
   5. 40 CFR 503.

1.03 SUBMITTALS:

A. Schedule of Demolition:
   1. Submit as specified in DIVISION 1.
   2. Submit proposed methods and operations of demolition for review prior to the start of Work. Include in the schedule the coordination for shutoff, capping, and continuation of utility services as required, together with details for dust, noise, and erosion control protection.
   3. Provide a detailed sequence of demolition and removal work to ensure the

uninterrupted progress of Owner's operations.

B. Submittals for Information Only:
   1. Permits and notices authorizing demolition.
   2. Certificates of severance of utility services.
   3. Permit for transport and disposal of debris.

C. Quality assurance submittals:
   1. Qualifications of non-destructive testing agencies.

D. The Contractor shall prepare a specific, detailed sludge holding basin closure plan. The closure plan should include, at a minimum, the following:
   1. Survey results of the sludge holding basins for existing levels of sludge and decant water.
   2. A characterization of the existing biosolids, including:
      a) General information about the basins and treatment plant.
      b) Operational status of the basins.
      c) Sampling plan proposal describing how and where representative biosolids samples will be collected must be provided, including a layout plan.
   3. Liquid disposal plan, including disposal location and schedule
   4. Solids disposal plan, including disposal location and schedule
   5. Mixing plan and test results for any sludge left in the lagoon
   6. Restoration plan

E. Project record documents.

F. Drawings and/or other media documenting locations of service lines and capped utilities.

1.04 QUALITY ASSURANCE:

A. Qualifications:
   1. Assign removal, cutting, and patching to trades and workers qualified to perform the Work in a manner that causes the least damage.

1.05 REGULATORY REQUIREMENTS:

A. Dispose of debris in accordance with governing regulatory agencies.

B. Comply with applicable air pollution control regulations.

C. Obtain permits for building demolition, transportation of debris to disposal site and dust control.

1.06 JOB CONDITIONS:

A. Do not interfere with use of adjacent structures and elements of the facility not subject to the Work described in this Section. Maintain free and safe passage to and from such facilities or adequate barriers to prevent unsafe passage.

B. Provide, erect, and maintain barricades, lighting, guardrails, and protective devices as required to protect building occupants, public, workers, and adjoining property:
   1. Conduct operations with minimum interference to public or private roadways.

C. Prevent movement, settlement, or collapse of structures adjacent services, driveways, and trees:
   1. Provide and place bracing or shoring.
   2. Cease operations and notify Engineer immediately when safety of structures appears to be endangered. Take precautions to properly support structure. Do not resume operations until safety is restored.
   3. Contractor shall assume liability for movement, settlement, or collapse and promptly

repair damage.

D. Provide and arrange for capping and plugging utility services. Disconnect and stub off.
   1. Notify affected utility company in advance and obtain approval before starting demolition.
   2. Place markers to indicate location of disconnected services.

E. Unknown conditions:
   1. The Contract Drawings may not represent all conditions at the Site and adjoining areas. Compare actual conditions with Contract Drawings before commencement of Work.
   2. Existing utilities and drainage systems below grade are located on the Contract Drawings based on record information from existing documents.
   3. If existing active services encountered are not indicated or otherwise made known to the Contractor and interfere with the permanent facilities under construction, notify the Engineer in writing, requesting instructions on their disposition. Take immediate steps to maintain service, and do not proceed with the Work until written instructions are received from the Engineer.

F. Owner may be continuously occupying areas immediately adjacent to areas of demolition. Conduct demolition Work in a manner that will minimize need for disruption of Owner's normal operations. Provide Owner a minimum of 72 hours' advance notice of demolition activities which will severely impact Owner's normal operations.

G. Condition of Structures to be Demolished:
   1. Owner assumes no responsibility for actual condition of structures to be demolished.

H. Explosives: The use of explosives will not be permitted.

I. Promptly repair damages caused to adjacent facilities by demolition operations at no cost to Owner.

J. Utility Services:
   1. Maintain existing utilities indicated to remain; keep in service and protect against damage during demolition operations.
   2. Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by Engineer, Owner, or authorities having jurisdiction. Provide temporary services during interruptions to existing utilities.
   3. Contractor shall shut off utilities serving each structure. Disconnecting and sealing indicated utilities before starting demolition operations shall be done by Contractor.

PART 2 - PRODUCTS - Not Applicable.

PART 3 - EXECUTION

3.01 INSPECTION:

A. Prior to commencement of demolition Work, inspect areas in which demolition will be performed. Photograph existing conditions of structures, surfaces, Equipment, or surrounding properties which could be misconstrued as damage resulting from demolition operations. Submit to Owner prior to starting Work.

3.02 PREPARATION:

A. Locate, identify, stub off, and disconnect utility services that are indicated to remain:
   1. Provide bypass connections as necessary to maintain continuity of service to occupied areas of Site. Provide minimum of 72 hours' advance notice to Owner if

shutdown of service is necessary during changeover.

B. Layout:
   1. The limits of demolition are indicated on the Contract Drawings. Confine demolition operations within the limits indicated on the Contract Drawings.
   2. Lay out demolition and removal work at the Site and coordinate with related Work for which demolition and removal is required. Clearly mark the extent of structural elements to be removed on the actual surfaces that will be removed.
   3. Arrange for Engineer's inspection of the lay out extents.
   4. Do not begin demolition/removal operations until the lay out markings have been reviewed by the Engineer.

3.03 DEMOLITION:

A. Perform demolition in a systematic manner in accordance with ANSI A10.6. Use such methods as required to complete demolition indicated on Contract Drawings in accordance with demolition schedule and governing regulations:
   1. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain using power-driven masonry saw or hand tools; do not use power-driven impact tools.
   2. Provide services for effective air and water pollution controls as required by local authorities having jurisdiction.
   3. Demolish and remove foundation walls to a depth as indicated on the Contract Drawings. Demolish and remove below-grade wood or metal construction. Break up below-grade concrete slabs and remove where indicated.
   4. Completely fill below-grade areas and voids resulting from demolition. Provide fill consisting of approved earth, gravel, or sand; free of trash and debris, frost and frozen materials, stones over 6 inches in diameter, roots, or other organic matter. Use satisfactory soil materials and place as specified in SECTION 31 20 50 – Site Preparation and Earthwork.
   5. Demolition of Roads or Paved Areas: Break up and remove construction including surface, base, and subbase unless otherwise indicated to remain.
   6. Fences: Remove fence construction including fabric, posts, other components, and any below-grade construction such as concrete.

B. Pollution Controls:
   1. Use water sprinkling, temporary enclosures, and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level. Comply with governing regulations pertaining to environmental protection.
   2. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.
   3. Clean adjacent structures and area of dust, dirt, and debris caused by demolition operations.

C. If unanticipated mechanical, electrical, or structural elements which conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to Owner and Engineer in written, accurate detail. Pending receipt of directive from Engineer, rearrange demolition schedule as necessary to continue overall job progress without delay.
   1. Do not remove anything beyond the limits of Work indicated without prior written authorization of the Engineer. If in doubt about whether to remove an item, obtain

written authorization of the Engineer prior to proceeding.

D. Rough grade areas affected by demolition as shown on the Contract Drawings.

3.04 LEAD BASED PAINT:

A. A number of paint coatings at the existing Todd Creek Wastewater Treatment Plant contain lead. When conducting demolition work that disturbs paint containing lead, follow U.S. Environmental Protection Agency (EPA) Regulations, OSHA Lead Regulations 29 CFR 1926.62 for construction or 1910.1025 for General Industry.

B. Contractor shall use lead-trained personnel, develop a lead compliance program, and allow no visible emissions into the environment for demolition activities.

C. Loose lead-containing paint chips and materials contaminated with loose lead-containing paint chips shall be collected for hazardous waste determination. Toxicity characteristic leaching procedure (TCLP) testing must be performed on the material to determine if the waste is hazardous.

1. If the waste is hazardous, the waste will be required to be containerized and disposed of as hazardous waste.

3.05 ASBESTOS CONTAINING MATERIALS (ACM):

A. Asbestos containing materials were surveyed within the Administration Building at the existing Todd Creek Wastewater Treatment Plant.

B. Approximately 80 square feet of black laboratory countertop within the administration building was identified as Category II non-friable ACM.

C. Approximately 1,500 square feet of drywall/joint compound system within the administration building was found to contain less than 1% asbestos.

D. These materials shall be removed prior to building demolition using manual methods that prevent them from being rendered friable.

E. Removal activities shall be conducted by a Missouri-licensed asbestos abatement contractor.

F. Non-friable removal is not regulated by the Kansas City, Missouri department of air quality; however, removal activities must comply with OSHA asbestos regulations 29 CFR 1926.1101.

3.06 MERCURY:

A. Contractor shall assume all fluorescent light tubes and metal-halide lamps to be mercury-containing, even at low concentrations.

3.07 POLYCHLORINATED BIPHENYLS (PCBs):

A. According to the EPA, suspect materials, including transformers and lighting ballasts (unless they are electronic), must be considered positive for PCBs unless the product is clearly marked with a label stating, “NO PCBs.”

B. Light ballasts were observed during the design survey as fluorescent ballasts which are not expected to contain PCBs; however, there is a possibility that light ballasts containing PCBs may be present that were not visually observed.

1. Contractor shall perform pre-demolition survey to verify that no materials to be demolished contain PCBs.

3.08 DISPOSAL OF DEMOLITION MATERIALS:

A. Remove debris, rubbish, and other materials resulting from demolition operations.

B. If hazardous materials are encountered during demolition operations, comply with

applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.

C. Burning of removed materials from demolished structures will not be permitted on Site.

D. Transport materials removed from demolished structures and dispose of off Site.

3.09 DISPOSAL OF LEAD BASED PAINT MATERIALS:

A. Building materials with intact lead paint may be eligible for disposal at a recycling facility, or a construction and demolition (C&D) or municipal solid waste (MSW) facility pending landfill notification and pre-approval by the facility accepting the lead-containing waste.

B. Contractor is required to obtain all approvals and manage all disposal.

3.10 DISPOSAL OF ASBESTOS CONTAINING MATERIALS (ACM):

A. While not regulated, non-friable ACM that is not rendered friable during abatement or demolition activities and materials containing less than 1% asbestos must be properly disposed in an approved landfill in accordance with solid waste laws. The disposal facility shall be contacted prior to disposal for information on packaging and delivery requirements.

3.11 DISPOSAL OF MERCURY:

A. Contractor shall handle mercury-containing products carefully, without breaking, and pack and dispose of the lamps as universal waste per regulations set forth in 40 CFR.273.

B. Contractor shall have a mercury spill kit with trained personnel available in the event that a mercury-containing product breaks.

3.12 DISPOSAL OF POLYCHLORINATED BIPHENYLS (PCBs):

A. During removal of light fixtures, Contractor shall check the label on each lighting ballast. If the ballast was manufactured prior to 1979 and is not labeled as “non-PCB”, it should be segregated from the non-PCB electronic ballasts and sent to a reputable recycler for disposal as PCB-containing waste.

3.13 DISPOSAL OF SOLIDS FROM EXISTING PROCESS BASINS:

A. All residuals from the existing process basins and the sludge holding basins shall be removed by Owner prior to structure demolition.

3.14 SLUDGE HOLDING BASINS CLOSURE:

A. Contractor shall be responsible for sludge holding basin closure, including preparation of a closure plan for the existing Todd Creek Wastewater Treatment Plant sludge holding basins and obtaining approval of this plan from the Missouri Department of Natural Resources (MDNR). Contractor’s sludge holding basin closure plan shall be provided to the Owner a minimum of thirty (30) days prior to initiating demolition work.

B. The closure plan shall be prepared in accordance with the MDNR Standard Condition Part III and the Wastewater Treatment Plant Closure PUB2568.

1. The closure plan will include a characterization of the biosolids, including:
   a. General information about the basins and treatment plant.
   b. Operational status of the basins.
   c. Sampling plan proposal describing how and where representative biosolids samples will be collected including a layout plan.
2. Owner will be responsible for dewatering and removal of sludge in basins prior to demolition. However, at no additional cost to Owner, Contractor shall remove and dispose of any remaining water and sludge from the basins according to procedures

described in this Section.

C. Contractor shall complete necessary sampling and documentation for sludge land application according to Standard Condition Part III and/or 40 CFR 503.
   1. Fecal coliform testing shall be completed to show compliance with Class B biosolids limitations. Fecal coliform must be less than two million colony forming units or two million most probable number to meet Class B biosolids requirements.
   2. All fecal samples must be presented as geometric mean per gram.
   3. Sludge not meeting the Class B requirements or PAN loading limits, shall be sent to a landfill.
   4. The allowable nitrogen loading that may be left in the lagoon shall be based on the plant available nitrogen (PAN) loading. The allowable PAN for a grass cover crop is 300 pounds/acre.
   5. Alternatively, site-specific application rates may be included in the closure plan for department consideration. PAN can be determined as noted in MDNR's Standard Condition Part III.
   6. Contractor shall provide additional soil as required to meet these requirements.
D. The sludge holding basin area shall be graded in accordance with the Contract Drawings and seeded to obtain ≥70% vegetative density over 100% of the site, to avoid ponding of storm water and provide adequate surface water drainage without creating erosion.

3.15 CLEANUP AND REPAIR:

A. Upon completion of demolition Work, remove tools, equipment, and demolished materials from site. Remove protections and leave interior areas broom clean.
B. Repair demolition performed more than that required. Return structures and surfaces that will remain to condition existing prior to commencement of demolition Work. Repair adjacent construction or surfaces soiled or damaged by demolition Work.

3.16 RESTORATION:

A. General:
   1. Repair damage caused by demolition to conditions equal to those that existed prior to beginning of demolition.
B. The cost of repairs shall be at the Contractor's expense, and no increase in the Contract Price.
C. Restore areas affected by removal of existing equipment, equipment pads and bases, piping, supports, electrical panels, electric devices, and conduits such that little or no evidence of the previous installation remains:
D. Remove concrete bases for equipment and supports by:
   1. Sawcutting clean, straight lines with a depth equal to the concrete cover over reinforcement minus 1/2-inch below finished surface.
E. Chip concrete within scored lines and cut exposed reinforcing steel and anchor bolts.
F. Terminate abandoned piping and conduits with blind flanges, caps, or plugs.

END OF SECTION 02 41 00

DIVISION 03 - CONCRETE

SECTION 03 10 00 – CONCRETE FORMWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes formwork for cast-in-place concrete.

1.03 RELATED REQUIREMENTS:

A. Section 03 20 00 – Concrete Reinforcement.
B. Section 03 30 00 – Concrete.

1.04 REFERENCE STANDARDS:

A. Applicable Standards:
   1. American Concrete Institute (ACI):
      a. ACI 117 - Specifications for Tolerances for Concrete Construction and Materials.
      b. ACI 301- Specifications for Structural Concrete.
      c. ACI 318 - Building Code Requirements for Reinforced Concrete.
      d. ACI 347R - Guide to Formwork for Concrete.
      e. ACI 350 - Code Requirements for Environmental Engineering Concrete Structures.
      f. ACI 350.5 - Specifications for Environmental Concrete Structures.
   2. ASTM International (ASTM):
      a. ASTM C31/C31M REV A– Standard Practice for Making and Curing Concrete Test Specimens in the Field.
      b. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
      c. ASTM C1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.

1.05 SUBMITTALS:

A. Include, but not limited to, the following:
   1. Type of form ties, waterstop device and patching detail for water containing structures. If more than one type of form tie is proposed, indicate the proposed locations for each.

PART 2 - PRODUCTS

2.01 MATERIALS FOR FACING:

A. Where concrete will be exposed to view after construction:
   1. Use exterior grade plywood at least 5/8 inch thick or steel forms capable of producing a smooth, uniform appearance.
   2. Do not use form-facing materials with raised grain, torn surfaces, worn edges, dents, or other defects that will impair the texture of concrete surfaces.
B. Where concrete will not be exposed to view after construction:
   1. Exterior grade plywood at least 5/8 inch thick.
   2. Steel.
   3. Wood fiberboard.

4. Dressed lumber free of loose knots.

C. Treat forms with commercially available form releasing agents that will not bond with, stain, or adversely affect concrete surfaces. Agents shall not impair subsequent treatment of concrete surfaces depending upon bond or adhesion, nor shall it impede the wetting of surfaces to be cured with water or curing compounds. Form releasing agents shall be VOC compliant with a maximum VOC content of 3.8 lbs./gal. (450 g/L), or less where area restrictions are more stringent.

D. Clean forms of sawdust, dust, dirt, and other foreign materials.

2.02 FORM TIES:

A. Break back, coil, or screw type, except where otherwise specified.

B. Use water-seal coil type in walls below grade and in walls of water bearing structures. Removable through-wall tapered ties shall not be used.

C. Coil type shall leave conical depression in concrete.

D. Space as required against pressure of fresh concrete.

E. The portion of the form tie remaining in place shall provide for a clearance of two times the minimum dimension of the tie, but not less than 3/4 inch, from the formed surface.

2.03 CHAMFER STRIPS:

A. Chamfer: 3/4 inch except where otherwise indicated.

B. Place in all forms to provide chamfer where concrete will have exposed projecting corners.

PART 3 - EXECUTION

3.01 FORM CONSTRUCTION:

A. Conform to ACI 301, 318, and 347R. Shop Drawings for formwork, shoring, and reshoring are not required to be submitted for approval.

B. Adequately brace, stiffen, and support forms to prevent perceptible deflection or settlement, and to hold plumb, level, and true to line.

C. Construct and maintain forms to the tolerances given in ACI 117.

D. Construct sufficiently tight to prevent mortar leakage.

E. Avoid offsets between adjacent forms and construct so that shores, braces, and stiffening members are in line with those below.

F. Space studs and stringers as required to support facing against concrete pressure, but not more than 12 inches for 5/8-inch plywood or 16 inches for 3/4-inch plywood. Maximum deflection of facing materials reflected on concrete surfaces exposed to view shall be 1/240 of the span between structural members of the formwork.

G. Use wales, strongbacks, shores, and bracing as required.

H. Form all necessary openings or chases for piping, ductwork, and similar items where indicated or as required for the Work.

I. Construct forms to be removable in sections without marring concrete surface.

J. Surface of forms shall provide a smooth, dense, plane surface to finished concrete where exposed to view.

K. Contractor shall be responsible for structural adequacy, design, engineering, and construction of the formwork.

L. Stay-in-place metal forms shall not be used.

3.02 TIME-IN-PLACE FOR FORMS:

A. It is the responsibility of Contractor to consider all applicable factors and leave the formwork in place until it is safe to remove them.

B. All removal shall be performed in a manner which will prevent damage to the concrete and ensure the complete safety of the structure.

C. Where forms support more than one element, the forms shall not be removed until the form removal criteria are met by all supported elements.

D. Evidence that concrete has gained sufficient strength to permit removal of forms shall be determined by tests on control cylinders. All control cylinders shall be stored in the structure or as near the structure as possible, so they receive the same curing conditions and protection methods as given those portions of the structure they represent. Control cylinders shall be removed from the molds at an age of no more than 24 hours. All control cylinders shall be prepared and tested in accordance with ASTM C31/C31M REV A and ASTM C39/C39M at the expense of Contractor by an independent laboratory that complies with ASTM C1077. Control cylinders shall be tested within 4 hours after removal from the Site.

E. Forms shall not be removed unless the minimum time or minimum compressive strength requirements below are met.

1. Formwork Not Supporting Weight of Concrete:
    a. Formwork for walls, columns, sides of beams, gravity structures, slabs-on-ground and other vertical type formwork not supporting the weight of concrete shall remain in place 24-hours minimum after concrete placement is completed.
2. Formwork Supporting Weight of Concrete:
    a. Formwork supporting weight of concrete and shoring shall not be removed until structural members have acquired sufficient strength to safely support their own weight and any construction or other superimposed loads to which the supported concrete may be subjected. As a minimum, no forms or shoring shall be loosened or removed until control concrete test cylinders indicate the concrete has attained the following compressive strengths for the respective structural members:

Structural Member	Percent of Design Compressive Strength
Unshored slab and beam forms or forms which can be removed without disturbing shores	70
Slab or beam shoring	85

END OF SECTION 03 10 00

SECTION 03 15 50 – VAPOR RETARDER

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes vapor retarder under concrete slabs on grade.

1.03 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 03 30 00 - Concrete.

1.04 REFERENCE STANDARDS:

A. Applicable Standards:
   1. American Concrete Institute (ACI):
      a. 302.1R- Guide to Concrete Floor and Slab Construction
      b. 302.2R - Guide for Slabs that Receive Moisture-Sensitive Flooring Materials
   2. American Society for Testing and Materials (ASTM):
      a. E96/E96M - Test Methods for Water Vapor Transmission of Materials.
      b. E154/E154M- Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
      c. E1643- Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs
      d. E1745 - Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

1.05 SUBMITTALS:

A. Submit as specified in DIVISION 01.
B. Include, but not limited to, the following:
   1. Product specification and data.
   2. Installation instructions.

PART 2 - PRODUCTS

2.01 VAPOR RETARDER:

A. Flexible, preformed sheet membrane material conforming to ASTM E1745, Class A or B having a minimum thickness of 10 mils.
B. Use under concrete slabs as follows:
   1. Admin Building
   2. Headworks Building
   3. UV Disinfection Building
   4. Solids Handling Building
   5. Blower Building
   6. Influent Pump Station Electrical Building

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install in accordance with ASTM E1643 and the following.
B. Remove sharp edges, projecting materials, and roughness which might penetrate vapor retarder.
C. Level and tamp or roll granular base.
D. Place vapor retarder sheeting with the longest dimension parallel with the direction of the concrete pour.
E. Lap vapor retarder over footing or seal to foundation wall, or both, and seal around penetrations such as utilities and columns to create a monolithic membrane between the surface of the slab and moisture sources below the slab and at the slab perimeter.
F. Lap joints 6 inches, or as instructed by the manufacturer, and seal with the manufacturer's recommended adhesive or pressure sensitive tape, or both.
G. Take precaution to protect vapor retarder from damage during installation of reinforcing steel and utilities and during placement of concrete.
H. Use only concrete brick type reinforcing bar supports, or provide 6-inch by 6-inch protective pads of asphaltic hardboard or other material recommended by the vapor retarder manufacturer to protect the vapor retarder from puncture.
I. Do not drive stakes through the vapor retarder.
J. Repair vapor retarder damaged during placement of reinforcing or concrete as instructed by manufacturer.

END OF SECTION 03 15 50

SECTION 03 20 00 – CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes steel reinforcement bars, ties, welded wire fabric, bolsters, chair supports, and accessories.

1.03 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 03 10 00 - Concrete Formwork.
B. Section 03 30 00 - Concrete.

1.04 REFERENCE STANDARDS:

A. Applicable Standards:
   1. American Society for Testing and Materials (ASTM):
      a. A615/A615M- Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.
      b. A706/A706M- Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
      c. A1064/A1064M– Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
   2. American Concrete Institute (ACI):
      a. 301- Specifications for Structural Concrete.
      b. SP 66 - Detailing Manual.
      c. 318- Building Code Requirements for Structural Concrete.
      d. 117 - Specifications for Tolerances for Concrete Construction and Materials.
   3. American Welding Society (AWS):
      a. A5.5 - Low Alloy Steel Electrodes for Shielded Metal Arc Welding.
      b. B2.1 - Welding Procedure and Performance Qualification.
      c. D1.4- Structural Welding Code Reinforcing Steel.
   4. Concrete Reinforcing Steel Institute (CRSI):
      a. Manual of Standard Practice.

1.05 SUBMITTALS:

A. Submit as specified in DIVISION 01.
B. Include, but not limited to, the following:
   1. Complete bar schedule, bar details, and erection drawings to conform to ACI SP 66.
   2. Drawing with each type of bent bar marked with identification mark. Straight bars shall have mark number or be identified by size and length.
   3. Erection drawings shall be clear, easily legible, and to a minimum scale of:
      a. 1/4 inch = 1 foot (1:50).
      b. 1/8 inch = 1 foot (1:100) if bars in each face are shown in separate views.
   4. Size and location of all openings.
   5. Concrete protective cover.
   6. Grade of steel.
   7. Lap splice lengths.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. Store steel reinforcement blocked up off the ground and in orderly stacks.
B. Store only bars with the same identifying label in the same stack.

1.07 TESTING:

A. Perform at the mill for each heat.
B. Submit certified test results upon request.

PART 2 - PRODUCTS

2.01 REINFORCEMENT BARS, TIES, AND STIRRUPS:

A. Materials:
   1. Conform to ASTM A615, Grade 60, except as otherwise specified.
   2. Cold-drawn wire for spiral column ties shall conform to ASTM A1064.
   3. Reinforcement indicated or specified to be welded shall conform to ASTM A706.
B. Fabrication of Bars:
   1. Fabricate with cold bends conforming to the recommended dimensions shown in ACI 318.
   2. Fabricate bars according to the tolerances given in ACI 117.
   3. Field fabrication will be allowed only if Contractor has equipment to properly fabricate steel.
   4. Attach metal or plastic tags with identifying mark or length corresponding to mark number or length on Drawing. Straight bars shall have mark number or size and length. Bent bars shall have mark number.
   5. Contractor may, at his option, continue steel reinforcement through openings in walls and slabs, then field-cut the opening so that there will be the required concrete cover between ends of bars and edge of opening.

2.02 WELDED WIRE REINFORCEMENT:

A. Conform to ASTM 1064.
B. Wire sizes W1.4 and smaller shall be galvanized.
C. Provide mats only. Rolled fabric is not acceptable.

2.03 BOLSTERS, CHAIRS, AND ACCESSORIES:

A. Conform to ACI SP 66 and the CRSI Manual of Standard Practice.
B. Provide all spacers, bolsters, chairs, ties, and other devices necessary to properly space, place, support, and fasten steel reinforcement in place during the concrete placement.
C. Metal accessories shall be galvanized or plastic-coated where legs will be exposed in finished concrete surfaces.
D. Do not use rocks, broken bricks, wood blocks, or concrete fragments for support of steel reinforcement.

2.04 PRECAST CONCRETE BLOCK BAR SUPPORTS:

A. May be used only for bar supports in slabs on ground.
B. Conform to ACI SP-66 and the CRSI Manual of Standard Practice.
C. Each block shall have a minimum of 9 square inches (5800 square millimeters) of bearing area. Space as required by the particular condition of weight, bearing surface, and rigidity of the steel reinforcement.

PART 3 - EXECUTION

3.01 PLACEMENT OF STEEL REINFORCEMENT:

A. Place all steel reinforcement before concrete is cast in accordance with approved erection drawings, ACI 117, ACI 318, and the CRSI Manual of Standard Practice.
B. Remove oil, mill scale, pitting, mud, loose rust, ice, and other materials that would reduce bond from bars before placing.
C. Tie securely with 16 gage (1.6 mm) or larger annealed iron wire.
D. Place to maintain concrete cover to conform to ACI 117 and ACI 318, unless otherwise indicated.
E. Splice steel where indicated. Splices shall be in full contact and shall conform to ACI 318.
    1. Unless otherwise indicated, lap splices shall be Class B as defined by ACI 318.
    2. Splice steel using Cadweld Series T-splices where indicated or approved.
        a. Provide a manufacturer's representative to give on site instructions to all welders who will perform the splices in the field.
        b. Contractor shall have the manufacturer's representative instruct, observe, and approve in writing those persons doing the welding.
        c. Contractor shall arrange for the manufacturer's representative to return at the request of the Engineer.
    3. Lenton Mechanical Splices:
        a. Lenton mechanical splices shall be used where indicated or approved.
        b. The Lenton mechanical splices shall develop in tension and compression at least 125% of the yield strength (Fy) of the bar spliced.
        c. Lenton mechanical splices shall be positive locking, taper threaded type coupler.
    4. Splices in members indicated as "tension tie members" shall be made with Cadweld Series T-splices or Lenton mechanical splices in accordance with ACI 318.
    5. Any additional Contractor-proposed splice shall be submitted for acceptance of location and splice length.
F. Lap welded wire reinforcement in accordance with ACI 318, but not less than the length of one mesh plus 2 inches (50 mm).
G. Connection of reinforcement bars to steel shapes or plate shall be with a Cadweld Series B-splice.
H. Do not bend bars embedded in hardened or partially hardened concrete without approval from Engineer. If bending is permitted, conform to procedures of ACI 301 unless otherwise prescribed by the governing building code.
I. Do not weld reinforcing bars unless specifically indicated. Where welding is indicated, provide bars conforming to ASTM A706/A706M and comply with AWS D1.4.

END OF SECTION 03 20 00

SECTION 03 30 00 – CONCRETE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes concrete and related items.

1.03 RELATED REQUIREMENTS:

A. Section 03 10 00 - Concrete Formwork.
B. Section 03 15 50 - Vapor Retarder.
C. Section 03 20 00 - Concrete Reinforcement.
D. Section 05 05 19 - Post-Installed Concrete Anchors
E. Section 05 12 00 - Steel.
F. Section 09 90 00 - Protective Coatings.

1.04 REFERENCE STANDARDS:

A. Comply with the provisions of the following codes, specifications, and standards, except as otherwise indicated.
B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
    1. American Concrete Institute (ACI):
        a. 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
        b. 301 - Specifications for Structural Concrete.
        c. 302.1R - Guide for Concrete Floor and Slab Construction.
        d. 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
        e. 305.1 – Specification for Hot Weather Concreting
        f. 306R - Committee Report on Cold Weather Concreting.
        g. 306.1 – Standard Specification for Cold Weather Concreting
        h. 308.1 - Standard Specification for Curing Concrete.
        i. 309R - Guide for Consolidation of Concrete.
        j. 318 - Building Code Requirements for Structural Concrete.
        k. 350 - Environmental Engineering Structures.
        l. 350.1 - Tightness Testing of Environmental Concrete Structures.
        m. 350.5 - Specifications for Environmental Concrete Structures
    2. ASTM International (ASTM):
        a. B370 - Copper Sheet and Strip for Building Construction.
        b. C31/C31M - Practice for Making and Curing Concrete Test Specimens in the Field.
        c. C33 - Concrete Aggregates.
        d. C39 - Test Method for Compressive Strength of Cylindrical Concrete Specimens.
        e. C40 - Test Method for Organic Impurities in Fine Aggregates for Concrete.
        f. C42 - Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
        g. C88 - Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.

h. C114 - Test Methods for Chemical Analysis of Hydraulic Cement.
i. C117 - Test Method for Material Finer than 75µ (No. 200) Sieve in Mineral Aggregates by Washing.
j. C136 - Test Method for Sieve Analysis of Fine and Coarse Aggregates.
k. C142 - Test Method for Clay Lumps and Friable Particles in Aggregates.
l. C143 - Test Method for Slump of Hydraulic Cement Concrete.
m. C150 - Portland Cement.
n. C172 - Practice for Sampling Freshly Mixed Concrete.
o. C192/C192M - Practice for Making and Curing Concrete Test Specimens in the Laboratory.
p. C231 - Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
q. C233 - Test Methods for Air-Entraining Admixtures for Concrete.
r. C260 - Air-Entraining Admixtures for Concrete.
s. C289 - Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method).
t. C309 - Liquid Membrane-Forming Compounds for Curing Concrete.
u. C430 - Test Method for Fineness of Hydraulic Cement by the 45µ (No. 325) Sieve.
v. C494 - Chemical Admixtures for Concrete.
w. C566 - Test Method for Total Evaporable Moisture Content of Aggregate by Drying.
x. C595/C595M - Blended Hydraulic Cements.
y. C618 - Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
z. C881 - Epoxy-Resin-Base Bonding Systems for Concrete.
aa. C1012 - Standard Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution
bb. C1107 - Packaged Dry, Hydraulic Cement Grout (Nonshrink).
cc. C1193 - Guide for Use of Joint Sealants.
dd. C1218 - Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
ee. C1260 - Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ff. C1293 - Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction
gg. C1315 - Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
hh. C1567 - Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
ii. C1602 – Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
jj. C1778 - Standard Guide for Reducing the Risk of Deleterious Alkali-Aggregate Reaction in Concrete
kk. D1751 - Preformed Expansion Joint Filler for Concrete Paving and Structural Construction. (Nonextruding and Resilient Bituminous Types).
ll. D1752 - Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

3. Concrete Plant Manufacturers Bureau (CPMB):
   a. 100 - Concrete Plant Standards.

b. 102 - Recommended Guide Specifications for Batching Equipment and Control Systems in Concrete Batch Plants.

4. Plant Mixer Manufacturers Division (PMMD):
   a. 100 - Concrete Plant Mixer Standards.
5. Federal Specification (FS):
   a. SS-S-200 - Sealants, Joint: Two-Component, Jet-Blast-Resistant, Cold-Applied, for Portland Cement Concrete Pavement.
   b. TT-S-227 - Sealing Compound: Elastomeric Type, Multi-Component (for Calking, Sealing, and Glazing in Buildings and Other Structures).
6. National Bureau of Standards (NBS) Specifications for Scales.
7. Truck Mixer Manufacturers Bureau (TMMB):
   a. Truck Mixer, Agitator and Front Discharge Concrete Carrier Standards.

1.05 SUBMITTALS:

A. Submit as specified in Division 01.

B. Include, but not limited to, product data and Shop Drawings of the following:
   1. Nonshrink grouts.
   2. Admixtures.
   3. Bonding agents.
   4. Curing agents.
   5. Floor hardeners, sealers, and coloring compounds
   6. Expansion joint materials.
   7. Formwork spray agents.
   8. Joint sealants.
   9. Waterstops.
   10. Construction joint layout plan.
   11. Concrete pour sequence plan.

C. Mill Certificates:
   1. Submit to Engineer a minimum of one copy for each cement shipment.

D. Concrete Mix Design:
   1. Submit the following test data for each mix design for approval prior to placing concrete. Resubmit for any change in each mix design
      a. Concrete:
         (1) Fine and coarse aggregate, water, and cement sources.
         (2) Mix proportions, slump, and air content.
         (3) Data on 30 consecutive satisfactory compressive strength tests and standard deviation calculations, laboratory trail batch strength curves.
            (a) Strength tests shall include any Type D admixtures used in final mix design.
         (4) Dry shrinkage test results
      b. Cement:
         (1) Mill certificate.
         (2) ASTM C430.
      c. Fine Aggregate:
         (1) ASTM C33.
         (2) ASTM C40.
         (3) ASTM C88.
         (4) ASTM C117.
         (5) ASTM C136.

(6) ASTM C142.
(7) Fineness modulus.
(8) ASTM C1260 or approved service records.

d. Coarse Aggregate:
(1) ASTM C33.
(2) ASTM C88.
(3) ASTM C136.
(4) ASTM C142.
(5) ASTM C1260 or approved service records.

E. Construction Joint layout
1. Dimensioned drawings showing location of all wall and slab construction joints.

1.06 QUALITY ASSURANCE:

A. Field Testing: Shall be performed by an ACI Concrete Field-Testing Technician Grade 1.
1. Reference Section 3.09 for concrete testing requirements.

B. Submit qualification records of field testing technicians prior to placing concrete.

PART 2 - PRODUCTS

2.01 CONCRETE:

A. Materials:
1. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
a. Portland cement shall conform to ASTM C595 Type IL. Supplement with the following:
(1) 15 to 25% Fly ash may be used as the pozzolan. Fly ash shall conform to ASTM C618, Class F.
(2) Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120. Content shall not exceed 50% of total cementitious content.
b. The maximum amount retained on the No. 325 sieve shall be 10% as determined in accordance with ASTM C430.
c. The maximum amount of alkalis ($NA_2O + 0.658\ K_2O$) shall be 0.60% determined in accordance with ASTM C114.
d. Use one brand of cement throughout the Project unless otherwise approved by Engineer.
2. Fine Aggregate:
a. Conform to ASTM C33.
b. Fineness modulus shall be between 2.3 and 3.1.
c. Approved service record of 3 years with a history indicating that the fine aggregate is not chemically reactive.
d. For a new fine aggregate source, or when 3 years' approved service records are not available, or when the service records are unacceptable; the aggregate shall be evaluated for potential reactivity. Aggregate must be considered innocuous in accordance with petrographic examination by ASTM C295 or when tested in accordance ASTM C1260.
e. Fine aggregate considered deleterious or potentially deleterious shall not be used without approval.
f. Maintain fine aggregate free of ice and frozen lumps.
3. Coarse Aggregate:

a. Conform to ASTM C33.
(1) Limits for deleterious substances and physical property requirements shall conform to Table 4 and applicable class designation 5S, 5M, or 1N.
b. Approved service record of 3 years with a history indicating that the coarse aggregate is not chemically reactive.
c. For a new coarse-aggregate source, when 3 years' approved service records are not available, or when the service records are unacceptable; the aggregate shall be evaluated for potential reactivity. Aggregate must be considered innocuous in accordance with petrographic examination by ASTM C295 or when tested in accordance with ASTM C1260.
d. Coarse aggregate considered deleterious or potentially deleterious shall not be used without approval.
e. Maintain coarse aggregate free of ice and frozen lumps.
f. Grading Requirements:
(1) Size No. 57, from 1-inch to No. 4 sieve for all concrete unless otherwise specified.
(2) From 3/8-inch to No. 4 sieve for topping concrete.

4. Mixing Water:
a. Only potable water will be acceptable.
5. Admixtures:
a. Water-Reducing Type:
(1) Conform to ASTM C494, Type A, D, F, and G.
(2) Conform to manufacturer's recommendations for use.
(3) Technical assistance of the manufacturer's field representative shall be furnished upon request.
b. Air-Entraining Type:
(1) Conform to ASTM C260.
(2) Conform to manufacturer's recommendations for use.
(3) Technical assistance of the manufacturer's field representative shall be furnished upon request.
c. Color: For electrical duct banks only, use a red dye additive mixed into the concrete.
d. Admixtures shall not contain any chloride ions.
e. Storage: Admixtures shall be stored in such a manner as to avoid contamination, evaporation, freezing, temperature changes, settling, or any damage which would adversely affect their characteristics.

B. Laboratory Testing of Materials for Use in Concrete:
1. An approved independent testing laboratory shall be selected and paid by Contractor to perform all required laboratory tests of materials proposed for use in the production of concrete and to determine mix proportions when laboratory trial batches are required.

C. Concrete Qualities Required:
1. Minimum 28-day compressive strength:
a. Structural concrete for liquid-holding structures: 4,500 psi.
b. Structural concrete for all construction unless otherwise indicated: 4,000 psi.
c. Roof Topping: 4,000 psi
d. Electrical Duct Banks: 4,000 psi
e. Pavements, Curbs, Gutters, Sidewalks, and drainage pavements: 4,000 psi.
f. Concrete Fill: 2,000 psi.

g. Compressive-strength determinations shall be made from 4-inch diameter by 8-inch long or 6-inch diameter by 12-inch long concrete cylinders tested in accordance with ASTM C39.

2. Concrete Slump:
   a. All concrete unless otherwise indicated: 2 to 4 inches prior to the addition of water reducing admixtures.
   b. Roof Topping: 4 to 6 inches.
   c. Electrical Duct Banks: 4 to 6 inches.
   d. Slump of concrete shall not exceed 8 inches including the effects of all water reducing admixtures.
   e. Slump of concrete shall be tested in accordance with ASTM C143. If the contractor wishes to use a mix with a slump outside the range listed above, the written approval from the engineer of record is required prior to mix design submittal.
3. Air Content:
   a. Structural concrete and all concrete unless otherwise indicated: 6% ±1.5%.
   b. Interior concrete slabs receiving vehicular or pedestrian traffic: 3% maximum.
   c. Roof Topping: 6% ±1.5%.
   d. Pavements, Curbs, Gutters, Sidewalks, and drainage pavements: 6% ±1.5%.
   e. Testing shall be in accordance with ASTM C231.
4. Water-Cement Ratio:
   a. In addition to the aforementioned requirements, water-cement ratios shall be limited as follows:
      (1) Water and Chemical Containing Elements: 0.40
      (2) All other elements: 0.45
5. Dry shrinkage shall not exceed 0.040 percent when tested in accordance with ASTM C157 for concrete used in liquid and chemical retaining structures.
6. Chloride Ion Content:
   a. Maximum water-soluble chloride ion content, in percent by weight of cement:
      (1) 0.10 for all concrete unless otherwise specified.
   b. Testing shall be in accordance with ASTM C1218.

D. Mix Proportions:
1. Concrete shall be homogeneous, readily placeable, uniformly workable, and finishable; proportioned to conform to ACI 211.1.
   a. Mix proportions for all concrete, unless otherwise specified, shall be selected preferably on the basis of field experience; but in the case where sufficient or suitable strength test data is not available, concrete shall be proportioned on the basis of laboratory trial mix design.
   b. Field experience using test results within the preceding year, with the materials and plant to be employed may be the basis of mix proportioning, provided that not less than 30 consecutive satisfactory compressive strength tests on concrete using the proposed materials with a similar mix are available. A compressive strength test is defined as the average 28-day compressive strength of two 6-inch by 12-inch or three 4-inch by 8-inch companion cylinders made conforming to ASTM C172 and ASTM C31 and tested conforming to ASTM C39
      (1) The standard deviation of compressive strength tests shall be computed as a basis for design of the mix. The design average compressive strength shall exceed the specified strength by at least:
         (a) 400 psi if standard deviation is less than 300 psi
         (b) 550 psi if standard deviation is 300 to 400 psi.

(c) 700 psi if standard deviation is 400 to 500 psi.
(d) 900 psi if standard deviation is 500 to 600 psi.
(e) 1,200 psi if standard deviation is greater than 600 psi.

c. Laboratory Trial Batch: When laboratory trial batches are used as a basis for determining mix proportions, all such Work shall be performed by the laboratory as specified in PART 2, Paragraph 2.01.B. - Laboratory Testing of Materials for Use in Concrete, this Section.
(1) Laboratory trial batches shall be used to establish a water-cement ratio, compression-strength curve, with at least three points, each representing the strength of a separate trial batch. At least one point shall be above and one below the strength required. Each point on the curve shall represent the average of at least three cylinders tested at 28 days or an earlier age when approved by Engineer. The slump and air content shall be at the maximum limits specified in PART 2, Paragraph 2.01.C. - Concrete Qualities Required, this Section.
(2) A point on the water-cement ratio, compressive-strength curve shall be selected that will provide an average compressive strength at least 1,200 psi greater than the specified minimum strength.
(3) Laboratory trial batches shall be used to determine the drying shrinkage of concrete trial mixes. A drying shrinkage test shall be conducted for every mix design proposed for the project. Drying shrinkage tests shall be conducted including all admixtures required in proposed mix designs. Three test specimens shall be prepared for each drying shrinkage test. Test specimens (4 inch by 4 inch by 11 inch prisms) shall be molded, cured, dried, and measured in accordance with ASTM C157 except with modifications listed below.
(a) After 7 days in the lime saturated water the specimen shall be removed and measured to determine the base length for drying shrinkage calculations. This point shall be considered day zero for time measurement. Specimens shall be immediately placed in a humidity-controlled room maintained at 73° F, ±3°F and 50 percent, ±4 percent relative humidity for the remainder of the test (21 days after day zero measurement). Final length measurement shall be conducted at 28 days after the addition of water to the cement during the mixing operations.

2. Mix proportions for roof or floor topping course:
a. Max Aggregate size 3/8-inch.
b. Minimum 28-day Compressive Strength: 4000 psi.
c. Maximum water cement ratio: .42
d. Maximum concrete slump of 4 inches.

E. Mixing and Delivery:
1. Conform to ACI 304R.
a. Ready-mixed concrete shall be produced and delivered conforming to ASTM C94 as applicable.
2. Cement temperature, when added to mix, shall not exceed 170ºF (77ºC).
3. Adjust the amount of mix water to compensate for the moisture content of the aggregates.
4. Concrete Plant:
a. Conform to "Concrete Plant Mixer Standards" of the Plant Mixer Manufacturers Division, Concrete Plant Manufacturers Bureau, and "Concrete Plant Standards" of the Concrete Plant Manufacturers Bureau.

b. Water added to concrete having a slump below the specified minimum shall be at Contractor's risk. If the water added produces a slump greater than the specified maximum, the concrete will be rejected. If water is added, the concrete shall be remixed for a minimum of 25 revolutions. Water shall not be added after the truck mixer has begun to discharge concrete.

c. Contractor shall furnish Owner with a concrete delivery ticket for each load of concrete. The ticket shall have the following information recorded:
   (1) Serial number of tickets.
   (2) Time batched.
   (3) Time arrived on jobsite.
   (4) Specified compressive strength of concrete at 28 days.
   (5) Amount of concrete (by volume).
   (6) Batch weights of all cementitious materials, aggregates, admixtures, and water.
   (7) Mix number.
   (8) Amount of water with-held (by volume).
   (9) Amount of all water added at jobsite by Contractor.
   (10) Name of ready-mix batch plant.
   (11) Date.
   (12) Truck number.
   (13) Name of purchaser.

5. Plant and truck mixer uniformity shall be tested according to ASTM C94. Frequency of tests shall be as specified in PART 3, this Section.

2.02 GROUT:

A. Grout for Dry Packing:
   1. Volume: 1 part Portland cement to 2 parts sand.
   2. Required for setting handrail posts, for setting equipment recommended by the manufacturer to be set with nonshrinking grout, and in other places indicated.
   3. Grout shall be nonmetallic and conform to ASTM C1107.
   4. Prepare and place conforming to manufacturer's printed instructions.
   5. For equipment bases, the concrete surfaces shall be grit blasted or roughened with a chipping hammer prior to grouting. The foundation plates shall be cleaned of any grease, oil, paint, primers, or epoxy coatings.

B. Grout for tie-hole patching:
   1. Dayton Superior 1107 Advantage Grout.
   2. Euclid Chemical, Speed Plug.
   3. W.R Meadows, Meadow-Plug.
   4. Engineer approved equal.

C. Grout for Bonding:
   1. Proportion (by weight): 1 part cement to 1-1/2 parts sand.
   2. Keep water to a minimum.

2.03 BONDING AGENT:

A. Provide moisture-insensitive, epoxy-resin bonding agent conforming to ASTM C881, Type V.

2.04 CONCRETE ACCESSORIES:

A. PVC Waterstops:
   1. Serrated virgin polyvinyl chloride equal to one of the following:

a. CJ-17: 9" Base Seal Waterstop
   (1) Sika Greenstreak Style 771
   (2) Vinylex Style BS9532
   (3) Engineer approved equal.
b. CJ-1, CJ-6, CJ-8 or CJ-10: 4" ribbed with center bulb
   (1) Sika Greenstreak Style 702
   (2) Vinylex Style RB4316
   (3) Engineer approved equal.

2. Provide factory fabricated waterstop corner transitions and intersections leaving only straight butt joint splices for the field.
3. Use for all locations unless otherwise specified.

B. Plastic Waterstops:
1. Non-swelling, Mastic/Asphaltic Waterstop:
   a. Greenstreak, Inc. - Lockstop.
   b. Henry Company - Synko-Flex (SF302).
2. Provide all accessories as recommended by the manufacturer including, but not limited to, primers, adhesives, and sealants to ensure watertight construction. Install per manufacturer's written instructions and recommendations.

C. Expansion Joints:
1. Expansion Joint Filler: Premolded cork of thickness indicated and conforming to ASTM D1752, Type III, self-expanding cork. Unless indicated to be asphalt-impregnated fiber.
2. Expansion Joint Filler: Preformed asphalt-impregnated fiber of thickness indicated and conforming to ASTM D1751. Use where indicated.
3. Bond Breaker: Polyethylene tape or other plastic tape as recommended by sealant manufacturer.
4. Sealant Backer Rod: Provide closed cell backer rod or other backing material as recommended by sealant manufacturer.
5. Joint Sealants:
   a. Multi-component sealant as follows:
      (1) Joint Sealant - General Use:
         (a) BASF Building Systems: Sonneborn Sonolastic NP 2 (vertical use) and Sonolastic SL 2 (horizontal use).
         (b) Epoxy Systems Products Company: Product #11.
         (c) Euclid Chemical Company: Eucolastic II.
         (d) Pecora Corporation: NR-200, Dynatred.
      (2) Joint Sealant - Wastewater Treatment and Storage Facilities:
         (a) BASF Building Systems: Sonneborn Polysulfide Sealant.
         (b) Pecora Corporation: Synthacalc GC2+.
         (c) Sika Corporation: Sikaflex-2c NS.

D. Preformed Contraction Joints: Zip Joint T-shaped plastic strip as manufactured by BoMetals, Inc., Powder Springs, Georgia. Depth of preformed construction joint shall exceed 1/4 of the slab thickness.

2.05 CURING AGENT:

A. Apply to all concrete surfaces unless otherwise indicated or specified.
B. Curing agent shall conform as follows:
1. ASTM C309, Type 1: Use where concrete surface is not exposed to direct sunlight after placement and for conditions where hot concreting does not apply.

2. ASTM C309, Type 1-D: Use where slabs are exposed to direct sunlight for a period of seven days minimum after placement. Curing and sealing agent with fugitive dye shall be readily distinguishable upon the concrete surface for at least four hours after application but shall be inconspicuous within seven days after application.
3. ASTM C309, Type 2: Use as specified in PART 3, Article 3.05 - Hot Weather Concreting, this Section.

C. Curing compound used on floors to be sealed, painted, tiled, topped, dampproofed, waterproofed, or covered with resilient floor covering shall be guaranteed not to interfere with application of sealer, paint, tile mortar, or tile adhesive after a 28-day curing period.

2.06 CONCRETE FLOOR CURING AND SEALING AGENT:

A. Apply to all interior concrete floor surfaces subject to vehicle or pedestrian traffic (not for liquid retaining basin slabs).
B. Curing and sealing agent shall conform as follows:
1. ASTM C1315, Type I, Class A: Use where slabs are not exposed to direct sunlight after placement and for conditions where hot concreting does not apply.
2. ASTM C1315, Type II, Class A: Use as specified in PART 3, Article 3.05 - Hot Weather Concreting, this Section.
C. Apply as soon as possible and in conformance with manufacturer's written instructions.

2.07 CONCRETE FLOOR HARDENER:

A. Apply to all interior concrete floors.
B. Liquid floor hardener shall be one of the following:
1. Tamms Industries - Clearseal WB300.
2. L&M Construction Chemicals, Inc. - Chem Hard.
3. ChemRex, Inc. - Sonneborn Sonosil.
4. Euclid Chemical Company - Euco Diamond Hard.
C. Apply as soon as possible and in conformance to manufacturer's recommendations.

PART 3 - EXECUTION

3.01 PREPARATION FOR CONCRETE PLACEMENT:

A. Openings Through Concrete: Provide openings through concrete as indicated and for the proper installation of all equipment, piping, wiring, ductwork, and similar items, installed under this Contract. Form all openings prior to placement of concrete unless noted otherwise.
B. Installation of Embedded Items:
1. Provide for accurate installation of embedded items installed under this Contract.
2. Securely fix floor drains in place to prevent flotation while placing concrete. Uniformly and accurately slope finish floor slab toward the drains.
3. Embedded items shall be as indicated or specified, or as selected by Contractor and approved by Engineer.
4. During cold weather, protect pipe sleeves, shear pockets, and blockouts from moisture which may freeze, expand, and crack the sleeve, pocket or blockout and concrete structure.
5. Grease or tape anchor bolt threads to protect from concrete splatter.
C. Installation of Joints:
1. Construction Joints:
a. Location:

(1) Locate joints, which are not indicated or specified, in conformance with ACI 318.
(2) Unless noted otherwise, construction joints shall be spaced no more than 25'-0" apart in vertical walls only. Flatwork or slabs may be placed in sections with a maximum area of 3000 square ft and a maximum aspect ratio of 1:1.5 (width:length).
(3) Obtain Engineer's approval of joints located by Contractor prior to preparation of reinforcing steel drawings.

b. Preparation and Installation:
(1) Clean and break laitance or other foreign material from bonding surface.
(2) Tighten forms remaining in place (where applicable) to prevent seepage between forms and hardened concrete.
(3) Provide waterstops as indicated or specified and as required in any new construction joint requested by Contractor.

c. Waterstops:
(1) Install in all construction joints where indicated.
(2) Install conforming to manufacturer's printed instructions. All joints and splices of PVC waterstop shall be 100% fused. Use thermostatically controlled splicing iron as recommended by manufacturer.

2. Expansion Joints:
a. Install filler, backer rod and sealant in strict conformance with manufacturer's written instructions.
b. Reinforcing steel shall not extend through expansion joints unless indicated otherwise.
c. Attach rigid joint filler to the face of the joint prior to placing adjacent concrete. The filler shall occupy the entire width of the joint.
d. Install sealant backer rod for sealant except where indicated to be omitted. Install bond breaker where indicated.
e. Clean joints surfaces immediately before application of sealant.
f. Install joint sealants to conform to ASTM C1193. Tool sealants to provide smooth, uniform bead with a slightly concave surface, eliminate air pockets, and ensure sealant contact and adhesion with sides of joint.
g. Protect joints from moisture and ice during freezing.

3. Contraction Joints: As specified in this PART 3, Article 3.03 - Finishing, this Section.

D. Cutting and Bonding to Existing Concrete:
1. Cutting Existing Concrete:
a. Use methods and equipment that will avoid damage to adjacent parts of the structure from heavy blows or vibration.
b. Cut existing concrete with power concrete saw where possible to prevent spalling and chipping and to form neat, straight edge.
c. Remove all loose or cracked concrete resulting from cutting existing concrete, leaving only sound, undamaged concrete adjacent to new Work.
d. Leave access opening edges with a neat, true grout surface to the opening size indicated.
e. Cut reinforcing steel with sufficient length remaining (approximately 38 bar diameters) for bending and lapping into new construction.

2. Bonding to Existing Concrete:
a. Roughen concrete to 1/4-inch (6-mm) amplitude by use of a pneumatic chipping hammer or other approved means.

b. Thoroughly clean the concrete surface and apply the bonding agent in accordance with manufacturer's written instructions.

3.02 PLACING OF CONCRETE:

A. Conventional Placing:

1. General Requirements:
   a. Conform to ACI 304R.
   b. Bonding surfaces, including reinforcement, shall be clean, free of laitance and foreign materials.
   c. Place concrete on properly prepared and unfrozen subgrade and only in dewatered excavation and forms.
   d. Use forms for all concrete except where otherwise indicated or specified.
   e. Do not place concrete that has partially hardened or has been contaminated by foreign materials.
   f. Prevent mud or foreign materials from entering the concrete or forms during placement operations.
2. Conveying:
   a. Convey concrete from the mixer and deposit in place by methods which will prevent the segregation or loss of materials.
   b. Equipment for chuting, pumping, and pneumatically conveying concrete shall be of such size and design as to provide a practically continuous flow of concrete at the delivery end.
   c. Aluminum conveying equipment shall not be used.
3. Depositing:
   a. Place concrete in continuous horizontal lifts not to exceed 2 feet, and place concrete against bulkheads and keyways at vertical joints.
   b. Maximum free drop of concrete and grout for bonding shall be 5 feet, in walls 10 inches or less in thickness, with 1-foot additional drop allowed for each inch of wall thickness over 10 inches, with a maximum drop of 10 feet.
   c. When vapor barrier is used, keep lapped joints closed and take precautions to avoid puncturing the barrier.
4. Consolidation of Concrete:
   a. Consolidate concrete in conformance with ACI 309R. Characteristics and application of concrete vibrators shall be as set forth in Table 5.1.5.
   b. Provide an adequate number of vibrators of sufficient capacity to keep up with the maximum rate of concrete placement. Keep on hand adequate standby equipment in good operating condition.
   c. Vibrate concrete only until the concrete is thoroughly consolidated and the voids filled, as evidenced by the leveled appearance of the concrete at the exposed surface and the embedment of the surface aggregate.
   d. Insert internal vibrators vertically to the full depth of the layer being placed and into the previous layer. Do not drag vibrators through the concrete. Insert and withdraw vibrator slowly with the vibrator running continuously so that no hole will be left in the concrete. Do not flow concrete from one location to another by use of a vibrator.
   e. Consolidate concrete layer to full depth when using a surface vibrator. Use thinner layers or a more powerful vibrator if necessary to achieve complete consolidation.
   f. Use form vibrators only where sections are too thin or where sections are inaccessible for internal vibrators.

5. Time Requirements:
   a. Place concrete at a sufficient rate to assure that lifts below have not taken initial set before fresh concrete is deposited.
   b. Place concrete within 45 minutes after mixing. This period may be extended to 1 hour and 30 minutes provided that the combined air temperature, relative humidity, and wind velocity are such that the plasticity of the fresh concrete is satisfactory for placement and consolidation, and that the specified mixing water is not exceeded. Concrete which has partially set shall not be retempered but shall be discarded.

B. Placing Concrete at Joints:
1. Take precautions to ensure tight, well-bonded construction joints with no air pockets or voids.
2. Take special precautions to avoid bending or displacing waterstop while placing concrete around it.
3. Delay construction at a joint a minimum of 16 hours where placement is continued past joint, except where otherwise indicated.

3.03 FINISHING:

A. Unformed Surfaces:
1. Screed Finish:
   a. Use as first stage for all concrete finishes.
   b. Use as final finish on surfaces that will be covered by additional concrete, grout placement, or mortar setting bed except as otherwise specified.
   c. Immediately after screeding, use a wood float, darby, or bullfloat to eliminate high and low spots and to embed large aggregate. This shall be done in a manner to produce even, uniform surfaces so that surface irregularities do not exceed 3/8 inch in 10 feet when used as final finish.
2. Floated Finish:
   a. Use as second stage of broomed, troweled, or magnesium-troweled finish.
   b. Use as final finish on all areas to receive built-up roofing.
   c. Float with mechanical float. Hand floating will be permitted only in areas inaccessible to mechanical float.
   d. On surfaces not to receive troweled finish, finish with wood or cork float after mechanical floating to a true uniform surface so that surface irregularities do not exceed 1/8 inch in 10 feet, except at floor drains.
3. Broomed Finish:
   a. Use as final finish on all outdoor slabs including pavements, sidewalks, loading docks, and equipment pads.
   b. After floated finish, draw a stiff bristle broom across the surface making uniform corrugations, perpendicular to the direction of traffic, not more than 1/16 inch deep.
4. Troweled Finish (Steel Trowel Finish):
   a. Use as final finish on inside floors and on all other unformed surfaces not otherwise indicated or specified.
   b. Trowel with mechanical steel trowel to obtain a smooth, dense finish. Hand steel trowel shall be used in areas not accessible by mechanical trowel. The final troweling shall be done after the concrete has become hard enough so that no mortar adheres to the edge of trowel and a ringing sound is produced as the trowel passes over the surface.

c. Do not trowel before surface water has evaporated or has been removed with a squeegee.
d. Finish to a true uniform surface so that surface irregularities do not exceed 1/8 inch in 10 feet, except at floor drains.
e. Do not add sand or cement to the floor surface.

5. Contraction Joints:
   a. Locate as indicated.
   b. Maintain true alignment with straightedge.
   c. Joints shall be grooved except where sawed joints are indicated.
      (1) Slab on grade joints shall be sawed.
   d. Grooved (Tooled) Joints:
      (1) Perform during the finishing process.
      (2) Width of groove shall not exceed 1/4 inch (6 mm).
      (3) Depth of groove shall be at least 1 inch (25 mm).
   e. Sawed Joints:
      (1) Cut joints with power blade as soon as concrete surface is firm enough to resist tearing or damage by the blade and before random shrinkage cracks can occur. (Usually required 4 to 12 hours after finishing.)
      (2) Make joints approximately 1/8 inch (3 mm) wide with depth equal to 1/4 the slab thickness unless otherwise indicated.
      (3) Seal where indicated with the same type sealant specified for expansion joint sealant.
6. Floor Flatness and Levelness:
   a. Applicable for steel and magnesium troweled finish floors, and other floors as indicated or specified.
   b. Finish to a true uniform surface so that surface irregularities do not exceed 1/8 inch in 10 feet, except at floor drains.

B. Formed Surfaces:
1. Repair surface defects as specified in PART 3, Paragraph 3.03.C. - Repair of Defective Surfaces, this Section.
2. Burlap (Rubbed) Finish:
   a. Apply burlap surface treatment to the following formed surfaces:
      (1) Concrete exposed to public view.
      (2) Concrete that is to be painted.
   b. Remove forms as soon as permitted in accordance with Section 03 10 00.
   c. Wet and fill all voids using mortar with the same sand-cement ratio as original concrete. Blend with white cement to match concrete color.
   d. Strike off all excess mortar flush with the surface using a burlap or canvas cloth with a circular motion.
   e. Remove all rough spots and rub with cloth to leave a surface of uniform texture and appearance.
   f. Finish shall result in a coating of mortar that will fill all small voids and air holes, leaving a smooth surface.
   g. Cure as specified in this PART 3, Article 3.04 - Curing, this Section.

C. Repair of Defective Surfaces:
1. Defined as any concrete surface showing misalignment, rock pockets, poor joints, holes from ties, voids, honeycomb, or any other defective area at time of form removal.
2. Repairing:
   a. Repair as soon as forms have been removed.

b. Chip surface back to minimum depth of 1/2 inch, chip edges perpendicular to surface, prewet depression and brush with neat cement immediately before patching.
c. Patch surfaces using stiff mortar with same sand-cement ratio as original concrete and with minimum water for placing. Blend with white cement to match concrete color.
d. Compact mortar into depressions so that after curing, hole is filled and mortar is flush with surface. Use hammer and ramming rod for compacting the holes.
e. Moist-cure for 3 days or use curing compound.
f. Engineer shall be notified of areas containing defects or where reinforcing steel is exposed, prior to determination of repair method.

3.04 CURING:

A. Cure concrete by one of the following methods in accordance with ACI 308.1:
1. Leaving in forms for a minimum of 7 days when the temperature is at least 50°F. When temperatures are below, follow requirements of cold weather concreting.
2. When absorbent wood forms are used, keep formwork wet until removed.
3. Use of saturated bats, soaker hoses, or sprinkler for a minimum of 7 days. Keep concrete continuously wet.
4. Using polyethylene sheets applied in full contact with surfaces.
5. Using liquid membrane forming compound:
a. Formed Surfaces: Apply (2) coats on all surfaces immediately after removal of forms. Apply the second coat in a direction perpendicular to the first coat.
b. Unformed Surfaces: Apply (2) coats after the concrete has been finished and is hardened sufficiently to walk on. Apply second coat in a direction perpendicular to the first coat.
6. Curing of concrete during hot or cold weather shall conform to PART 3 - Hot Weather Concreting and Cold Weather Concreting, this Section.

3.05 HOT WEATHER CONCRETING:

A. Work shall conform to all requirements of ACI Specification 305.1, Specification for Hot Weather Concreting, except as modified by these contract documents.
B. Follow the requirements of ACI 305.1 if any of the following conditions occur:
1. When the temperature is 90ºF or above.
2. When the temperature is likely to rise above 90ºF within the 24-hour period after concrete placement.
3. When there is any combination of high air temperature, low relative humidity, and wind velocity which would impair either concrete strength or quality.
C. Fresh concrete shall have a maximum temperature of 95ºF at time of discharge.
D. Dampen subgrade and forms with cool water immediately prior to placement of concrete.
E. Protect freshly placed concrete immediately after placement so that the rate of evaporation as determined by ACI 305.1 Equations 3.1.3 does not exceed 0.2 pound per square foot per hour.
F. Protect concrete with suitable insulation if rapidly decreasing nighttime temperatures occur, which would cause thermal shock to concrete placed during warm daytime temperatures.
G. Protect the concrete with temporary wet covering during any appreciable delay between placement and finishing.
H. Begin curing unformed surfaces immediately after finishing and continue for 24 hours. Curing shall consist of application and maintenance of water-saturated material to all exposed

surfaces; horizontal, vertical, and otherwise. After the 24-hour interval, continue curing using one of the following methods:

1. Moist curing for 6 days.
2. Application of one coat of curing compound as specified.
3. Application and maintenance of curing paper or heat-reflecting plastic sheets for 6 more days.

I. Strip forms and apply curing compound as specified. Do not allow concrete surfaces to dry prior to application of curing compound.

3.06 COLD WEATHER CONCRETING:

A. Work shall conform to all requirements of ACI 306.1, Standard Specification for Cold Weather Concreting, except as modified by the requirements of these Contract Documents.
   1. Modification to Section 3.2.2: Temperature shall be measured twice per day until protection may be terminated
   2. Modification to Section 3.4.5: Refer to Section 03 10 00 to determine when forms may be removed.

B. Follow the requirements of ACI 306.1 if any of the following conditions apply:
   1. When the temperature is 40ºF or is likely to fall below 40ºF during the 24-hour period after concrete placement.

C. Minimum temperature for concrete as mixed shall be as indicated in Table 3.2.1 of ACI 306.1. Maximum temperature for concrete as mixed shall be 20ºF greater than the corresponding minimum temperature, unless a higher temperature is required by an accepted curing method.

D. Place and maintain concrete so that its temperature is never less than the temperature indicated in Table 3.2.1 of ACI 306.1. Maintain the required temperature for the time duration indicated on Tables 5.1 and 7.1 of ACI 306R.

E. Monitor temperature of concrete in place at corners or edges of formwork as applicable.

F. Air Heaters:
   1. Do not expose concrete to carbon monoxide or carbon dioxide fumes from heaters or engines.
   2. Salamanders will not be permitted.
   3. Heaters shall be indirect fired heaters which use a heat exchanger to avoid direct contact with combustion air or portable hydronic heaters.
   4. Personnel shall be present at all times to maintain safe, continuous operation of heating system.

G. Control temperature and humidity of protected concrete so that excessive drying of concrete surfaces does not occur.

H. Calcium chloride will not be permitted as a concrete accelerator or to thaw frozen subgrade prior to concrete placement.

I. The maximum allowable temperature drop during the first 24-hour period after protection is discontinued shall be as indicated on line 1 of Table 5.1 of ACI 306R.

J. Cure the concrete in accordance with Chapter 10 of ACI 306R.

3.07 LOW-STRENGTH CONCRETE:

A. Low-Strength Concrete:
   1. Defined as either:
      a. Concrete whose average, of any sets of three consecutive 28-day compressive strength tests, is below the required 28-day strength.

b. Concrete whose individual 28-day strength test (average of two 6-inch by 12-inch cylinders or three 4-inch by 8-inch cylinders) is more than 500 psi below the required 28-day strength.

2. Should concrete meet either definition of low-strength concrete as a minimum, the Contractor shall take the following steps:
   a. Increase the cement content. The increase shall be based on a statistical evaluation of the strength data, the design water-cement ratio, compressive-strength curve, and acceptable mix-design literature as follows:
      (1) If sufficient concrete has been furnished to accumulate 30 tests, these should be used to establish a new target average strength in accordance with ACI 318, Section 5.3.
      (2) If less than 30 tests have been made, the new target average strength should be at least as great as the average strength used in the initial selection of the mix proportions. Increase the target average strength based on a statistical evaluation of the available strength data, the design water-cement ratio, compressive-strength curve, and acceptable mix-design literature. If the statistical average equals or exceeds the initial mix-design level, a further increase in the average level is required.
   b. Remove and replace with acceptable concrete when the quality and location of the low-strength concrete is such that Engineer considers the strength or durability of the structure is impaired and so orders.
3. Low-strength concrete shall be considered defective Work as defined in General Conditions.

B. Potentially Low-Strength Concrete: Defined as concrete whose 7-day test (average of two 6-inch by 12-inch cylinders or three 4-inch by 8-inch cylinders) is less than 70% of the specified minimum 28-day compressive strength.

C. Construction delays caused by low-strength or potentially low-strength concrete shall not relieve Contractor from responsibility for late completion even though extensions of time may be granted.

3.08 MISCELLANEOUS CONCRETE ITEMS:

A. Concrete Seal Slab (Mud Slab):
1. Apply to the ground surface immediately beneath all "on-grade" slabs and footings where indicated or specified.
2. Seal slab shall consist of a concrete slab of the thickness indicated but not less than 2 inches.
3. Accurately screed so that the top of the seal slab will not be higher than the bottom elevation of structural slabs or footings to be placed thereon.
4. Do not place seal slab until after all excavating in the area have been completed and all drain lines, conduits, and other items under the area are completed and properly backfilled and compacted.

B. Equipment Bases:
1. Construct equipment bases, pads, and foundations as indicated or, when not indicated, conforming to equipment manufacturer's requirements.
2. Reinforce conforming to typical detail unless otherwise indicated.
3. Equipment bases shall include concrete, reinforcing steel, form work as required, and anchor bolts. Place grout for equipment installed under this Contract.
4. Finish top area of bases between anchor bolts and forms with a troweled finish.

3.09 TESTING:

A. Field Testing of Concrete Plant and Mixing Trucks:
   1. The concrete plant shall be inspected and tested to ensure conformance with ACI 304R and the "Concrete Plant Standards of the Concrete Plant Manufacturers Bureau." The scales shall be calibrated at the initial setup and at 3-month intervals thereafter.
   2. Mixing trucks shall be inspected and tested to ensure conformance with ACI 304R and "Truck Mixer and Agitator Standards of the Truck Mixer Manufacturers Bureau" of the National Ready-Mix Concrete Association. Tests shall be done at initial setup and every 3 months thereafter.
   3. Submit test reports when requested.

B. Construction Testing Service
   1. Owner shall select an independent material testing service for field testing. The material testing service shall furnish test equipment, test cylinder molds, and certified personnel to perform all required field tests, make the required concrete test cylinders, and deliver test cylinders to the testing laboratory. The prescribed tests shall be made in the presence of or with the concurrence of the Owner.
   2. Contractor shall schedule and coordinate with the independent testing service.
   3. Field testing shall be paid for by the contractor using the Inspection and Testing Allowance.
   4. If additional compressive strength tests are desired by the contractor to obtain additional data points for scheduling purposes the contractor shall pay for the additional tests.

C. Field Testing of Concrete and Making of Concrete Test Cylinders:
   1. Field testing personnel shall be on Site throughout placement of concrete.
   2. Concrete sampling for tests and cylinder making shall be done conforming to ASTM C172. Samples shall be taken at random and at the point of truck discharge.
   3. Perform the following tests:
      a. Prepare test cylinders conforming to ASTM C31, with not less than one set of cylinders from each day's placement for each 100 cubic yards or fraction thereof.
         (1) A set of cylinders is defined as the following for different cylinder sizes:
            (a) 6-inch by 12-inch: 4 cylinders
            (b) 4-inch by 8-inch: 5 cylinders
      b. Slump test conforming to ASTM C143. Perform tests on the first batch produced each day, for every 50 cubic yards or fraction thereafter, and with every set of test cylinders. Additional tests shall be run when directed by Engineer.
      c. Air content test conforming to ASTM C231. Perform for first batch of day and with each set of test cylinders.
      d. The batch of concrete being tested for slump or air content shall not be placed until acceptable results are obtained.
      e. Discard concrete used for slump and air tests.
      f. Perform concrete and air temperature tests for first batch of day and with each set of test cylinders. Additional readings shall be taken when directed by Engineer.
      g. Any batch of concrete with slump or air content not in conformance with Specifications shall be rejected.
      h. Furnish slump, air content, and temperature test results to the testing laboratory for inclusion in the cylinder test reports.

D. Laboratory Testing Concrete During Construction:
   1. Laboratory will cure and test concrete cylinders conforming to ASTM C192 and C39, testing 1 cylinder at 7 days of age, [two, three (for 4-inch cylinders)]at 28 days of age and one hold cylinder.

2. Contractor shall have the right to observe all phases of concrete cylinder curing and testing. Should Contractor observe any deviations from the prescribed testing procedures that he considers detrimental to concrete strength test results, he shall immediately notify Owner in writing.
3. Contractor shall make arrangements with the testing laboratory to receive copies of test reports. The cost of providing a maximum of two copies of each report to the Contractor will be paid by Owner.
4. Should the test results indicate low strength concrete as defined in PART 3, Article 3.07 - Low-Strength Concrete, this Section, Contractor shall take immediate corrective action.
5. Should the statistical data indicate an excessive margin of safety, the concrete mix may be modified subject to Engineer's approval.
6. Should the material tests taken during construction indicate nonconformance with the Specifications, Contractor shall take immediate corrective action.

E. Water Leakage Tests:
1. Refer to specification 01480 Water Tightness.

3.10 REPAIR, REPLACEMENT, AND FIELD MODIFICATIONS:

A. Embedded items and concrete that are misplaced or damaged during construction shall not be repaired, replaced, or field-modified without approval of Engineer.

END OF SECTION 03 30 00

SECTION 03 41 00 – PRECAST STRUCTURAL CONCRETE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This section covers precast, prestressed structural concrete construction, delegated design, manufacture, transportation, erection, and other related items such as anchorage, bearing pads, storage, and protection of precast concrete.

B. Precast includes:

1. Precast structural concrete.
2. Precast structural concrete with thin-brick facings.
3. Precast structural concrete with commercial architectural finish.

1.03 RELATED REQUIREMENTS:

A. DIVISION 03, Section - Cast-in-Place Concrete for concrete topping.
B. DIVISION 04, Section - Unit Masonry and Exterior Stone Cladding.
C. DIVISION 05, Section - Structural Steel Framing, Metal Fabrication, and Anchorage.
D. DIVISION 07, Section - Water Repellants, Sheet Metal Flashing and Trim, Penetration Firestopping and Joint Sealants.

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated. For international projects reference applicable metric code as required.

B. ACI International:

1. ACI 301 - Specifications for Structural Concrete.
2. ACI 318 - Building Code Requirements for Structural Concrete.
3. ACI 423.7 - Specification for Unbonded Single-Strand Tendon Materials.

C. ACI International/The Masonry Society.

1. ACI 216.1/TMS 0216 - Code Requirements for Determining Fire Resistance of Concrete and Masonry Construction Assemblies.

D. American Association of State Highway and Transportation Officials:

1. AASHTO M 251 - Specification for Plain and Laminated Elastomeric Bridge Bearings.

E. American Welding Society:

1. AWS C5.4 - Recommended Practices for Stud Welding.
2. AWS D1.1/D1.1M - Structural Welding Code - Steel.
3. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel.

F. ASTM International (ASTM):

1. ASTM A27 - Specification for Steel Castings, Carbon, for General Application.
2. ASTM A36 - Specification for Carbon Structural Steel.
3. ASTM A47 - Specification for Ferritic Malleable Iron Castings.
4. ASTM A108 - Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
5. ASTM A123- Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
6. ASTM A153- Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
7. ASTM A184 - Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.

8. ASTM A276 - Specification for Stainless Steel Bars and Shapes.
9. ASTM A283 - Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
10. ASTM A307 - Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
11. ASTM A325- Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
12. ASTM A416 - Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete.
13. ASTM A490 - Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
14. ASTM A496 - Specification for Steel Wire, Deformed, for Concrete Reinforcement.
15. ASTM A500 - Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
16. ASTM A563 - Specification for Carbon and Alloy Steel Nuts.
17. ASTM A572 - Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
18. ASTM A615 - Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
19. ASTM A666 - Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
20. ASTM A675 - Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties.
21. ASTM A706 - Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
22. ASTM A722 - Specification for Uncoated High-Strength Steel Bars for Prestressing Concrete.
23. ASTM A767 - Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
24. ASTM A775 - Specification for Epoxy-Coated Reinforcing Steel Bars.
25. ASTM A780 - Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
26. ASTM A884 - Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
27. ASTM A886 - Specification for Steel Strand, Indented, Seven-Wire Stress-Relieved for Prestressed Concrete.
28. ASTM A934 - Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
29. ASTM A1064 - Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
30. ASTM B633 - Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
31. ASTM C33 - Specification for Concrete Aggregates.
32. ASTM C42 - Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete Products.
33. ASTM C67 - Test Methods for Sampling and Testing Brick and Structural Clay Tile.
34. ASTM C144 - Specification for Aggregate for Masonry Mortar.
35. ASTM C150 - Specification for Portland Cement.
36. ASTM C260 - Specification for Air-Entraining Admixtures for Concrete.
37. ASTM C330 - Specification for Lightweight Aggregates for Structural Concrete.
38. ASTM C404 - Specification for Aggregates for Masonry Grout.

39. ASTM C494 - Specification for Chemical Admixtures for Concrete.
40. ASTM C567 - Test Method for Determining Density of Structural Lightweight Concrete.
41. ASTM C578- Specification for Rigid, Cellular Polystyrene Thermal Insulation.
42. ASTM C591 - Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
43. ASTM C595 - Specification for Blended Hydraulic Cements.
44. ASTM C618 - Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
45. ASTM C642 - Test Method for Density, Absorption, and Voids in Hardened Concrete.
46. ASTM C881 - Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
47. ASTM C920 - Specification for Elastomeric Joint Sealants.
48. ASTM C979 - Specification for Pigments for Integrally Colored Concrete.
49. ASTM C989 - Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
50. ASTM C1017 - Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
51. ASTM C1077 - Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
52. ASTM C1107 - Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
53. ASTM C1218- Test Method for Water-Soluble Chloride in Mortar and Concrete.
54. ASTM C1240 - Specification for Use of Silica Fume for Use as a Mineral Admixture in Hydraulic-Cement Concrete, Mortar, and Grout.
55. ASTM C1354 - Test Method for Strength of Individual Stone Anchorages in Dimension Stone.
56. ASTM C1582 - Specification for Admixtures to Inhibit Chloride-Induced Corrosion of Reinforcing Steel in Concrete.
57. ASTM C1610 - Test Method for Static Segregation of Self-Consolidating Concrete Using Column Technique.
58. ASTM C1611 - Test Method for Slump Flow of Self-Consolidating Concrete.
59. ASTM C1621 - Test Method for Passing Ability of Self-Consolidating Concrete by J-Ring.
60. ASTM C1712 - Test Method for Rapid Assessment of Static Segregation Resistance of Self-Consolidating Concrete Using Penetration Test.
61. ASTM D412 - Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.
62. ASTM D2240- Test Method for Rubber Property-Durometer Hardness.
63. ASTM D4397- Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.
64. ASTM E165 - Test Method for Liquid Penetrant Examination.
65. ASTM E329 - Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
66. ASTM E488 - Test Methods for Strength of Anchors in Concrete Elements.
67. ASTM E709 - Guide for Magnetic Particle Examination.
68. ASTM E1444 - Practice for Magnetic Particle Testing.
69. ASTM F436 - Specification for Hardened Steel Washers.
70. ASTM F593 - Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
71. ASTM F844 - Specification for Washers, Steel, Plain (Flat), Unhardened for General Use.

72. ASTM F1852 - Specification for Twist-Off Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
73. ASTM F3125 – Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi and 150 ksi Minimum Tensile Strength

G. Master Painters Institute:
1. MPI#79-2004 - Alkyd Anti-Corrosive Metal Primer.

H. Military Specification and Standards:
1. MIL-C-882E - Cloth, Duck, Cotton or Cotton-Polyester Blend, Synthetic Rubber, Impregnated, and Laminated, Oil Resistant.

I. Precast/Prestressed Concrete Institute:
1. PCI MNL 116 - Manual for Quality Control for Plants and Production of Structural Precast Concrete Products.
2. PCI MNL 117 - Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products.
3. PCI MNL 120 - PCI Design Handbook - Precast and Prestressed Concrete.
4. PCI MNL 124 - Design for Fire Resistance of Precast Prestressed Concrete.
5. PCI MNL 127 - PCI Erector's Manual - Standards and Guidelines for the Erection of Precast Concrete Products.
6. PCI MNL 135 - Tolerance Manual for Precast and Prestressed Concrete Construction.
7. PCI TR-6 - Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants.
8. Architectural Precast Concrete - Color and Texture Selection Guide.

J. Research Council on Structural Connections:
1. RCSC Specification for Structural Joints Using ASTM High-Strength Bolts.

K. SSPC - The Society for Protective Coatings:
1. SSPC-PA 1 - Paint Application Specification No. 1 - Shop, Field, and Maintenance Painting of Steel.
2. SSPC-Paint 25 - Paint Specification No. 25 - Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel Type I and Type II.
3. SSPC-SP 3 - Surface Preparation Specification No. 3 - Power Tool Cleaning.

1.05 DEFINITIONS:

A. Design Reference Sample: Sample of approved precast structural concrete color, finish, and texture, preapproved by Engineer.

B. Professional Engineer: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated.

C. Engineering services are defined as those performed for installations that are similar to those indicated for this Project in material, design, and extent.

1.06 PERFORMANCE REQUIREMENTS:

A. Delegated Design: Design precast structural concrete, including comprehensive engineering analysis by a qualified professional engineer, licensed in the state of Missouri, using performance requirements and design criteria indicated.

B. Design of units and embedments shall be performed by structural analysis in accordance with ACI 318 or PCI MNL-210.

C. Structural analysis shall include evaluations of the effects of connections, holes, discontinuities, concentrated loads, and joints.

D. Design, furnish, and install all necessary temporary bracing and connections required for erection.
E. Structural Performance: Precast structural concrete units shall be designed for the load conditions and spans indicated, and any additional loads imposed by openings, work of other trades, concrete topping indicated, and all loading and restraining conditions from fabrication, handling, and erection. Connections shall withstand design loads indicated within limits and under conditions indicated.
F. Structural Performance: Provide precast structural concrete units and connections capable of withstanding the design loads within limits and under conditions indicated on the Contract Drawings.
    1. Design precast structural concrete framing system and connections to maintain clearances at openings, to allow for fabrication and construction tolerances, to accommodate live-load deflection, shrinkage and creep of primary building structure, and other building movements. Maintain precast structural concrete deflections within limits of ACI 318.
        a. Thermal Movements: Allow for in-plane thermal movements resulting from annual ambient temperature changes of 120ºF.
    2. Design precast concrete units and connections to maintain clearances at openings, to allow for fabrication and construction tolerances, to accommodate live-load deflection, shrinkage and creep of primary building structure, and other building movements as follows:
        a. Upward and downward movement of 1/2 inch minimum.
        b. Coordinate openings with the manufacture of the component.

1.07 SUBMITTALS:
A. Product Data: For each type of product indicated.
B. Design Mixtures: For each precast concrete mixture. Include compressive strength and water-absorption tests.
C. Shop Drawings: Include member locations, plans, elevations, dimensions, shapes and sections, openings, support conditions, and types of reinforcement, including special reinforcement. Detail fabrication and installation of precast structural concrete units, including connections at member ends and to adjoining construction.
    1. Indicate joints, reveals, drips, chamfers, and extent and location of each surface finish.
    2. Indicate separate face and backup mixture locations and thicknesses.
    3. Indicate type, size, and length of welded connections by AWS standard symbols.
    4. Detail loose and cast-in hardware, lifting and erection inserts, connections, and joints.
    5. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
    6. Include and locate openings larger than by 6 inches. Where additional structural support is required, include header design.
    7. Indicate location of each precast structural concrete unit by same identification mark placed on panel.
    8. Indicate relationship of precast structural concrete units to adjacent materials.
    9. Indicate locations, dimensions, and details of thin-brick units, including corner units and special shapes, and joint treatment.
    10. Indicate locations, dimensions, and details of stone facings, anchors, and joint widths.
    11. Indicate estimated camber for precast floor slabs with concrete toppings.
    12. Indicate shim sizes and grouting sequence.
D. Permissible Design Deviations:

1. Design deviations, supported by complete design calculations and drawings, shall be submitted for approval with explicit description of desired deviation included.
2. Design deviations shall provide an installation equivalent to the basic intent without incurring additional cost to the owner.
3. Design deviations shall not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.

E. Product Design Criteria:
1. Loadings for Design:
   a. Initial handling and erection stresses.
   b. International Building Code (IBC) 2018 loads.
   c. All dead and live loads as specified on the Contract Drawings.
   d. All other loads specified for member, where applicable.
2. Design criteria shall state all applicable standards, codes, and specifications for which precast sections are to be designed.
3. Submit calculations sealed by a qualified professional engineer licensed in the state of Missouri.

F. Samples:
1. For each type of finish indicated on exposed surfaces of precast structural concrete units with architectural finish, in sets of three, illustrating full range of finish, color, and texture variations expected; approximately 12 by 12 by 2 inches.
   a. Where other faces of precast concrete unit are exposed, include Samples illustrating workmanship, color, and texture of backup concrete as well as facing concrete.
2. Samples for each brick unit required, showing full range of color and texture expected. Include Samples showing color and texture of joint treatment.
   a. Grout Samples for Initial Selection: Color charts consisting of actual sections of grout showing manufacturer's full range of colors.
   b. Grout Samples for Verification: Showing color and texture of joint treatment.

G. Delegated-Design Submittal: For precast structural concrete indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer, licensed in the state of Missouri responsible for their preparation.
1. Show precast structural concrete unit types, connections, types of reinforcement, including special reinforcement, and concrete cover on reinforcement. Indicate location, type, magnitude, and direction of loads imposed on the building structural frame from precast structural concrete.
2. Engineers review is only for the limited purpose of:
   a. Verifying that performance and design criteria in the Contract were used.
   b. Checking for compliance with the engineers design concept.

H. Qualification Data: For Installer and fabricator.

I. Welding certificates.

J. Material Certificates: For the following, from manufacturer:
1. Cementitious materials.
2. Reinforcing materials and prestressing tendons.
3. Admixtures.
4. Bearing pads.
5. Insulation.
6. Structural-steel shapes and hollow structural sections.
7. Thin-brick units and accessories.

K. Material Test Reports: For aggregates, by a qualified testing agency.

L. Preconstruction test reports.
M. Source quality-control reports.
N. Field quality-control and special inspection reports.

1.08 QUALITY ASSURANCE:

A. Fabricator Qualifications: A firm that assumes responsibility for engineering precast structural concrete units to comply with performance requirements. Responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
   1. Participates in PCI's Plant Certification program at time of bidding and is designated a PCI-certified plant as follows:
      a. Group A, Category A1 – Architectural Cladding and Load Bearing Units or A-B by the new PCI Architectural Standards.
      b. Group C, Category C2 - Prestressed Hollowcore and Repetitively Produced Products.
      c. Group C, Category C3A - Prestressed Straight Strand Structural Members.
      d. Group C, Category C4 - Prestressed Deflected-Strand Structural Members.
B. Installer Qualifications: A precast concrete erector qualified at time of bidding, as evidenced by PCI's Certificate of Compliance, to erect Category S2 - Complex Structural Systems.
C. Testing Agency Qualifications: Qualified according to ASTM C1077 and ASTM E329 for testing indicated.
D. Design Standards: Comply with ACI 318 and design recommendations in PCI MNL 120 applicable to types of precast structural concrete units indicated.
E. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 116.
F. Fire-Resistance Calculations: Where indicated, provide precast structural concrete units whose fire resistance meets the prescriptive requirements of authorities having jurisdiction or has been calculated according to ACI 216.1/TMS 0216 and is acceptable to authorities having jurisdiction.
G. Sample Panels: After sample approval and before fabricating precast structural concrete units with architectural finish and thin-brick facing, produce a minimum of two sample panels approximately 8 sq. ft. in area for review by Engineer. Incorporate full-scale details of architectural features, finishes, textures, and transitions in sample panels.
   1. Locate panels where indicated or, if not indicated, as directed by Engineer.
   2. Damage part of an exposed-face surface for each finish, color, and texture, and demonstrate adequacy of repair techniques proposed for repair of surface blemishes.
   3. After approval of repair technique, maintain one sample panel at fabricator's plant and one at Project Site in an undisturbed condition as a standard for judging the completed Work.
   4. Demolish and remove sample panels when directed.
H. Mockups: After sample panel approval but before production of precast structural concrete units with architectural finish and thin-brick facing, construct full-sized mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockup as indicated on Drawings including sealants and precast structural concrete units with an architectural finish complete with anchors, connections, flashings, and joint fillers.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Engineer specifically approves such deviations in writing.

I. Preinstallation Conference: Conduct conference at Project Site.

1.09 DELIVERY, STORAGE, AND HANDLING:

A. Support units during shipment on nonstaining shock-absorbing material in same position as during storage.

B. Store units with adequate bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.
1. Store units with dunnage across full width of each bearing point unless otherwise indicated.
2. Place adequate dunnage of even thickness between each unit.
3. Place stored units so identification marks are clearly visible, and units can be inspected.

C. Handle and transport units in a position consistent with their shape and design in order to avoid excessive stresses that would cause cracking or damage.

D. Lift and support units only at designated points shown on Shop Drawings.

1.10 COORDINATION:

A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction before starting that Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.01 MOLD MATERIALS:

A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that will provide continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.
1. Mold-Release Agent: Commercially produced liquid-release agent that will not bond with, stain or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.

B. Form Liners: Units of face design, texture, arrangement, and configuration to match those used for precast concrete design reference sample. Furnish with manufacturer's recommended liquid-release agent that will not bond with, stain, or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.

2.02 REINFORCING MATERIALS:

A. Reinforcing Bars: ASTM A615, Grade 60, deformed.

B. Steel Bar Mats: ASTM A184, fabricated from ASTM A615, Grade 60, deformed bars, assembled with clips.

C. Plain-Steel Welded Wire Reinforcement: ASTM A1064, flat sheet.

D. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 116.

2.03 PRESTRESSING TENDONS:

A. Pretensioning Strand: ASTM A416, Grade 250 or Grade 270, uncoated, 7-wire.

2.04 CONCRETE MATERIALS:

A. Portland Cement: ASTM C150, Type I or Type III, gray, unless otherwise indicated.
   1. For surfaces exposed to view in finished structure, mix gray with white cement, of same type, brand, and mill source.

B. Blended Hydraulic Cement: ASTM C595, Type IS, Portland blast-furnace slag, Type IP, Portland-pozzolan, Type I (PM), pozzolan-modified Portland, Type I (SM), slag-modified Portland cement.

C. Supplementary Cementitious Materials [at Precaster's option]:
   1. Fly Ash: ASTM C618, Class C or F, with maximum loss on ignition of 3%.
   2. Metakaolin Admixture: ASTM C618, Class N.
   3. Silica Fume Admixture: ASTM C1240, with optional chemical and physical requirement.
   4. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.

D. Normal-Weight Aggregates: ASTM C33.
   1. Face-Mixture-Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.
      a. Gradation: To match design reference sample.
   2. Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand of same material as coarse aggregate unless otherwise approved by Engineer.

E. Coloring Admixture: ASTM C979, synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable, and nonfading.

F. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 116.

G. Air-Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures.

H. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15% chloride ions or other salts by weight of admixture.
   1. Water-Reducing Admixtures: ASTM C494, Type A.
   2. Retarding Admixture: ASTM C494, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C494, Type D.
   4. Water-Reducing and Accelerating Admixture: ASTM C494, Type E.
   5. High-Range, Water-Reducing Admixture: ASTM C494, Type F.
   6. High-Range, Water-Reducing and Retarding Admixture: ASTM C494, Type G.
   7. Plasticizing Admixture: ASTM C1017, Type I.
   8. Plasticizing and Retarding Admixture: ASTM C1017, Type II.
   9. Corrosion-Inhibiting Admixture: ASTM C1582.

2.05 STEEL CONNECTION MATERIALS:

A. Carbon-Steel Shapes and Plates: ASTM A36.

B. Carbon-Steel-Headed Studs: ASTM A108, Grade 1010 through 1020, cold finished, AWS D1.1, Type A or B, with arc shields and with minimum mechanical properties of PCI MNL 116.

C. Carbon-Steel Plate: ASTM A283, Grade C.

D. Malleable-Iron Castings: ASTM A47, Grade 32510 or Grade 35028.

E. Carbon-Steel Castings: ASTM A27, Grade 60-30 (Grade 415-205).

F. High-Strength, Low-Alloy Structural Steel: ASTM A572.

G. Carbon-Steel Hollow Structural Sections: ASTM A500, Grade B.

H. Wrought Carbon-Steel Bars: ASTM A675, Grade 65 (Grade 450).

I. Deformed-Steel Wire or Bar Anchors: ASTM A496 or ASTM A706, Grade 60 (Grade 420).

J. Carbon-Steel Bolts and Studs: ASTM A307, Grade A; carbon-steel, hex-head bolts, and studs; carbon-steel nuts, ASTM A563; and flat, unhardened steel washers, ASTM F844.
K. Zinc-Coated Finish: For exterior steel items and items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A123 or ASTM A153.
   1. For steel shapes, plates, and hollow sections to be galvanized, limit silicon content of steel to less than 0.03% or to between 0.15% and 0.25%, or limit sum of silicon and 2.5 times phosphorous content to 0.09%.
   2. Galvanizing Repair Paint: ASTM A780.
L. Shop-Primed Finish: Prepare surfaces of nongalvanized-steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP 3, and shop apply lead- and chromate-free, rust-inhibitive primer, complying with performance requirements in MPI#79 according to SSPC-PA 1.
M. Welding Electrodes: Comply with AWS standards.

2.06 STAINLESS-STEEL CONNECTION MATERIALS:
A. Stainless-Steel Plate: ASTM A666, Type 304, of grade suitable for application.
B. Stainless-Steel Bolts and Studs: ASTM F593, Alloy 304 or 316, hex-head bolts, and studs; stainless-steel nuts; and flat, stainless-steel washers. Lubricate threaded parts of stainless-steel bolts with an antiseize thread lubricant during assembly.
C. Stainless-Steel-Headed Studs: ASTM A276, with minimum mechanical properties of PCI MNL 116.

2.07 BEARING PADS:
A. Provide one of the following bearing pads for precast structural concrete units as recommended by precast fabricator for application:
   1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100% polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, Type A durometer hardness of 50 to 70, ASTM D2240; minimum tensile strength 2,250 psi, ASTM D412.
   2. Random-Oriented, Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Type A durometer hardness of 70 to 90, ASTM D2240; capable of supporting a compressive stress of 3,000 psi with no cracking, splitting, or delaminating in the internal portions of pad. Test one specimen for every 200 pads used in Project.
   3. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded to an elastomer; Type A durometer hardness of 80 to 100, ASTM D2240; complying with MIL-C-882E.
   4. Frictionless Pads: PTFE, glass-fiber reinforced, bonded to stainless- or mild-steel plate, or random-oriented-fiber-reinforced elastomeric pads, of type required for in-service stress.
   5. High-Density Plastic: Multimonomer, nonleaching, plastic strip.

2.08 ACCESSORIES:
A. Precast Accessories: Provide clips, hangers, high-density plastic or steel shims, and other accessories required to install structural precast concrete units.

2.09 GROUT MATERIALS:
A. Sand-Cement Grout: Portland cement as specified in Section 2.04 and clean, natural sand, ASTM C144 or ASTM C404. Mix at ratio of 1 part cement to 2-1/2 to 3 parts sand, by volume, with minimum water required for placement and hydration. Water-soluble chloride ion content

shall be less than 0.06% by weight of cement when tested according to ASTM C1218/C1218M.

2.10 THIN BRICK AND ACCESSORIES:

A. Thin Brick: Thickness not less than 1/2 inch or more than 1 inch , and as follows:
   1. Dimensional Tolerances: +0 inch or -1/16 inch for any dimension 8 inches or less, and +0 inch or -3/32 inch for any dimension greater than 8 inches.
   2. Out-of-Square Tolerance: ±1/16 inch.
   3. Warpage Tolerance: +0 inch or -1/16 inch.
   4. Variation of Shape from Specified Angle: ±1 degree.
   5. Modulus of Rupture: Not less than 250 psi when tested according to ASTM C67.
   6. Tensile Bond Strength: Not less than 150 psi when tested before and after freeze-thaw test according to ASTM E488 as modified. Adhere a steel plate with a welded rod on a single thin-brick face with epoxy for each test.
   7. 24-Hour Cold-Water Absorption: Not more than 6% when tested according to ASTM C67.
   8. Freeze-Thaw Resistance: No detectable disintegration or separation after 300 freezing-and-thawing cycles when tested according to ASTM C666, Method B.
   9. Efflorescence: Tested according to ASTM C67 and rated "not effloresced."
   10. Back Surface Texture: Scored, combed, wire roughened, ribbed, keybacked, or dovetailed.

B. Special Shapes: Include corners, edge corners, and end edge corners.

C. Face Size: 2-1/4 inches high by 7-5/8 inches long

D. Face Color and Texture: Match Architect's samples

E. Pointing Grout: Packaged, polymer-modified, sanded grout complying with ANSI A118.7 and as follows:
   1. Polymer Type: Acrylic resin in dry, redispersible form, packaged with other dry ingredients or liquid-latex form for adding packaged dry-grout mix.
   2. Colors: As selected by Engineer from manufacturer's full range.

2.11 INSULATED FLAT-WALL PANEL ACCESSORIES:

A. Polyisocyanurate Board Insulation: ASTM C591, Type I, 1.8 lbs./cu. ft. unfaced, with thickness of 4 inches.

B. Wythe Connectors: Glass-fiber-reinforced vinyl-ester connectors, Epoxy-coated carbon-fiber grid or Fiberglass trusses manufactured to connect wythes of precast concrete panels.

2.12 CONCRETE MIXTURES:

A. Prepare design mixtures for each type of precast concrete required.
   1. Limit use of fly ash to 20% replacement of Portland cement by weight and granulated blast-furnace slag to 20% of Portland cement by weight; metakaolin and silica fume to 10% of Portland cement by weight.

B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast structural concrete fabricator's option.

C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 (ACI 318M) or PCI MNL 116 when tested according to ASTM C1218/C1218M.

D. Normal-Weight Concrete Mixtures: Proportion face and backup mixtures or full-depth mixtures, at fabricator's option by either laboratory trial batch or field test data methods, or both, according to ACI 301, with materials to be used on Project, to provide normal-weight concrete with the following properties:

1. Minimum Compressive Strength (28 Days): 5,000 psi.
2. Maximum Water-Cementitious Materials Ratio: 0.45.

E. Water Absorption: For structural precast concrete with an architectural finish, limit to 6% by weight or 14% by volume, tested according to ASTM C642, except for boiling requirement.

F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 116.

G. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

H. Concrete Mix Adjustments: Concrete mix design adjustments may be proposed if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

2.13 MOLD FABRICATION:

A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.

1. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during concrete placement. Coat form liner with form-release agent.

B. Maintain molds to provide completed precast structural concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.

1. Form joints are not permitted on faces of structural precast concrete with an architectural finish that is exposed to view in the finished work.
2. Edge and Corner Treatment: Uniformly chamfered.

2.14 THIN-BRICK FACINGS:

A. Place form-liner templates accurately to provide grid for thin-brick facings. Provide solid backing and supports to maintain stability of liners while placing thin bricks and during concrete placement.

B. Securely place thin-brick units face down into form-liner pockets and place concrete backing mixture.

C. Clean faces and joints of brick facing.

2.15 FABRICATION:

A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.

1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1 and AWS C5.4.

B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing precast structural concrete units to supporting and adjacent construction.

C. Cast-in reglets, slots, holes, and other accessories in precast structural concrete units as indicated on the Contract Drawings.

D. Cast-in openings larger than 6 inches in any dimension. Contractor shall not drill or cut openings or prestressing strand without Engineer and Manufacturers approval.
E. Cast-in items need by other trades such as conduit and electrical boxes as shown on drawings.
F. Reinforcement: Comply with recommendations in PCI MNL 116 for fabricating, placing, and supporting reinforcement.
    1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcement exceeds limits specified in ASTM A775, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
    2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
    3. Place reinforcing steel and prestressing strand to maintain at least 3/4-inch minimum concrete cover. Increase cover requirements for reinforcing steel to 11/2 inches when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
    4. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.
G. Reinforce precast structural concrete units to resist handling, transportation, and erection stresses and specified in-place loads.
H. Prestress tendons for precast structural concrete units by either pretensioning or post-tensioning methods. Comply with PCI MNL 116.
    1. Delay detensioning or post-tensioning of precast, prestressed structural concrete units until concrete has reached its indicated minimum design release compressive strength as established by test cylinders cured under same conditions as concrete.
    2. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.
    3. If concrete has been heat cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.
    4. Protect strand ends and anchorages with bituminous, zinc-rich, or epoxy paint to avoid corrosion and possible rust spots.
    5. Protect strand ends and anchorages with a minimum of 1-inch thick, nonmetallic, nonshrink, grout mortar and sack rub surface. Coat or spray the inside surfaces of pocket with bonding agent before installing grout.
I. Comply with requirements in PCI MNL 116 and in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.
J. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units.
K. Thoroughly consolidate placed concrete by vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air on surfaces. Use equipment and procedures complying with PCI MNL 116.
    1. Place self-consolidating concrete without vibration according to PCI TR-6. Ensure adequate bond between face and backup concrete, if used.
L. Comply with PCI MNL 116 procedures for hot- and cold-weather concrete placement.
M. Identify pickup points of precast structural concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or

permanently mark casting date on each precast structural concrete unit on a surface that will not show in finished structure.

N. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.

O. Discard and replace precast structural concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 116 and meet Engineer's approval.

2.16 CASTING INSULATED WALL PANELS:

A. Cast, screed, and consolidate wythe supported by mold.

B. Place insulation boards abutting edges and ends of adjacent boards. Insert wythe connectors through insulation and consolidate concrete around connectors according to connector manufacturer's written instructions.

C. Ensure bottom wythe and insulation layer are not disturbed after bottom wythe reaches initial set.

D. Cast, screed, and consolidate top wythe to meet required finish.

E. Maintain temperature below 150ºF in bottom concrete wythe.

2.17 FABRICATION TOLERANCES:

A. Fabricate precast structural concrete units to shapes, lines, and dimensions indicated so each finished unit complies with PCI MNL 116 product dimension tolerances as well as position tolerances for cast-in items.

B. Thin-Brick-Faced Precast Structural Concrete Units: Restrict the following misalignments to 2% of number of bricks in a unit:

1. Alignment of Mortar Joints:
   a. Jog in Alignment: 1/8 inch.
   b. Alignment with Panel Centerline: ±1/8 inch.
2. Variation in Width of Exposed Mortar Joints: ±1/8 inch.
3. Tipping of Individual Bricks from the Panel Plane of Exposed Brick Surface: +1/16 inch; -1/4 inch less than or equal to depth of form-liner joint.
4. Exposed Thin-Brick Surface Parallel to Primary Control Surface of Panel: +1/4 inch; -1/8 inch.
5. Individual Thin-Brick Step in Face from Panel Plane of Exposed Thin-Brick Surface: +1/16 inch; -1/4 inch less than or equal to depth of form-liner joint.

2.18 COMMERCIAL FINISHES:

A. Grade B Finish: Fill air pockets and holes larger than 1/4 inch in diameter with sand-cement paste matching color of adjacent surfaces. Fill air holes greater than 1/8 inch in width that occur more than once per 2 sq. in. Grind smooth form offsets or fins larger than 1/8 inch. Repair surface blemishes due to holes or dents in molds. Discoloration at form joints is permitted.

B. Grade A Finish: Repair surface blemishes and fill air holes with the exception of air holes 1/16 inch in width or smaller, and form marks where the surface deviation is less than 1/16 inch. Float apply a neat cement-paste coating to exposed surfaces. Rub dried paste coat with burlap to remove loose particles. Discoloration at form joints is permitted. Grind smooth all form joints.

C. Smooth, steel trowel finish unformed surfaces. Consolidate concrete, bring to proper level with straightedge, float, and trowel to a smooth, uniform finish.
D. Apply roughened surface finish according to ACI 318 to precast concrete units that will receive concrete topping after installation.

2.19 COMMERCIAL ARCHITECTURAL FINISHES:

A. Manufacture member faces free of joint marks, grain, and other obvious defects with corners, including false joints, uniform, straight, and sharp. Finish exposed-face surfaces of precast concrete units to match approved mockups and as follows:
   1. Textured-Surface Finish: Impart by form liners or inserts.
   2. Abrasive-Blast Finish: Use abrasive grit, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces.
   3. Acid-Etched Finish: Use acid and hot-water solution, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces. Protect hardware, connections, and insulation from acid attach.
   4. Sand-Embedment Finish: Use selected stones placed in a sand bed in bottom of mold, with sand removed after curing.
   5. Thin-Brick Facing: See "Thin-Brick Facings" Article.

2.20 SOURCE QUALITY CONTROL:

A. Testing: Test and inspect precast structural concrete according to PCI MNL 116 requirements.
   1. Test and inspect self-consolidating concrete according to PCI TR-6, ASTM C1610, ASTM C1611, ASTM C1621, and ASTM C1712.
B. Strength of precast structural concrete units will be considered deficient if units fail to comply with ACI 318 requirements for concrete strength.
C. If there is evidence that strength of precast concrete units may be deficient or may not comply with ACI 318 requirements, employ a qualified testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C42.
   1. A minimum of three representative cores shall be taken from units of suspect strength, from locations directed by Engineer.
   2. Test cores in an air-dry condition or, if units will be wet under service conditions, test cores after immersion in water in a wet condition.
   3. Strength of concrete for each series of three cores will be considered satisfactory if average compressive strength is equal to at least 85% of 28-day design compressive strength and no single core is less than 75% of 28-day design compressive strength.
   4. Report test results in writing on same day that tests are performed, with copies to Engineer, Contractor, and precast concrete fabricator. Test reports shall include the following:
      a. Project identification name and number.
      b. Date when tests were performed.
      c. Name of precast concrete fabricator.
      d. Name of concrete testing agency.
      e. Identification letter, name, and type of precast concrete unit(s) represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.
D. Patching: If core test results are satisfactory and precast structural concrete units comply with requirements, clean, and dampen core holes and solidly fill with same precast concrete mixture that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.

E. Defective Units: Discard and replace precast structural concrete units that do not comply with requirements, including strength, manufacturing tolerances, and color and texture range. Chipped, spalled, or cracked units may be repaired, subject to Engineer's approval. Engineer reserves the right to reject precast units that do not match approved samples, sample panels, and mockups. Replace unacceptable units with precast concrete units that comply with requirements.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance of the Work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.
C. Do not install precast concrete units until supporting cast-in-place concrete has attained minimum allowable design compressive strength or until supporting steel or other structure is adequate to receive loads from precast concrete units.

3.02 INSTALLATION:

A. Install clips, hangers, bearing pads, and other accessories required for connecting precast structural concrete units to supporting members and backup materials.
B. Erect precast structural concrete level, plumb, and square within specified allowable tolerances. Provide temporary structural framing, supports, and bracing as required to maintain position, stability, and alignment of units until permanent connections are complete.
    1. Install temporary steel or plastic spacing shims or bearing pads as precast structural concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
    2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
    3. Remove projecting lifting devices and use plastic patch caps or sand-cement grout to fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
C. Connect precast structural concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.
    1. Do not permit connections to disrupt continuity of roof flashing.
D. Field cutting of precast units is not permitted without approval of the Engineer.
E. Fasteners: Do not use drilled or powder-actuated fasteners for attaching accessory items to precast, prestressed concrete units.
F. Welding: Comply with applicable requirements in AWS D1.1 and AWS D1.4 for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.
    1. Protect precast structural concrete units and bearing pads from damage by field welding or cutting operations, and provide noncombustible shields as required.
    2. Clean weld-affected steel surfaces with chipping hammer followed by brushing, and apply a minimum 4.0-mil thick coat of galvanized repair paint to galvanized surfaces according to ASTM A780.
    3. Visually inspect and remove, reweld, or repair incomplete and defective welds.

G. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.
   1. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot.
   2. For pretensioned and slip critical connections, use one of the following methods to assure proper bolt pretension:
      a. Turn-of-Nut: According to RCSC "Specification for Structural Joints Using High-Strength Bolts."
      b. Calibrated Wrench: According to RCSC "Specification for Structural Joints Using High-Strength Bolts."
      c. Twist-off Tension Control Bolt: ASTM F1852.
      d. Direct-Tension Control Bolt: ASTM F1852.

H. Grouting or Dry-Packing Connections and Joints: Grout connections and joints and open spaces at keyways, connections, and joints where required or indicated on Shop Drawings. Retain flowable grout in place until hard enough to support itself. Alternatively, pack spaces with stiff dry-pack grout material, tamping until voids are completely filled.
   1. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces.
   2. Fill joints completely without seepage to other surfaces.
   3. Trowel top of grout joints on roofs smooth and uniform. Finish transitions between different surface levels not steeper than 1 to 12.
   4. Place grout end cap or dam in voids at ends of hollow-core slabs.
   5. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.
   6. Keep grouted joints damp for not less than 24 hours after initial set.

3.03 ERECTION TOLERANCES:

A. Erect precast structural concrete units level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 135.

B. Minimize variations between adjacent slab members by jacking, loading, or other method recommended by fabricator and approved by Engineer.

3.04 FIELD QUALITY CONTROL:

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
   1. Erection of precast structural concrete members.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Visually inspect field welds and test according to ASTM E165 or to ASTM E709 and ASTM E1444. High-strength bolted connections will be subject to inspections.

D. Testing agency shall report test results promptly and in writing to Contractor and Engineer.

E. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.

F. Additional testing and inspecting, at Contractor's expense, shall be performed to determine compliance of replaced or additional work with specified requirements.

G. Prepare test and inspection reports.

3.05 REPAIRS:

A. Repair precast structural concrete units if permitted by Engineer.
   1. Repairs may be permitted if structural adequacy, serviceability, durability, and appearance of units have not been impaired.

B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet.
C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A780.
D. Remove and replace damaged precast structural concrete units that cannot be repaired or when repairs do not comply with requirements as determined by Engineer.

3.06 CLEANING:

A. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.
B. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
    1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's written recommendations. Protect other work from staining or damage due to cleaning operations.
    2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION 03 41 00

SECTION 03 52 16 – LOW DENSITY CELLULAR CONCRETE FILL

PART 1 - GENERAL

1.01 SUMMARY:

A. Section includes non-pervious, Low Density Cellular Concrete Fill (LDCCF). Provide LDCCF at the locations shown on the drawings, and as specified herein.

B. Related Work Specified Elsewhere:

1. Concrete: SECTION 03 30 00.

1.02 REFERENCES:

A. American Concrete Institute:

1. ACI 301-2005 - Specification for Structural Concrete.
2. ACI 523-2006 – Guide for Cast-in-Place Low-Density Cellular Concrete.

B. ASTM International:

1. ASTM C138-12 - Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
2. ASTM C150-12 - Specification for Portland Cement.
3. ASTM C172-10 - Practice for Sampling Freshly Mixed Concrete.
4. ASTM C332-09 - Specification for Lightweight Aggregates for Insulating Concrete.
5. ASTM C494-13 – Specification for Chemical Admixtures for Concrete.
6. ASTM C495-12 - Test Method for Compressive Strength of Lightweight Insulating Concrete.
7. ASTM C513-11 – Test Method for Obtaining and Testing Specimens of Hardened Lightweight Insulating Concrete for Compressive Strength.
8. ASTM C595-13 – Specification for Blended Hydraulic Cements.
9. ASTM C618-12 - Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
10. ASTM C796-12 – Test Method for Foaming Agents for Use in Producing Cellular Concrete Using Preformed Foam.
11. ASTM C869-11 - Specification for Foaming Agents Used in Making Preformed Foam for Cellular Concrete.
12. ASTM C1157-11 – Performance Specification for Hydraulic Cement.
13. ASTM C1240-12 – Specification for Silica Fume Used in Cementitious Mixtures.

1.03 SUBMITTALS:

A. With their bid, the prime contractor shall list the product and qualified foam producer of the LDCCF and shall not employ any product or producer without the prior approval of the engineer.

B. Design mix for LDCCF.

C. Product Certificates: For the following, from manufacturer:

1. Cementitious materials.
2. Foaming agents.
3. Admixtures.

1.04 QUALITY ASSURANCE:

A. The subcontractor shall have a record of experience and quality of work placing LDCCF that is satisfactory to the engineer.

B. The subcontractor shall be capable of developing a mix design, batching, mixing, handling and placing LDCCF.

C. The subcontractor shall be regularly engaged in the production and placement of LDCCF.

D. The subcontractor shall have satisfactorily completed during the last three (3) years at least five (5) similar projects.
E. Use skilled workmen who are experienced and familiar with the requirements and the methods for proper performance of this work.
F. The specialized batching, mixing and placing equipment shall be approved by the foam manufacturer of the LDCCF. Transit mixers are not acceptable for these applications.

1.05 PROJECT CONDITIONS:
A. Do not place LDCCF unless ambient temperature is at least 32ºF (0ºC) and rising.
B. The area to be filled shall not have any standing water in it prior to placement of LDCCF.

PART 2 - PRODUCTS

2.01 MATERIALS:
A. Cementitious Material: Portland cement should meet the requirements of ASTM C150, ASTM C595 or C1157. Pozzolans and other cementitious materials may be used
B. Foaming Agent: ASTM C869 and ASTM C796.
C. Water: Clean, potable.

2.02 DESIGN MIXTURES:
A. Prepare design mixtures for LDCCF by laboratory trial batch method or by field-test data method. For trial batch method, use a qualified independent testing agency for preparing and reporting proposed mixture designs.
1. Limit use of fly ash to not exceed 25 % of portland cement by weight.
B. Limit water-soluble chloride ions to the maximum percentage by weight of cement or cementitious material permitted by ACI 301.

2.03 LOW DENSITY CELLULAR CONCRETE:
A. Produce cellular lightweight insulating concrete with the following minimum physical properties using cementitious materials, air-producing liquid-foaming agents, and the minimum amount of water necessary to produce a workable mix.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Celcore Incorporated.
b. Cellular Concrete LLC, Mearlcrete Division.
c. Elastizell Corporation of America.
d. Geofill Cellular Concrete
2. As-Cast Unit Weight: Maximum 50 lb/ft^3 at point of placement, when tested according to ASTM C138.
3. Compressive Strength: Minimum 80 lb/in^2, when tested according to ASTM C495.

PART 3 - EXECUTION

3.01 MIXING AND PLACING:
A. Mix and place LDCCF according to foam manufacturer's written instructions, using equipment and procedures approved by foam manufacturer.
B. Avoid excessive handling of the LDCCF.
C. Place LDCCF in lifts to not exceed 3 feet 0 inches in depth.
D. The final surface finish shall be within 0.2 feet of the plan elevation.

E. The LDCCF shall not be vibrated or disturbed. Vehicles, equipment, backfill or other loadings on the fill material shall not be permitted until the material has attained a compressive strength of at least 20 lb/in^2.

3.02 FIELD QUALITY CONTROL:

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to sample materials, perform field tests and inspections, and prepare test reports.
B. During Placement of initial batches, check density and adjust the mix as required to obtain the specified cast density at the point of placement.
C. Contractor shall record and measure wet cast densities at the point of placement hourly.
D. A minimum of four (4) 3”x6” cylinders shall be molded for each 250 cubic yards placed
E. Testing samples of LDCCF obtained according to ASTM C172, except as modified by ASTM C495, shall be performed according to the following requirements:
    1. Determine as-cast unit weight during each hour of placement, according to ASTM C138.
    2. Determine oven-dry unit weight and compressive strength according to ASTM C495. Make a set of at least four (4) 3”x6” cylinders for each day's placement, but not less than one set of cylinders for each 250 cubic yards placed. Two (2) cylinders may be tested at any age after 3 days for compressive strength. At least two (2) cylinders shall be tested at 28 days for compressive strength.

3.03 DEFECTIVE WORK:

A. Remove and replace LDCCF that fails to comply with requirements.

END OF SECTION 03 52 16

DIVISION 04 - MASONRY

SECTION 04 20 00 - UNIT MASONRY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Concrete masonry units.
   2. Lintels.
   3. Mortar and grout materials.
   4. Reinforcement.
   5. Accessories.
   6. Mortar and grout mixes.

1.02 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).
B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Shop Drawings: For the following:
   1. Masonry Units: Indicate sizes, profiles, coursing, and locations of special shapes.
   2. Reinforcing Steel: Indicate bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315R. Indicate elevations of reinforced walls.

1.05 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
   1. Submittal is for information only. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.
B. Material Certificates: For each type of the following:
   1. Masonry units.
      a. Include data on material properties.
      b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
   2. Cementitious materials. Include name of manufacturer, brand name, and type.
   3. Mortar admixtures.
   4. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
   5. Grout mixes. Include description of type and proportions of ingredients.
   6. Reinforcing bars.
   7. Joint reinforcement.
C. Qualification Statements: For testing agency.
D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
2. Include test reports, in accordance with ASTM C1019, for grout mixes required to comply with compressive strength requirement.

E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined in accordance with TMS 602.

F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.06 QUALITY ASSURANCE

A. Qualifications:
1. Installers: All masonry flashing installers must complete the International Masonry Institute Flashing Upgrade training course.
2. Testing Agency Qualifications: Qualified in accordance with ASTM C1093 for testing indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.08 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
1. Extend cover a minimum of 24 inches (610 mm) down both sides of walls, and hold cover securely in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602.
   1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602.

PART 2 - PRODUCTS

2.01 SOURCE LIMITATIONS

A. Obtain exposed masonry units cementitious mortar components and mortar aggregate from single source producer or manufacturer.

B. For exposed masonry units and cementitious mortar components, obtain each color and grade from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.02 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.
   1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) in accordance with TMS 602.
   2. Determine net-area compressive strength of masonry by testing masonry prisms in accordance with ASTM C1314.

2.03 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 ft. (6 m) vertically and horizontally of a walking surface.

2.04 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
   1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
   2. Provide bullnose units for outside corners unless otherwise indicated.

B. CMUs: ASTM C90, normal weight.
   1. Size (Width): Manufactured to dimensions 3/8 inch (10 mm) less than nominal dimensions.

2.05 LINTELS

A. Solid Concrete Masonry Lintels: ASTM C1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength of not less than that of CMUs.

B. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Division 3 "Concrete Reinforcment," and with reinforcing bars indicated.
C. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.06 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
   1. Alkali content will not be more than 0.1 percent when tested in accordance with ASTM C114.
B. Hydrated Lime: ASTM C207, Type S.
C. Mortar Cement: ASTM C1329/C1329M.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Lafarge North America Inc.
D. Preblended Dry Mortar Mix: Packaged blend made from portland cement and hydrated lime or mortar cement, sand, and admixtures and complying with ASTM C1714/C1714M.
   1. Preblended Dry Portland Cement Mortar Mix:
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) Amerimix is a trademark of Bonsal American, an Oldcastle company.
         2) Sakrete; CRH Americas, Oldcastle APG.
E. Aggregate for Mortar: ASTM C144.
   1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
   2. For joints less than 1/4 inch (6.4 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
   3. White-Mortar Aggregates: Natural white sand or crushed white stone.
   4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
F. Aggregate for Grout: ASTM C404.
G. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Euclid Chemical Company (The); an RPM company.
      b. GCP Applied Technologies Inc.
H. Water: Potable.

2.07 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60 (Grade 420).
B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch (3.77-mm) steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Heckmann Building Products, Inc.
   b. Hohmann & Barnard, Inc.
   c. Wire-Bond.

C. Masonry-Joint Reinforcement, General: ASTM A951/A951M.
1. Interior Walls: Hot-dip galvanized carbon steel.
2. Wire Size for Side Rods: 0.148-inch (3.77-mm) diameter.
3. Wire Size for Cross Rods: 0.148-inch (3.77-mm) diameter.
4. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (406 mm) o.c.
5. Provide in lengths of not less than 10 ft. (3 m), with prefabricated corner and tee units.

D. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder type with single pair of side rods.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Hohmann & Barnard, Inc.
   b. Wire-Bond.

2.08 ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene urethane or PVC.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, Designation M2AA-805 or PVC, complying with ASTM D2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

2.09 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime or mortar cement mortar unless otherwise indicated.
3. For reinforced masonry, use portland cement-lime or mortar cement mortar.
4. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
1. For masonry below grade or in contact with earth, use Type M.
2. For reinforced masonry, use Type N.
3. For mortar parge coats, use Type S or Type N.
4. For exterior, above-grade, load-bearing, nonload-bearing walls, and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.

D. Grout for Unit Masonry: Comply with ASTM C476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C476, Table 1 or paragraph 4.2.1.2 for specified 28-day compressive strength indicated, but not less than 2000 psi (14 MPa).
3. Provide grout with a slump of 8 to 11 inches (203 to 279 mm) as measured in accordance with ASTM C143/C143M.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
   2. Verify that foundations are within tolerances specified.
   3. Verify that reinforcing dowels are properly placed.
   4. Verify that substrates are free of substances that impair mortar bond.
B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
B. Build chases and recesses to accommodate items specified in this and other Sections.
C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.
F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

3.03 TOLERANCES

A. Dimensions and Locations of Elements:
   1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch (13 mm) or minus 1/4 inch (6.4 mm).
   2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch (13 mm).
   3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6.4 mm) in a story height or 1/2 inch (13 mm) total.
B. Lines and Levels:
   1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 ft. (6.4 mm in 3 m), or 1/2-inch (13-mm) maximum.
   2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 ft. (3.2 mm in 3 m), 1/4 inch in 20 ft. (6.4 mm in 6 m), or 1/2-inch (13-mm) maximum.

3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 ft. (6.4 mm in 3 m), 3/8 inch in 20 ft. (10 mm in 6 m), or 1/2-inch (13-mm) maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 ft. (3.2 mm in 3 m), 1/4 inch in 20 ft. (6.4 mm in 6 m), or 1/2-inch (13-mm) maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 ft. (6.4 mm in 3 m), 3/8 inch in 20 ft. (10 mm in 6 m), or 1/2-inch (13-mm) maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 ft. (6.4 mm in 3 m), or 1/2-inch (13-mm) maximum.

C. Joints:
1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3.2 mm), with a maximum thickness limited to 1/2 inch (13 mm).
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3.2 mm).
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (10 mm) or minus 1/4 inch (6.4 mm).
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3.2 mm).
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch (1.6 mm) from one masonry unit to the next.

3.04 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch (102-mm) horizontal face dimensions at corners or jambs.

C. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet units if required before laying fresh masonry.

D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

E. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

F. Fill cores in hollow CMUs with grout 24 inches (610 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

G. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
1. Install compressible filler in joint between top of partition and underside of structure above.
2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors, and push tubes down into grout to provide 1/2-inch (13-mm) clearance between end of anchor rod and end of tube. Space anchors 48 inches (1219 mm) o.c. unless otherwise indicated.
3. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 07 84 43 "Joint Firestopping."

3.05 MORTAR BEDDING AND JOINTING

A. Lay CMUs as follows:
   1. Bed face shells in mortar and make head joints of depth equal to bed joints.
   2. Bed webs in mortar in all courses of piers, columns, and pilasters.
   3. Bed webs in mortar in grouted masonry, including starting course on footings.
   4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
   5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.06 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (152 mm).
   1. Space reinforcement not more than 16 inches (406 mm) o.c.
   2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.
   3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.07 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:
   1. Provide an open space not less than 1/2 inch (13 mm) wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
   2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
   3. Space anchors as indicated, but not more than 24 inches (610 mm) o.c. vertically and 36 inches (914 mm) o.c. horizontally.

3.08 CONTROL AND EXPANSION JOINTS

A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry using one of the following methods:
   1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
   2. Install preformed control-joint gaskets designed to fit standard sash block.

3. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

3.09 LINTELS

A. Install steel lintels where indicated.
B. Provide concrete lintels where indicated and where openings of more than 24 inches (610 mm) for block-size units are indicated without structural steel or other supporting lintels.
C. Provide minimum bearing of 8 inches (203 mm) at each jamb unless otherwise indicated.

3.10 REINFORCED UNIT MASONRY

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
   1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
   2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.
B. Placing Reinforcement: Comply with requirements in TMS 602.
C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
   1. Comply with requirements in TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
   2. Limit height of vertical grout pours to not more than 60 inches (1524 mm).

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements will be at Contractor's expense.
B. Inspections: Special inspections in accordance with Level 3 in TMS 402.
   1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
   2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
   3. Place grout only after inspectors have verified proportions of site-prepared grout.
C. Testing Frequency: One set of tests for each 5000 sq. ft. (464 sq. m) of wall area or portion thereof.
D. Concrete Masonry Unit Test: For each type of unit provided, in accordance with ASTM C140/C140M for compressive strength.
E. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, in accordance with ASTM C780.
F. Grout Test (Compressive Strength): For each mix provided, in accordance with ASTM C1019.

3.12 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent

construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
   2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
   3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
   4. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.13 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
   1. Crush masonry waste to less than 4 inches (102 mm) in each dimension.
   2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 31"Earthwork."
   3. Do not dispose of masonry waste as fill within 18 inches (457 mm) of finished grade.

C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 20 00

DIVISION 05 - METALS

SECTION 05 05 19 – POST INSTALLED ANCHORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This section includes post installed adhesive anchors, mechanical anchors and epoxy anchorage of rebar in hardened concrete.

1.03 RELATED WORK SPECIFIED ELSEWHERE:

1. Section 03 20 00 - Concrete Reinforcement
2. Section 03 30 00 - Concrete
3. Section 05 12 00 - Steel
4. Division 22 Hangers and Supports Section.
5. Division 23 Hangers and Supports Section.
6. Division 26 Hangers and Supports Section.

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
   1. International Building Code (IBC).
   2. American Concrete Institute (ACI):
      a. 318 – Building Code Requirements for Reinforced Concrete.
      b. 355.2 – Qualification of Post-Installed Mechanical Anchors in Concrete.
      c. 355.4 – Qualification of Post-Installed Adhesive Anchors in Concrete
   3. International Code Council Evaluation Service (ICC-ES)
      a. AC01 – Acceptance Criteria for Expansion Anchors in Masonry Elements
      b. AC58 – Acceptance Criteria for Adhesive Anchors in Masonry Elements
      c. AC60 - Acceptance Criteria for Anchors in Unreinforced Masonry Elements
      d. AC193 – Acceptance Criteria for Mechanical Anchors in Concrete Elements
      e. AC308 – Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements
   4. International Association of Plumbing and Mechanical Officials (IAPMO)

1.05 SUBMITTALS:

A. Submit as specified in DIVISION 1.
B. Include but not limited to, the following:
   1. Product specification data with recommended design values and physical characteristics for epoxy dowels, expansion and undercut anchors.
   2. Quality Assurance Submittals:
      a. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
      b. Certificates:
         (1) ICC ES Evaluation Reports.
   3. Manufacturer’s installation instructions.

4. Installer Qualifications & Procedures: Submit installer qualifications as stated in Section 1.06.B. Submit a letter of procedure stating method of drilling, the product proposed for use, the complete installation procedure, manufacturer training date, and a list of the personnel to be trained on anchor installation.

C. Closeout Submittals: Submit the following:
1. Record Documents: Project record documents for installed materials in accordance with Division 1 Closeout Submittals Section.

1.06 QUALITY ASSURANCE

A. Installer Qualifications:
1. All personnel installing adhesive anchors shall be ACI adhesive anchor certified.

B. Installer Training: Conduct a thorough training with the manufacturer or the manufacturer's representative for the installer on the project. Training to consist of a review of the complete installation process for drilled-in anchors, to include but not limited to:
1. hole drilling procedure
2. hole preparation & cleaning technique
3. adhesive injection technique & dispenser training / maintenance
4. rebar dowel preparation and installation
5. proof loading/torquing

C. Certifications: Unless otherwise authorized by the Engineer, anchors shall have one of the following certifications:
1. ICC ES Evaluation Report indicating conformance with current applicable ICC ES Acceptance Criteria.
2. IAPMO UES Evaluation Report indicating conformance with current applicable acceptance criteria.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to job site in manufacturer's clearly labeled unopened packaging, complete with installation instructions.

B. Protect and handle materials in accordance with manufacturer's recommendations to prevent damage or deterioration.

PART 2 - PRODUCTS:

2.01 MATERIALS

A. Fasteners and Anchors:
1. Bolts and Studs: ASTM A307; ASTM A449 where "high strength" is indicated on the Drawings.
2. Carbon and Alloy Steel Nuts: ASTM A563.
3. Carbon Steel Washers: ASTM F436.
4. Carbon Steel Threaded Rod: ASTM A36; or ASTM A193 Grade B7; or ISO 898 Class 5.8.
5. Wedge Anchors: ASTM A510; or ASTM A108.
6. Stainless Steel Bolts, Hex Cap Screws, and Studs: ASTM F593.
7. Stainless Steel Nuts: ASTM F594.
8. Zinc Plating: ASTM B633.
9. Hot-Dip Galvanizing: ASTM A153.
10. Reinforcing Dowels: ASTM A615

2.02 MECHANICAL ANCHORS

A. Mechanical anchors shall meet the qualification criteria of ACI 355.2, ICC-ES AC01 (masonry) or AC193 (concrete).

B. Use of mechanical anchors in permanently submerged conditions shall not be permitted.

C. Unless otherwise indicated on the Drawings, provide stainless steel anchors. Stainless steel anchors shall be AISI Type 304 stainless steel provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. Stainless steel nuts shall conform to ASTM F594 unless otherwise specified. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.

D. The type of anchors shall be as follows:

1. Wedge type, torque-controlled, with impact section to prevent thread damage complete with required nuts and washers.
   a. Life safety applications (Including but not limited to handrail and direct tension hangers)
      (1) Simpson Strong Tie – Strong Bolt 2
      (2) Hilti Kwik Bolt TZ
      (3) DeWalt – Power-Stud SD2
   b. Low risk to life safety (small pipe stands, Unistrut, etc.)
      (1) Simpson Strong Tie – Wedge All
      (2) Hilti Kwik Bolt 3
      (3) DeWalt – Power-Stud SD1
2. Screw Anchors: screw type. Pre-drilling of the hole requires a standard ANSI drill bit with the same diameter as the anchor and installing the anchor will be done with an impact wrench. Provide anchors with a diameter and anchor length marking on the head. Type and size as indicated on Drawings.
   a. Hilti Kwik-HUS-EZ
   b. Simpson Titen HD
3. Heavy Duty Undercut Anchors: Bearing type. Installed anchor shall have a minimum tension bearing area in the concrete, measured as the horizontal projection of the bearing surface, not less than two times the net tensile area of the anchor bolt. The installed anchor shall exhibit a form fit between the bearing elements and the undercut in the concrete. Type and size as indicated on Drawings.
   a. Simpson Strong Tie – Torq-Cut
   b. Hilti HDA Undercut Anchor
   c. DeWalt – Atomic+ Undercut
   d. Use only where specifically called for on drawings

2.03 ADHESIVE ANCHORS

A. Adhesive anchors shall meet the qualification criteria of ACI 355.4, ICC-ES A58 (masonry) or A308 (concrete).

B. Adhesive anchors shall not be installed in concrete less than 21 days of age.

C. Unless otherwise indicated on the Drawings, provide stainless steel anchors. Stainless steel anchors shall be AISI Type 304 stainless steel provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. All nuts shall conform to ASTM F594 unless otherwise specified. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.

D. Reinforcing dowels shall be A615 Grade 60.
E. The type of anchors shall be as follows:
    1. Epoxy Anchors – Life safety applications (Fall protection).
        a. Simpson Strong Tie – SET 3G
        b. Hilti – HIT-RE500 V3
        c. Hilti – HIT-HY200 V3
        d. DeWalt– PE1000+
        e. Adhesives Technology – Ultrabond HS-1CC
    2. Adhesive Anchors: (Used for non-vibrating equipment anchorage and other non-life safety attachments)
        a. Simpson Strong Tie – AT-XP
        b. Hilti – HIT-HY200 V3
        c. DeWalt– AC200+
        d. Adhesives Technology – Ultrabond EXP-3CC
    3. Epoxy Rebar Dowels:
        a. Simpson Strong Tie – SET 3G
        b. Hilti HIT-RE500 V3
        c. Adhesives Technology – Ultrabond HS-1CC
    4. Anchorage to Masonry, ICC-ES AC58 & AC60:
        a. Hilti HIT-HY270
            (1) Provide Hilti HIT-SC mesh sleeve when anchoring to hollow masonry.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Drilled-In Anchors:
    1. Drill holes with rotary impact hammer drills using carbide-tipped bits, hollow drill bit system, or core drills using diamond core bits. Drill bits shall be of diameters as specified by the anchor manufacturer. Unless otherwise shown on the Drawings, all holes shall be drilled perpendicular to the concrete surface.
        a. Cored Holes: Where anchors are permitted to be installed in cored holes, use core bits with matched tolerances as specified by the manufacturer. Properly clean cored hole per manufacturer's instructions.
        b. Embedded Items: Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Exercise care in coring or drilling to avoid damaging existing reinforcing or embedded items. Take precautions as necessary to avoid damaging prestressing tendons, electrical and telecommunications conduit, and gas lines.
            (1) Notify the Engineer prior to abandoning and relocating anchor holes if reinforcing steel or other embedded items are encountered during drilling and the specified embedment depth has not been met.
        c. Base Material Strength: Unless otherwise specified, do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
    2. Perform anchor installation in accordance with manufacturer instructions.
    3. Wedge Anchors, Heavy-Duty Sleeve Anchors, and Undercut Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in part to be fastened. Set anchors to manufacturer's recommended torque, using a torque wrench. Following attainment of 10% of the

specified torque, 100% of the specified torque shall be reached within 7 or fewer complete turns of the nut. If the specified torque is not achieved within the required number of turns, the anchor shall be removed and replaced unless otherwise directed by the Engineer.

4. Cartridge Injection Adhesive Anchors: Clean all holes per manufacturer instructions to remove loose material and drilling dust prior to installation of adhesive. Inject adhesive into holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive. Follow manufacturer recommendations to ensure proper mixing of adhesive components. Sufficient adhesive shall be injected in the hole to ensure that the annular gap is filled to the surface. Remove excess adhesive from the surface. Shim anchors with suitable device to center the anchor in the hole. Do not disturb or load anchors before manufacturer specified cure time has elapsed.
5. Observe manufacturer recommendations with respect to installation temperatures for cartridge injection adhesive anchors and capsule anchors.

3.02 REPAIR OF DEFECTIVE WORK

A. Remove and replace misplaced or malfunctioning anchors. Fill empty anchor holes and patch failed anchor locations with high-strength non-shrink, nonmetallic grout. Anchors that fail to meet proof load or installation torque requirements shall be regarded as malfunctioning.

END OF SECTION 05 05 19

SECTION 05 12 00 – STEEL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes fabrication and erection of the structural steel and other steel or metal items as defined in AISC Manual, Code of Standard Practice.

1.03 RELATED REQUIREMENTS:

A. Division 3 Concrete.
B. Section 05 05 19 – Post-Installed Anchors.
C. Section 09 90 00 - Protective Coatings.

1.04 REFERENCE STANDARDS:

A. American Institute of Steel Construction (AISC):
   1. Steel Construction Manual.
   2. 303 - Code of Standard Practice for Steel Buildings and Bridges.
B. American Welding Society (AWS):
   1. A4.3 - Standard Methods for Determination of the Diffusible Hydrogen Content of Martensitic, Bainitic, and Ferritic Steel Weld Metal Produced by Arc Welding.
   2. A5.1 - Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding.
   3. A5.4 - Specification for Stainless-Steel Electrodes for Shielded Metal Arc Welding.
   4. A5.5 - Specification for Low-Alloy Steel Electrodes for Shielded Metal Arc Welding.
   5. B4.0 - Standard Methods for Mechanical Testing of Welds.
   6. B5.1 - Specification for the Qualification of Welding Inspectors.
   7. C4.1 - Oxygen Cutting Surface Roughness Gauge and Chart for Criteria Describing Oxygen Cut Surfaces.
   8. C5.4 - Recommended Practices for Stud Welding.
   9. D1.1 - Structural Welding Code - Steel.
   10. D1.6 - Structural Welding Code - Stainless Steel.
   11. QC1 - Standard for AWS Certification of Welding Inspectors.
C. ASTM International:
   1. A1 - Carbon Steel Tee Rails.
   2. A6 - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
   3. A36 - Carbon Structural Steel.
   4. A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
   5. A106 - Seamless Carbon Steel Pipe for High-Temperature Service.
   6. A108 - Steel Bar, Carbon and Alloy, Cold-Finished.
   7. A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   8. A143 - Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
   9. A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware - AASHTO No.: M232.
   10. A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
   11. A193 - Alloy-Steel and Stainless-Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications.

12. A240 - Chromium and Chromium-Nickel Stainless-Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
13. A264 - Stainless Chromium-Nickel Steel-Clad Plate.
14. A307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
15. A312 - Seamless, Welded, and Heavily Cold Worked Austenitic Stainless-Steel Pipes.
16. A384 - Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies.
17. A385 - Providing High-Quality Zinc Coatings (Hot-Dip)
18. A449 - Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use.
19. A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
20. A563 - Carbon and Alloy Steel Nuts.
21. A572 - High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
22. A588 - High-Strength Low-Alloy Structural Steel, up to 50 ksi [345 MPa] Minimum Yield Point, with Atmospheric Corrosion Resistance - AASHTO No.: M222.
23. A673 - Sampling Procedure for Impact Testing of Structural Steel.
24. A780 - Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
25. A786 - Hot-Rolled Carbon Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.
26. A992 - Structural Steel Shapes.
27. A1011/A1011M - Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High- Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
28. B695 - Coatings of Zinc Mechanically Deposited on Iron and Steel.
29. C1107 - Packaged, Dry Hydraulic Cement Grout (Nonshrink).
30. F436 - Hardened Steel Washers.
31. F593 - Stainless-Steel Bolts, Hex Cap Screws, and Studs.
32. F594 - Stainless-Steel Nuts.
33. F959 - Compressible-Washer-Type Direct Tension Indicator for Use with Structural Fasteners.
34. F1554 - Anchor Bolts, Steel, 36-, 55-, and 105-ksi Yield Strength.
35. F2329 - Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners.
36. F3125 - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions

D. The National Association of Architectural Metal Manufacturers (NAAMM):
   1. MBG 531 - Metal Bar Grating Manual.
   2. MBG 532 - Heavy Duty Metal Bar Grating Manual.
   3. MBG 533 - Welding Specifications for Fabrication of Steel, Aluminum and Stainless-Steel Bar Grating.

E. Research Council on Structural Connections (RCSC):
   1. Specification for Structural Joints Using High-Strength Bolts.

F. Society for Protective Coatings (SSPC) Surface Preparation Specifications:
   1. SP1 - Solvent Cleaning.
   2. SP3 - Power Tool Cleaning.
   3. SP5 - White Metal Blast Cleaning.
   4. SP6 - Commercial Blast Cleaning.

5. SP10 - Near-White Blast Cleaning.
6. SP11 - Power Tool Cleaning to Bare Metal.

G. Occupational Safety and Health Administration (OSHA) - All applicable OSHA regulations, including, but not limited to 29 CFR Part 1910 and Part 1926 Subpart R - Steel Erection.

1.05 SUBMITTALS:

A. Submit as specified in Division 01.

B. Includes, but not limited to, the following:

1. Fabrication and erection drawings for all Work. A reproduction of Engineer-prepared Contract Drawings may be used for erection drawings such as to indicate information on erection or to identify detail drawing references. Where the drawings are revised to show this additional information, Engineer's title block and professional seal shall be removed from the drawing. These erection drawings shall be revised for subsequent Engineer revisions to the Contract Drawings.
2. Fabrication and erection drawings shall be grouped in sets or sequences and shall be identified separately for each building, structure, or area.
3. In the event that drawing revisions are necessary, fabrication and erection drawings shall be clearly clouded showing all changes from the previous revision.
4. All necessary information for the fabrication, including connection material specifications and sizes as well as filler metal for welds, of the component part of the structure, presented on drawings to conform to recognized standard practice, AISC Manual and AWS Code.
5. Drawings indicating stud shear connector spacing regardless of whether connectors are shop-applied or field-applied.
6. Drawings showing each piece including anchor bolts marked for identification to correspond to erection drawings.
7. Proposed method and location for erection piece mark numbering.
8. Manufacturer's literature on products including, but not limited to, grating, stair treads, stair nosings, stud shear connectors, grout, concrete anchors, and protective coatings.
9. AWS Certified Welding Inspector Certificates.
10. Welder qualification records.
11. Qualified welding procedure specifications and procedure qualification test results if welding processes differ from those prequalified by AWS.

C. High-Strength Connection Bolt and Nut Manufacturer's Inspections Certificate:

1. Certify that bolts, nuts, and washers furnished comply with all of the requirements of these Specifications, and shall provide complete manufacturer's mill test reports (Manufacturer's Inspections Certificate).
2. Certificate numbers shall appear on the product containers and correspond to the identification numbers on the mill test reports.
3. Manufacturer's symbol and grade markings shall appear on all bolts and nuts.

1.06 QUALITY ASSURANCE:

A. Fabricator Qualifications: Fabricator shall participate in the AISC Certification Program and be designated an AISC Certified Plant, Category BU (formerly known as Category STD).

B. Erector Qualifications: Erector shall participate in the AISC Certification Program and be designated an AISC Certified Erector, Category (ACSE) (CSE).

C. Each piece of mill material shall be legibly marked with the heat number, size of section, length, and mill identification marks in accordance with ASTM A6 plus the fabrication mill

order number. Alternate material tracking procedures may be used when approved by Engineer.

D. For material other than ASTM A36/A36M, the appropriate specification number, grade, heat number and fabrication mill order number shall be transferred to the remnant.

E. Mill material with specified minimum yield strength higher than 36 ksi shall be marked with the color designated in ASTM A6/A6M. Alternate material tracking procedures may be used if approved by the purchaser.

F. Welder Qualifications:
   1. Welders shall be previously qualified by passing the tests prescribed in the AWS D1.1 or by passing such other tests as Engineer may accept. Welders of stainless steel shall be previously qualified in accordance with AWS D1.6.
   2. Welders shall have been tested within the past 12 months, and their qualification shall be considered as remaining in effect unless the welder is not engaged in a given process of welding for a period exceeding 6 months.

G. Inspection: Material or workmanship may be subject to inspection in the shop and field. Engineer shall have unrestricted entry to fabrication facilities and erection site at all times while work is being performed.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. Handle and store all steel and appurtenances as specified in Division 01.

B. Deliver steel in the order needed for erection as follows:
   1. Loose base plates.
   2. Steel embedded in concrete.
   3. Erection bolts.
   4. First tier columns and framing for all its levels (including stairs, ladders, and guardrail).
   5. Columns and framing for remaining tiers in order.

C. Railcars and/or trucks shall be loaded and cribbed so they can be readily unloaded.

D. All steel and its coatings shall be protected from damage caused by handling, storage, and shipping.

E. All materials and documentation shall be inspected immediately upon receipt at the erection site to determine that all items in the bill of material have been supplied, to assure that all documentation has been received, and to check for any damage.

F. Store all steel and appurtenances blocked-up off the ground and in orderly stacks.

G. Protect all items with shop applied protective coatings from corrosion. Store in an environment and manner consistent with type of coating.

PART 2 - PRODUCTS

2.01 BASIC MATERIALS:

A. Steel: Conform to the following unless otherwise indicated or specified.
   1. Wide flange (WF) shapes and tees cut from WF: ASTM A992 (50 ksi yield strength) or ASTM A572, Grade 50.
   2. M shapes, S shapes, HP (bearing piles), channels, and angles: ASTM A36 or ASTM A572, Grade 50, unless noted otherwise.
   3. Structural plates and bars: ASTM A36 or ASTM A572 Grade 50, unless noted otherwise.

B. Corrosion-Resistant Steel: Conform to ASTM A588, Grade 50.

C. Rail Steel: Conform to No. 1 rail, ASTM A1 of the weight indicated or specified.

D. Stainless or Heat-Resisting Chromium-Nickel Steel: Conform to ASTM A167 and A240.

E. Connection Bolts, Nuts, Washers, and Compressible Washer-Type, Direct Tension Indicators:
   1. Conform to ASTM A3125 Grade A325, Type 1, unless otherwise indicated or specified.
   2. Be galvanized when connecting galvanized steel.
   3. Conform to A3125, Type 3, for use with A588, Grade 50.
   4. Compressible Washer-Type, Direct-Tension Indicators:
      a. ASTM F959 Type 325 for use with A325 bolts.
      b. ASTM F959 Type 490 for use with A490 bolts.
      c. Galvanized for use with galvanized bolts.
   5. Nuts: Heavy Hex conforming to ASTM A563 Grade DH.
   6. Flat and beveled washers: Conform to ASTM F436.

F. Anchor Bolts:
   1. Conform to ASTM F1554, Grade 36, unless otherwise indicated to be stainless steel or high strength.
   2. Machine Bolts: Conform to ASTM F1554, Grade 36.
   3. Stainless Steel: Conform to ASTM F593, Type 304, with nuts conforming to ASTM F594. Sleeves shall conform to ASTM A312.
   4. High Strength: Conform to ASTM A449 with nuts conforming to ASTM A563.
   5. Washers:
      a. For ASTM F1554 and A449 Bolts: Conform to F436.
      b. For Stainless-Steel Bolts: Conform to ASTM A167, Type 304, and dimensional tolerances of F436.
   6. Galvanize all anchor bolts, nuts, and washers except stainless steel.

G. Pipe for Structural Uses: Conform to ASTM A53, Type E or S, Grade B, or ASTM A106, Grade B.

H. Square and Rectangular Tubing Hollow Structural Sections (HSS): Conform to ASTM A500, Grade C.

I. Round Hollow Structural Sections (HSS): Conform to ASTM A500, Grade B.

J. Grating:
   1. Main Bars: Conform to ASTM A1011, Commercial Steel (Type B).
   2. Cross Bars: Same as main bars.

K. Shear Stud Connectors: Manufacture from cold-finished carbon steel conforming to ASTM A108, Grade 1015 or 1020.

L. Checkered Plate: Conform to ASTM A786 with A36 material and with deformations of the 4-way type.

M. Threaded Rods: Conform to ASTM A36.

N. Welding:
   1. For ASTM A36 steel, use E70 electrodes for shielded metal arc welding, F7 series electrodes for submerged arc welding, E70T series electrodes for flux-cored arc welding, and ER70S series electrodes for gas metal arc welding. Select "matching" electrodes in accordance with Table 3.1 AWS D1.1.
   2. For ASTM A588 steel, use E70 low-hydrogen electrodes for shielded metal arc welding, F7 series electrodes for submerged arc welding, E70T series electrodes for flux-cored arc welding, and ER70S series electrodes for gas metal arc welding. Select "matching" electrodes in accordance with Tables 3.1 and 3.3, AWS D1.1.
   3. For ASTM A572, Grade 50 steel or ASTM A992 steel, use E70 low-hydrogen electrodes for shielded metal arc welding, F7 series electrodes for submerged arc welding, E70T series electrodes for flux-cored arc welding, and ER70S series electrodes for gas metal arc welding. Select "matching" electrodes in accordance with Table 3.1, AWS D1.1.

4. For ASTM A167 or ASTM A312 stainless steel, use shielded metal arc welding, gas metal arc welding, gas tungsten arc welding, or flux-cored arc welding. Select "matching" electrodes in accordance with Table 3.3 of AWS D1.6.

O. Galvanizing:
1. Conform to ASTM A123.
2. Nuts, bolts, and washers shall be hot-dip galvanized to conform to ASTM F2329 or mechanically galvanized to conform to ASTM B695.
3. All holes required for bolts and attachment of other elements shall be drilled prior to galvanizing.

2.02 STEEL FABRICATION:

A. Fabricate all steel to conform to AISC Code of Standard Practice for Structural Steel Buildings and Bridges, AISC 360, and applicable portions of OSHA 29 CFR Part 1910 and Part 1926.

B. Permissible variations for sweep, camber, length, and cross section of all steel members shall conform to ASTM A6, AISC Manual, Part 1 and AISC Code of Standard Practice unless indicated otherwise.

C. Field-measure existing steel and structures where necessary to ensure fabrication fit-up of new steel.

D. All pieces shall be clearly marked with a permanent identifying erection mark number. Method and location of marking shall be approved by Engineer. Erection markings for galvanized steel shall be mechanically stamped on steel tags with 1/8-inch minimum thickness. Tags shall be bent to provide clearance for galvanizing between the member and the tag, except at the tag ends. Tag ends shall be welded to the member.

E. Fabricator shall mark all shear connector locations (if field-applied) for composite beams by means of center punch and paint circle or other approved means so that field layout of shear connectors is not required. Do not paint shear connector contact surface.

F. Provide grout holes in base plates having the least dimension greater than 24 inches. Holes shall be as close to center as practicable and minimum of 2 inches in diameter.

G. Shop Milling:
1. Perform at the base of columns and at the top of column base plates, except that rolled-steel bearing plates of 4-inch thickness or less may be straightened by pressing.
2. Perform on butted ends for bolted or partial penetration-welded column splices. Shop milling is not required for welded column splices with full penetration welds.
3. Perform at ends of columns which butt against a plate.

H. Welding:
1. All welding shall be shielded metal arc, submerged arc, or flux-cored arc, or gas metal arc. For gas metal arc welding, the short-circuiting mode of filler metal transfer is not permitted. Other welding processes may be used provided they are qualified by applicable tests as prescribed in the AWS D1.1 (AWS D1.6 for stainless steel) and approved by Engineer prior to use. For the use of any other welding process, submit a qualified welding procedure specification and the procedure qualification test results. Welding processes shall be approved for use only after receipt of specific written approval from the Engineer.
2. Conform to AWS Code and AISC Manual.
3. Perform fabrication welding inspection in accordance with AWS D1.1. (AWS D1.6 for stainless steel). This welding inspection shall be performed by AWS Certified Welding Inspector(s) (CWI). All such Certified Welding Inspectors shall be qualified and certified in accordance with the provisions of AWS QC1. Only individuals so qualified shall be authorized to perform fabrication/erection or verification inspection of the

welding performed under the provisions of AWS D1.1 (AWS D1.6 for stainless steel) and these Contract Documents. Certifications verifying the qualifications of welding inspectors shall be submitted prior to commencement of structural welding operations or prior to welding inspection performed by an individual welding inspector. Defective welds shall be corrected.

I. Shop Connections:
   1. Weld or bolt except when otherwise indicated or specified.
   2. Shop portions of connections may be welded equivalent to any bolted connection specified if Engineer concurs.
   3. Welded connections shall be as indicated or in accordance with acceptable alternative designs:
      a. Welds of connection angles to beam webs shall conform to AISC Manual, Part 10, Table 10-2 with particular regard for minimum web thickness. Provide longer connection angles or reinforce web as required.
      b. All butt-joint groove welds shall be complete penetration welds unless otherwise indicated and shall conform to the applicable standards in AISC Manual, Part 8, with special emphasis on maintaining root opening. Accomplish this for single-bevel, butt-joint welds by using backup plates or by chipping out and welding on the opposite side.
      c. Prepare weld bevels with a mechanically guided cutting torch or by grinding.
      d. Remove all run-out tabs.
   4. Bolted connections shall conform to AISC Manual, Parts 9 and 10.
      a. All bolted connections shall be made with Bearing Type connections using 3/4-inch bolts, nuts, and washers unless otherwise indicated or specified.
      b. Bearing Type Connections: Capacity of beam connections shall have a minimum capacity of that specified in AISC Manual, Part 10, Table 10.1 for "Standard Holes" in bearing type connections (thread condition N) with the number of bolt rows indicated. A minimum of one hardened washer shall be supplied with each bolt.
      c. Use the minimum number of rows of bolts for beam connections so that bottom row is at or below the centerline of the beam.
      d. Bolts to be installed in the shop shall be tightened in accordance with the provisions for field connections in PART 3.

J. Provisions for Field Connections:
   1. Provide with bolted connections unless otherwise indicated or specified. The number of rows and number of bolts indicated on the Drawings or stated in the Specifications is the minimum number of rows or bolts. Provide additional bolts or connection devices, if necessary, to comply with OSHA regulation 29 CFR 1926, Subpart R - Steel Erection.
   2. Provide for field welding only when so indicated or where approved by Engineer.
   3. Provide all members to be field-welded with bolted erection connections adequate to resist erection stresses prior to field welding.

K. Comply with OSHA 29 CFR 1926, Subpart R - Steel Erection.

2.03 COLUMN BASE AND EQUIPMENT ANCHOR BOLTS:

A. Furnish for all columns and equipment furnished and installed under this Contract, (and as required to install all equipment furnished by others for installation under this Contract unless otherwise indicated).

2.04 EDGE ANGLES, PLATES, AND LINTELS:

A. Furnish around and over openings as indicated.

B. Keep plates and edge angles flush at intersections and fillet-weld to give a neat appearance at the exposed intersecting surfaces.
C. Provide lintel length of opening width +1 foot 4 inches unless otherwise indicated.
D. Properly align, level, and plumb edge angles and plates before concrete is placed.

2.05 STEEL FLOOR GRATING:

A. One-piece, resistance-welded, carbon-steel construction without notching of bearing or cross bars before welding and conforming to NAAMM MBG 531 or 532.
B. Main Bearing Bars:
   1. Thickness: 3/16 inch or; 3/8 inch for grating specifically noted on drawings as "Heavy Duty".
   2. Depth: As indicated on drawings.
   3. Spacing: Not more than 1-3/16 inches on center or; 1-3/8 inches on center for "Heavy Duty" grating.
   4. Configuration of top surface of main bars unless otherwise indicated:
      a. Exterior - Exposed to Weather: Serrated.
      b. Interior - Not Exposed to Weather: Plain.
C. Cross Bars:
   1. Spacing: 4 inches o.c.
   2. One of the following shapes and minimum sizes:
      a. Hexagon: 5/16-inch diameter of inscribed circle or; 7/16 inch for "Heavy Duty" grating.
      b. Rectangular: 1/2 inch by 3/16 inch or; 5/8 inch by 1/4 inch for "Heavy Duty" grating.
      c. Square: 1/4 inch with spiral twist or; 1/2 inch for "Heavy Duty" grating.
      d. Round: 3/8-inch diameter or, 1/2 inch for "Heavy Duty" grating.
D. Fabrication:
   1. Fabrication shall conform to NAAMM MBG 531 or; MBG 532 for "Heavy Duty" grating, and MBG 533.
   2. Crossbars shall match crossbars of adjacent sections to form a continuous pattern of straight lines.
   3. Provide all openings in grating indicated and as required for installation of all piping, wiring, and equipment installed under this Contract.
   4. Band all openings 4 inches and larger with a metal bar same size as main bearing bar and extend 4 inches above top of grating. Band bars shall be same depth as bearing bars. Weld to each bearing bar with a 3/16-inch fillet weld 3/4 inch long. Tack weld to all crossbars.
   5. Trim-band all locations as follows:
      a. Open end of grating at head of a ladder.
      b. Manway opening.
      c. Hinged sections.
      d. Grating panels with four crossbars or less.
      e. Other locations as indicated.
E. Shop Finish:
   1. Hot-dip galvanize after fabrication except where otherwise indicated.
F. Grating shall be manufactured by one of the following:
   1. Tru-Weld Grating, Inc., Wexford, Pennsylvania.
   2. Amico-Klemp Corporation, Chicago, Illinois.
   3. IKG-Borden, Clark, New Jersey.

4. Approved equal.

G. Provisions for Grating Connections:
   1. Provide sufficient quantity of grating connecting devices to provide two fasteners at each support +10% extra fasteners.
   2. Clip-type connections using mechanical beam clamps:
      a. Hilti X MGR Grating Fastening System.
      b. Grating Fasteners, Inc. G-Clips.
      c. Lindapter North America Grate-Fast.
   3. Grating Hatches, Locks, Lift Handles and other Custom Fabrications:
      a. Ohio Gratings, Inc.
      b. Grating Systems, Inc.
      c. Engineer-approved equal.
   4. Finish of grating fasteners shall match finish of grating.

2.06 STAIRS:

A. General Construction:
   1. Stringer sizes indicated are minimum acceptable size.
   2. Cross-brace stringers to provide lateral stability where the horizontal run exceeds 12 feet.
   3. Provide struts and hangers where indicated or as otherwise required for proper support.

B. Treads:
   1. Open-riser type with grating conforming to PART 2 - Steel Floor Grating, this Section, and of the same type as specified herein, with main bars 1 inch by 3/16 inch unless indicated otherwise.
   2. Treads damaged during construction shall be replaced immediately.
   3. Nosings for grating stair treads shall be:
      a. Standard checkered-plate nosing. Coating shall be same as specified for stair treads. Attach to treads by welding.
      b. As indicted on Drawings.
   4. Bolt tread to each stringer with a minimum of two 3/8-inch bolts.

C. Grating Landings:
   1. Landings shall be of grating conforming to PART 2 - Steel Floor Grating, this Section.

2.07 CHECKERED PLATE:

A. Plate shall be of thickness indicated with surface deformations of the 4-way type.
B. Fasten in place with screws spaced at 18 inches with a minimum of one at each corner of each piece or as otherwise indicated.
C. Screws shall be 1/4-inch countersunk stainless steel.

2.08 STUD SHEAR CONNECTORS:

A. General:
   1. Conform to specification for Stud Shear Connectors in AISC Manual, Part 16.
   2. Number, size, and spacing shall be as indicated.

B. Stud Shear-Connector Welding:
   1. Conform to AWS C5.4 for stud welding and recommendations of the connector manufacturer. Fillet welding of studs is not approved.
   2. Stud shear connectors shall be shop- or field-welded at Contractor's option. Studs that obstruct walking surfaces of beams or joists shall be field welded. Conform to the requirements of 29 CFR 1926, Subpart R - Steel Erection.

3. Stud welding, equipment, and power requirements for stud welding shall conform to manufacturer's recommendations.
4. Clean stud shear-connector weld area of scale, rust, oil, paint, and any other foreign substance that would inhibit sound welds.
5. All welding ferrules for stud shear-connectors shall be removed from studs and deck prior to placement of concrete.

C. Inspection:
1. Workmanship of the stud shear-connector welding will be verified as follows:
a. Studs shall be at least 1/8 inch shorter after welding.
b. Studs shall have a 360-degree weld fillet at base with no undercut.
c. Any stud having a questionable weld will be subjected to a bend test by bending the stud away from its axis until failure occurs but not exceeding 30 degrees. Failure should occur in the stud, not in the weld. Replace studs that do not bend 30 degrees without failure or otherwise do not meet these Specifications.

2.09 CONCRETE ANCHORS:

A. Furnish and install manually expanded and adhesive anchor types as specified in Section 05 05 19.
B. Furnish sizes indicated and install to conform to manufacturer's printed instructions.
C. Concrete anchors that are not specifically indicated to be high strength steel or stainless steel shall be carbon steel with surface plating or galvanizing in accordance with manufacturer's standard.
D. Anchors indicated to be high strength steel anchors shall be surface plated or galvanized in accordance with manufacturer's standard.
E. Anchors indicated to be stainless steel shall be manufactured from 300 series stainless steel per the manufacturer's standard unless specifically indicated to conform to Type 304, 316.
F. Installed adhesive anchors shall not be disturbed or loaded until the anchor has been in place longer than the manufacturer's cure time for the adhesive.

2.10 SHOP-PROTECTIVE COATING:

A. Prepare surface and apply primer (first coat) as specified in Section 09 90 00.
B. Apply primer in shop to all steel including connections, except for the following surfaces:
1. Where encased in concrete.
2. Covered with gunite.
3. Within 3 inches adjacent to field welds.
4. On faying surfaces of bolted connections when using alkyd primer.
5. Top flange and anchors on composite beams.

2.11 GALVANIZING:

A. General:
1. Galvanize all steel (including structural steel members, grating, floor plate, and fasteners) after fabrication.
2. Do not galvanize ASTM A490 bolts or crane rails.
3. Conform to ASTM A123 for structural shapes and plates.
4. Nuts, bolts, and washers shall be hot-dip galvanized to conform to ASTM F2329 or mechanically galvanized to conform to ASTM B695.

B. Fabrication:
1. Safeguard against embrittlement in accordance with ASTM A143.
2. Safeguard against warping and distortion in accordance with ASTM A384.

3. Fabrication details shall be in accordance with ASTM A385 to allow for the creation of high quality zinc coatings.
4. Cutting, drilling, and welding shall be performed before galvanizing.
5. Weld slag shall be removed before galvanizing.
6. Edges of tightly contacting surfaces shall be seal welded using minimum 1/8-inch fillet welds.
7. Vent holes shall be provided for piping or tubular assemblies (including guardrail and handrail) as required by ASTM A385.
8. Potential issues which could cause a problem in galvanizing shall be brought to the Engineer's attention prior to galvanizing.

C. Galvanizing of Steel Hardware:
1. Nuts shall be tapped oversize in accordance with ASTM A563.
2. Nut threads shall be re-tapped after hot-dip galvanizing to provide proper fit.
3. Direct tension indicators shall be mechanically galvanized by the manufacturer in accordance with Class 50 of ASTM B695.

D. Repair:
1. Any damage to galvanizing shall be repaired in accordance with ASTM A780.
2. Before repair of damaged galvanized coating, exposed substrate metal shall be cleaned to bright metal and free of all visual rust, oil, or grease. Any nonadhering galvanizing shall be removed to the extent that the surrounding galvanizing is integral and adherent.
3. If surface defects exceed 2% of a member's area, the defects shall be repaired by redipping the member in the zinc bath.
4. Cold repair using an organic zinc rich coating shall be permitted if the following conditions exist:
   a. Total damaged area is less than 1% of the total coated area of the member being repaired.
   b. No single repair is greater than 2 square inches (1300 mm^2).
   c. No single repair is greater than 12 inches (300 mm) long.
5. For cold repair:
   a. Repair areas in accordance with ASTM A780, Method A2.
   b. Apply organic zinc-rich primer containing a minimum of 93% zinc in dry film by weight. Apply in multiple coats (allowing proper recoat time) to achieve 8-mil dry film thickness.
   c. Color shall approximately match the color of galvanizing.
   d. Cold galvanizing compound shall be one of the following:
      (1) Crown North American Professional Products Co. Inc. - Cold galvanizing compound.
      (2) Sentry Chemical Company - Galvonic.
      (3) Subox, Division of Carboline - Galvanox Type II.
      (4) ZRC Worldwide - Cold Galvanizing Compound.
6. Hot repairs shall be made in the shop if any of the following conditions exist:
   a. Total damaged area is greater than 1% but less than 2% of the total coated area of the member being repaired.
   b. Any single repair is at least 2 square inches (1300 mm^2) in area.
   c. Any single repair is 12 inches (300 mm) long or more.
7. Hot repair shall be made using zinc alloy rod or powder manufactured for the repair of galvanized steel.
8. Flux, heavy ash, or heavy dross inclusions shall be removed by brushing, grinding, or filing as required.

9. Galvanized steel which has been rejected shall be stripped, regalvanized, and submitted again for inspection.
10. Correction of excessive warpage that exceeds ASTM A6/A6M criteria shall be performed by press straightening if possible.
11. The application of localized heating to straighten shall be approved by Engineer.
12. If galvanized tension control bolts are used, all bare steel surfaces (i.e., bolt ends) shall be repair galvanized in accordance with this Section.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Field-check location and elevation of column anchor bolts and footings before erecting structural steel columns.
B. Field-measure existing steel for plumbness and elevation at connecting points.
C. Submit the method and sequence of erection for acceptance.
D. Assure that all preassemblies not specifically indicated on Contract Drawings to be preassembled before lifting shall maintain structural integrity during lifting.

3.02 STEEL ERECTION:

A. Erect all steel to conform to AISC specifications, codes, and standards or any local, state or federal codes which may exceed such requirements. Comply with applicable OSHA regulations including 29 CFR 1926, Subpart R - Steel Erection.
B. Protect existing structure from weather when connecting steel to existing structure.
C. Protect steel and anchor bolt sleeves from entrapped water that can cause damage from freezing or corrosion.
D. Column Base Plates:
    1. Prior to setting base plates, clean out sleeves of all foreign material and liquid. Clean bearing surface on foundation and bottom of base plate.
    2. Grout under base plates with a flowable nonshrink grout, taking special care not to disturb their grade and alignment.
    3. Flowable nonshrink grout shall conform to ASTM C1107.
    4. Cut off exposed edges of the grout at 45 degrees along the edges of the base plates after grout has acquired its initial set.
    5. In hot or cold weather conform to manufacturer's recommendations for temperature control for grouting operations.
E. Erection Bracing:
    1. Provide all necessary erection bracing and be responsible for structural adequacy, design, engineering, and construction of erection bracing.
    2. Provide all necessary temporary struts, ties, cables, temporary flooring, planking, and scaffolding in connection with the erection of the structural steel or support of erection machinery.
    3. Place as required to maintain proper position against loads from erection equipment, construction material, and wind.
    4. Leave bracing in place until sufficient steel connections, concrete slabs, exterior walls, and roof decks are in place to ensure stability of the structure.
F. Connections:
    1. Unless otherwise indicated, connections shall be bolted bearing type.
    2. Tighten high-strength bolts to correct bolt tension in accordance with AISC Manual, Part 16, "Specification for Structural Joints Using High-Strength Bolts."

a. Bearing Type Connections: Tighten all bolts to the pretensioned condition, except that beam-to-beam connections in floor framing which do not connect to any bracing members may be tightened to the snug-tightened condition:
b. Furnish the inspecting wrench and one man to assist the Engineer when inspections are performed.
c. Provide Skidmore-Wilhelm Bolt-Tension calibrator or approved equal for adjusting inspection wrench in accordance with "Specification for Structural Joints Using High-Strength Bolts", Section 9.
d. Three bolt, nut, and washer assemblies from each lot supplied shall be tested in a tension measuring device at the jobsite at the beginning of the bolting start-up to demonstrate that the bolts and nuts, when used together, can develop tension not less than that provided in "Specification for Structural Joints Using High-Strength Bolts", Table 8.1 for the size and grade. The bolt tension shall be developed by tightening the nut.
e. The job-inspecting torque shall be determined in accordance with "Specification for Structural Joints Using High-Strength Bolts", Section 8.
f. The minimum number of bolts inspected and any required retightening shall be per "Specification for Structural Joints Using High-Strength Bolts", Section 9.
g. Comply with OSHA regulation 29 CFR 1926, Subpart R - Steel Erection.

3. Compressible Washer-Type, Direct-Tension Indicators:
   a. The use of compressible washer-type, direct-tension indicators is an acceptable alternative to the requirements of PART 3, Paragraph 2.F. - Connections, this Section, in determining specified minimum bolt tension.
   b. Direct-tension indicators shall be manufactured by one of the following:
      (1) Turnasure, L.L.C., Langhorne, Pennsylvania.
      (2) Applied Bolting Technology Products, Inc.
      (3) Approved equal.
   c. Manufacture, install, and store in accordance with manufacturer's written instructions and ASTM F959.
   d. Provide Skidmore-Wilhelm Bolt Tension Calibrator or approved equal to allow Engineer random verification that the direct-tension indicators provide proper bolt tension.
4. Where required for connection fit-up, bolt holes may be adjusted in one of the following manners (flame cutting or flame enlargement of holes is not allowed):
   a. Reamed to AISC allowable maximum size for oversized holes.
   b. Holes may be filled with weld metal, ground smooth, and field-drilled.
   c. Other Engineer-approved method.
5. Welded Connections:
   a. Make welded connections as indicated and leave all erection bolts in place after completion of welding unless otherwise indicated.
   b. Reinforce connections when members requiring fillet welds are not in contact.
   c. Use backup bars or spacer bars on all butt welds where root opening exceeds 3/16-inch.
   d. Remove all run-out tabs.

G. Welding and Welders:
1. The requirements for erection welding and welders shall be the same as specified for basic materials and for steel fabrication.
2. All welds shall be stamped with a mark identifying the welder. Remove welders from Work after two defective welds.

3. Perform erection-welding inspection in accordance with AWS D1.1. (AWS D1.6 for stainless steel.) This welding inspection shall be performed by AWS Certified Welding Inspector(s) (CWI). All such Certified Welding Inspectors shall be qualified and certified in accordance with the provisions of AWS QC1. Only individuals so qualified shall perform fabrication/erection or verification inspection of the welding performed under the provisions of AWS D1.1 Code (AWS D1.6 for stainless steel) and these Contract Documents. Certifications verifying the qualifications of welding inspectors shall be submitted prior to commencement of structural welding operations or prior to welding inspection performed by an individual welding inspector. Defective welds shall be corrected.

H. Protect pipe sleeves, other anchorage members, and concrete bases from deleterious materials at all times, and from water which may cause ice damage during freezing weather.

I. Grating:
   1. Grating installation shall conform to NAAMM MBG 531 or MBG 532 and as specified herein.
   2. Space fasteners as required to overcome irregularities and maintain grating contact with supports. Minimum anchorage of each panel shall be two fasteners at each support.
   3. Install grating fasteners per manufacturer's printed instructions.
   4. All grating shall be removable unless otherwise indicated.

J. Stud Shear Connectors: The requirements for field-installed stud shear connectors shall be the same as specified for shop-installed connectors.

K. Concrete Anchors:
   1. Install anchors to conform to manufacturer's printed instructions.
   2. The hole tolerances, drill bits, and anchor installation torque shall be as per manufacturer's printed recommendations.

3.03 FIELD-PROTECTIVE COATINGS:

A. Surface preparation, priming, and finish coating are specified in Section 09 90 00.

3.04 REPAIR OF GALVANIZED SURFACES:

A. Repair all damaged galvanized surfaces in accordance with the "Galvanizing" paragraph in PART 2, this Section.

END OF SECTION 05 12 00

SECTION 05 45 00 - ALUMINUM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes the following aluminum-fabricated items:
   1. Structural shapes and plate.
   2. Pipe handrail and guardrails.
   3. Grating and treads.
   4. Tread plates.
   5. Ladders.
   6. Nuts and bolts.

1.03 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 05 12 00 - Steel Grating and Floor Plates.
B. Section 08 34 83 - Floor Access Doors.

1.04 REFERENCE STANDARDS:

A. Applicable Standards:
   1. Aluminum Association (AA):
      a. Aluminum Design Manual.
   2. American National Standards Institute (ANSI):
      a. A14.3 - Fixed Ladders - Safety Requirements.
   3. ASTM International (ASTM):
      a. A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
      b. B209 - Aluminum and Aluminum Alloy Sheet and Plate.
      c. B221(B211) - Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.
      d. B308 - Aluminum Alloy 6061 T6 Standard Structural Profiles.
      e. B429 - Aluminum-Alloy Extruded Structural Pipe and Tube.
      f. B632 - Aluminum-Alloy Rolled Tread Plate.
      g. F436 - Hardened Steel Washers.
      h. F467 - Nonferrous Nuts for General Use.
      i. F468 - Nonferrous Bolts, Hex Cap Screws, and Studs for General Use.
      j. F593 - Stainless-Steel Bolts, Hex Cap Screws, and Studs.
      k. F594 - Stainless-Steel Nuts.
   4. American Welding Society (AWS):
      a. D1.2 - Structural Welding Code - Aluminum.

1.05 DEFINITIONS:

A. Handrails: A single pipe supported on a guardrail or brackets from a wall, as on a stairway or ramp, to furnish persons with a handhold in case of tripping.
B. Guardrails and railings: A vertical barrier erected along exposed edges of a floor opening, wall opening, ramp, platform, runway, or stairway to prevent falls of persons. The top member of a guardrail serves as a handrail. The terms handrails, guardrails, and railings may be used interchangeably.

C. Toeboards: A vertical barrier at floor level erected along exposed edges of a floor opening, wall opening, platform, runway, or ramp to prevent falls of materials.

1.06 SUBMITTALS:

A. Submit as specified in DIVISION 01.
B. Include, but not limited to, the following:
   1. Specifications.
   2. Fabrication and erection drawings including sizes, connections, anchorage, size and type of fasteners, and accessories.
   3. Catalog cuts.
   4. Structural computations and metal properties.
   5. Material samples.
   6. Manufacturer's assembly and installation instructions.
   7. Manufacturer's maintenance manual.

1.07 QUALITY ASSURANCE:

A. Guardrails and handrails shall be the product of a company normally engaged in the manufacture of pipe railings.
B. Inspection: Material and workmanship will be subject to inspection in the shop and field.
C. Welder Qualifications:
   1. Welders shall be previously qualified by passing the tests prescribed in the AWS D1.2 Qualification Section and the AA Qualification Standard for Structural Welding of Aluminum, or by passing such other tests as Engineer may accept.
   2. Welders shall have been tested within the past 12 months, and their qualification will be considered as remaining in effect unless the welder has not engaged in a given process of welding for a period exceeding 6 months.
   3. Submit two certified copies of the qualification records as evidence of qualification to the above mentioned codes.

1.08 DELIVERY, STORAGE, AND HANDLING:

A. Protect aluminum Work from abuse, staining, or damage during shipment, storage, erection, and installation.
B. Store in a manner to prevent warping of materials.
C. Materials shall be properly packaged to prevent scratching and denting during shipment, storage, and erection. Maintain protective wrapping until Project is completed.

1.09 DESIGN REQUIREMENTS:

A. Guardrails, handrails, and ladders shall be designed and fabricated in strict compliance with the requirements of the IBC 2018.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS:

A. Fabricate all aluminum to conform to AA specifications, codes, and standards.
B. Standard tolerances of all aluminum members shall conform to AA Aluminum Design Manual.
C. Fabricate all materials free of blemishes, tool marks, burrs, and other defects.
D. Shop-fabricate insofar as possible.
E. Welding:
   1. Conform to AA Aluminum Design Manual, and AWS D1.2.

2. All welding shall be performed using inert gas, shielded arc, or resistance welding processes. Welding processes that require welding flux shall not be used.
3. All welding shall be accomplished using filler Alloy 4043.
4. Contractor shall perform fabrication inspection of welds in accordance with AWS D1.2 to determine the acceptability of welds. Inspection shall be performed by an AWS Certified Welding Inspector qualified in accordance with AWS Standard for Qualification and Certification of Welding Inspectors.
5. Joints found to be defective shall be repaired by rewelding.

2.02 STRUCTURAL SHAPES AND PLATE:

A. Conform to ASTM B209 and ASTM B308.
B. Conform to AA Aluminum Standards and Data.
C. Shall be aluminum Alloy 6061 T6 unless otherwise specified.

2.03 NUTS AND BOLTS:

A. Bolts, nuts, and washers shall be AISI Type 304 stainless steel.
B. Bolts shall conform to ASTM F593.
C. Nuts shall conform to ASTM F594.
D. Washers shall conform to ASTM A167 with dimensional tolerances of ASTM F436.

2.04 HANDRAILS AND GUARDRAILS:

A. Acceptable Products/Manufacturers:
   1. Peak to Peak Engineered Railings, Wheat Ridge, CO.
   2. "TUFrail" by Thompson Fabricating, Birmingham, AL.
   3. "Interna-Rail" by The Wagner Companies, Milwaukee, WI.
   4. "Wesrail II" by Moultrie Manufacturing Co., Moultrie, GA.
B. Rails and Posts:
   1. Conform to ASTM B221 or B429.
   2. 1-1/2 inch nominal diameter (1.9 inch o.d.), aluminum Alloy 6105-T5 with clear anodized finish Aluminum Association designation M32-C22-A41 (215-R1). Pipe schedule shall be as required by design but shall be not less than Schedule 40.
   3. Provide linear expansion joints a maximum of 40 ft.-0 inches o.c.
C. Fittings and Accessories:
   1. Floor flanges where indicated.
   2. Wall brackets with 3-inch minimum clearance between handrail and finish wall surface and as indicated for ladder rails.
   3. Fasteners and anchors of stainless steel and of type as required by substrate.
D. Toeboard (Kick Plate):
   1. Toeboard shall conform to OSHA standards. Toeboard shall be a minimum of 4 inches high and shall be an extrusion that attaches to the posts with clamps that will allow for expansion and contraction between posts. Toeboards shall be set 1/4 inch above the walking surface. Toeboards shall be provided on all guardrails where shown on Drawings. Toeboards shall be shipped in stock lengths for field installation.

2.05 LADDERS:

A. Aluminum ladder shall be "TUFLadder" as manufactured by Thompson Fabricating (Birmingham, AL), or approved equal.
B. Rungs shall be designed to provide a non-slip, "Power grip" surface with a 1-inch wide striated top surface and a semi-circular bottom. The straight sides and semi-circular bottom shall have

striations at approximately 5/16-inch centers for enhanced gripping. Rungs shall be an aluminum extrusion, Alloy 6063-T6, of sufficient section modulus and moment of inertia to withstand design loads.

C. Side rails shall be 1-1/2-inches Schedule 40 aluminum pipe, Alloy 6105-T5, 6063-T6, or 6061-T6. Pipe shall conform to ASTM B429 or B221.

D. Design and fabricate ladder to meet requirements of OSHA, ANSI A14.3, and applicable building codes.

E. Finish: Pipe for side rails shall have same finish as handrail if ladder is located at an opening in the handrail. Rungs, cage, and brackets shall be "mill" finish.

F. Every ladderway floor opening or platform shall be guarded by standard railing with standard toeboard on all exposed sides (except at the entrance to the opening), with passage through railing provided with a self-closing swinging gate. Self-closing gates shall be as manufactured by FabEnCo, Inc., Houston, TX or approved equal. All hardware shall be stainless steel.
   1. Two-rail systems - Model A82-24.
   2. Three-rail systems - Model XL82-24.

G. Provide “L1E” ladder extension post by Halliday or engineer approved equal at top of interior ladder at hatch location.

H. Ladder Fall Arrest System: For ladders taller than 24 feet, provide an aluminum, rail-type personal fall arrest system in compliance with OSHA requirements.

2.06 GRATINGS AND TREADS:

A. Grating:
   1. Conform to ASTM B221, aluminum Alloy 6061 or Alloy 6063, mill finish.
   2. Main Bars: 3/16 inch thick (unless otherwise noted) and spaced not more than 1-3/16 inches o.c. Depth as indicated on drawings, dovetail slotted to receive cross bars.
   3. Cross Bars: Of depth as required by main bars, spaced not more than 4 inches o.c. Top surface shall be flush with top of main bars.
   4. Configuration of top surface of main bars unless otherwise indicated.
      a. Exterior - Exposed to Weather: Serrated or Striated.
      b. Interior - Not Exposed to Weather: Plain or Striated.
   5. Provide with aluminum "saddle clip"-type fasteners and stainless steel bolts.

B. Treads:
   1. Manufacturer's standard rectangular, with corrugated nosing, aluminum Alloy 6061 T6 or 6063-T6.
   2. Main Bars: Depth as indicated on drawings by 3/16 inch thickness, spaced not more than 1-3/16 inch o.c.
   3. Crossbars: Spaced not more than 4 inches o.c.
   4. Top Surface of Grating Tread: Serrated or Striated.
   5. Provide with stainless-steel hardware.

C. Fabrication:
   1. Main bars shall be vertical within a tolerance of 0.10-inch per inch of depth.
   2. Longitudinal bow (before fastening to supports) shall be less than 1/200 of the length.
   3. Transverse bow before fastening to supports shall be less than 3/8 inch in 3 feet.
   4. Crossbars shall not deviate from a straight line perpendicular to the main bars by more than 3/16-inch in 3 feet.
   5. Crossbars shall match crossbars of adjacent sections to form a continuous pattern of straight lines.
   6. Panel width and length tolerances shall be +1/4 inch.

7. Provide all openings in grating indicated and as required for installation of all piping, wiring, and equipment installed under this Contract.
8. Band all openings 4 inches and larger with a bar same size as main bearing bar. Weld to each bearing bar with a 3/16-inch fillet weld, 3/4 inch long. Tack weld to all crossbars.
9. Trim band all locations as follows:
    a. Open end of grating at head of a ladder.
    b. Grating edges that are not perpendicular or parallel to the main bars.
    c. Grating panels with four crossbars or less.
    d. Other locations as indicated.

D. Manufacturer:
1. Gratings and treads shall be as manufactured by one of the following:
    a. Alabama Meals Industries Corporation, Birmingham, AL.
    b. Barnett Bates Corporation, Joliet, IL.
    c. Ohio Grating, Canton, OH.
    d. Grating Pacific, Los Alamitos, CA
    e. IKG Industries, Aberdeen, NJ.

2.07 TREAD PLATES:

A. Conform to ASTM B632, Alloy 6061-T6, mill finish.
B. Thickness as indicated with surface deformations of the 4 way type.
C. Fasten in place with 1/4-inch countersunk stainless steel screws spaced 24 inches o.c. with a minimum of one screw located at each corner of a panel.

PART 3 - EXECUTION

3.01 GENERAL:

A. Conform to applicable standards of AA.
B. Protect aluminum at contact with other metals, grout, and concrete by a heavy brush coat of alkali-resistant bituminous coating, or a nonporous tape or gasket. Coating is not required for aluminum in contact with stainless-steel bolts. Apply bituminous coating at 15-mil minimum dry film thickness and which shall be one of the following:
1. Carboline - Bitumastic No. 50.
2. Tnemec - H.B. Tnemecol 46-465.

3.02 INSTALLATION:

A. Aluminum Handrail and Guardrail:
1. Space posts a maximum of 6 ft.-0 inches o.c. except where otherwise indicated.
2. Install posts as indicated on fabrication drawings.
3. Install toeboards (kick plates) and anchor to each post with clamps and bolts. Allow ¼-inch space between bottom of toeboard and top of floor surface.
4. Install handrail to walls with brackets spaced not greater than 6 ft.-0 inches o.c., except where otherwise indicated.
    a. Use anchors as indicated on fabrication drawings.
5. Protect aluminum after cleaning with a clear methacrylate lacquer coating.

B. Grating and Treads:
1. Space fasteners as required to overcome irregularities and maintain grating contact with supports. Minimum anchorage of each panel will be two fasteners at each end and one fastener at each intermediate support.
2. Unless indicated as fixed, fasten grating with clips using stainless-steel bolts.

3. Bolt stair treads to stringers with a minimum of two 3/8-inch stainless-steel bolts at each end of tread.
4. All grating shall be removable unless otherwise indicated.

C. Ladders: Install as indicated. Ladder shall be securely fastened to wall or substrate.
D. Tread Plates: Install as indicated and as specified in PART 2, this Section.

3.03 CLEANING:

A. Clean all aluminum surfaces after installation free of smudges, stains, or other deleterious substances.

END OF SECTION 05 45 00

DIVISION 06 – WOOD AND PLASTICS

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Wood products.
   2. Wood-preservative-treated lumber.
   3. Fire-retardant-treated lumber.
   4. Miscellaneous lumber.
   5. Plywood backing panels.

1.02 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal (38 mm actual) size in least dimension.
B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) size or greater but less than 5 inches nominal (114 mm actual) size in least dimension.
C. Exposed Framing: Framing not concealed by other construction.
D. Lumber grading agencies, and abbreviations used to reference them, include the following:
   1. NeLMA: Northeastern Lumber Manufacturers' Association.
   2. NLGA: National Lumber Grades Authority.
   3. SPIB: The Southern Pine Inspection Bureau.
   4. WCLIB: West Coast Lumber Inspection Bureau.
   5. WWPA: Western Wood Products Association.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
   3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency in accordance with ASTM D5664.
   4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.04 INFORMATIONAL SUBMITTALS

A. Material Certificates:
   1. For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
   2. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.01 WOOD PRODUCTS

A. Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
   3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
   4. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content:
   1. Boards: 15 percent.
   2. Dimension Lumber: 15 percent for 2-inch nominal (38-mm actual) thickness or less; 19 percent for more than 2-inch nominal (38-mm actual) thickness unless otherwise indicated.

2.02 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1, Use categories as follows:
   1. UC1: Interior construction not in contact with ground or subject to moisture. Include the following items:
      a. Wood sills, sleepers, blocking, furring, and similar concealed members in contact with masonry or concrete.
      b. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
      c. Wood floor plates that are installed over concrete slabs-on-grade.
      d. Wood furniture.
      e. Wood millwork.
   2. UC2: Interior construction not in contact with ground but may be subject to moisture. Include the following items:
      a. Wood sills, sleepers, blocking, furring, and similar concealed members in contact with masonry or concrete.
      b. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
      c. Wood floor plates that are installed over concrete slabs-on-grade.
      d. Wood millwork.
      e. Wood flooring.
   3. UC3A (Commodity Specification A): Coated sawn products in exterior construction not in contact with ground but exposed to all weather cycles including intermittent wetting. Include the following items:

a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
b. Wood framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.

4. UC3A (All Other Commodity Specifications): Coated products excluding sawn products in exterior construction not in contact with ground, exposed to all weather cycles but protected from liquid water. Include the following items:
   a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
   b. Wood framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.
   c. Wood sheathing.
5. UC3B (Commodity Specification A): Uncoated sawn products in exterior construction not in contact with ground, exposed to all weather cycles including intermittent wetting but with sufficient air circulation for wood to dry. Excludes sawn products not in contact with ground but with ground contact-type hazards. Include the following items:
   a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
   b. Wood framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.
6. UC3B (All Other Commodity Specifications): Uncoated products excluding sawn products in exterior construction not in contact with ground, exposed to all weather cycles including prolonged wetting. Include the following items:
   a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
   b. Wood framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.
7. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
8. For exposed items indicated to receive a stained or natural finish, chemical formulations are not to require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
9. After treatment, redry boards and dimension lumber to 19 percent maximum moisture content.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:
   1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
   2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.

2.03 FIRE-RETARDANT-TREATED LUMBER

A. General: Interior lumber to be fire-retardant-treated materials, materials are to comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
   1. Treatment is not to promote corrosion of metal fasteners.
   2. Exterior Type: Treated materials are to comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering in accordance with ASTM D2898. Use for exterior locations and where indicated.

C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency and other information required by authorities having jurisdiction.

E. Application: Treat all rough carpentry unless otherwise indicated.

2.04 MISCELLANEOUS LUMBER

A. Provide fire-retardant miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
   1. Blocking.
   2. Nailers.
   3. Furring.
   4. Grounds.
   5. Utility shelving.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.

C. Utility Shelving: Lumber with 15 percent maximum moisture content of any of the following species and grades:
   1. Eastern white pine, Idaho white, lodgepole, ponderosa, or sugar pine; Premium or No. 2 Common (Sterling) grade; NeLMA, NLGA, WCLIB, or WWPA.
   2. Mixed southern pine or southern pine; No. 1 grade; SPIB.
   3. Hem-fir or hem-fir (north); Select Merchantable or No. 1 Common grade; NLGA, WCLIB, or WWPA.
   4. Spruce-pine-fir (south) or spruce-pine-fir; Select Merchantable or No. 1 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

D. Concealed Boards: 15 percent maximum moisture content and any of the following species and grades:
   1. Mixed southern pine or southern pine; No. 2 grade; SPIB.
   2. Hem-fir or hem-fir (north); Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
   3. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.05 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, C-C Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.

2.06 FASTENERS

A. General: Fasteners are to be of size and type indicated and comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches (38 mm) into wood substrate.
   1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.
B. Nails, Brads, and Staples: ASTM F1667.
C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 ICC-ES AC58 ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.

2.07 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).
B. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
B. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locatenailers, blocking, and similar supports to comply with requirements for attaching other construction.
C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
   1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.
F. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
G. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
   1. Use inorganic boron for items that are continuously protected from liquid water.

2. Use copper naphthenate for items not continuously protected from liquid water.

H. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

I. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   1. Table 2304.10.1, "Fastening Schedule," in ICC's International Building Code (IBC).
   2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.

J. Securely attach roofing nailers to substrates by anchoring and fastening to withstand bending, shear, or other stresses imparted by Project wind loads and fastener-resistance loads as designed in accordance with ASCE/SEI 7.

K. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.02 INSTALLATION OF WOOD BLOCKING AND NAILERS

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach wood blocking to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

END OF SECTION 06 10 00

SECTION 06 41 16 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Plastic-laminate-clad architectural cabinets.
   2. Cabinet hardware and accessories.
   3. Miscellaneous materials.

B. Related Requirements:
   1. Section 06 10 00 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.

1.02 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.04 ACTION SUBMITTALS

A. Product Data:
   1. Plastic-laminate-clad architectural cabinets.
   2. Cabinet hardware and accessories.
   3. Miscellaneous materials.

B. Product Data Submittals: For each product.
   1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

C. Shop Drawings:
   1. Include plans, elevations, sections, and attachment details.
   2. Show large-scale details.
   3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   4. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets.

D. Samples for Verification: For the following:
   1. Plastic Laminates: 8 by 10 inches (200 by 250 mm) for each type, color, pattern, and surface finish required.
      a. Provide one sample applied to core material with specified edge material applied to one edge.
   2. Thermally Fused Laminate (TFL) Panels: 8 by 10 inches (200 by 250 mm), for each color, pattern, and surface finish.
   3. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

B. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.06 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.08 FIELD CONDITIONS

A. Environmental Limitations with Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 25 and 55 percent during the remainder of the construction period.

B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction and indicate measurements on Shop Drawings.

C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.01 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.

1. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

B. Architectural Woodwork Standards Grade: Custom.

C. Type of Construction: Frameless.

D. Door and Drawer-Front Style: Flush overlay.

E. High-Pressure Decorative Laminate: ISO 4586-3, grades as indicated or if not indicated, as required by quality standard.

F. Exposed Surfaces:

1. Plastic-Laminate Grade: HGS.
2. Edges: PVC edge banding, 3.0 mm thick, matching laminate in color, pattern, and finish.
3. Pattern Direction: As indicated.

G. Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: Thermally fused laminate panels.
   a. Edges of Thermally Fused Laminate Panel Shelves: PVC or polyester edge banding.

b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, ISO 4586-3, grade to match exposed surface.

2. Drawer Sides and Backs: Thermally fused laminate panels with PVC or polyester edge banding.
3. Drawer Bottoms: Thermally fused laminate panels.

H. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, ISO 4583-3, grade to match exposed surface.

I. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

J. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
1. As indicated by laminate manufacturer's designations.

2.02 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
1. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130.
2. Particleboard (Medium Density): ANSI A208.1, Grade M-2-Exterior Glue.
3. Thermally Fused Laminate (TFL) Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of ISO 4586.

2.03 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products in accordance with test method indicated by a qualified testing agency.
1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
1. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.

2.04 CABINET HARDWARE AND ACCESSORIES

A. Cabinet Hardware: Provide cabinet hardware and accessory materials associated with architectural cabinets.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Hettich America L.P.
   b. Julius Blum & Co., Inc.
   c. Knape & Vogt Manufacturing Company.

B. Butt Hinges: 2-3/4-inch (70-mm), five-knuckle steel hinges made from 0.095-inch- (2.4-mm-) thick metal, and as follows:
   1. Semiconcealed Hinges for Overlay Doors: ANSI/BHMA A156.9, B01521.

C. Back-Mounted Pulls: ANSI/BHMA A156.9, B02011.

D. Wire Pulls: Back mounted, solid metal, 4 inches (100 mm) long, 5/16 inch (8 mm) in diameter.

E. Shelf Rests: ANSI/BHMA A156.9, B04013; metal.

F. Drawer Slides: ANSI/BHMA A156.9.
   1. Heavy-Duty (Grade 1HD-100 and Grade 1HD-200): Undermount.
      a. Type: Full extension.
      b. Material: Zinc-plated ball bearing slides.
      c. Motion Feature: Self-closing mechanism.
   2. General-purpose drawers more than 3 inches (75 mm) high, but not more than 6 inches (150 mm) high and not more than 24 inches (600 mm) wide, provide 100 lb (45 kg) load capacity.

G. Door Locks: ANSI/BHMA A156.11, E07121.

H. Drawer Locks: ANSI/BHMA A156.11, E07041.

I. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.

J. Grommets for Cable Passage: 2-inch (51-mm) OD, molded-plastic grommets and matching plastic caps with slot for wire passage.
   1. Color: Black.

K. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.
   1. Satin Stainless Steel: ANSI/BHMA 630.

L. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

2.05 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesive for Bonding Plastic Laminate: Type I, waterproof type as selected by fabricator to comply with requirements.
   1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.06 FABRICATION

A. Fabricate architectural cabinets to dimensions, profiles, and details indicated.

B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
   1. Notify Architect seven days in advance of the dates and times architectural cabinet fabrication will be complete.
   2. Trial fit assemblies at manufacturer's shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be

removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.

C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.01 PREPARATION

A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

3.02 INSTALLATION

A. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.

B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.

C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.

D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm) using concealed shims.

1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (400 mm) o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch (38-mm) penetration into wood framing, blocking, or hanging strips or No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

3.03 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets on exposed and semi-exposed surfaces.

END OF SECTION 06 41 16

SECTION 06 85 81 – FIBER REINFORCED PLASTIC COVERS

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section defines the design requirements for the Fiber Reinforced Plastic (FRP) Covers as described in the contract drawings and documents for two (2) Thickened Sludge Holding Tanks.

1.02 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Procurement Documents, apply to this Section.

1.03 RELATED REQUIREMENTS:

A. Related Sections include but are not necessarily limited to:
   1. Procurement documents.
   2. Division 5 – Metals
   3. Section 09 90 00 – Protective Coatings

1.04 REFERENCES:

A. Applicable Codes and Standards: Design, fabricate, assemble, and test Equipment and Materials so that upon installation in accordance with the manufacturer's recommended procedures for this application, the Equipment will conform to the requirements of the Federal Occupational Safety and Health Standards and the applicable provisions of:
   1. ASTM International (ASTM):
      a. ASTM A240 – Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
      b. ASTM A276 – Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels.
      c. ASTM C864 – Standard Specifications for Performed Gasket and Sealing Material.
      d. ASTM D638 – Standard Test Method for Tensile Properties of Plastics
      e. ASTM D790 – Standard Test Method for Flexural Properties of Plastics
      f. ASTM D695 – Standard Test Method for Compressive Strength of Plastics
      g. ASTM D2584 – Test Method for Ignition Loss of Coved Reinforced Resins.
      h. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Plastics
      i. ASTM F594 – Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
   2. American Society of Civil Engineers (ASCE):
      a. 7, Minimum Design Loads for Buildings and Other Structures.
   3. International Code Council (ICC):
      a. International Building Code, 2018 (IBC 2018)

1.05 SUBMITTALS:

A. Submit as specified in DIVISION 1.

B. Drawings describing the completed structure and all its components shall be submitted complete with materials of construction and typical details and accompanied by a Certificate of Design.

B. Certifications:
   1. Complete set of design drawings and calculations providing a complete design of all members and connections, including concrete anchor design, signed by a Professional

Engineer registered in the State where the project is located. Calculations are submitted for record purposes only but will be checked for compliance with contract documents.

C. Design calculations verifying conformance to deflection limits shall be submitted. Deflection calculations are required for structural members as well as walking surface.
D. Shop drawings shall specify all materials. The size, number, and location of the following shall be indicated: handles, fasteners, structural members, connections, attachments, openings, and other items not listed that are a necessary component of a complete installation.
E. Shop drawings shall provide erection procedures and directions.
F. Provisions for special openings, removable sections, access panels with hinges, seals for inlet/outlet ports or vents, or other areas as noted on the drawings shall be provided and detailed by the manufacturer on the shop drawings.
G. Product Data: Manufacturer's data sheets on each product to be used including:
    1. Calculations, design data, and test reports as applicable indicating compliance with requirements.
    2. Storage and handling instructions.
    3. Installation instructions.
    4. Drawings including layouts, product description, connection and framing details, fastener types and spacing.
    5. Miscellaneous certifications.

1.06 QUALITY ASSURANCE:

A. Tank cover manufacturer shall have completed U.S projects of similar type as required in this scope and shall submit statement that states the location and description of the installations.
B. Contractor shall verify all field dimensions for development of manufacturer's drawings.
C. Contractor shall review and confirm in writing approval of manufacturer's drawings.
D. Engineer for FRP covers: Professional Engineer licensed in the State the project is located in.

1.07 PROJECT CONDITIONS

A. Provide all required anchors for attaching the cover system to existing concrete structure. Anchors shall be Type 316 stainless steel. Size determined by manufacturer.

1.08 WARRANTY:

A. Manufacturer shall warrant the equipment to be free from defects in material and workmanship for a period of 1 year from the date of equipment acceptance.

PART 2 - PRODUCTS

2.01 DESCRIPTION

A. The FRP cover system shall be a flat, removable, walk-on type. It shall consist of a series of FRP panels with an integral bi-directiona1 slip resistant surface, and a supporting structure consisting of FRP structural components with stainless steel connection hardware. The surface of the covers shall be flat without any protruding items that may cause a tripping hazard. The extents of the FRP covers are as indicated on the drawings.
B. The FRP covers shall not weigh more than 100 pounds to allow for removal. Provide integral lifting handles at each end of all panels. Each panel must be removable without needing to remove more than the two adjacent panels. Hold-down extrusions longer than the width of the panel is prohibited.

C. Raised surfaces without the use of texturing to achieve slip resistance is not acceptable. The use of checkered plate, paint, tape, sandblasting, or other applied systems to achieve the slip resistant surface is prohibited.
D. The FRP covers shall be sloped to prevent ponding which may result in over-stressing the FRP covers. The slope of the FRP covers shall match the slope of the Thickened Sludge Tank walls as indicated in the drawings.
E. Provide hinged inspection hatches as described in Section 2.04(J). Refer to the drawings for hatch locations. Provide additional framing members, as required, to adequately support FRP cover at hatch locations.
F. The cover surface paneling shall be designed as an air and watertight system under the specified loading conditions.
G. The cover shall be outfitted for six (6) Odor Control system nozzles. Each nozzle will be attached by way of 10" diameter opening. Final opening size and installation of nozzles to the FRP cover shall be coordinated with Odor Control Manufacturer. Refer to the drawings for nozzle locations.
H. Provide all necessary cover panels, structural supports, inspection hatches, gaskets, flashing and trim, hardware, anchors and fasteners and other items necessary for a complete FRP cover system. Refer to drawings for specified locations for inspection hatches and openings. All materials and appurtenances shall be furnished by the same supplier.

2.02 ACCEPTABLE MANUFACTURES:

A. The flat cover shall be as manufactured by:
1. Enduro Composites
2. Nefco
3. Engineer Approved Equal

2.03 DESIGN LOADS:

A. The FRP cover system shall be designed to sustain the loads specified herein. Design loads shall be in accordance with IBC 2018 and ASCE 7.
1. Risk Category III.
2. Dead Load: The dead load shall be defined as the weight of the structure and all material permanently attached to and supported by the structure.
3. Live Load:
a. Uniform Live Load: 60 psf.
b. Concentrated Load: 300 lbs on a 12-inch by 12-inch area, applied to produce the maximum load effect on structural elements under consideration, not to be considered to act concurrently with the specified uniform live load.
4. Snow Loads:
a. Ground Snow Load, p_g: 20 psf.
b. Snow Exposure Factor, C_e: 0.9.
c. Thermal Factor, C_t: 1.2.
d. Unbalanced and snow drift loads considered, as appropriate.
5. Wind Loads:
a. Ultimate Design Wind Speed, V: 120 mph.
b. Nominal Design Wind Speed, V_{asd}: 93 mph.
c. Wind Exposure: C.
d. Internal Pressure Coefficient: +/- 0.18.
6. Seismic Loads:
a. Mapped Spectral Response Acceleration Parameters:

(1) Short-Period Mapped Spectral Acceleration, S_S: 0.091g.
(2) 1-Second Period Mapped Spectral Acceleration, S_1: 0.067g.

b. Site Class: D.
c. Design Spectral Acceleration Parameters:
(1) Short-Period Design Spectral Acceleration, S_{DS}: 0.097g.
(2) 1-Second Period Design Spectral Acceleration, S_{D1}: 0.106g.
d. Seismic Design Category: B.

7. Load Combinations: Comply with IBC 2018 and ASCE 7.
8. Deflections: Comply with IBC 2018.
9. Temperature: The load combinations listed above shall be considered for a temperature change of 100 degrees F below the installation temperature and 100 degrees F above the installation temperature and for a material temperature range of 40 degrees F below zero to 160 degrees F above zero.
10. Maximum weight of any individual removable or operable section: 100 lbs.

2.04 MATERIALS:

A. Resin systems shall be premium grade vinyl ester or polyester resin with corrosion resistance to hydrogen sulfide rich environment and with flame spreading rating of 25 or less per ASTM E84.
1. Covers shall be designed specifically for installation over Thickened Sludge Storage Tanks and capable of withstanding corrosion, pitting and degradation.

B. All splice joints shall be interlocked and gasketed.

C. Resin system shall be formulated to provide protection against ultra-violet degradation.

D. FRP structural components including cover panels, beams, and framing shall be manufactured by pultrusion process. Contact molded, hand-laid up or filament wound fiberglass materials are not acceptable as structural components.

E. FRP Cover:
1. Glass fiber reinforcements shall be 50% (min) of the material weight.
2. Materials shall exhibit these physical properties (at a minimum):

a.	Tensile Strength	64,000 psi	ASTM D 638
b.	Flexural Strength	61,000 psi	ASTM D 790
c.	Flexural Modulus	1.8×10^6	ASTM D 790
d.	Barcol Hardness	45	ASTM D2583
e.	Notched Izod (ft-lb/in)	25	ASTM D 256
f.	Water Absorption	.20% max	ASTM D 570
g.	Thermal Expansion (in/°F)	7.0×10^{-6}	ASTM D696

h. Procedure used in determining the above properties shall be in accordance with the ASTM standards using the method designated above. Test coupons shall be prepared in accordance with the appropriate ASTM test method.

3. Cover panels shall be sealed at side-laps with EPDM gasket. Side-lap gaskets shall be factory installed and oriented vertically, so they are compressed when the locking channel is placed into position.
4. Top-of-tank cover panels shall have factory applied, non-skid, and UV resistant surface.
5. Dissimilar materials shall be separated from each other using approved gaskets or coatings.
6. All components shall be treated with UV inhibitors.

F. Structural Framing

1. FRP and/or stainless steel structural components shall be attached to the inner tank wall to support the cover system. Maximum frame depth of 24 inches below bottom of FRP panels.
2. FRP support structure or components shall be Vinyl Ester. If Fire Retardant (FR) is required, flame spread rating of 25 or less per ASTM E84 test shall be a minimum.
3. Metal structure or components shall be stainless steel and comply with the following:
   a. Plate, sheet, strips: ASTM A240, Type 316.
   b. Bars and shapes: ASTM A276, Type 316.
   c. Use of FRP for connection elements is not be allowed.
4. Support framing shall be sized, spaced, and arranged such that each panel will accommodate the design load criteria in this specification, independently of any other panel. Provide additional supporting elements at openings and penetrations as required.

G. Flashing
1. Flashing shall be FRP or Stainless Steel.

C. Fasteners
1. Provide all required fasteners for equipment furnished. Fasteners shall comply with the following:
   a. Stainless steel bolts: ASTM F593, Type 316 with matching nuts and washers.
   b. Size determined by manufacturer.

H. Anchors
1. Provide all required anchors for attaching the cover system to the concrete structure. See Specification Section 05 05 19.
2. Anchors shall be Type 316 stainless steel. Size determined by manufacturer.

I. Inspection Hatches:
1. Hatch opening dimensions: See drawings.
2. Inspection hatches shall be hinged, raised or flat, with one-leaf hatch door and fabricated from pultruded fiberglass components.
3. Inspection hatches and supporting framing shall fit inside a single deck panel so individual deck panels with hatches can be removed without affecting adjacent panels.
4. Underside of raised hatch lids shall be sealed with factory installed neoprene bulb gasket. Perimeter hatch curb shall be sealed to decking surface with adhesive sealant.
5. Underside of flat hatch lids shall be sealed with factory installed Flat gasket. Perimeter hatch curb shall be sealed to decking surface with adhesive sealant.
6. Hatch lids shall have factory applied non-skid, UV resistant surface with plastic or stainless-steel lift handles.
7. Hatch openings shall be factory cut in cover deck panels by manufacturer.

J. Gaskets and Sealants
1. All panel side laps, and perimeter conditions shall have gaskets.
2. Adhesive sealant shall be applied by contractor at various locations as required by manufacturer for odor containment.

PART 3 - EXECUTION

3.01 MATERIAL HANDLING

A. At time of delivery, all materials shall be inspected for shipping damage. Freight company and manufacturer shall be notified immediately of any damage or quantity shortages.
1. Contractor shall protect FRP materials from cuts, scratches, gouges, abrasions, and impacts. When lifting FRP materials, spreader bars shall be used (not wire slings unless

materials are fully protected). FRP components shall not be dragged across one another unless separated by a non-scratching spacer.

3.02 INSTALLATION:

A. All work shall be executed by skilled mechanics with a supervisor experienced in the erection of FRP flat panel covers. The covers shall be erected in proper alignment as shown in the manufacturer's drawings.
B. Before placing and attaching components, erector must confirm alignment and location of bearing plates, surfaces, brackets, saddles, etc. All bearing surfaces must be clean and free of debris.
C. Before placing secondary framing members or deck, erector must check the alignment and location of supports.
D. Erection shall proceed according to sequence shown on the approved drawings.
E. Position FRP tank cover beams in locations, as shown on the manufacturer's drawings. Field modifications (cuts, copes, holes, etc.) other than work shown on the drawings are not allowed without the manufacturer's written consent.
F. Anchor FRP beams and adjust tank cover components into final position with proper bearing and alignment at joints, laps, and supports before fastening. Refer to the manufacturer's installation instructions for proper fastener selection, fastener location, driving techniques, and pertinent information for fastening equipment.
G. Starting at end shown on the manufacturer's drawings, position and place cover deck panels in locations as shown. Field modifications (cuts, copes, holes, etc.) other than work shown on the drawings are not allowed without the manufacturer's written consent.
H. Fasten or anchor FRP cover deck panels into location as shown on the drawings.
I. Place and attach flashing as shown on the drawings.

3.03 PERFORMANCE TESTING:

A. Materials shall comply with Federal and Local laws or ordinances, applicable codes, standards, regulations, and/or regulatory agency requirements.
B. Air Leakage
    1. Air leakage rate shall not exceed 0.2 CFM/SF at negative pressure of 0.2 inches of water column for a 5-minute duration per Air Leakage Test in accordance with Procedural Standards for Adjusting and Balancing of Environmental Systems.
    2. Testing shall be conducted by independent test agency certified by Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB).

END OF SECTION 06 85 81

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

SECTION 07 16 00 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes the following:
   1. Coal Tar-Epoxy dampproofing for all below grade exterior walls except those containing potable water. Refer to structural drawings.

1.03 SUBMITTALS:

A. Submit as specified in DIVISION 01.
B. Product data for type of product specified, including data substantiating that materials comply with requirements for dampproofing material specified. Include recommended method of application, recommended primer, number of coats, coverage or thickness, and recommended protection course.
   1. Certification by dampproofing manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

1.04 QUALITY ASSURANCE:

A. Installer Qualifications: Engage an experienced Installer who has complete bituminous dampproofing similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
B. Single-Source Responsibility: Obtain primary dampproofing materials and primers from one source and by a single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

1.05 PROJECT CONDITIONS

A. Substrate: Proceed with dampproofing only after substrate construction and penetrating work have been completed.
B. Weather Limitations: Proceed with dampproofing only when existing and forecasted weather conditions will permit work to be performed according to manufacturer's recommendations and warranty requirements.
C. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has thoroughly cured.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. Deliver materials in sealed containers or cartons bearing the manufacturer's label.
B. Protect materials to keep clean, dry, and within manufacturer's temperature limitations.

1.07 WARRANTY

A. The Manufacturer shall warrant that all material shall be free from defects caused by faulty material or workmanship for a minimum period of one (1) year from the date of Substantial Completion, unless otherwise specified.
B. Warranties shall comply with the requirements of Section 01 78 36.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:
   1. Coal Tar-Epoxy Dampproofing:
      a. Tnemec Tneme-Tar Hi Build Series 46H-413; 16-20 mils DFT.
      b. Or engineer approved equal

2.02 BITUMINOUS DAMPPROOFING:

A. General: Provide products recommended by manufacturer for designated application and suitable for service intended.

B. Cold-Applied, Coal Tar-Epoxy Dampproofing: Roll or spray applied heavy-duty water-resistant epoxy coating made with pitch for protection of concrete from severe chemical fumes and corrosive vapors. Coating shall be suitable for buried or immersion conditions.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Clean substrate of projections and substances detrimental to Work; comply with recommendations of prime materials manufacturer. Remove oil, grease form release agents, laitance, loose materials, and slick surfaces.

B. Install cant strips and similar accessories as recommended by prime materials manufacturer even though not indicated.

C. Fill voids, seal joints, and apply bond breakers, if any, as recommended by prime materials manufactuer, with particular attention at construction joints.

D. Install separate flashings and corner protection stripping, as recommended by prime materials manufacturer, to precede application of dampproofing. Comply with manufacturer's recommendations. Pay particular attention to requirements at building expansion joints, if any.

E. Surface prep per manufacturer recommendations: including abrasive blasting all surfaces per SSPC-SP13/NACE 6; ICRI CSP 2-4 Surface Preparation of Concrete.

F. Prime substrate as recommended by prime materials manufacturer.

G. Protection of Other Work: Do not allow liquid and mastic compounds to enter and clog drains and conductors. Prevent spillage and migration onto other surfaes of work by masking or otherwise protecting adjoining work.

3.02 INSTALLATION, GENERAL:

A. Comply with manufacturer's recommendations except where more stringent requirements are indicated or specified and where Project conditions require extra precautions to ensure satisfactory performance of work.

B. Apply vertical dampproofing down walls from finished-grade line to top of footing, extend over top of footing, and down a minimum of 6 inches (150 mm) over outside face of footing. Extend 12 inches (300 mm) onto intersecting walls and footings, but do not extend onto surfaces exposed to view when the Project is completed.

3.03 PROTECTION AND CLEANING:

A. Protect exterior, below-grade dampproofing membrane from damage until backfill is completed. Remove overspray and spilled materials from surfaces not intended to receive dampproofing.

END OF SECTION 07 16 00

SECTION 07 42 93 - SOFFIT PANELS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Metal soffit panels.

B. Related Requirements:
   1. Section 07 41 13.16 "Standing-Seam Metal Roof Panels" for standing-seam metal roof panels.

1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.03 ACTION SUBMITTALS

A. Product Data:
   1. Metal soffit panels.

B. Product Data Submittals:
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

C. Sustainable Design Submittals:

D. Shop Drawings:
   1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
   2. Accessories: Include details of flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches (1:10).

E. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, tests performed by a qualified testing agency.

C. Sample Warranties: For special warranties.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
D. Retain strippable protective covering on metal panels during installation.
E. Copper Panels: Wear gloves when handling to prevent fingerprints and soiling of surface.

1.08 FIELD CONDITIONS
A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.09 COORDINATION
A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY
A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.
2. Warranty Period: Two years from date of Substantial Completion.
B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS
A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/240 of the span.
B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E283 at the following test-pressure difference:
1. Test-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa).
C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:
1. Test-Pressure Difference: 2.86 lbf/sq. ft. (137 Pa).
D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.02 METAL SOFFIT PANELS

A. Provide metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.

B. Flush-Profile Metal Soffit Panels: Solid panels formed with vertical panel edges and a flat pan between panel edges; with flush joint between panels.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Berridge Manufacturing Company.
   b. CENTRIA, a Nucor Brand.
   c. PAC-CLAD; Petersen Aluminum Corporation; a Carlisle company.
2. Material: Same material, finish, and color as metal roof panels.
3. Aluminum Sheet: Coil-coated sheet, ASTM B209 (ASTM B209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
   a. Thickness: 0.032 inch (0.81 mm).
   b. Surface: Smooth, flat finish.
   c. Exterior Finish: Two-coat fluoropolymer.
   d. Color: As selected by Architect from manufacturer's full range.
4. Panel Coverage: 12 inches (305 mm).
5. Panel Height: 1.0 inch (25 mm).

2.03 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 (Z275) hot-dip galvanized coating designation or ASTM A792/A792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.04 FABRICATION

A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
2. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
3. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
4. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal soffit panel manufacturer for application but not less than thickness of metal being secured.

2.05 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Aluminum Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal panel manufacturer.
2. Examine sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal panel manufacturer.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Miscellaneous Supports: Install sub-framing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.
   1. Soffit Framing: Wire tie furring channels to supports.

3.03 INSTALLATION OF METAL SOFFIT PANELS

A. Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Shim or otherwise plumb substrates receiving metal panels.
   2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
   3. Install screw fasteners in predrilled holes.
   4. Locate and space fastenings in uniform vertical and horizontal alignment.
   5. Install flashing and trim as metal panel work proceeds.
   6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
   7. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
B. Fasteners:
   1. Aluminum Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
   1. Apply panels and associated items true to line for neat and weathertight enclosure.
   2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
   3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
   4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
E. Watertight Installation:
   1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels and elsewhere as needed to make panels watertight.
   2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
   3. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with sealant and fastened together by interlocking clamping plates.
F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling, and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

3.04 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 42 93

SECTION 07 41 13.16 - STANDING-SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Standing-seam metal roof panels.

B. Related Requirements:

1. Section 07 42 93 "Soffit Panels" for metal panels used in horizontal soffit applications.
2. Section 07 72 53 "Snow Guards" for prefabricated devices designed to hold snow on the roof surface, allowing it to melt and drain off slowly.

1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of roof accessories and roof-mounted equipment.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review structural loading limitations of deck during and after roofing.
6. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal panels.
7. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
8. Review temporary protection requirements for metal panel systems during and after installation.
9. Review procedures for repair of metal panels damaged after installation.
10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.03 ACTION SUBMITTALS

A. Product Data: For standing-seam metal roof panels. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Sustainable Design Submittals:

C. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches (1:10).

D. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

E. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Metal Panels: 12 inches (305 mm) long by actual panel width. Include clips, fasteners, closures, and other metal panel accessories.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.
B. Product Test Reports: For standing-seam metal roof panels, for tests performed by a qualified testing agency.
C. Field quality-control reports.
D. Sample Warranties: For special warranties.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
B. UL-Certified, Portable Roll-Forming Equipment: UL-certified, portable roll-forming equipment capable of producing metal panels warranted by manufacturer to be the same as factory-formed products. Maintain UL certification of portable roll-forming equipment for duration of work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
D. Retain strippable protective covering on metal panels during installation.
E. Copper Panels: Wear gloves when handling to prevent fingerprints and soiling of surface.

1.08 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.09 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.
B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.010 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.
2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 20 years from date of Substantial Completion.

C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
   1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Energy Performance:
   1. Provide roof panels according to one of the following when tested according to CRRC-1:
      a. Three-year, aged solar reflectance of not less than 0.55 and emissivity of not less than 0.75.
      b. Three-year, aged Solar Reflectance Index of not less than 64 when calculated in accordance with ASTM E1980.

B. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
   1. Wind Loads: As indicated on Drawings.
   2. Other Design Loads: As indicated on Drawings.
   3. Deflection Limits: For wind loads, no greater than 1/240 of the span.

C. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E1680 at the following test-pressure difference:
   1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).

D. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E1646 at the following test-pressure difference:
   1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).

E. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
   1. Uplift Rating: UL 90.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.02 STANDING-SEAM METAL ROOF PANELS

A. Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
   1. Aluminum Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E1637.

B. Vertical-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and a flat pan between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and mechanically seaming panels together.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ATAS International, Inc.
   b. Berridge Manufacturing Company.
   c. Drexel Metals.
   d. PAC-CLAD; Petersen Aluminum Corporation; a Carlisle company.
2. Aluminum Sheet: Coil-coated sheet, ASTM B209 (ASTM B209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
   a. Thickness: 0.032 inch (0.81 mm).
   b. Surface: Smooth, flat finish.
   c. Exterior Finish: Two-coat fluoropolymer.
   d. Color: As indicated by manufacturer's designations.
3. Clips: Two-piece floating to accommodate thermal movement.
   a. 0.0250-inch- (0.635-mm-) clip and 0.0625-inch- (1.587-mm-) base thick, stainless-steel sheet.
4. Joint Type: Single folded.
5. Panel Coverage: 16 inches (406 mm).
6. Panel Height: 2.0 inches (51 mm).

2.03 ROOF INSULATION

A. Insulation over Solid Deck:
1. Composite Polyisocyanurate Board Insulation: ASTM C1289, with factory-applied facing board on one major surface, as indicated below by type, and felt or glass-fiber mat facer on the other surface.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Atlas Polyiso Roof and Wall Insulation
      2) Carlisle Syntec Systems
      3) CertainTeed; SAINT-GOBAIN
      4) GAF
      5) Hunter Panels; a Carlisle company
      6) Insulfoam; a Carlisle Company
      7) Johns Manville; a Berkshire Hathaway company
   b. Facer: Type V oriented strand board facer, 7/16 inch thick.
   c. Size: 48 by 48 inches or 48 by 96 inches.
   d. Thickness: To achieve R-49.

2.04 UNDERLAYMENT

A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils (0.76 mm) thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.
1. Thermal Stability: Stable after testing at 240 deg F (116 deg C); ASTM D1970.
2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C); ASTM D1970.

3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Carlisle WIP Products; a brand of Carlisle Construction Materials.
   b. Henry Company.
   c. Owens Corning.

2.05 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Sub-framing and Furring: ASTM C645; cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 (Z275) hot-dip galvanized coating designation or ASTM A792/A792M, Class AZ50 (Class AZM150) coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
   1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
   2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
   3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or pre-molded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Gutters: Formed from same material as roof panels, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- (2400-mm-) long sections, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced a maximum of 36 inches (914 mm) o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match roof fascia and rake trim.

E. Downspouts: Formed from same material as roof panels. Fabricate in 10-foot- (3-m-) long sections, complete with formed elbows and offsets, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Finish downspouts to match gutters.

F. Roof Curbs: Fabricated from same material as roof panels, 0.048-inch (1.2-mm) nominal thickness; with bottom of skirt profiled to match roof panel profiles and with welded top box and integral full-length cricket. Fabricate curb sub-framing of 0.060-inch- (1.52-mm-) nominal thickness, angle-, C-, or Z-shaped steel sheet. Fabricate curb and sub-framing to withstand indicated loads of size and height indicated. Finish roof curbs to match metal roof panels.
   1. Insulate roof curb with 1-inch- (25-mm-) thick, rigid insulation.

G. Panel Fasteners: Self-tapping screws designed to withstand design loads.

H. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
   1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
   2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.

3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.06 FABRICATION

A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

2.07 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Aluminum Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
   1. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
      a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

3.03 INSTALLATION OF UNDERLAYMENT

A. Insulation and Cover Board: Install adhesive applied ridged insulation and cover board per section 07 54 23 “THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING.”

B. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches (152 mm) staggered 24 inches (610 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.
   1. Apply over the entire roof surface.

C. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 07 62 00 "Sheet Metal Flashing and Trim."

3.04 INSTALLATION OF STANDING-SEAM METAL ROOF PANELS

A. Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Shim or otherwise plumb substrates receiving metal panels.
   2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
   3. Install screw fasteners in predrilled holes.
   4. Locate and space fastenings in uniform vertical and horizontal alignment.
   5. Install flashing and trim as metal panel work proceeds.
   6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
   7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
   8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.
1. Install clips to supports with self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

H. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches (914 mm) o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

I. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1524 mm) o.c. in between.
1. Provide elbows at base of downspouts to direct water away from building.

J. Roof Curbs: Install flashing around bases where they meet metal roof panels.

K. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.05 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.06 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect metal roof panel installation, including accessories. Report results in writing.

B. Remove and replace applications of metal roof panels where tests and inspections indicate that they do not comply with specified requirements.

C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

D. Prepare test and inspection reports.

3.07 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 41 13.16

SECTION 07 44 00 – CONCRETE FACED PANELS

PART 1 - GENERAL

1.01 SUMMARY:

A. Section Includes:
   1. Concrete faced insulated perimeter wall panels.

1.02 REFERENCES:

A. ASTM International (ASTM):
   1. C518 - Standard Test Method for Steady State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
   2. C947 - Standard Test Method for Flexural Properties of Thin-Section Glass-Fiber-Reinforced Concrete (Using Simple Beam With Third-Point Loading).
   3. C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
   4. D696 - Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between 30 176C and 30 176C With a Vitreous Silica Dilatometer.
   5. D1037 - Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials.
   6. D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
   7. D2394 - Standard Test Methods for Simulated Service Testing of Wood and Wood Base Finish Flooring.
   8. D4716 - Standard Test Method for Determining the (In plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
   9. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   10. E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

1.03 SUBMITTALS:

A. Action Submittals:
   1. Product Data: Manufacturer's data sheets on each product to be used, including:
      a. Preparation instructions and recommendations.
      b. Storage and handling requirements and recommendations.
      c. Installation methods.
   2. Samples:
      a. Color chips representing manufacturer's full range of available colors and patterns.
      b. After color selection submit samples of each color and patterns.

1.04 QUALITY ASSURANCE:

A. Manufacturer: Provides design, engineering, fabrication, and testing of required components and assemblies for complete system.
B. Mockup: Provide mockup for evaluation of surface preparation techniques and application workmanship.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.
B. Store panels flat.
C. Do not drop panels.

1.06 SITE CONDITIONS:

A. Substrate and ambient air temperature in accordance with manufacturer's requirements.

1.07 WARRANTY:

A. Manufacturer’s standard year warranty against defects in materials and workmanship.

PART 2 - PRODUCTS

2.01 MANUFACTURER:

A. Contract Documents are based on products by T. Clear Corporation
B. Approved Equal.

2.02 MATERIALS:

A. Concrete Faced Insulated Perimeter Wall Panels:
    1. Source: WallGUARD Concrete Faced Insulated Perimeter Wall Panels by T. Clear Corporation.
    2. Construction:
        a. Extruded polystyrene board, ASTM C578, Type IV, rigid, closed cell, with integral high-density skin, with integral 5/16 inch thick latex-modified concrete facing.
        b. Board Size: 2 x 4 feet x 3-5/16 inches thick.
        c. Edges: Tongue-and-groove sides, square ends.
        d. thermal resistance: Long term aged R-value of 5 per inch, tested to ASTM C518.
        e. Foam compressive strength: Minimum 35 PSI, tested to ASTM D1621.
        f. Compressive strength: Minimum 40 PSI, tested to ASTM D 1621.
        g. Water absorption: Maximum 0.7 percent by volume, tested ASTM D2842.
        h. Water vapor permeance: 0.8, tested to ASTM E96/E96M.
        i. Coefficient of lineal thermal Expansion: 3.5 x 10-5 inches per inch x degree F, tested to ASTM D696.
    3. Accessories:
        a. Metal cap flashing: 24 gage galvanized steel J-channel; 2-1/4 inches wide, 4 inch long leg and 2-1/4 inch short leg; prefinished, color to be selected.
        b. Clips and fasteners: Corrosion-resistant, sized to suit application; as supplied by insulation manufacturer.
        c. Reference specification 07 62 00 and drawings for perimeter flashing.

PART 3 - EXECUTION

3.01 INSTALLATION – GENERAL:

A. Install in accordance with manufacturer's instructions.
B. To be installed on the underside of concrete floor slab as indicated on drawings.

3.02 INSTALLATION – CONCRETE FACED INSULATED PERIMETER WALL PANELS:

A. Surfaces to Receive Panels: Flat, sound, clean, and free from irregularities and or jagged surfaces.
B. Lay out panels to maximize board sizes. Do not use boards less than 6 inches wide.
C. Install panels in orientation to maximize full sheets.
D. Install fastening clips and cap flashings.
E. Fill all gaps ½” or more around penetrations.

3.03 PROTECTION:

A. Protect installed products from damage during construction.

END OF SECTION 07 44 00

SECTION 07 54 23 - THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Thermoplastic polyolefin (TPO) roofing system.
   2. Accessory roofing materials.
   3. Vapor retarder.
   4. Roof insulation.
   5. Insulation accessories and cover board.
   6. Walkways.

B. Related Requirements:
   1. Section 06 10 00 "Rough Carpentry" for wood nailers, curbs, and blocking.
   2. Section 07 62 00 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
   3. Section 07 71 00 "Roof Specialties" for manufactured copings.
   4. Section 07 92 00 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

1.02 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D1079 and glossary in NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to Work of this Section.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Roofing Conference: Conduct conference at Project site.
   1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
   2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
   3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
   5. Review structural loading limitations of roof deck during and after roofing.
   6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
   7. Review governing regulations and requirements for insurance and certificates if applicable.
   8. Review temporary protection requirements for roofing system during and after installation.
   9. Review roof observation and repair procedures after roofing installation.

1.04 ACTION SUBMITTALS

A. Product Data:
   1. Thermoplastic polyolefin (TPO) roofing system.
   2. Accessory roofing materials.
   3. Vapor retarder.
   4. Roof insulation.

5. Insulation accessories and cover board.
6. Walkways.

B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:
1. Layout and thickness of insulation.
2. Base flashings and membrane termination details.
3. Flashing details at penetrations.
4. Tapered insulation layout, thickness, and slopes.
5. Roof plan showing orientation of steel roof deck and orientation of roof membrane, fastening spacings, and patterns for mechanically fastened roofing system.
6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

C. Samples for Verification: For the following products:
1. Roof membrane and flashings, of color required.
2. Walkway pads or rolls, of color required.

D. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer manufacturer and testing agency.

B. Manufacturer Certificates:
1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
a. Submit evidence of compliance with performance requirements.
2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.

C. Product Test Reports: For roof membrane and insulation, for tests performed by a qualified testing agency, indicating compliance with specified requirements.

D. Evaluation Reports: For components of roofing system, from ICC-ES.

E. Field Test Reports:
1. Concrete internal relative humidity test reports.

F. Field quality-control reports.

G. Sample Warranties: For manufacturer's special warranties.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is UL listed or listed in SPRI's Directory of Roof Assemblies for roofing system identical to that used for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.09 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
1. Special warranty includes roof membrane, base flashings, roof insulation, cover boards,] vapor retarder, and other components of roofing system.
2. Warranty Period: 30 years from date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as roof membrane, base flashing, roof insulation, cover boards,] vapor retarders, and walkway products, for the following warranty period:
1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing system and flashings to withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings to remain watertight.
1. Accelerated Weathering: Roof to withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
2. Impact Resistance: Roof membrane to resist impact damage when tested according to ASTM D3746, ASTM D4272, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.

B. Material Compatibility: Roofing materials to be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.

C. Wind Uplift Resistance: Design roofing system to resist the following wind uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1897:
1. As indicated on drawings.

D. SPRI's Directory of Roof Assemblies Listing: Roof membrane, base flashings, and component materials comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and are listed in SPRI's Directory of Roof Assemblies for roof assembly identical for that specified for this Project.
1. Wind Uplift Load Capacity: 120 psf.

E. Energy Star Listing: Roofing system to be listed on the DOE's Energy Star "Roof Products Qualified Product List" for low-slope roof products.

F. Energy Performance: Roofing system to have an initial solar reflectance of not less than 0.70 and an emissivity of not less than 0.75 when tested in accordance with ANSI/CRRC S100.
G. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
H. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.02 THERMOPLASTIC POLYOLEFIN (TPO) ROOFING SYSTEM

A. TPO Sheet: ASTM D6878/D6878M, Fleece backed, internally fabric- or scrim-reinforced, TPO sheet.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Carlisle Syntec Systems.
b. Firestone Building Products.
c. Johns Manville; a Berkshire Hathaway company.
2. Source Limitations: Obtain components for roofing system from roof membrane manufacturer.
3. Thickness: 135 mils (3.4 mm), nominal.
4. Exposed Face Color: White.

2.03 ACCESSORY ROOFING MATERIALS

A. General: Accessory materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.
1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.
B. Sheet Flashing: Manufacturer's standard unreinforced TPO sheet flashing, 55 mils (1.4 mm) thick, minimum, of same color as TPO sheet.
C. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.
D. Bonding Adhesive: Manufacturer's standard.
E. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.
F. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick (25 mm wide by 1.3 mm thick), prepunched.
G. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.
H. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.04 VAPOR RETARDER

A. Laminated Sheet Vapor Retarder: Two-layer, fire-retardant polyethylene laminate, reinforced with cord grid.
1. Permeance Rating: Not more than 0.062 perm (3.556 ng/Pa x s x sq. m) when tested in accordance with ASTM E96/E96M.
2. Flame-Spread Index: Not more than 5 when tested in accordance with ASTM E84.
3. Smoke-Developed Index: Not more than 35 when tested in accordance with ASTM E84.
4. Tape: Pressure-sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.05 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by TPO roof membrane manufacturer.

B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Atlas Polyiso Roof and Wall Insulation.
   b. Carlisle Syntec Systems.
   c. Hunter Panels; a Carlisle company.
   d. Johns Manville; a Berkshire Hathaway company.
2. Compressive Strength: 20 psi (138 kPa).
3. Size: 48 by 48 inches (1219 by 1219 mm) or 48 by 96 inches (1219 by 2438 mm).
4. Thickness:
   a. Base Layer: 1-1/2 inches (38 mm).
   b. Upper Layer(s): To achieve R-49.

C. Tapered Insulation: Provide factory-tapered insulation boards.

1. Material: Match roof insulation.
2. Minimum Thickness: 1/4 inch (6.35 mm).
3. Slope:
   a. Roof Field: 1/4 inch per foot (1:48) unless otherwise indicated on Drawings.
   b. Saddles and Crickets: 1/2 inch per foot (1:24) unless otherwise indicated on Drawings.

D. Insulation Accessories

1. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.
2. Fasteners: Factory-coated steel fasteners with metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.
3. Induction-Welding Plates: Minimum 3-inch (76-mm) diameter with recessed center, 0.034-inch (0.86-mm) thick, aluminum-zinc-alloy-coated steel plates, factory-coated with adhesive formulated for roof membrane, with corresponding corrosion-resistant fasteners.

2.06 COVER BOARD

A. General: Cover board as recommended in writing by roofing membrane manufacturer for intended use and compatible with other roofing system components.

B. Glass-Mat Gypsum Cover Board: ASTM C1177/C1177M, water-resistant gypsum board.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. CertainTeed; SAINT-GOBAIN
   b. Georgia-Pacific Gypsum LLC
   c. Gold Bond Building Products, LLC provided by National Gypsum Company
   d. USG Corporation
2. Thickness: 1/2 inch.
3. Surface Finish: Fiberglass facer.

2.07 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch (5 mm) thick and acceptable to roofing system manufacturer.

1. Size: Approximately 36 by 60 inches (914 by 1524 mm).

2. Color: Contrasting with roof membrane.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
   1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
   2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
   3. Verify that joints in precast concrete roof decks have been grouted flush with top of concrete.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.03 INSTALLATION OF ROOFING, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions, SPRI's Directory of Roof Assemblies listed roof assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning Work on adjoining roofing.

3.04 INSTALLATION OF INSULATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.

B. Comply with roofing system and roof insulation manufacturer's written instructions for installing roof insulation.

C. Installation Over Concrete Decks:
   1. Install base layer of insulation with joints staggered not less than 24 inches (610 mm) in adjacent rows.
      a. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
      b. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
      c. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches (610 mm).
         1) Trim insulation so that water flow is unrestricted.
      d. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
      e. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

f. Adhere base layer of insulation to vapor retarder according to SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
   1) Set insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches (305 mm) from previous layer of insulation.
   a. Staggered end joints within each layer not less than 24 inches (305 mm) in adjacent rows.
   b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
   c. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
   d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches (610 mm).
      1) Trim insulation so that water flow is unrestricted.
   e. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
   f. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
   g. Adhere each layer of insulation to substrate using adhesive according to SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
      1) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

3.05 INSTALLATION OF COVER BOARDS

A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction.
   1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
   2. At internal roof drains, conform to slope of drain sump.
      a. Trim cover board so that water flow is unrestricted.
   3. Cut and fit cover board tight to nailers, projections, and penetrations.
   4. Adhere cover board to substrate using adhesive according to SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
      a. Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

3.06 INSTALLATION OF ADHERED ROOF MEMBRANE

A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.
B. Unroll roof membrane and allow to relax before installing.
C. Start installation of roofing in presence of roofing system manufacturer's technical personnel.
D. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
E. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer, and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.

F. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeter of roofing.
G. Apply roof membrane with side laps shingled with slope of roof deck where possible.
H. Seams: Clean seam areas, overlap roof membrane, and hot-air weld side and end laps of roof membrane and sheet flashings, to ensure a watertight seam installation.
   1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roof membrane and sheet flashings.
   2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
   3. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.
I. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

3.07 INSTALLATION OF BASE FLASHING
A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.
B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.08 INSTALLATION OF WALKWAYS
A. Flexible Walkways:
   1. Install flexible walkways at the following locations:
      a. Retain one or more subparagraphs below. Revise to suit Project.
      b. Perimeter of each rooftop unit.
      c. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
      d. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
      e. Top and bottom of each roof access ladder.
      f. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
      g. Locations indicated on Drawings.
      h. As required by roof membrane manufacturer's warranty requirements.
   2. Provide 6-inch (76-mm) clearance between adjoining pads.
   3. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.09 FIELD QUALITY CONTROL
A. Testing Agency: Engage a qualified testing agency to perform tests and to inspect substrate conditions, surface preparation, roof membrane application, sheet flashings, protection, and drainage components, and to furnish reports to Architect.
B. Perform the following tests:
   1. Flood Testing: Flood test each roof area for leaks, according to recommendations in ASTM D5957, after completing roofing and flashing but before overlying construction is

placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.

a. Perform tests before overlying construction is placed.
b. Flood to an average depth of 2-1/2 inches (65 mm) with a minimum depth of 1 inch (25 mm) and not exceeding a depth of 4 inches (100 mm). Maintain 2 inches (50 mm) of clearance from top of base flashing.
c. Flood each area for 24 hours.
d. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.
    1) Cost of retesting is Contractor's responsibility.
e. Testing agency to prepare survey report indicating locations of initial leaks, if any, and final survey report.

2. Infrared Thermography: Testing agency surveys entire roof area using infrared color thermography according to ASTM C1153.
    a. Perform tests before overlying construction is placed.
    b. After infrared scan, locate specific areas of leaks by electrical capacitance/impedance testing or nuclear hydrogen detection tests.
    c. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
        1) Cost of retesting is Contractor's responsibility.
    d. Testing agency to prepare survey report of initial scan indicating locations of entrapped moisture, if any.
3. Nuclear Hydrogen Detection Testing: Testing agency surveys entire roof area for entrapped water within roof assembly according to ANSI/SPRI/RCI NT-1.
    a. Perform tests before overlying construction is placed.
    b. After testing, repair leaks, repeat tests, and make further repairs until roofing and flashing installations are watertight.
        1) Cost of retesting is Contractor's responsibility.
    c. Testing agency to prepare survey report indicating locations of entrapped moisture, if any.

C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.
D. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
E. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.10 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.11 ROOFING INSTALLER'S WARRANTY

A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: Kansas City Water Services Department.
2. Owner Address: 4800 East 63rd Street, Kansas City. MO 64130.
3. Building Name/Type: Todd Creek Wastewater Treatment Plant.
4. Building Address: _____..
5. Area of Work: All low slopped roofs.
6. Acceptance Date: _____.
7. Warranty Period: 30 years and 2 years workmanship.
8. Expiration Date: _____.

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period Roofing Installer will, at Roofing Installer's own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

    a. lightning;
    b. peak gust wind speed exceeding 120 mph (54 m/sec);
    c. fire;
    d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
    e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
    f. vapor condensation on bottom of roofing; and
    g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this

Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.

5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION 07 54 23

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Wall sheet metal fabrications.
   2. Miscellaneous sheet metal fabrications.

B. Related Requirements:
   1. Section 06 10 00 "Rough Carpentry" for wood nailers, curbs, and blocking.
   2. Section 07 71 00 "Roof Specialties" for manufactured copings, roof-edge specialties, roof-edge drainage systems, reglets, and counterflashings.

1.02 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
   3. Review requirements for insurance and certificates if applicable.
   4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.04 ACTION SUBMITTALS

A. Product Data:
   1. Wall sheet metal fabrications.
   2. Miscellaneous sheet metal fabrications.

B. Product Data Submittals:
   1. Underlayment materials.
   2. Elastomeric sealant.
   3. Butyl sealant.
   4. Epoxy seam sealer.

C. Sustainable Design Submittals:

D. Shop Drawings: For sheet metal flashing and trim.
   1. Include plans, elevations, sections, and attachment details.
   2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
   3. Include identification of material, thickness, weight, and finish for each item and location in Project.
   4. Include details for forming, including profiles, shapes, seams, and dimensions.
   5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
   6. Include details of termination points and assemblies.
   7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.

8. Include details of roof-penetration flashing.
9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashings.
10. Include details of special conditions.
11. Include details of connections to adjoining work.

E. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied finishes.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.
B. Sample Warranty: For special warranty.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.
B. Special warranty.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.
   1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
   2. Protect stored sheet metal flashing and trim from contact with water.
B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.08 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
      b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, are to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim are not to rattle, leak, or loosen, and are to remain watertight.
B. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint

sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.02 SHEET METALS

A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B209 (ASTM B209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.

1. Exposed Coil-Coated Finish:
   a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Color: As selected by Architect from manufacturer's full range.
3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil (0.013 mm).

C. Stainless Steel Sheet: ASTM A240/A240M, Type 304, dead soft, fully annealed; with smooth, flat surface.

1. Finish: ASTM A480/A480M, No. 4 (polished directional satin).
   a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
   b. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
      1) Run grain of directional finishes with long dimension of each piece.
      2) When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.03 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
   a. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.

D. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

F. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Fry Reglet Corporation.
   2. Source Limitations: Obtain reglets from single source from single manufacturer.
   3. Material: Stainless steel, 0.0188 inch (0.477 mm) thick.
   4. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
   5. Accessories:
      a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
      b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.
   6. Finish: Mill.

2.04 FABRICATION, GENERAL

A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.
   1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
   2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
   3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
   4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
   5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:
   1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
   2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
   1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

E. Seams:
   1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.

F. Do not use graphite pencils to mark metal surfaces.

2.05 WALL SHEET METAL FABRICATIONS

A. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following materials:
   1. Aluminum: 0.032 inch (0.81 mm) thick.

2.06 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:
   1. Stainless Steel: 0.0188 inch (0.477 mm) thick.
B. Overhead-Piping Safety Pans: Fabricate from the following materials:
   1. Stainless Steel: 0.0250 inch (0.635 mm) thick.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
   1. Verify compliance with requirements for installation tolerances of substrates.
   2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
   3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.
   1. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of sealant.
   3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
   4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
   5. Install continuous cleats with fasteners spaced not more than 12 inches (300 mm) o.c.
   6. Space individual cleats not more than 12 inches (300 mm) apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
   7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
   8. Do not field cut sheet metal flashing and trim by torch.
   9. Do not use graphite pencils to mark metal surfaces.
B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
   1. Coat concealed side of stainless steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
   2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
   1. Space movement joints at maximum of 10 feet (3 m) with no joints within 24 inches (600 mm) of corner or intersection.
   2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.
   3. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.
   1. Use sealant-filled joints unless otherwise indicated.
      a. Embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant.
      b. Form joints to completely conceal sealant.
      c. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way.
      d. Adjust setting proportionately for installation at higher ambient temperatures.
         1) Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
   2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

3.03 INSTALLATION OF WALL FLASHINGS

A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Install sheet metal flashing and trim to comply with performance requirements and cited sheet metal standard.
   1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
   2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

C. Reglets: Installation of reglets is specified in Division 3 "Concrete." Division 4 "Unit Masonry."

3.04 INSTALLATION OF MISCELLANEOUS FLASHING

A. Equipment Support Flashing:
   1. Coordinate installation of equipment support flashing with installation of roofing and equipment.
   2. Weld or seal flashing with elastomeric sealant to equipment support member.

B. Overhead-Piping Safety Pans:
   1. Suspend pans from structure above, independent of other overhead items such as equipment, piping, and conduit, unless otherwise indicated on Drawings.
   2. Pipe and install drain line to plumbing waste or drainage system.

3.05 INSTALLATION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.06 CLEANING

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean off excess sealants.

3.07 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.
B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.
C. Maintain sheet metal flashing and trim in clean condition during construction.
D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 07 62 00

SECTION 07 71 00 - ROOF SPECIALTIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Copings.
   2. Roof-edge specialties.
   3. Roof-edge drainage systems.
   4. Reglets and counterflashings.
   5. Downspout splash pads.

B. Related Requirements:
   1. Division 5 "Steel" for downspout guards and downspout boots.
   2. Section 06 10 00 "Rough Carpentry" for wood nailers, curbs, and blocking.
   3. Section 07 41 13.16 "Standing-Seam Metal Roof Panels" for roof-edge drainage-system components provided by metal-roof-panel manufacturer.
   4. Section 07 62 00 "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.
   5. Section 07 72 53 "Snow Guards" for manufactured snow guard devices.
   6. Section 07 92 00 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.
   7. Division 22 "Heating, Ventilation and Air Conditioning" for set-on-type curbs, equipment supports, and vents.

C. Preinstallation Conference: Conduct conference at Project site.
   1. Meet with Owner, Architect, Owner's insurer if applicable, roofing-system testing and inspecting agency representative, roofing Installer, roofing-system manufacturer's representative, Installer, structural-support Installer, and installers whose work interfaces with or affects roof specialties, including installers of roofing materials and accessories.
   2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
   3. Review special roof details, roof drainage, and condition of other construction that will affect roof specialties.

1.02 ACTION SUBMITTALS

A. Product Data:
   1. Copings.
   2. Roof-edge specialties.
   3. Roof-edge drainage systems.
   4. Reglets and counterflashings.

B. Product Data Submittals: For each product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

C. Sustainable Design Submittals:

D. Shop Drawings: For roof specialties.
   1. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work.
   2. Include details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
   3. Indicate profile and pattern of seams and layout of fasteners, cleats, clips, and other attachments.

4. Detail termination points and assemblies, including fixed points.
5. Include details of special conditions.

E. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.

1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.
B. Product Certificates: For each type of roof specialty.
C. Product Test Reports: For copings, for tests performed by a qualified testing agency.
D. Sample Warranty: For manufacturer's special warranty.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are SPRI ES-1 tested to specified design pressure.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.
B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

1.07 FIELD CONDITIONS

A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.
B. Coordination: Coordinate roof specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.08 WARRANTY

A. Roofing-System Warranty: Roof specialties are included in warranty provisions in Section 074113.16 "Standing-Seam Metal Roof Panels" and 075423 “Thermoplastic-Polyolefin (TPO) Roofing.”
B. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
    1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
        a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
        b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
        c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
    2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 SOURCE LIMITATIONS

A. Obtain roof specialties approved by manufacturer providing roofing-system warranty specified in Section 074113.16 "Standing-Seam Metal Roof Panels" and 075423 “Thermoplastic-Polyolefin (TPO) Roofing.”.

2.02 PERFORMANCE REQUIREMENTS

A. General Performance: Roof specialties to withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. SPRI Wind Design Standard: Manufacture and install copings and roof-edge specialties tested in accordance with SPRI ES-1 and capable of resisting the following design pressures:
   1. Design Pressure: As indicated on Drawings.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.03 COPINGS

A. Metal Copings: Manufactured coping system consisting of metal coping cap in section lengths not exceeding 12 feet (3.6 m), concealed anchorage; with corner units, end cap units, and concealed splice plates with finish matching coping caps.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ATAS International, Inc.
      b. Berridge Manufacturing Company.
      c. Drexel Metals.
      d. PAC-CLAD; Petersen Aluminum Corporation; a Carlisle company.
   2. Formed Aluminum Sheet Coping Caps: Aluminum sheet, thickness as required to meet performance requirements.
      a. Surface: Smooth, flat finish.
      b. Finish: Two-coat fluoropolymer.
      c. Color: As selected by Architect from manufacturer's full range.
   3. Corners: Factory mitered and continuously welded.
   4. Coping-Cap Attachment Method: Snap-on or face leg hooked to continuous cleat with back leg fastener exposed, fabricated from coping-cap material.
      a. Snap-on Coping Anchor Plates: Concealed, galvanized-steel sheet, 12 inches (300 mm) wide, with integral cleats.
      b. Face-Leg Cleats: Concealed, continuous galvanized-steel sheet.

2.04 ROOF-EDGE SPECIALTIES

A. Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet (3.6 m) and a continuous metal receiver with integral drip-edge cleat to engage fascia cover and secure single-ply roof membrane. Provide matching corner units.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. ATAS International, Inc.
   b. Drexel Metals.
2. Formed Aluminum Sheet Fascia Covers: Aluminum sheet, 0.050 inch (1.27 mm) thick.
   a. Surface: Smooth, flat finish.
   b. Finish: Two-coat fluoropolymer.
   c. Color: As selected by Architect from manufacturer's full range.
3. Corners: Factory mitered and continuously welded.
4. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.
5. Receiver: Aluminum sheet, 0.050 inch (1.27 mm) thick or Extruded aluminum, 0.080 inch (2.03 mm) thick.

2.05 ROOF-EDGE DRAINAGE SYSTEMS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   1. ATAS International, Inc.
   2. Drexel Metals.

B. Gutters: Manufactured in uniform section lengths not exceeding 12 feet (3.6 m), with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch (25 mm) above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.
   1. Aluminum Sheet: 0.050 inch (1.27 mm) thick.
   2. Gutter Profile: Style A in accordance with SMACNA's "Architectural Sheet Metal Manual."
   3. Corners: Factory mitered and continuously welded.
   4. Gutter Supports: Straps with finish matching the gutters.
   5. Gutter Accessories: Wire ball downspout strainer.

C. Downspouts: Plain rectangular complete with mitered elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
   1. Formed Aluminum: 0.050 inch (1.27 mm) thick.

D. Parapet Scuppers: Manufactured with closure flange trim to exterior, 4-inch- (100-mm-) wide wall flanges to interior, and base extending 4 inches (100 mm) beyond cant or tapered strip into field of roof.
   1. Formed Aluminum: 0.050 inch (1.27 mm) thick.

E. Conductor Heads: Manufactured conductor heads, each with flanged back and stiffened top edge, and of dimensions and shape indicated, complete with outlet tube that nests into upper end of downspout, exterior flange trim,.
   1. Formed Aluminum: 0.050 inch (1.27 mm) thick.

F. Aluminum Finish: Two-coat fluoropolymer.
   1. Color: As selected by Architect from manufacturer's full range.

2.06 REGLETS AND COUNTERFLASHINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   1. ATAS International, Inc.
   2. Berridge Manufacturing Company.
   3. Drexel Metals.
   4. Fry Reglet Corporation.

B. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:
   1. Formed Aluminum: 0.050 inch (1.27 mm) thick.
   2. Corners: Factory mitered and continuously welded.
   3. Surface-Mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
   4. Concrete Type, Embedded: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.

C. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches (100 mm) and in lengths not exceeding 12 feet (3.6 m) designed to snap into reglets and compress against base flashings with joints lapped, from the following exposed metal:
   1. Formed Aluminum: 0.032 inch (0.81 mm) thick.

D. Accessories:
   1. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where reglet is provided separate from metal counterflashing.
   2. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

E. Aluminum Finish: Two-coat fluoropolymer.
   1. Color: As selected by Architect from manufacturer's full range.

2.07 MATERIALS

A. Aluminum Sheet: ASTM B209 (ASTM B209M), alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.

B. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.

2.08 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      a. ATAS International, Inc.
      b. Carlisle WIP Products; a brand of Carlisle Construction Materials.
      c. Henry Company.
      d. Owens Corning.
   2. Thermal Stability: ASTM D1970/D1970M; stable after testing at 240 deg F (116 deg C).
   3. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F (29 deg C).

B. Felt: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

2.09 MISCELLANEOUS MATERIALS

A. Splash Pads: Precast concrete type; minimum 3,000 psi (21 MPa) at 28 days, with minimum 5 percent air entrainment. Provide at all downspouts,

B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:

1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
3. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
4. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel in accordance with ASTM A153/A153M or ASTM F2329.

C. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

D. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.

E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

F. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

2.10 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Coil-Coated Aluminum Sheet Finishes:

1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
    a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
    b. Concealed Surface Finish: Apply pretreatment and manufacturer's standard acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.

C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF UNDERLAYMENT

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches (152 mm) staggered 24 inches (610 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.

1. Apply continuously under copings roof-edge specialties and reglets and counterflashings.
2. Coordinate application of self-adhering sheet underlayment under roof specialties with requirements for continuity with adjacent air barrier materials.

3.03 INSTALLATION, GENERAL

A. Install roof specialties in accordance with manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.
   1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
   2. Provide uniform, neat seams with minimum exposure of solder and sealant.
   3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
   4. Torch cutting of roof specialties is not permitted.
   5. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
   1. Coat concealed side of uncoated aluminum roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
   2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
   1. Space movement joints at a maximum of 12 feet (3.6 m) with no joints within 18 inches (450 mm) of corners or intersections unless otherwise indicated on Drawings.
   2. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

D. Fastener Sizes: Use fasteners of sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.

F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F (4 deg C).

3.04 INSTALLATION OF COPINGS

A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor copings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.
   1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at manufacturer's required spacing that meets performance requirements.

3.05 INSTALLATION OF ROOF-EDGE SPECIALTIES

A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.06 INSTALLATION OF ROOF-EDGE DRAINAGE SYSTEMS

A. Install components to produce a complete roof-edge drainage system in accordance with manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.

B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 24 inches (610 mm) apart. Attach ends with rivets and seal with sealant to make watertight. Slope to downspouts.
   1. Install gutter with expansion joints at locations indicated but not exceeding 50 feet (15.2 m) apart. Install expansion-joint caps.

C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c.
   1. Provide elbows at base of downspouts at grade to direct water away from building.

D. Splash Pans: Install where downspouts discharge on low-slope roofs. Set in elastomeric sealant.

E. Parapet Scuppers: Install scuppers through parapet where indicated. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
   1. Loosely lock front edge of scupper with conductor head.

F. Conductor Heads: Anchor securely to wall with elevation of conductor top edge 1 inch (25 mm) below scupper discharge.

3.07 INSTALLATION OF REGLETS AND COUNTERFLASHINGS

A. Coordinate installation of reglets and counterflashings with installation of base flashings.

B. Embedded Reglets: See Division 3 "Concrete" for installation of reglets.

C. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches (100 mm) over top edge of base flashings.

D. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches (100 mm) over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with butyl sealant. Fit counterflashings tightly to base flashings.

3.08 CLEANING AND PROTECTION

A. Clean and neutralize flux materials. Clean off excess solder and sealants.

B. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.

C. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 71 00

SECTION 07 72 53 - SNOW GUARDS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Rail-type, seam-mounted snow guards.

1.02 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   1. Rail-type, seam-mounted snow guards.
B. Shop Drawings: Include roof plans showing layouts and attachment details of snow guards.
   1. Include details of rail-type snow guards.
C. Samples:
   1. Rail-Type Snow Guards: Bracket, 12-inch- (300-mm-) long rail, and installation hardware.
D. Delegated Design Submittals: For snow guards, include analysis reports signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Include calculation of number and location of snow guards.

1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer's experience with providing delegated design engineering services of the kind indicated, including documentation that the engineer is licensed in the jurisdiction in which the Project is located.
B. Product Test Reports: For each type of snow guard, for tests performed by a qualified testing agency, indicating load at failure of attachment to roof system identical to roof system used on this Project.

1.04 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit adhesive-mounted snow guards to be installed, and adhesive cured, according to adhesive manufacturer's written instructions.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Division 1 "Quality Control," to design snow guards, including attachment to roofing material and roof deck, as applicable for attachment method, based on the following:
   1. Roof snow load.
   2. Snow drifting
   3. Roof slope.
   4. Roof type.
   5. Roof dimensions.
   6. Roofing substrate type and thickness.
   7. Snow guard type.
   8. Snow guard fastening method and strength.
   9. Snow guard spacing.
   10. Coefficient of Friction Between Snow and Roof Surface: 0.

11. Factor of Safety: 2.

B. Performance Requirements: Provide snow guards that withstand exposure to weather and resist thermally induced movement without failure, rattling, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
   1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

C. Structural Performance: Snow guards to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.
   1. Snow Loads: As indicated on Drawings.

2.02 RAIL-TYPE SNOW GUARDS

A. Rail-Type, Seam-Mounted Snow Guards:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Alpine SnowGuards.
      b. PMC Industries, Inc.
      c. S-5! Metal Roof Innovations, Ltd.
   2. Description: Snow guard rails fabricated from metal pipes, bars, or extrusions, anchored to brackets and equipped with one rail.
   3. Brackets and Baseplate: ASTM B209 (ASTM B209M) aluminum; mill finished or ASTM A240/A240M, Type 304 stainless steel; mill.
   4. Bars: ASTM B221 (ASTM B221M) aluminum; mill finish or ASTM A240/A240M, Type 304 stainless steel; mill finish.
      a. Profile: Round.
   5. Seam Clamps: ASTM B221 (ASTM B221M) aluminum extrusion or ASTM B85/B85M aluminum casting with stainless steel set screws incorporating round nonpenetrating point; designed for use with applicable roofing system to which clamp is attached.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, snow guard attachment, and other conditions affecting performance of the Work.
   1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prime substrates according to snow guard manufacturer's written instructions.

3.03 INSTALLATION

A. Install snow guards according to manufacturer's written instructions.
   1. Space rows as recommended by manufacturer.

B. Attachment for Standing-Seam Metal Roofing:
   1. Do not use fasteners that will penetrate metal roofing or fastening methods that void metal roofing finish warranty.
   2. Rail-Type, Seam-Mounted Snow Guards:
      a. Install brackets to vertical ribs in straight rows.
      b. Secure with stainless steel set screws, incorporating round nonpenetrating point, on same side of standing seam.

c. Torque set screw in accordance with manufacturer's written instructions.
d. Install cross members to brackets.

END OF SECTION 07 72 53

SECTION 07 84 13 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Penetration firestopping systems.

B. Related Requirements:

1. Section 07 84 43 "Joint Firestopping" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

1.02 ACTION SUBMITTALS

A. Product Data: Penetration firestopping systems.

B. Sustainable Design Submittals:

C. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly developed in accordance with current International Firestop Council (IFC) guidelines. Obtain approval of authorities having jurisdiction prior to submittal.

1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Listed System Designs: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.04 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Approvals according to FM Approvals 4991, "Approval Standard for Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.07 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.01 SOURCE LIMITATIONS

A. Obtain penetration firestop systems for each type of opening indicated from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:
   1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
   2. Test in accordance with testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
      a. Penetration firestop systems installed with products bearing the classification marking of a qualified product certification agency in accordance with listed system designs published by a qualified testing agency.
         1) UL in its online directory "Product iQ."
         2) Intertek Group in its "Directory of Building Products."
         3) FM Approvals in its "Approval Guide."

2.03 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems are to be compatible with one another, with the substrates forming openings, and with penetrating items if any.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. 3M Building and Construction.
      b. Hilti, Inc.
      c. Tremco Incorporated.

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined in accordance with ASTM E814 or UL 1479.
   1. F-Rating: Not less than the fire-resistance rating of the wall penetrated.
   2. Membrane Penetrations: Install recessed fixtures such that the required fire resistance will not be reduced.

C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined in accordance with ASTM E814 or UL 1479.
   1. F-Rating: At least one hour, but not less than the fire-resistance rating of the floor penetrated.
   2. T-Rating: At least one hour, but not less than the fire-resistance rating of the floor. The following floor penetrations do not require a T-rating:
      a. Those within the cavity of a wall.
      b. Floor, tub, or shower drains within a concealed space.
      c. 4-inch (200-mm) or smaller metal conduit penetrating directly into metal-enclosed electrical switchgear.
   3. W-Rating: Provide penetration firestopping systems with a Class 1 W-rating in accordance with UL 1479.

D. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, in accordance with ASTM E84.

E. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by

penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

1. Permanent forming/damming/backing materials.
2. Substrate primers.
3. Collars.
4. Steel sleeves.

2.04 FILL MATERIALS

A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

B. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

C. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

D. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

E. Fire-Rated Cable Sleeve Kits: Complete kits designed for new or existing cable penetrations through walls to accept standard accessories.

F. Fire-Rated Cable Pathways: Single or gangable device modules composed of a steel raceway with integral intumescent material and requiring no additional action in the form of plugs, twisting closure, putty, pillows, sealant, or otherwise to achieve fire and air-leakage ratings.

G. Wall-Opening Protective Materials: Intumescent, non-curing putty pads or self-adhesive inserts for protection of electrical switch and receptacle boxes.

H. Fire-Rated HVAC Retaining Angles: Steel angle system with integral intumescent firestop gasket for use around rectangular steel HVAC ducts without fire dampers.

I. Firestop Plugs: Flexible, re-enterable, intumescent, foam-rubber plug for use in blank round openings and cable sleeves.

J. Fire-Rated Cable Grommet: Molded two-piece grommet made of plenum-grade polymer and foam inner core for sealing small cable penetrations in gypsum walls up to 1/2 inch (13 mm) in diameter.

K. Endothermic Wrap: Flexible, insulating, fire-resistant, endothermic wrap for protecting membrane penetrations of utility boxes, critical electrical circuits, communications lines.

2.05 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:
   1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
   2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.03 INSTALLATION OF PENETRATION FIRESTOPPING SYSTEMS

A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.
   1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

C. Install fill materials by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
   2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
   3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 IDENTIFICATION

A. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
   1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Designation of applicable testing and inspecting agency.
   4. Date of installation.
   5. Manufacturer's name.
   6. Installer's name.

3.05 FIELD QUALITY CONTROL

A. Engage a qualified testing agency to perform tests and inspections according to ASTM E2174.

B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

C. Proceed with enclosing penetration firestopping systems with other construction activities only after inspection reports are issued and installations comply with requirements.

3.06 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION 07 84 13

SECTION 07 84 43 - JOINT FIRESTOPPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Joints in or between fire-resistance-rated construction.

B. Related Requirements:
   1. Section 07 84 13 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers.

1.02 ACTION SUBMITTALS

A. Product Data:
   1. Joints in or between fire-resistance-rated construction.

B. Sustainable Design Submittals:

C. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.
   1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly developed in accordance with current International Firestop Council (IFC) guidelines.

1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Listed System Designs: For each joint firestopping system, for tests performed by a qualified testing agency.

1.04 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Approvals according to FM Approvals 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.07 COORDINATION

A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 - PRODUCTS

2.01 SOURCE LIMITATIONS

A. Obtain joint firestop systems for each type of joint opening indicated from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:
   1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
   2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
      a. Joint firestop systems installed with products bearing the classification marking of a qualified product certification agency in accordance with Listed System Designs published by a qualified testing agency.
         1) UL in its online directory "Product iQ."
         2) Intertek Group in its "Directory of Building Products."

2.03 JOINT FIRESTOPPING SYSTEMS

A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems must accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
   1. Joint firestopping systems that are compatible with one another, with the substrates forming openings, and with penetrating items, if any.
   2. Provide products that, upon curing, do not re-emulsify, dissolve, leach, breakdown, or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture.
   3. Provide firestop products that do not contain ethylene glycol.

B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E1966 or UL 2079.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. 3M Building and Construction.
      b. Hilti, Inc.
      c. Tremco Incorporated.
   2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.

C. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.

2.04 ACCESSORIES

A. Provide components of joint firestopping systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning: Before installing joint firestopping systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
   1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
   2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Apply a suitable bond-breaker to prevent three-sided adhesion in applications where this condition occurs, such as the intersection of a gypsum wall to floor or roof assembly where the joint is backed by a steel ceiling runner or track.

3.03 INSTALLATION

A. General: Install joint firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install elastomeric fill materials for joint firestopping systems by proven techniques to produce the following results:
   1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
   2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
   3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 IDENTIFICATION

A. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
   1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Designation of applicable testing agency.
   4. Date of installation.
   5. Manufacturer's name.
   6. Installer's name.

3.05 FIELD QUALITY CONTROL

A. Engage a qualified testing agency to perform tests and inspections in accordance with ASTM E2393.

B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.

C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.06 CLEANING AND PROTECTION

A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated joint firestopping systems immediately and install new materials to produce joint firestopping systems complying with specified requirements.

3.07 JOINT FIRESTOPPING SYSTEM SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's online directory "Product iQ" under product Category XHBN.

B. Where Intertek Group-listed systems are indicated, they refer to design numbers in Intertek Group's "Directory of Building Products" under product category Firestop Systems.

C. Wall-to-Wall, Joint Firestopping Systems: .
   1. UL-Classified Systems: WW-D- 0000-0999.
   2. Assembly Rating: 1 hour.
   3. Nominal Joint Width: As indicated.
   4. Movement Capabilities: Class I - 50 percent compression or extension.

D. Floor-to-Wall, Joint Firestopping Systems: .
   1. UL-Classified Systems: FW- S- 0000-0999.
   2. Assembly Rating: 1 hour.
   3. Nominal Joint Width: As indicated.

E. Head-of-Wall, Fire-Resistive Joint Firestopping Systems: .
   1. UL-Classified Systems: HW-D- 0000-0999.
   2. Intertek Group-Listed Systems: .
   3. Assembly Rating: 1 hour.
   4. Nominal Joint Width: As indicated.
   5. Movement Capabilities: Class I - 50 percent compression or extension.

END OF SECTION 07 84 43

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Silicone joint sealants.
   2. Urethane joint sealants.
   3. Mildew-resistant joint sealants.
   4. Butyl joint sealants.
   5. Latex joint sealants.

B. Related Requirements:
   1. Section 07 92 19 "Acoustical Joint Sealants" for sealing joints in sound-rated construction.
   2. Division 32 for sealing joints in paved roads, parking lots, walkways, and curbing.

1.02 ACTION SUBMITTALS

A. Product Data:
   1. Silicone joint sealants.
   2. Urethane joint sealants.
   3. Mildew-resistant joint sealants.
   4. Butyl joint sealants.
   5. Latex joint sealants.

B. Samples for Initial Selection: Manufacturer's standard color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Joint-Sealant Schedule: Include the following information:
   1. Joint-sealant application, joint location, and designation.
   2. Joint-sealant manufacturer and product name.
   3. Joint-sealant formulation.
   4. Joint-sealant color.

1.03 INFORMATIONAL SUBMITTALS

A. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

B. Field Quality-Control Reports: For field-adhesion-test reports, for each sealant application tested.

C. Sample warranties.

1.04 CLOSEOUT SUBMITTALS

A. Manufacturers' special warranties.

B. Installer's special warranties.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Authorized representative who is trained and approved by manufacturer.

B. Testing Agency Qualifications: Qualified in accordance with ASTM C1021 to conduct the testing indicated.

1.06 PRECONSTRUCTION TESTING

A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
   1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
   2. Conduct field tests for each kind of sealant and joint substrate.
   3. Notify Architect seven days in advance of dates and times when test joints will be erected.
   4. Test Method: Test joint sealants in accordance with Method A, Tail Procedure, in ASTM C1521.
      a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
   5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
   6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.07 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
   2. When joint substrates are wet.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.08 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
   1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
   2. Disintegration of joint substrates from causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.01 SOURCE LIMITATIONS

A. Obtain joint sealants from single manufacturer for each sealant type.

2.02 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.03 SILICONE JOINT SEALANTS

A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. GE Construction Sealants; Momentive Performance Materials Inc.
   b. Pecora Corporation.
   c. Sika Corporation - Building Components.
   d. The Dow Chemical Company.

2.04 URETHANE JOINT SEALANTS

A. Urethane, M, NS, 50, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 50, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Pecora Corporation.

2.05 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. GE Construction Sealants; Momentive Performance Materials Inc.
   b. Pecora Corporation.
   c. Sika Corporation - Building Components.
   d. The Dow Chemical Company.
   e. Tremco Incorporated.

2.06 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C1311.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Pecora Corporation.
   b. Sika Corporation - Building Components.

2.07 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Pecora Corporation.
      b. Tremco Incorporated.

2.08 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin), Type O (open-cell material), Type B (bicellular material with a surface skin), or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.09 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
   1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
   2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

a. Concrete.
b. Masonry.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
   a. Metal.
   b. Glass.
   c. Porcelain enamel.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of sealant backings.
   2. Do not stretch, twist, puncture, or tear sealant backings.
   3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants in accordance with requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealant from surfaces adjacent to joints.
   2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
   3. Provide concave joint profile in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.
   4. Provide flush joint profile at locations indicated on Drawings in accordance with Figure 8B in ASTM C1193.
   5. Provide recessed joint configuration of recess depth and at locations indicated on Drawings in accordance with Figure 8C in ASTM C1193.

a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.04 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
   a. Extent of Testing: Test completed and cured sealant joints as follows:
      1) Perform 10 tests for the first 1000 ft. (300 m) of joint length for each kind of sealant and joint substrate.
      2) Perform one test for each 1000 ft. (300 m) of joint length thereafter or one test per each floor per elevation.
   b. Test Method: Test joint sealants in accordance with Method A, Tail Procedure, in ASTM C1521.
      1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
   c. Inspect tested joints and report on the following:
      1) Whether sealants filled joint cavities and are free of voids.
      2) Whether sealant dimensions and configurations comply with specified requirements.
      3) Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
   d. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
   e. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
2. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

C. Prepare test and inspection reports.

3.05 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.06 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 92 00

SECTION 07 92 19 - ACOUSTICAL JOINT SEALANTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Acoustical joint sealants.

B. Related Requirements:
   1. Section 07 92 00 "Joint Sealants" for elastomeric, latex, and butyl-rubber-based joint sealants for nonacoustical applications.

1.02 ACTION SUBMITTALS

A. Product Data:
   1. Acoustical joint sealants.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants, showing full range of available colors for each product exposed to view.

C. Acoustical Joint-Sealant Schedule: Include the following information:
   1. Joint-sealant application, joint location, and designation.
   2. Joint-sealant manufacturer and product name.
   3. Joint-sealant formulation.
   4. Joint-sealant color.

D. Sustainable Design Submittals:

1.03 INFORMATIONAL SUBMITTALS

A. Test and Evaluation Reports:
   1. Product Test Reports: For each type of acoustical joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.

B. Sample warranties.

1.04 CLOSEOUT SUBMITTALS

A. Warranty Documentation:
   1. Manufacturers' special warranties.
   2. Installer's special warranties.

1.05 WARRANTY

A. Installer's Special Warranty: Installer agrees to repair or replace acoustical joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 ACOUSTICAL JOINT SEALANTS

A. Acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies in accordance with ASTM E90.

B. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C834.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. DAP Products Inc.
b. Hilti, Inc.
c. OSI Sealants; Henkel Corporation.
d. Pecora Corporation.

2. Colors of Exposed Acoustical Joint Sealants: As selected by Architect from manufacturer's full range of colors.

C. Acoustical Sealant for Concealed Joints: Manufacturer's standard nonsag, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber acoustical sealant.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. OSI Sealants; Henkel Corporation.
b. Pecora Corporation.
c. Tremco Incorporated.
d. USG Corporation.

2.02 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by acoustical joint-sealant manufacturer where required for adhesion of sealant to joint substrates.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive acoustical joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where recommended by acoustical joint-sealant manufacturer. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.

B. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

3.04 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of acoustical joint sealants and of products in which joints occur.

3.05 PROTECTION

A. Protect acoustical joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated acoustical joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 92 19

SECTION 08 16 13 - FIBERGLASS DOORS AND FRAMES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Fiberglass Reinforced Plastic (FRP) Doors.
   2. Fiberglass Resin Transfer Molded Door Frames

B. Related Requirements:
   1. Section 08 71 00 "Door Hardware" for hardware related to “Fiberglass Doors and Frames.”
   2. Section 08 80 00 “Glazing” for insulating glazing installed in “Fiberglass Doors and Frames.”

1.02 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.04 ACTION SUBMITTALS

A. Product Data:
   1. Interior fiberglass doors and frames.
   2. Exterior fiberglass doors and frames.

B. Product Data Submittals: For each product.
   1. Include construction details, material descriptions, core descriptions, and finishes.

C. Shop Drawings: Include the following:
   1. Elevations of each door type.
   2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
   3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   4. Locations of reinforcement and preparations for hardware.
   5. Details of each different wall opening condition.
   6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
   7. Details of anchorages, joints, field splices, and connections.
   8. Details of accessories.
   9. Details of moldings, removable stops, and glazing.

D. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of fiberglass doors and frames.

E. Samples for Verification:
   1. Finishes: For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fiberglass doors and frames.

B. Warranty Documentation:

1. Manufacturers' special warranties.

1.06 QUALITY ASSURANCE

A. Referenced Standards
   1. American Society for Testing and Materials (ASTM)
   2. Society of Automotive Engineers (SAE)
   3. International Building Code, Plastics (Chapter 26)
   4. UL Standards for Safety UL10B / UL10C, UBC 7-2
   5. ANSI A250.4 1,000,000 cycle test.

B. Manufacturer Qualifications: A company specialized in the manufacture of fiberglass reinforced plastic (FRP) doors and frames as specified herein with a record of successful in-service performance for the applications as required for this project.

C. Installer Qualifications: An experienced installer who has completed fiberglass door and frame installations similar in material, design, and extent to those indicated and whose work has resulted in construction with a record of successful in-service performance.

D. Source limitations: Obtain fiberglass reinforced plastic doors and resin transfer molded fiberglass frames through one source fabricated from a single manufacturer, including fire rated fiberglass frames. This ensures complete uniformity of physical properties and consistency in the resin chemistry tailored for this application.
   1. Hardware and accessories for all FRP doors as specified in Section 08 71 00 provided and installed by the fiberglass door and frame manufacturer.
   2. Glass for windows in doors is furnished and installed by door and frame manufacturer in accordance with related section, Division 8, Glazing.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Each door and frame to be delivered individually crated for protection from damage in cardboard containers, clearly marked with project information, door location, specific reference number as shown on drawings, and shipping information. Each crate contains the fasteners necessary for installation as well as complete installation instructions.
   1. Doors are stored in the original container on edge, out of inclement weather for protection against the elements.
   2. Handle doors pursuant to the manufacturer’s recommendations as posted on the outside of crate.

B. Handling and storage of the doors and frames after receipt is the responsibility/liability of the customer. It is recommended that the doors be stored indoors in a vertical position, clear of the floor, with blocking between the doors to permit air circulation between the doors and prevent damage to the door faces. Rain/water or condensation must not be allowed to collect or lay between stored doors. Do not wrap in plastic sheeting as it will promote condensation formation within. Permanent discoloration can result

1.08 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fiberglass doors and frames that fail(s) in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, delamination and failure due to corrosion.
   2. Warranty Period: Lifetime from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Chem-Pruf Door Co., Ltd.
2. Cline Doors, Inc.
3. Corrim Company
4. Special-Lite
5. Tiger Door.

2.02 SOURCE LIMITATIONS

A. Obtain fiberglass doors and frames from single source from single manufacturer.

2.03 PERFORMANCE REQUIREMENTS

A. Pultruded structural shapes for stiles; rails, frames, and astragals to exhibit the following minimum longitudinal coupon properties (per ASTM):
   1. Tensile strength (D638) 30,000 psi
   2. Comprehensive strength (D695) 30,000 psi
   3. Flexural strength (D790) 30,000 psi
   4. Flexural modulus (D790) 1,600,000 psi
   5. Shear strength (D2846) 4,500 psi
   6. Impact, notched (D256) 25 ft-lb/in
   7. Barcol hardness (D2853) 50

B. Core material to exhibit the following minimum coupon properties (per ASTM):
   1. Shear strength, longitudinal direction (C273) 68.2 psi
   2. Shear strength, transverse direction (C273) 25.8 psi
   3. Shear modulus, longitudinal direction (C273) 6940 psi
   4. Shear modulus, transverse direction (C273) 1878 psi Shear elongation, longitudinal direction (C393 short beam) 1.79%
   5. Shear elongation, longitudinal direction (C393 short beam) 1.79%
   6. Shear elongation, transverse direction (C393 short beam) 2.72%
   7. Maximum facing stress, longitudinal direction (C393 short beam) 735 psi
   8. Maximum facing stress, transverse direction (C393 short beam) 289 psi
   9. Maximum core shear stress, longitudinal direction (C393 short beam) 63.8 psi
   10. Maximum core shear stress, transverse direction (C393 short beam) 24.9 psi
   11. Modulus of elasticity (EI) per 1" width, longitudinal direction (C393 short beam) 4.92E+04 psi
   12. Modulus of elasticity (EI) per 1" width, transverse direction (C393 short beam) 1.97E+04 psi
   13. Maximum facing stress, longitudinal direction (C393 long beam) 9011 psi
   14. Maximum facing stress, transverse direction (C393 long beam) 4727 psi
   15. Maximum core shear stress, longitudinal direction (C393 long beam) 48.3 psi
   16. Maximum core shear stress, transverse direction (C393 long beam) 23.5psi
   17. Modulus of elasticity (EI) per 1" width, longitudinal direction (C393 long beam) 1.14E+05 psi
   18. Modulus of elasticity (EI) per 1" width, transverse direction (C393 long beam) 7.23E+05 psi
   19. Stiffness "D", longitudinal direction (C393 long beam) 379,270 psi
   20. Stiffness "D", longitudinal direction (C393 long beam) 260,608 psi
   21. Compressive strength (C365) 53 psi
   22. Compressive modulus (C365) 2110 psi
   23. Density (C271) 2.42 lb/ft

C. Adhesive to exhibit the following minimum coupon properties (per SAE)
   1. Tensile Strength (D882-83A modified) minimum 2000 psi
   2. 8-day 25º C at 100% humidity Cross Peel (SAE J1553) minimum 330 psi

3. 7-day immersion in seawater Cross Peel (SAE J1553) minimum 330 psi
4. 30-day immersion in saltwater Cross Peel (SAE J1553) minimum 330 psi
5. 72-hour immersion in gasoline Cross Peel (SAE J1553) minimum 330 psi
6. 72-hour immersion in 20% sulfuric acid Cross Peel (SAE J1553) minimum 300 psi CI.

D. ANSI A250.4 1,000,000 cycle test
1. 4’ x 8’ door (up to a full lite) and frame successfully tested in excess of 1,000,000 cycles with no failure of any of the design features of the door or frame.

2.04 FIBERGLASS REINFORCED POLYESTER DOORS

A. Heavy Duty Fiberglass Reinforced Polyester Doors.
1. Design: FRP doors to be of seamless press-molded construction. Laminated FRP face sheets applied while wet and uncured to an internal door stile and rail subframe/core assembly and then press-molded under heat and pressure. The composite door panel must be integrally fused over its entire surface area, not just adhesive-bonded at perimeter stiles and rails. Doors to remain under pressure during curing for flat, warp-free surfaces.
2. Stiles & Rails: A high-modulus pultruded FRP square or rectangular tube subframe is to be provided within the door. Tubes are to be mitered and joined internally at the corners with solid polymer blocks to yield a one-piece unit that does not require any secondary external sealing. Provide a tubular midrail across width of door at lock height, and additional horizontal rails where specific design conditions dictate. Doors incorporate molded-in FRP edge strips, chemically bonded to the subframe stiles, for machining of hardware mortises so as not to cut or otherwise compromise the integrity of the pultruded stiles, nor allow moisture to penetrate the core of the door. Chemically weld connections. No mechanical fasteners are allowed. The use or inclusion of aluminum, steel, gypsum or wood into stile and rail construction is not permitted.
3. Core: Polyurethane foam, minimum 6 pcf density to be completely enclosed within the stile and rail subframe. Use of balsa wood is not permitted.
4. Internal Reinforcement: High-modulous pultruded tubular FRP, high-density polymer compression blocks, or plastic compression blocking at all hardware locations, and corner locations. Do not use wood blocking, steel or aluminum reinforcing plates, ribs or fittings. A minimum of 900 lbs of pullout strength is required for each factory supplied hinge screw.
5. Faces: Door facings to utilize a chemical resistant thermosetting polyester resin system with fiber reinforcing layers. Furnish door faces as shown on the drawings and in the door elevations. Use chopped strand mat layers to provide bond integrity between gelcoat, laminated facings and the internal door structure. Structural reinforcement in the form of a knitted multi-layer material with layers of uni-directional glass fiber oriented in both the vertical and horizontal directions for high stiffness, impact resistance and resistance to warping. Gelcoat surface integrally molded to be 25/30 mils thick (wet) ultra-violet light stabilized marine grade NPG-isophthalic polyester gelcoat.

B. Finish: The exposed FRP door faces have a 3-4 mils (wet) factory applied two-part aliphatic polyurethane fully cured coating of industrial urethane. Coating has a minimum hardness of H to 2H. Finish is slightly textured semi-gloss to minimize the visual effects of wear and tear.

C. Lites and Louvers: Provisions for lites and louvers are to be made during manufacture and No field cutting of FRP doors. Cutouts are to be totally enclosed by pultruded FRP stiles and rails incorporated into the door structure. Lite and louver cutouts that expose core material are not acceptable.
1. Lites: Glass per job specification to be factory furnished, glazed, and installed. Glazing thickness is 1” insulating. Centered glazing is installed between 45-degree pultruded FRP glazing stops and vinyl foam tape with concealed compression retainers for glazing. No exposed fasteners or exposed silicone will be allowed for securing glazing. Stainless

steel screws may be allowed for other glazing thicknesses. All glazing stop material is pultrued FRP with a minimum fiberglass content of 50%. Metal, pvc, or vinyl "Glass Kit" type lites are not acceptable for non-fire rated openings.

a. Refer to section 08 08 00 "GLAZING" for insulating glazing types.

2. Louvers: Fiberglass inverted V blade privacy or flat blade louvers to be factory furnished and installed. All louvers and louver trim is manufactured exclusively from putruded FRP profiles with a minimum fiberglass content of 50%. All louvers are coated to match the door in color and sheen. Inverted V blade is 3/32" minimum thickness, flat blade louver is 3/16" minimum thickness. Adhesives for louver assembly to meet or exceed all requirements in section 2.5.1 Mechanical Properties and test performance. Metal, PVC, vinyl or other non-fiberglass louvers are not acceptable for non-fire rated openings.

2.05 FIBERGLASS REINFORCED POLYESTER FRAMES:

A. Heavy Duty Fiberglass Reinforced Polyester Frames s.

1. Design: FRP Door frames furnished under this specification to utilize a high-modulus pultruded structural FRP shape. The frame section is standard double rabbeted 5-3/4" deep x 2" face, 3/16" thick, with integral 5/8" doorstop, to match typical hollow metal configurations. Additional jamb profiles and widths are available.
2. Corner Joints: Frame jambs and header are joined at corners via miter connections with hidden FRP angle clips and associated fasteners. Post and beam corners will not be acceptable.
3. Hardware Reinforcements: FRP reinforcing is chemically welded to door frame material at required locations. Minimum screw pullout strength of 1100 lb per #12 x 1-1/4" sheet metal screw is required. Mechanically fastened reinforcements are not permitted.
4. Anchors:
   a. BOLT-IN: Provide manufacturer's required number of 3/8" diameter x 4" long flat head stainless steel sleeve anchors for masonry openings, 3/8" diameter x 4" machine screw with nut and washers for structural steel openings, #14 x 4" stainless steel flat head sheet metal screws for wood or steel stud openings. Include extra anchors for additional frame height in two-foot increments above 8'-0". Provide single bolt anchor at center of all headers over four feet in nominal width. Stainless Steel fasteners furnished by the manufacturer.
   b. GROUT-IN: Provide manufacturer's required number of wire or strap type masonry anchors for installation into block wall. Fill frame cavity with grout.

B. Finish: Frames have a 3-4 mils (wet) factory applied two-part aliphatic polyurethane fully cured coating of industrial urethane. Industrial urethane chemical coating color topcoat, to match the color and sheen of the doors, for superior weatherability. Gelcoat may not be sprayed onto the frame as a secondary coating.

2.06 ACCESSORIES

A. Astragals: Pairs of doors to be furnished with an astragal from the manufacturer made of same pultruded FRP material as door stile, rail and edge as required. Astragal is located on the meeting stile edge of each inactive leaf of double door pairs. Astragal is installed to cover meeting stile gap to effect seal and security.

B. Transoms: Transoms are identical to the doors in finish, construction, materials, thickness and reinforcement.

C. Fasteners: Fasteners for hardware are type 304 CRSS (18-8 series corrosion resistant stainless steel) with no exception. No carbon steel or aluminum components are to be used.

2.07 FABRICATION OF FIBERGLASS DOORS AND FRAMES

A. Factory fabricate fiberglass doors and frames.

B. Hardware
   1. Doors are factory mortised and drilled for mortise template butt hinges, with #12 x 3" long stainless-steel screws for hinge attachment. Provide 161 cylindrical lock bore, rim deadbolt, ANSI 86 mortise lock edge prep and pocket, or flushbolt cutouts as required.
   2. Frames are factory machined and drilled for all hardware requiring mortises, with #12 x 1-1/4" long stainless-steel screws for hinge attachment.
   3. Hardware is furnished as listed in section 08 70 00 coordinated and installed by experienced mechanics.
   4. Supplier will furnish manufacturer's standard templates and installation instructions preparation instructions prior to door and frame factory-initiated manufacture.

2.08 GENERAL FINISH REQUIREMENTS
A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.09 FINISHES
A. Gelcoat may not be sprayed onto the frame as a secondary coating.

PART 3 - EXECUTION

3.01 EXAMINATION
A. Examine openings for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Examine roughing-in for low-voltage and electrical to verify actual locations of connections before installation.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION
A. Remove shipping spreaders installed at factory.

3.03 INSTALLATION OF FIBERGLASS DOORS AND FRAMES
A. Install door opening assemblies in accordance with shop drawings and manufacturer's printed installation instructions, using installation methods and materials specified in installation instructions.
B. Field alteration of doors or frames to accommodate field conditions is strictly prohibited.
C. Site tolerances: Maintain plumb and level tolerance specified in manufacturer's printed installation instructions.

3.04 ADJUSTING
A. Adjust doors in accordance with the door manufacturer's instructions to swing open and shut without binding remaining in place at any angle without moving by gravitational influence.
B. Adjust door hardware to operate correctly in accordance with hardware manufacturer's maintenance instructions.

3.05 CLEANING
A. Clean exposed surfaces of FRP doors and frames with a mild, non-abrasive cleaner and water.

3.06 PROTECTION
A. Protect door opening assemblies and door hardware from damage by subsequent construction activities until final inspection.

END OF SECTION 08 16 13

SECTION 08 31 13 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Access doors and frames.

B. Related Requirements:
   1. Section 07 72 00 "Roof Accessories" for roof hatches.
   2. Section 23 33 00 "Air Duct Accessories" for heating and air-conditioning duct access doors.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples: For each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches (150 by 150 mm) in size.

C. Product Schedule: For access doors and frames. Use same designations indicated on Drawings.

1.03 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

PART 2 - PRODUCTS

2.01 ACCESS DOORS AND FRAMES

A. Flush Access Doors with Exposed Flanges:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ACUDOR Products, Inc.
      b. Babcock-Davis.
      c. Cendrex Inc.
      d. MIFAB, Inc.
      e. Williams Bros. Corporation of America (The).
   2. Description: Face of door flush with frame, with exposed flange and concealed hinge.
   3. Optional Features: Stainless Steel Piano hinges and Masonry anchors.
   4. Locations: Wall.
   5. Door Size: as indicated or as required.
   6. Stainless Steel Sheet for Door: Nominal 0.062 inch (1.59 mm), 16 gage, ASTM A480/A480M No. 4 finish.
   7. Frame Material: Same material, thickness, and finish as door.
   8. Latch and Lock: Corrosion resistant cam latch, screwdriver.

B. Interior Flush GFRG Access Doors with Concealed Flanges:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      a. ACUDOR Products, Inc.
      b. Babcock-Davis.
      c. Cendrex Inc.

d. MIFAB, Inc.
e. Williams Bros. Corporation of America (The).

2. Description: Face of concealed-hinge door flush with frame, with concealed flange for gypsum board installation.
3. Locations: Ceiling.
4. Door Size: as indicated or as required.
5. Door Type Corrosion Resistant Concealed-hinge, square corner.
6. Door and Frame Material: Unpainted glass-fiber-reinforced gypsum, with frames reinforced for hardware and fastenings.
7. Latch and Lock: Corrosion resistant cam latch, screwdriver operated.

2.02 MATERIALS

A. Stainless Steel Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, Type 316. Remove tool and die marks and stretch lines, or blend into finish.
B. Stainless Steel Flat Bars: ASTM A666, Type 316. Remove tool and die marks and stretch lines, or blend into finish.
C. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy 6063.
D. Aluminum Sheet: ASTM B209 (ASTM B209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
E. Frame Anchors: Same material as door face.

2.03 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
   1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
D. Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

2.04 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
   1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
E. Stainless Steel Finishes:
   1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
   2. Polished Finish: ASTM A480/A480M No. 4 finish. Grind and polish surfaces to produce uniform finish, free of cross scratches.

a. Run grain of directional finishes with long dimension of each piece.
b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.01 EXAMINATION
A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION
A. Comply with manufacturer's written instructions for installing access doors and frames.

3.03 ADJUSTING
A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 08 31 13

SECTION 08 33 23 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Insulated service doors.

B. Related Requirements:
   1. Section 05 12 00 "Steel" for miscellaneous steel supports, door-opening framing, corner guards, and bollards.

1.02 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory.
   1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
   1. Include plans, elevations, sections, and mounting details.
   2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
   4. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.
   5. Show locations of controls, locking devices, and other accessories.
   6. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.
   1. Include similar Samples of accessories involving color selection.

D. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:
   1. Curtain slats.
   2. Bottom bar with sensor edge.
   3. Guides.
   4. Brackets.
   5. Hood.
   6. Locking device(s).
   7. Include similar Samples of accessories involving color selection.

1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For special warranty.

1.04 CLOSEOUT SUBMITTALS

A. Special warranty.

B. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
   1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

1.06 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of doors that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.
   1. Obtain operators and controls from overhead coiling-door manufacturer.

2.02 PERFORMANCE REQUIREMENTS

A. Structural Performance, Exterior Doors: Capable of withstanding the following design wind loads:
   1. Design Wind Load: As indicated on Drawings.
   2. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
   3. Operability under Wind Load: Design overhead coiling doors to remain operable under design wind load, acting inward and outward.

2.03 DOOR ASSEMBLY

A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Cookson; a CornellCookson company.
      b. Cornell; a CornellCookson company.
      c. Overhead Door Corporation.
      d. Wayne Dalton; a division of Overhead Door Corporation.

B. Operation Cycles: Door components and operators capable of operating for not less than 100,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
   1. Include tamperproof cycle counter.

C. Air Infiltration: Maximum rate of 1.0 cfm/sq. ft. (5.1 L/s per sq. m) at 15 and 25 mph (24.1 and 40.2 km/h) when tested according to ASTM E283 or DASMA 105.

D. Insulated Door Curtain R-Value: 7.7 deg F x h x sq. ft./Btu (1.356 K x sq. m/W).

E. Insulated Door Assembly U-Factor: 0.13 Btu/deg F x h x sq. ft. (0.738 W/K x sq. m).

F. Door Curtain Material: Stainless steel.

G. Door Curtain Slats: Flat profile slats of 3-1/4-inch (83-mm) center-to-center height.
   1. Fenestrated Slats: Approximately 3- by 5/8-inch (76- by 16-mm) openings spaced approximately 1-1/2 inches (38 mm) apart and beginning 12 inches (305 mm) from jamb guides.
   2. Insulated-Slat Interior Facing: Metal.
   3. Gasket Seal. Manufacturer's standard continuous gaskets between slats.

H. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch (38 by 38 by 3 mm) thick; fabricated from stainless steel extrusions and finished to match door.
I. Curtain Jamb Guides: Stainless steel with exposed finish matching curtain slats.
J. Hood: Match curtain material and finish.
   1. Shape: Round.
   2. Mounting: Face of wall.
K. Locking Devices: Equip door with locking device assembly.
   1. Locking Device Assembly: Corrosion resistant single-jamb side locking bars, operable from inside with thumbturn.
L. Manual Door Operator: Push-up operation or Chain-hoist operator depending on height of door.
M. Electric Door Operator:
   1. Usage Classification: Heavy duty, 25 or more cycles per hour and more than 90 cycles per day.
   2. Operator Location: Wall.
   3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 ft. (2.44 m) or lower.
   4. Motor Exposure: Exterior, wet, and humid. Provide Explosion proof operator at Class I listed locations.
   5. Motor Electrical Characteristics:
      a. Horsepower: 1 hp.
      b. Voltage: 208 V ac, single phase, 60 Hz .
   6. Emergency Manual Operation: Chain type.
   7. Obstruction-Detection Device: Automatic electric sensor edge on bottom bar.
      a. Sensor Edge Bulb Color: Black.
   8. Control Station(s): Interior mounted.
N. Curtain Accessories: Equip door with weatherseals.
O. Door Finish:
   1. Stainless Steel Finish: ASTM A480/A480M No. 4 (polished directional satin).
   2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.04 MATERIALS, GENERAL

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.05 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
   1. Stainless Steel Door Curtain Slats: ASTM A240/A240M or ASTM A666, Type 304; sheet thickness of 0.025 inch (0.64 mm); and as required.
   2. Vision-Panel Glazing: Manufacturer's standard clear glazing, fabricated from transparent acrylic sheet or fire-protection-rated glass as required for type of door; set in glazing channel secured to curtain slats.
   3. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E84 or UL 723. Enclose insulation completely within slat faces.
   4. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.

B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

2.06 HOODS

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
   1. Stainless Steel: 0.025-inch- (0.64-mm-) thick, stainless-steel sheet, Type 304, complying with ASTM A240/A240M or ASTM A666.

B. Removable Metal Soffit: Formed or extruded from same metal and with same finish as curtain.

2.07 LOCKING DEVICES

A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.

B. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.08 CURTAIN ACCESSORIES

A. Weatherseals for Exterior Doors: Equip each exterior door with weather-stripping gaskets fitted to entire exterior perimeter of door for a weather-resistant installation unless otherwise indicated.
   1. At door head, use 1/8-inch- (3-mm-) thick, replaceable, continuous-sheet baffle secured to inside of hood or field-installed on the header.
   2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch- (3-mm-) thick seals of flexible vinyl, rubber, or neoprene.

2.09 COUNTERBALANCE MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. (2.5 mm/m) of span under full load.

C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.10 MANUAL DOOR OPERATORS

A. General: Equip door with manual door operator by door manufacturer.

B. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum 25-lbf (111-N) force for door operation. Provide stainless-steel hand chain with chain holder secured to operator guide.

2.11 ELECTRIC DOOR OPERATORS

A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
   1. Comply with NFPA 70.
   2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.
   3. Provide Explosion proof operator at Class I Division 1 listed locations.

B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.

C. Door Operator Location(s): Operator location indicated for each door.
   1. Wall Mounted: Operator is mounted to the inside front wall on the left or right side of door and connected to door drive shaft with drive chain and sprockets. Side room is required for this type of mounting. Wall-mounted operator can also be mounted above or below shaft; if above shaft, headroom is required.

D. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated for each door assembly.
   1. Electrical Characteristics: Minimum as indicated for each door assembly. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. (203 mm/s) and not more than 12 in./sec. (305 mm/s), without exceeding nameplate ratings or service factor.
   2. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
   3. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

F. Obstruction-Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel.
   1. Electric Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
      a. Self-Monitoring Type: Four-wire-configured device designed to interface with door operator control circuit to detect damage to or disconnection of sensor edge.

G. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."
   1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
   2. Exterior-Mounted Units: Full-guarded, standard-duty, surface-mounted, weatherproof type, NEMA ICS 6, Type 4 enclosure, key operated.
   3. Provide Explosion proof at Class I Division 1 listed locations.

H. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf (111 N).

I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.12 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.13 STAINLESS STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run grain of directional finishes with long dimension of each piece.
2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
3. Directional Satin Finish: ASTM A480/A480M No. 4.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.

C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with the accessibility standard.

D. Power-Operated Doors: Install according to UL 325.

3.03 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. After electrical circuitry has been energized, operate doors to confirm proper motor rotation and door performance.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.04 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
   1. Adjust exterior doors and components to be weather resistant.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust seals to provide tight fit around entire perimeter.

3.05 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service includes 12 months' full maintenance by skilled employees of coiling-door Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door operation. Parts and supplies are to be manufacturer's authorized replacement parts and supplies.
   1. Include 24-hour-per-day, seven-day-per-week, emergency callback service.

3.06 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 08 33 23

SECTION 08 34 83 – FLOOR ACCESS DOORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. Section includes aluminum and stainless steel floor access doors.

1.03 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

B. ASTM International:

1. ASTM A 666 - Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
2. ASTM A 793 – Standard Specification for Rolled Floor Plate, Stainless Steel.
3. ASTM A 879/A 879M - Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface.
4. ASTM A 1008/A 1008M - Specifications for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
5. ASTM B 209 - Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
6. ASTM B 221 - Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
7. ASTM B 632 – Standard Specification for Aluminum-Alloy Rolled Tread Plate.
8. ASTM F 2329 - Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners.

C. National Association of Architectural Metal Manufacturers (NAAMM):

1. Metal Finishes Manual for Architectural and Metal Products.

D. Occupational Safety and Health Administration (OSHA):

1. 29 CFR 1910.28 – Duty to have Fall Protection and Falling Object Protection.

1.04 SUBMITTALS:

A. Product Data: Submit manufacturer's product data for each type of product.

1. Include construction details, materials, individual components, profiles, and finishes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but not limited to, the following:

1. Acudor Products, Inc.
2. Babcock-Davis.
3. The BILCO Company.
4. Dur-Red Products.
5. Halliday Products, Inc.
6. Karp Associates, Ltd.
7. Milcore; Commercial Products Group of Hart & Cooley, Inc.
8. Nystrom, Inc.

9. U.S.F. Fabrications.

2.02 PERFORMANCE CRITERA:

A. Loading Criteria:
   1. 300-psf live load for all Floor Access Doors where doors are subjected to pedestrian traffic only.
   2. AASHTO H20 for all Floor Access Doors where doors are subjected to vehicular traffic.
B. All floor access doors over areas where potable water will be present shall be gasketed to be flood/watertight.

2.03 MATERIALS:

A. Rolled-Stainless Steel Floor Plate: ASTM A793, manufacturer's standard finish.
B. Stainless Steel Sheet, Strip, Plate, and Flat Bars: ASTM A666. Remove tool and die marks and stretch lines, or blend into finish.
C. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.
D. Aluminum-Alloy Rolled Tread Plate: ASTM B632. Alloy 6061-T6.
E. Aluminum Sheet: ASTM B209, manufacturer required alloy and temper for type of use and finish indicated.
F. Frame Anchors: Type 316 stainless steel.

2.04 ALUMINUM FLOOR ACCESS DOORS:

A. Gutter Channel Frame Aluminum Floor Access Door:
   1. Frame: Mill finish aluminum, gutter profile, with integral drainage coupling and perimeter gasket.
   2. Door: Single or double leaf; 1/4"-inch thick diamond pattern mill-finish aluminum plate.
   3. Size: As indicated on drawings.
   4. Hardware:
      a. Material and Finish: Type 316 stainless steel, including latch and lifting mechanism assemblies, hold open arms, and brackets, hinges, pins, and fasteners.
      b. Hinges: Heavy-duty butt hinges with stainless pins.
      c. Operating Mechanism: Adjustable counterbalancing springs, heavy-duty hold-open arm that automatically locks door open at 90 degrees, release handle with vinyl grip that allows for one-handed closure, and recessed lift handle.
      d. Latch: Stainless steel slam latch.
      e. Lock: Recessed padlock hatch.

2.05 STAINLESS STEEL FLOOR ACCESS DOORS:

A. Gutter Channel Frame Stainless Steel Floor Access Door:
   1. Frame: Type 316 stainless steel, gutter profile, with integral drainage coupling and perimeter gasket.
   2. Door: Single or Double leaf; 1/4" thick, diamond pattern, Type 316 stainless steel plate.
   3. Size: As indicated on drawings.
   4. Latch: Stainless steel slam latch.
   5. Lock: Recessed padlock hatch.
   6. Hardware:
      a. Material and Finish: Type 316 stainless steel, including latch and lifting mechanism assemblies, hold-open arms, and brackets, hinges, pins, and fasteners.
      b. Hinges: Heavy-duty butt hinges with stainless steel pins.

c. Operating mechanism: Adjustable counterbalancing springs, heavy-duty hold-open arm that automatically locks door open at 90 degrees, release handle with vinyl grip that allows for one-handed closure, and recessed lift handle.
d. Latch: Stainless steel slam latch.
e. Lock: Recessed padlock hasp.

2.06 FABRICATION:

A. Provide floor access doors manufactured as integral units ready for installation.
B. For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
C. Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices, and fasteners of type required to secure floor access doors to types of supports indicated.
D. Latching Mechanism: Furnish number required to hold doors in flush, smooth plane when closed.
E. Install fall protection grating as required in Article 2.08 FALL PROTECTION GRATING, this section.

2.07 FINISHES:

A. Comply with NAAMM's "Meal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable temporary protective covering before shipping.
C. Appearance of Finished Work: Noticeable variations in the same piece are not acceptable.
D. Stainless Steel: Bright, cold-rolled, unpolished ASTM A480 No. 2B finish.

2.08 FALL PROTECTION GRATING:

A. Furnish and install fall protection grating system on all floor access doors during fabrication.
B. Grating: Panels shall be of aluminum construction in the alloy and temper standard of the manufacturer, complying with 29 CFR 1910.23
C. Color: High-visibility safety yellow.
D. Hold Open System: Type 316 hold open device that locks grating open at 90 degrees.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. Install floor access doors in accordance with the manufacturer's written instructions and approved submittals. Locate units level, plumb, and in proper alignment with adjacent work.
B. Aluminum: For aluminum floor access doors installed in concrete, apply an alkali-resistant bituminous coating, 15-mil minimum dry film thickness.
   1. Carboline – Bitumastic No. 50.
   2. Tnemec – H.B. Tnemecol 46-465.

3.03 ADJUSTING:

A. Adjust doors and hardware as required for proper operation.

END OF SECTION 08 34 83

SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Aluminum-framed storefront systems.
   2. Aluminum-framed entrance door systems.
   3. Aluminum-framed window systems.

B. Related Requirements:
   1. Division 1 "Mockups" for preconstruction wall mockup.

1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Sustainable Design Submittals:

C. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
   1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
   2. Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
      a. Joinery, including concealed welds.
      b. Anchorage.
      c. Expansion provisions.
      d. Glazing.
      e. Flashing and drainage.
   3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
   4. Include point-to-point wiring diagrams showing the following:
      a. Power requirements for each electrically operated door hardware.
      b. Location and types of switches, signal device, conduit sizes, and number and size of wires.

D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

E. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

1.04 INFORMATIONAL SUBMITTALS

A. Certificates:
   1. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.
      a. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.

B. Test and Evaluation Reports:
   1. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by manufacturer and witnessed by a qualified testing agency.
C. Source Quality-Control Submittals:
   1. Source quality-control reports.
D. Quality-Control Program: Developed specifically for Project, including fabrication and installation, in accordance with recommendations in ASTM C1401. Include periodic quality-control reports.
E. Qualification Statements:
   1. For Installer and field testing agency.
F. Sample warranties.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For aluminum-framed entrances and storefronts.

1.06 QUALITY ASSURANCE

A. Qualifications:
   1. Installers: An entity that employs installers and supervisors who are trained and approved by manufacturer and that employs a qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors and that employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program.
   2. Testing Agency: Qualified in accordance with ASTM E699 for testing indicated and acceptable to Owner and Architect.
B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
   1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.07 WARRANTY

A. Special Warranty: Installer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures, including, but not limited to, excessive deflection.
      b. Noise or vibration created by wind and thermal and structural movements.
      c. Deterioration of metals and other materials beyond normal weathering.
      d. Water penetration through fixed glazing and framing areas.
      e. Failure of operating components.
   2. Warranty Period: 10 years from date of Substantial Completion.
B. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
   1. Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Delta E units when tested in accordance with ASTM D 2244.

b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D 4214.
c. Cracking, peeling, or chipping.

2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from a single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:
a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

B. Structural Loads:
1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.

C. Deflection of Framing Members Supporting Glass: At design wind load, as follows:
1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches.
2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.
3. Cantilever Deflection: Limited to 2L/175 at unsupported cantilevers.

D. Structural: Test in accordance with ASTM E330/E330M as follows:
1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

E. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

F. Water Penetration under Dynamic Pressure: Test in accordance with AAMA 501.1 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
2. Maximum Water Leakage: No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.

G. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:
1. Thermal Transmittance (U-factor):
   a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.36 Btu/sq. ft. x h x deg F determined in accordance with NFRC 100.
   b. Entrance Doors: U-factor of not more than 0.36 Btu/sq. ft. x h x deg F determined in accordance with NFRC 100.
2. Solar Heat-Gain Coefficient (SHGC):
   a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.35 as determined in accordance with NFRC 200.
   b. Entrance Doors: SHGC of not more than 0..36 as determined in accordance with NFRC 200.
3. Air Leakage:
   a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft. when tested in accordance with ASTM E283.
   b. Entrance Doors: Air leakage of not more than 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..
4. Condensation Resistance Factor (CRF):
   a. Fixed Glazing and Framing Areas: CRF for the system of not less than 55 as determined in accordance with AAMA 1503.
   b. Entrance Doors: CRF of not less than 63 as determined in accordance with AAMA 1503.

H. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested in accordance with AAMA 501.5.
   a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
   b. Low Exterior Ambient-Air Temperature: 0 deg F.
   c. Interior Ambient-Air Temperature: 75 deg F.

2.03 STOREFRONT SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. EFCO Corporation.
2. Kawneer Company, Inc.; Arconic Corporation.
3. OldCastle BuildingEnvelope (OBE).
4. Tubelite Inc.

B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
1. Exterior Framing Construction: Thermally broken.

2. Interior Vestibule Framing Construction: Nonthermal.
3. Glazing System: Retained mechanically with gaskets on four sides.
4. Glazing Plane: Front.
5. Finish: Clear anodic finish**.**
6. Fabrication Method: Field-fabricated stick system.
7. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
8. Steel Reinforcement: As required by manufacturer.

C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.04 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.
1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch-thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
2. Door Design: As indicated.
3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
a. Provide nonremovable glazing stops on outside of door.
4. Finish: Match adjacent storefront framing finish.

2.05 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 08 71 00 "Door Hardware."

B. General: Provide entrance door hardware and entrance door hardware sets indicated in "Entrance Door Hardware Sets" Article for each entrance door, to comply with requirements in this Section.
1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products complying with BHMA standard referenced.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
3. Opening-Force Requirements:
a. Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbf to set the door in motion and not more than 15 lbf to open the door to its minimum required width.
b. Accessible Interior Doors: Not more than 5 lbf to fully open door.

C. Continuous-Gear Hinges: BHMA A156.26.

D. Mortise Auxiliary Locks: BHMA A156.5, Grade 1.

E. Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing in accordance with UL 305.

F. Cylinders:
1. As specified in Section 08 71 00 "Door Hardware."

G. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.
H. Operating Trim: BHMA A156.6.
I. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.
J. Weather Stripping: Manufacturer's standard replaceable components.
   1. Compression Type: Made of ASTM D2000 molded neoprene or ASTM D2287 molded PVC.
   2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.
K. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
L. Thresholds: BHMA A156.21 raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch.

2.06 GLAZING

A. Glazing: Comply with Section 08 80 00 "Glazing."
B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

2.07 MATERIALS

A. Sheet and Plate: ASTM B209.
B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
C. Structural Profiles: ASTM B308/B308M.
D. Steel Reinforcement:
   1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
   2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
   3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.
E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.

2.08 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
   1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
   2. Reinforce members as required to receive fastener threads.
B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
   1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.
C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.
E. Rigid PVC filler.

2.09 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations.
   2. Accurately fitted joints with ends coped or mitered.
   3. Physical and thermal isolation of glazing from framing members.
   4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   5. Provisions for field replacement of glazing from.
   6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Storefront Framing: Fabricate components for assembly using shear-block system or screw-spline system.

F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

G. At interior and exterior doors, provide compression weather stripping at fixed stops.

H. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
   1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
   2. At exterior doors, provide weather sweeps applied to door bottoms.

I. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

J. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.010 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Seal perimeter and other joints watertight unless otherwise indicated.

G. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Set continuous sill members and flashing in full sealant bed, as specified in Section 07 92 00 "Joint Sealants," to produce weathertight installation.

I. Install joint filler behind sealant as recommended by sealant manufacturer.

J. Install components plumb and true in alignment with established lines and grades.

3.03 INSTALLATION OF GLAZING

A. Install glazing as specified in Section 08 80 00 "Glazing."

3.04 INSTALLATION OF WEATHERSEAL SEALANT

A. Install weatherseal sealant to completely fill cavity, in accordance with sealant manufacturer's written instructions, to produce weatherproof joints.

3.05 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE DOORS

A. Install entrance doors to produce smooth operation and tight fit at contact points.
1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware in accordance with entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.06 ERECTION TOLERANCES

A. Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:
   a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
   b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
   c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.07 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections: Perform the following tests on [representative areas of aluminum-framed entrances and storefronts] [mockups].
1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested in accordance with AAMA 501.2 and shall not evidence water penetration.
   a. Perform a minimum of three tests in areas as directed by Architect.
2. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..
   a. Perform a minimum of three tests in areas as directed by Architect.

3. Water Penetration: ASTM E1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft., and shall not evidence water penetration.

C. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.08 MAINTENANCE SERVICE

A. Entrance Door Hardware Maintenance:

1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.
2. Initial Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Use parts and supplies that are the same as those used in the manufacture and installation of original equipment.

END OF SECTION 08 41 13

SECTION 08 45 23 - FIBERGLASS-SANDWICH-PANEL ASSEMBLIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes aluminum-framed assemblies incorporating fiberglass-sandwich panels as follows:
   1. Wall assemblies.
   2. Roof assemblies.
   3. Skylight assemblies.

1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum components of panel assemblies.
B. Sustainable Design Submittals:
C. Shop Drawings: For panel assemblies.
   1. Include plans, elevations, sections, details, and attachments to other work.
   2. Include details of provisions for assembly expansion and contraction and for draining moisture within the assembly to the exterior.
D. Samples: In manufacturer's standard size.
   1. For each type of fiberglass-sandwich panel.
   2. For each type of exposed finish for framing members.
E. Delegated Design Submittals: For panel assemblies indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified installer and manufacturer and testing agency.
B. Product Test Reports: For each fiberglass-sandwich-panel assembly, for tests performed by a qualified testing agency.
C. Evaluation Reports: For fiberglass-sandwich-panel assemblies from ICC-ES.
D. Field quality-control reports.
E. Sample Warranties: For special warranties.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For panel assemblies to include in maintenance manuals.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: For fiberglass-sandwich panels, a qualified manufacturer whose facilities, processes, and products are monitored by an independent, accredited quality-control agency for compliance with applicable requirements in ICC-ES AC04 or ICC-ES AC177.
   1. Panel system must be listed by an ANSI accredited Evaluation Service, which requires quality control inspections and fire, structural, and water infiltration testing of sandwich panel systems by an accredited agency.
B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.07 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of panel assemblies that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      c. Water leakage.
   2. Warranty Period: Five years from date of Substantial Completion.

B. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace fiberglass-sandwich panels that exhibit defects in materials or workmanship within specified warranty period.
   1. Defects include, but are not limited to, the following:
      a. Fiberbloom.
      b. Delamination of coating, if any, from exterior face sheet.
      c. Color change exceeding requirements.
      d. Delamination of panel face sheets from panel cores.
   2. Warranty Period: 10 years from date of Substantial Completion.

C. Special Aluminum-Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
   1. Failures include, but are not limited to, checking, crazing, peeling, chalking, and fading of finishes.
   2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Division 1 fop quality requirements, to design fiberglass-sandwich-panel assemblies.

B. Structural Loads: As indicated on Drawings.

C. Deflection Limits:
   1. Vertical Panel Assemblies: Limited to 1/60 of clear span for each assembly component.

D. Structural-Test Performance: Provide panel assemblies tested in accordance with ASTM E330, as follows:
   1. When tested at positive and negative wind-load design pressures, assemblies do not show evidence of deflection exceeding specified limits.
   2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not show evidence of material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
   3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

E. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 4 for basic protection.
   1. Large-Missile Test: For glazing located within 30 feet of grade.
   2. Small-Missile Test: For glazing located between 30 feet and 60 feet above grade.

F. Water Penetration under Static Pressure: Provide panel assemblies that do not evidence water penetration through fixed glazing and framing areas when tested in accordance with ASTM E331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..

G. Water Penetration under Dynamic Pressure: Provide panel assemblies that do not evidence water leakage through fixed glazing and framing areas when tested in accordance with

AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..

1. Maximum Water Leakage: No uncontrolled water penetrating aluminum-framed systems or water appearing on systems' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water that is controlled by flashing and gutters and drained to the exterior, or water that cannot damage adjacent materials or finishes.

H. Thermal Movements: Allow for thermal movements from ambient- and surface-temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 110 deg F, ambient; 150 deg F, material surfaces.

I. Energy Performance: Provide panel assemblies with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. Thermal Transmittance (U-Factor): Fixed glazing and framing areas to have U-factor of not more than 0.29 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.
2. Solar Heat Gain Coefficient (SHGC): Fixed glazing and framing areas to have a SHGC of no greater than 0.36 as determined in accordance with NFRC 200.
3. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.30 cfm/sq. ft. of fixed wall area as determined in accordance with ASTM E283 at a minimum static-air-pressure differential of 1.57 lbf/sq. ft.

2.02 FIBERGLASS-SANDWICH-PANEL ASSEMBLIES

A. Fiberglass-Sandwich-Panel Assemblies: Translucent assemblies that are supported by aluminum framing and glazed with fiberglass-sandwich panels.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Kalwall Corporation.

2.03 FIBERGLASS-SANDWICH PANELS

A. Fiberglass-Sandwich Panels: Uniformly colored, translucent, thermoset, fiberglass-reinforced-polymer face sheets bonded to both sides of a grid core.

1. Core Insulation: Fill panel cores with aerogel.

B. Panel Thickness: 2-3/4 inches.

C. Grid Core: Mechanically interlocked, extruded-aluminum I-beams, with a minimum flange width of 7/16 inch.

1. Extruded Aluminum: ASTM B221, in alloy and temper recommended in writing by manufacturer.
2. I-Beam Construction: Thermally broken, extruded aluminum.
3. Grid Pattern: As selected from manufacturer’s full range.

D. Exterior Face Sheet:

1. Thickness: 0.070 inch.
2. Color: As selected by Architect from manufacturer's full range.
3. Protective Weathering Surface: Manufacturer's standard.

E. Interior Face Sheet:

1. Thickness: 0.045 inch.
2. Color: As selected by Architect from manufacturer's full range.

F. Fiberglass-Sandwich-Panel Adhesive: Manufacturer's standard for permanent adhesion of facings to cores.

G. Panel Strength:

1. Maximum Panel Deflection: 3-1/2 inches when a 4-by-12-foot panel is tested in accordance with ASTM E72 at 34 lbf/sq. ft., with a maximum 0.090-inch set deflection after five minutes.
2. Panel Support Strength: Capable of supporting, without failure, a 300-lbf concentrated load when applied to a 3-inch-diameter disk in accordance with ASTM E661.

H. Panel Performance:
1. Self-Ignition Temperature: 650 deg F or more in accordance with ASTM D1929.
2. Smoke-Developed Index: 450 or less in accordance with ASTM E84, or 75 or less in accordance with ASTM D2843.
3. Combustibility Classification: Class CC1 based on testing in accordance with ASTM D635.
4. Interior Finish Classification: Class A based on testing in accordance with ASTM E84.
5. Color Change: Not more than 3.0 units Delta E, when measured in accordance with ASTM D2244, after outdoor weathering compliant with procedures in ASTM D1435.
   a. Outdoor Weathering Conditions: Sixty months in southern Florida.
6. Impact Resistance: No fracture or tear at impact of 60 ft. x lbf by a 3-1/4-inch-diameter, 5-lb freefalling ball in accordance with UL 972 test procedure.
7. Haze Factor: Greater than 90 percent when tested in accordance with ASTM D1003.

2.04 ALUMINUM FRAMING SYSTEMS

A. Components: Manufacturer's standard extruded-aluminum members of thickness required and reinforced as required to support imposed loads.
1. Construction: Thermally broken, extruded aluminum.

B. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.
1. Sheet and Plate: ASTM B209.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
3. Extruded Structural Pipe and Tubes: ASTM B429/B429M.
4. Structural Profiles: ASTM B308/B308M.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning skylight components.

D. Fasteners and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding fasteners and accessories; compatible with adjacent materials.
1. At closures, retaining caps, or battens, use ASTM A193/A193M, 300 series stainless steel screws.
2. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
3. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.

E. Anchor Bolts: ASTM A307, Grade A, galvanized steel.

F. Concealed Flashing: Corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

G. Exposed Flashing and Closures: Aluminum sheet not less than 0.050 inch thick, finished to match framing.

H. Galvanized steel lifting eyebolts. Providing multiple aluminum clip angles as lifting attachment points does not meet the design intent and is not acceptable. Anchor bolts shall be accessed from the outside by removing the perimeter flashing.

I. Framing Gaskets: Manufacturer's standard.

J. Frame-System Sealants: As recommended in writing by manufacturer.

K. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.05 FABRICATION

A. Frame System Fabrication:
   1. Fabricate components that, when assembled, have the following characteristics:
      a. Profiles that are sharp, straight, and free of defects or deformations.
      b. Accurately fitted joints with ends coped or mitered.
      c. Internal guttering systems or other means to drain water passing through joints, and moisture migrating within assembly to exterior.
   2. Fabricate sill closures with weep holes and for installation as continuous component.
   3. Reinforce components as required to receive fastener threads.

B. Panel Fabrication: Factory assemble and seal panels.
   1. Laminate face sheets to grid core under a controlled process using heat and pressure to produce straight adhesive bonding lines that cover width of core members and that have sharp edges.
      a. White spots indicating lack of bond at intersections of grid-core members are limited in number to four for every 40 sq. ft. of panel and limited in diameter to 3/64 inch.
   2. Fabricate with grid pattern that is symmetrical about centerlines of each panel.
   3. Fabricate panel to allow condensation within panel to escape.
   4. Reinforce panel corners.

2.06 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 DELIVERY, STORAGE AND HANDLING

A. Deliver panel system, components, and materials in manufacturer’s standard protective packaging.

B. Store panels on the long edge; several inches above the ground, blocked and under cover in accordance with manufacturer’s storage and handling instructions.

3.03 INSTALLATION

A. General: Comply with manufacturer's written instructions.
   1. Do not install damaged components.
   2. Fit joints between aluminum components with hairline joints free of burrs and distortion.
   3. Rigidly secure nonmovement joints.
   4. Install anchors with separators and isolators to prevent metal corrosion, electrolytic deterioration, and immobilization of moving joints.
   5. Seal joints watertight unless otherwise indicated.

B. Metal Protection: Where aluminum components will contact dissimilar materials, protect against galvanic action by painting contact surfaces with corrosion-resistant coating or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.

C. Install components plumb and true in alignment with established lines and elevations.
D. Skylight Assemblies: Install continuous aluminum sill closures with weatherproof expansion joints and locked and sealed corners. Locate weep holes at rafters. Install components to drain water passing through joints and moisture migrating within assembly to exterior.
E. Erection Tolerances: Install panel assemblies to comply with the following maximum tolerances:
    1. Alignment: Limit offset from true alignment to 1/32 inch where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches; otherwise, limit offset to 1/8 inch.
    2. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet, but no greater than 1/2 inch over total length.

3.04 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
    1. Water-Spray Test: Before installation of interior finishes has begun, panel assemblies to be tested in accordance with AAMA 501.2 and not show evidence of water penetration.
    2. Water Penetration under Static Pressure: Before installation of interior finishes has begun, areas to be tested in accordance with ASTM E1105.
        a. Test Procedures: Test under uniform and cyclic static-air pressure.
        b. Water Penetration: None.
B. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.
C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
D. Prepare test and inspection reports.

3.05 CLEANING

A. Clean the panel system, interior and exterior, immediately after installation.
B. Refer to manufacturer's written recommendations.

END OF SECTION 08 45 23

SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Mechanical door hardware for the following:
      a. Swinging doors.
   2. Cylinders for door hardware specified in other Sections.
   3. Electrified door hardware.

B. Related Requirements:
   1. Section 08 31 13 "Access Doors and Frames" for access door hardware.
   2. Section 08 33 23 "Overhead Coiling Doors" for door hardware provided as part of overhead coiling door assemblies.
   3. Section 08 41 13 "Aluminum-Framed Entrances and Storefronts" for entrance door hardware, except cylinders.
   4. Division 28 for detection devices installed at door openings and provided as part of an intrusion-detection system.
   5. Division 28 for connections to building fire-alarm system.

1.02 COORDINATION

A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

C. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

D. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Conference participants shall include Installer's Architectural Hardware Consultant and Owner's security consultant.

B. Keying Conference: Conduct conference at Project site.
   1. Conference participants shall include Installer's Architectural Hardware Consultant and Owner's security consultant.
   2. Incorporate conference decisions into keying schedule after reviewing door hardware keying system including, but not limited to, the following:

a. Flow of traffic and degree of security required.
b. Preliminary key system schematic diagram.
c. Requirements for key control system.
d. Requirements for access control.
e. Address for delivery of keys.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For electrified door hardware.
1. Include diagrams for power, signal, and control wiring.
2. Include details of interface of electrified door hardware and building safety and security systems.

C. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
1. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
2. Format: Use same scheduling sequence and format and use same door numbers as in door hardware schedule in the Contract Documents.
3. Content: Include the following information:
a. Identification number, location, hand, fire rating, size, and material of each door and frame.
b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
d. Fastenings and other installation information.
e. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
f. Mounting locations for door hardware.
g. List of related door devices specified in other Sections for each door and frame.

D. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and Architectural Hardware Consultant.

B. Product Certificates: For each type of electrified door hardware.
1. Certify that door hardware for use on each type and size of labeled fire-rated doors complies with listed fire-rated door assemblies.

C. Product Test Reports: For compliance with accessibility requirements, for tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

D. Field quality-control reports.

E. Sample Warranty: For special warranty.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals.

B. Schedules: Final door hardware and keying schedule.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.
   1. Warehousing Facilities: In Project's vicinity.
   2. Scheduling Responsibility: Preparation of door hardware and keying schedule.
   3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as an Architectural Openings Consultant (AOC).

1.08 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Owner will purchase, take delivery and install cores and keying.

1.09 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including excessive deflection, cracking, or breakage.
      b. Faulty operation of doors and door hardware.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:
   a. Exit Devices: Two years from date of Substantial Completion.
   b. Manual Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain each type of door hardware from single manufacturer.
1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

2.02 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.

B. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that complies with requirements of assemblies tested in accordance with UL 1784 and installed in compliance with NFPA 105.
1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at the tested pressure differential of 0.3-inch wg (75 Pa) of water.

C. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

E. Accessibility Requirements: For door hardware on doors in an accessible route, comply with ICC A117.1.
1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22.2 N).
2. Comply with the following maximum opening-force requirements:
   a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
   b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.
5. Adjust spring hinges so that, from an open position of 70 degrees, the door will take at least 1.5 seconds to move to the closed position.

2.03 HINGES

A. Hinges: BHMA A156.1. Provide template-produced hinges.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Hager Companies.
b. McKinney Products Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.
c. STANLEY; dormakaba USA, Inc.

2.04 CONTINUOUS HINGES

A. Continuous Hinges: BHMA A156.26; minimum 0.120-inch- (3.0-mm-) thick, hinge leaves with minimum overall width of 4 inches (102 mm); fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

B. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Hager Companies.
b. McKinney Products Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.
c. STANLEY; dormakaba USA, Inc.

2.05 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
1. Bored Locks: Minimum 1/2-inch (13-mm) latchbolt throw.
2. Mortise Locks: Minimum 3/4-inch (19-mm) latchbolt throw.
3. Deadbolts: Minimum 1.25-inch (32-mm) bolt throw.

C. Lock Backset: 2-3/4 inches (70 mm) unless otherwise indicated.

D. Lock Trim:
1. Description: As indicated.
2. Levers: Cast.
3. Escutcheons (Roses): Wrought.
4. Dummy Trim: Match lever lock trim and escutcheons.

E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
3. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.

F. Bored Locks: BHMA A156.2; Grade 1; Series 4000.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Schlage Commercial Locks, an Allegion plc company.

2.06 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: BHMA A156.3.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Precision Hardware, Inc.; dormakaba Group.
b. SARGENT Manufacturing Company; ASSA ABLOY.
c. Von Duprin, an Allegion plc company.

2.07 LOCK CYLINDERS

A. Standard Lock Cylinders: BHMA A156.5; Grade 1 permanent cores; face finished to match lockset.
1. Core Type: Interchangeable.
2. Manufacture: BEST Access Solutions, Inc.; dormakaba USA Inc.

B. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.08 KEYING

A. Keying System: Factory registered, provided and keyed by owner.

2.09 OPERATING TRIM

A. Operating Trim: BHMA A156.6; stainless steel unless otherwise indicated.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
a. Hager Companies.

2.10 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. LCN an Allegion plc company.
b. SARGENT Manufacturing Company; ASSA ABLOY.

2.11 CONCEALED CLOSERS

A. Concealed Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves. Comply with manufacturer's written instructions

for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

2.12 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: BHMA A156.16.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Hager Companies.
      b. Ives Hardware, an Allegion plc company.
      c. Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.

2.13 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Hager Companies.
      b. National Guard Products, Inc.
      c. Pemko Manufacturing Company Inc.; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.
      d. Sealeze.

B. Maximum Air Leakage: When tested in accordance with ASTM E283 with tested pressure differential of 0.3-inch wg (75 Pa), as follows:
   1. Smoke-Rated Gasketing: 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) of door opening.
   2. Gasketing on Single Doors: 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) of door opening.
   3. Gasketing on Double Doors: 0.50 cfm per ft. (0.000774 cu. m/s per m) of door opening.

2.14 THRESHOLDS

A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Hager Companies.
      b. National Guard Products, Inc.
      c. Pemko Manufacturing Company Inc.; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.
      d. Sealeze.

2.15 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; fabricated from minimum 0.050-inch- (1.3-mm-) thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Hager Companies.
      b. Ives Hardware, an Allegion plc company.

c. Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY.
d. Trimco.

2.16 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.
1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.
1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Fire-Rated Applications:
   a. Wood or Machine Screws: For the following:
      1) Hinges mortised to doors or frames.
      2) Strike plates to frames.
      3) Closers to doors and frames.
   b. Steel Through Bolts: For the following unless door blocking is provided:
      1) Surface hinges to doors.
      2) Closers to doors and frames.
      3) Surface-mounted exit devices.
3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.17 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Doors and Frames: For surface-applied door hardware, drill and tap doors and frames in accordance with ANSI/SDI A250.6.

3.03 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
   1. Standard Doors and Frames: ANSI/SDI A250.8.
   2. Custom Doors and Frames: HMMA 831.

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.
   1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
   2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule, but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches (750 mm) of door height greater than 90 inches (2286 mm).

E. Lock Cylinders: Install construction cores to secure building and areas during construction period.

F. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room. Verify location with Architect.

1. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.

G. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 07 92 00 "Joint Sealants."

H. Stops: Provide wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

I. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
1. Do not notch perimeter gasketing to install other surface-applied hardware.

J. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

K. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.04 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
2. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 70 degrees and so that closing time complies with accessibility requirements of authorities having jurisdiction.
3. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.05 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.06 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.07 DEMONSTRATION

A. Engage Installer to train Owner's maintenance personnel to adjust, operate, and maintain door hardware.

3.08 DOOR HARDWARE SCHEDULE

A. Hardware Set 1 - Exterior Card Reader Single Storefront: Each door to have the following:

#	Type	Description	Model	Finish	Manuf.
1**	Exit Device	Rim - Latch Retraction	QEL XP98 L-NL	630	Von Duprin
*	Hinge	Continuous Gear Hinge			
*	Closer	Concealed Overhead ADA			
*	Gasket	Manufacturer’s Standard			
*	Door Bottom	Manufacturer’s Standard			
*	Sill	ADA Threshold			
	Power Supply and cable harnesses				

B. Hardware Set 2 - Exterior Card Reader Single FRP: Each door to have the following:

#	Type	Description	Model	Finish	Manuf.
1	Hinge	Continuous Hinge	661HD WT EPT	628	Hager
1**	Exit Device	Rim - Latch Retraction	QEL XP98 L-NL	630	Von Duprin
1	Closer	Parallel Arm	4040XP-3077SCNS	689	LCN
1 set	Gasket	Perimeter	881S N	MF	Hager
1	Sill	Saddle Threshold	412S	MF	Hager
1	Door Bottom	Heavy Duty Automatic	747S N	MF	Hager
1	Protection Plate	Armor	220S	630	Hager
	Power Supply and cable harnesses				

C. Hardware Set 3 - Exterior Card Reader Double FRP & Exterior Double FRP Removable Transom: Each door to have the following:

#	Type	Description	Model	Finish	Manuf.
2	Hinge	Continuous Gear Hinge	12-600XHD EPT	628	Hager
1**	Exit Device	Rim - Latch Retraction	QEL XP98 L-NL	630	Von Duprin
1	Exit Device	Rim – Exit Only	XP98 EO	630	Von Duprin
2	Closer	Parallel Arm	4040XP-3077SCNS	689	LCN
1**	Mullion	Keyed Removable	KR 5654-XP	628	Von Duprin
2 sets	Gasket	Perimeter	881S N	MF	Hager
1	Gasket	Mullion Seal	710S	BK	Hager
2	Sill	Saddle Threshold	412S	MF	Hager
2	Door Bottom	Heavy Duty Automatic	747S N	MF	Hager

2	Protection Plate	Armor	220S	630	Hager
*	Power Supply and cable harnesses				

D. Hardware Set 4 - Interior Card Reader Electrical Room: Each door to have the following:

#	Type	Description	Model	Finish	Manuf.
1	Hinge	Continuous Gear Hinge	12-600XHD EPT	628	Hager
1**	Exit Device	Rim - Latch Retraction	QEL XP98 L-NL	630	Von Duprin
1	Closer	Parallel Arm	4040XP-3077SCNS	689	LCN
1 set	Gasket	Perimeter	881S N	MF	Hager
1	Sill	Saddle Threshold	412S	MF	Hager
1	Protection Plate	Armor	220S	630	Hager
*	Power Supply and cable harnesses				

E. Hardware Set 5 - Interior Stair: Each door to have the following:

#	Type	Description	Model	Finish	Manuf.
1	Hinge	Continuous Gear Hinge	12-600XHD	628	Hager
1**	Exit Device	Rim	XP98-F L	630	Von Duprin
1	Closer	Parallel Arm	4040XP-3077SCNS	689	LCN
1 set	Gasket	Perimeter	881S N	MF	Hager
1	Protection Plate	Armor	220S	630	Hager

F. Hardware Set 6 - Interior Storage / Janitor / Mechanical: Each door to have the following:

#	Type	Description	Model	Finish	Manuf.
3	Hinge	Ball-Bearing w/ SS Pin	BB1199	630	Hager
1**	Latch set	Classroom Function	ND70PD RHO	626	Schlage
1	Protection Plate	Kick	190S	630	Hager

G. Hardware Set 7 - Interior Restroom: Each door to have the following:

#	Type	Description	Model	Finish	Manuf.
3	Hinge	Ball-Bearing w/ SS Pin	BB1199	630	Hager
1**	Latch set	Privacy Lock	ND40S RHO	626	Best
1	Protection Plate	Kick	190S	630	Hager

H. Hardware Set 8 - Interior Single Office / Control / Laboratory / Conference / Break: Each door to have the following:

#	Type	Description	Model	Finish	Manuf.
3	Hinge	Ball-Bearing w/ SS Pin	BB1199	630	Hager
1**	Latch set	Office Function	ND50PD RHO	626	Schlage
1	Protection Plate	Kick	190S	630	Hager

I. Hardware Set 9 - Interior Single Locker: Each door to have the following:

#	Type	Description	Model	Finish	Manuf.
3	Hinge	Ball-Bearing w/ SS Pin	BB1199	630	Hager
1**	Latch set	Corridor Function	ND73PD RHO	626	Schlage
1	Closer	Parallel Arm	4040XP-3077	689	LCN

1	Protection Plate	Kick	190S	630	Hager

J. Hardware Set 10 - Interior Single Storefront: Each door to have the following:

#	Type	Description	Model	Finish	Manuf.
1**	Exit Device	Rim - Latch Retraction	XP98 L	630	Von Duprin
*	Hinge	Continuous Gear Hinge			
*	Closer	Concealed Overhead ADA			
*	Gasket	Manufacturer's Standard			
*	Sill	ADA Threshold			

A. Hardware Set 11 - Exterior Card Reader Single FRP Class 1 Div 2: Each door to have the following:

#	Type	Description	Model	Finish	Manuf.
1	Hinge	Continuous Hinge	661HD WT EPT	628	Hager
1**	Exit Device	Rim - Latch Retraction	PN XP98 L-NL	630	Von Duprin
1	Closer	Parallel Arm	4040XP-3077SCNS	689	LCN
1 set	Gasket	Perimeter	881S N	MF	Hager
1	Sill	Saddle Threshold	412S	MF	Hager
1	Door Bottom	Heavy Duty Automatic	747S N	MF	Hager
1	Protection Plate	Armor	220S	630	Hager
1	Request to exit	Class 1 REX	Falcon EX XL	N/A	BEA
1	Pneumatic Controls	Place in electrical room	7982	N/A	LCN
	Power Supply, tubing, cabling and cable harnesses				

* Hardware by Door Manufacturer
**All cylinders are FSIC and work with owner's Best keyway system.

END OF SECTION 08 71 00

SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Glass products.
   2. Insulating glass.
   3. Glazing sealants.
   4. Glazing tapes.
   5. Miscellaneous glazing materials.

1.02 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.
C. IBC: International Building Code.
D. Interspace: Space between lites of an insulating-glass unit.

1.03 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   2. Review temporary protection requirements for glazing during and after installation.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Sustainable Design Submittals:
C. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.
D. Glazing Accessory Samples: For sealants and colored spacers, in 12-inch lengths. Install sealant Samples between two strips of material representative in color of adjoining framing system.
E. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer manufacturers of fabricated glass units.
B. Product Certificates: For glass.
C. Product Test Reports: For fabricated glass and glazing sealants, for tests performed by a qualified testing agency.
   1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
D. Preconstruction adhesion and compatibility test report.

E. Sample Warranties: For special warranties.

1.07 QUALITY ASSURANCE

A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved and certified by primary glass manufacturer.

B. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors and who employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program.

C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.09 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.10 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

C. Manufacturer's Special Warranty for Heat-Soaked Tempered Glass: Manufacturer agrees to replace heat-soaked tempered glass units that spontaneously break due to nickel sulfide (NiS) inclusions at a rate exceeding 0.3 percent (3/1000) within specified warranty period. Coverage for any other cause is excluded.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations for Glass: Obtain tinted and coated glass from single source from single manufacturer.

B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:
   1. Design Wind Pressures: As indicated on Drawings.
   2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
   3. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.

C. Windborne-Debris-Impact Resistance: Exterior glazing shall pass ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 4 for basic protection.
   1. Large-Missile Test: For glazing located within 30 feet of grade.

D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
   1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
   2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
   3. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.
   4. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
   5. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

2.03 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. NGA Publications: "Glazing Manual."
   2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.
D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.
   1. Minimum Glass Thickness for Exterior Lites: 6 mm.
E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.04 GLASS PRODUCTS
A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. AGC Glass Company North America, Inc.
      b. Cardinal Glass Industries, Inc.
      c. Guardian Glass LLC.
      d. Pilkington North America; NSG Group.
      e. Saint-Gobain Glass Corp.
      f. Vitro Architectural Glass.
B. Tinted Annealed Float Glass: ASTM C1036, Type I, Class 2 (tinted), Quality-Q3.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. AGC Glass Company North America, Inc.
      b. Pilkington North America; NSG Group.
      c. Saint-Gobain Glass Corp.
      d. Vitro Architectural Glass.
C. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
   1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
D. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
   1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
E. Reflective- and Low-E-Coated Vision Glass: ASTM C1376.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Cardinal Glass Industries, Inc.
      b. Guardian Glass LLC.
      c. Pilkington North America; NSG Group.
      d. Saint-Gobain Glass Corp.
      e. Vitro Architectural Glass.

2.05 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.
   1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
   2. Perimeter Spacer: Manufacturer's standard spacer material and construction.
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) Saint-Gobain Glass Corp.
         2) Technoform Glass Insulation North America.
         3) Thermix; a brand of Ensinger USA.
   3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.06 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
C. Setting Blocks:
   1. Silicone with Shore A durometer hardness of 85, plus or minus 5.
   2. Type recommended in writing by sealant or glass manufacturer.
D. Spacers:
   1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
   2. Type recommended in writing by sealant or glass manufacturer.
E. Edge Blocks:
   1. Silicone with Shore A durometer hardness per manufacturer's written instructions.
   2. Type recommended in writing by sealant or glass manufacturer.
F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.07 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
   1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
      a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep systems.
   3. Minimum required face and edge clearances.
   4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.03 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch-minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.04 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners

and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.05 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.06 MONOLITHIC GLASS SCHEDULE

A. Clear Glass Type: Annealed float glass.

1. Minimum Thickness: 6 mm.

B. Clear Glass Type: Fully tempered float glass.

1. Minimum Thickness: 6 mm.
2. Safety glazing required.

3.07 INSULATING GLASS SCHEDULE

A. Low-E-Coated, Tinted Insulating Glass Type:

1. Basis-of-Design Product: Guardian Glass SuperNeutral 68 CrystalBlue.
2. Overall Unit Thickness: 1 inch.
3. Minimum Thickness of Each Glass Lite: 6 mm.
4. Outdoor Lite: Tinted Annealed (Fully tempered where required) float glass.
5. Tint Color: Blue.
6. Interspace Content: Argon.
7. Indoor Lite: Clear Annealed (Fully tempered where required) float glass.
8. Low-E Coating: Sputtered on second surface.
9. U-Factor: 0.29 maximum.
10. Light to Solar Gain: 1.51 minimum.
11. Visible Light Transmittance: 44 percent minimum.
12. SGHC: 0.29 maximum.
13. Safety glazing where required.

END OF SECTION 08 80 00

SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Non-load-bearing steel framing systems for interior partitions.
   2. Suspension systems for interior ceilings and soffits.
   3. Grid suspension systems for gypsum board ceilings.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Sustainable Design Submittals:

1.03 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of code-compliance certification for studs and tracks.
B. Evaluation Reports: For firestop tracks post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.04 QUALITY ASSURANCE

A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association the Steel Framing Industry Association the Steel Stud Manufacturers Association.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Notify manufacturer of damaged materials received prior to installation.
B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
C. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing."

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Design framing systems in accordance with AISI S220, "North American Specification for the Design of Cold-Formed Steel Framing - Nonstructural Members," unless otherwise indicated.
B. Design Loads: As indicated on architectural Drawings or 5 lbf/sq. ft. (239 Pa) minimum as required by the IBC.
C. Design framing systems to accommodate deflection of primary building structure and construction tolerances and to withstand design loads with a maximum deflection of 1/240.

2.02 FRAMING SYSTEMS

A. Framing Members, General: Comply with AISI S220 for conditions indicated.
   1. Steel Sheet Components: Comply with AISI S220 requirements for metal unless otherwise indicated
   2. Protective Coating: Comply with AISI S220; ASTM A653/A653M, G40 (Z120); or coating with equivalent corrosion resistance. Galvannealed products are unacceptable.
      a. Coating demonstrates equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.

B. Studs and Track: AISI S220.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ClarkDietrich.
      b. SCAFCO Steel Stud Company; Stone Group of Companies.
      c. Steel Construction Systems; Stone Group of Companies.
   2. Minimum Base-Steel Thickness: As required by performance requirements for horizontal deflection minimum 0.0269 inch (0.683 mm).
   3. Depth: As indicated on Drawings.

C. Slip-Type Head Joints: Where indicated, provide one of the following:
   1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to tracks while allowing 1-1/2-inch (38-mm) minimum vertical movement.
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) ClarkDietrich.
         2) SCAFCO Steel Stud Company; Stone Group of Companies.
         3) Steel Construction Systems; Stone Group of Companies.
   2. Single Long-Leg Track System: ASTM C645 top track with 2-inch- (51-mm-) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top track and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.
   3. Double-Track System: ASTM C645 top outer tracks, inside track with 2-inch- (51-mm-) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.
   4. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) ClarkDietrich.
         2) SCAFCO Steel Stud Company; Stone Group of Companies.
         3) Steel Construction Systems; Stone Group of Companies.

D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ClarkDietrich.
      b. SCAFCO Steel Stud Company; Stone Group of Companies.
      c. Steel Construction Systems; Stone Group of Companies.
   2. Minimum Base-Steel Thickness: 0.0296 inch (0.752 mm).

E. Cold-Rolled Channel Bridging: Steel, 0.0538-inch (1.367-mm) minimum base-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ClarkDietrich.
      b. SCAFCO Steel Stud Company; Stone Group of Companies.
      c. Steel Construction Systems; Stone Group of Companies.
   2. Depth: 1-1/2 inches (38 mm).
   3. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 by 38 mm), 0.068-inch- (1.72-mm-) thick, galvanized steel.

F. Resilient Furring Channels: 1/2-inch- (13-mm-) deep, steel sheet members designed to reduce sound transmission.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ClarkDietrich.
      b. SCAFCO Steel Stud Company; Stone Group of Companies.
      c. Steel Construction Systems; Stone Group of Companies.
   2. Configuration: Asymmetrical or hat shaped.

G. Cold-Rolled Furring Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
   1. Depth: 3/4 inch (19 mm).
   2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch (0.8 mm).
   3. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.

2.03 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.

B. Hanger Attachments to Concrete:
   1. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC58 or AC308 as appropriate for the substrate.
      a. Uses: Securing hangers to structure.
      b. Type: Torque-controlled, expansion anchor
      c. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941 (ASTM F1941M), Class Fe/Zn 5, unless otherwise indicated.

C. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch (4.12 mm) in diameter.

D. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-steel thickness of 0.0538 inch (1.367 mm) and minimum 1/2-inch- (13-mm-) wide flanges.
   1. Depth: 2 inches (51 mm) 1-1/2 inches (38 mm).

E. Furring Channels (Furring Members):
   1. Cold-Rolled Channels: 0.0538-inch (1.367-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges, 3/4 inch (19 mm) deep.
   2. Resilient Furring Channels: 1/2-inch- (13-mm-) deep members designed to reduce sound transmission.
      a. Configuration: Asymmetrical or hat shaped.

2.04 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.
   1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
   1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.03 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.
   1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.
B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
D. Install bracing at terminations in assemblies.

3.04 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
   1. Single-Layer Application: 16 inches (406 mm) o.c. unless otherwise indicated.
   2. Multilayer Application: 16 inches (406 mm) o.c. unless otherwise indicated.
   3. Tile Backing Panels: 16 inches (406 mm) o.c. unless otherwise indicated.
B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
C. Install studs so flanges within framing system point in same direction.
D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
   1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
   2. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
E. Direct Furring:
   1. Screw to wood framing.
   2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.
F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

3.05 INSTALLING CEILING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
   1. Hangers: 48 inches (1219 mm) o.c.
   2. Carrying Channels (Main Runners): 48 inches (1219 mm) o.c.
   3. Furring Channels (Furring Members): 24 inches (610 mm) o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
      a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
      a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
   3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
   4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
   5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
   6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
   7. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

E. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 22 16

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Interior gypsum board ceilings.
B. Related Requirements:
   1. Section 07 92 19 "Acoustical Joint Sealants" for acoustical joint sealants installed in gypsum board assemblies.
   2. Section 09 22 16 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.02 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Gypsum ceiling board.
   2. Mold-resistant gypsum board.
   3. Interior trim.
   4. Joint treatment materials.
   5. Acoustical sealant.
B. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other work.

1.03 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.04 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
C. Do not install panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.01 SOURCE LIMITATIONS

A. Obtain each type of gypsum panel and joint finishing material from single source with resources to provide products of consistent quality in appearance and physical properties.

2.02 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.03 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.04 INTERIOR GYPSUM BOARD CEILINGS

A. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. CertainTeed; SAINT-GOBAIN.
      b. Georgia-Pacific Gypsum LLC.
      c. USG Corporation.
   2. Core: 5/8 inch (15.9 mm), Type X.
   3. Long Edges: Tapered.
   4. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.05 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.
   1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
   2. Shapes:
      a. Cornerbead.
      b. LC-Bead: J-shaped; exposed long flange receives joint compound.
      c. Expansion (control) joint.

2.06 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:
   1. Interior Gypsum Board: Paperless.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
      a. Use setting-type compound for installing paper-faced metal trim accessories.
   3. Fill Coat: For second coat, use setting-type, sandable topping compound.
   4. Finish Coat: For third coat, use drying-type, all-purpose compound.

2.07 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
   1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.

C. Acoustical Sealant: As specified in Section 07 92 19 "Acoustical Joint Sealants."

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with ASTM C840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

G. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

H. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.03 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Mold-Resistant Type: All locations.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.04 INSTALLATION OF TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. LC-Bead: Use at exposed panel edges.

3.05 FINISHING OF GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:

1. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
    a. Primer and its application to surfaces are specified in Section 09 90 00 "Protective Coatings."

3.06 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 29 00

SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.01 SUMMARY
- A. Section includes acoustical panels and exposed suspension systems for interior ceilings.
- B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.02 PREINSTALLATION MEETINGS
- A. Preinstallation Conference: Conduct conference at Project site.

1.03 ACTION SUBMITTALS
- A. Product Data: For each type of product.
- B. Samples: Do not submit samples.

1.04 INFORMATIONAL SUBMITTALS
- A. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.
- B. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.
- C. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For finishes to include in maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS
- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.
  2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
  3. Hold-Down Clips: Equal to 2 percent of quantity installed.
  4. Impact Clips: Equal to 2 percent of quantity installed.

1.07 DELIVERY, STORAGE, AND HANDLING
- A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.08 FIELD CONDITIONS
- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: Class A according to ASTM E1264.
   2. Smoke-Developed Index: 50 or less.

2.03 ACOUSTICAL PANELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Armstrong Ceiling & Wall Solutions.
   2. Certainteed; SAINT-GOBAIN.
   3. USG Corporation.

B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

C. Classification: Provide panels as follows:
   1. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2, water felted; with vinyl overlay on face.
   2. Pattern: E (lightly textured).

D. Color: White.

E. Light Reflectance (LR): Not less than 0.85.

F. Ceiling Attenuation Class (CAC): Not less than 35.

G. Noise Reduction Coefficient (NRC): Not less than 0.75.

H. Edge/Joint Detail: Reveal sized to fit flange of exposed suspension-system members.

I. Thickness: 3/4 inch (19 mm).

J. Modular Size: 24 by 24 inches (610 by 610 mm).

K. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273, ASTM D3274, or ASTM G21 and evaluated according to ASTM D3274 or ASTM G21.

2.04 METAL SUSPENSION SYSTEM

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Armstrong Ceiling & Wall Solutions.
   2. Certainteed; SAINT-GOBAIN.
   3. USG Corporation.

B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C635/C635M and designated by type, structural classification, and finish indicated.
   1. High-Humidity Finish: Where indicated, provide coating tested and classified for "severe environment performance" according to ASTM C635/C635M.

C. Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip

galvanized, G30 (Z90) coating designation; with prefinished 9/16-inch- (15-mm-) wide metal caps on flanges.

1. Structural Classification: Intermediate-duty system.
2. End Condition of Cross Runners: Override (stepped) type.
3. Face Design: Flat, flush.
4. Cap Material: Cold-rolled steel or aluminum.
5. Cap Finish: Painted white.

2.05 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
   1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E488/E488M or ASTM E1512 as applicable, conducted by a qualified testing and inspecting agency.
      a. Type: Postinstalled expansion anchors.
      b. Corrosion Protection: Stainless-steel components complying with ASTM F593 and ASTM F594, Group 1 Alloy 304 or 316.
      c. Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B164 for UNS No. N04400 alloy.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:
   1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
   2. Stainless-Steel Wire: ASTM A580/A580M, Type 304, nonmagnetic.
   3. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch- (2.69-mm-) diameter wire.

2.06 METAL EDGE MOLDINGS AND TRIM

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Armstrong Ceiling & Wall Solutions.
   2. Certainteed; SAINT-GOBAIN.
   3. USG Corporation.

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
   1. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
   2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2.07 ACOUSTICAL SEALANT

A. Acoustical Sealant: As specified in Section 07 92 19 "Acoustical Joint Sealants."

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.03 INSTALLATION

A. Install acoustical panel ceilings according to ASTM C636/C636M and manufacturer's written instructions.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, post-installed mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
6. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
7. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post-installed anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.
1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
2. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
3. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
4. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
5. Protect lighting fixtures and air ducts according to requirements indicated for fire-resistance-rated assembly.

3.04 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m), non-cumulative.

B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m), non-cumulative.

3.05 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 13

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Thermoset rubber base.
   2. Rubber molding accessories.

B. Related Requirements:
   1. Section 12 35 53.13 "Metal Laboratory Casework"

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
   2. Include manufacturer's written installation instructions for each type of substrate.

B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

C. Samples for Verification: For each type of exposed product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.

D. Product Schedule: For resilient base and accessory products.

1.03 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For resilient base and accessory products, for tests performed by a qualified testing agency.

1.04 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Furnish not less than 10 linear ft. for every 500 linear ft. or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.06 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F , in spaces to receive resilient products during the following periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: As determined by testing identical products in accordance with ASTM E648 or ASTM E662 by a qualified testing agency.
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.02 RESILIENT BASE

A. Thermoset Rubber Base:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Mannington Mills, Inc
      b. Roppe Corporation; Roppe Holding Company
      c. Tarkett USA
   2. Classification: ASTM F1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
   3. Style and Location:
      a. Style B, Cove: Provide in areas with resilient floor coverings.
   4. Thickness: 0.125 inch.
   5. Height: To be coordinated with final laboratory casework selection. Reference section 13 35 53.13.
   6. Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.
   7. Outside Corners: Preformed.
   8. Inside Corners: Job formed or preformed.
   9. Colors: Match Architect's sample.

2.03 INSTALLATION MATERIALS

A. Adhesives: Water-resistant type recommended in writing by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
   1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Prepare substrates in accordance with manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces in accordance with ASTM F710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 10 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
    a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft in 24 hours.
    b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum [75]<Insert number> percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
D. Do not install resilient products until materials are the same temperature as space where they are to be installed.
    1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.03 INSTALLATION OF RESILIENT BASE

A. Comply with manufacturer's written instructions for installing resilient base.
B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
E. Do not stretch resilient base during installation.
F. Preformed Corners: Install preformed corners before installing straight pieces.
G. Job-Formed Corners:
    1. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
        a. Miter corners to minimize open joints.

3.04 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
B. Perform the following operations immediately after completing resilient-product installation:
    1. Remove adhesive and other blemishes from surfaces.
    2. Damp-mop horizontal surfaces to remove marks and soil.
C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09 65 13

SECTION 09 84 00 - CEMENTITIOUS WOOD FIBER CEILINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes cementitious wood fiber plank acoustical ceiling and wall system.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: Do not submit samples.

1.04 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each acoustical ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.

B. Evaluation Reports (if applicable): For proprietary anchors or fasteners used for attachment to concrete, CMU, or structural steel, submit ICC-ES or equivalent evaluation reports verifying allowable loads and compliance with code requirements.

C. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Materials:

1. Furnish extra materials matching products installed, packaged with protective covering for storage, and clearly labeled for identification.
    a. Acoustical Panels:
        1) Provide full-size panels equal to 2 percent of quantity installed, but not less than two panels of each size, type, and finish.
    b. Mounting Components:
        1) Provide 2 percent of quantity installed, or a minimum of four of each type, of exposed fasteners, trim, and mounting clips or channels required for reinstallation or future repairs.
    c. Touch-Up Materials:
        1) Provide manufacturer’s recommended touch-up paint or coating for field repairs of cut or damaged edges.
    d. Acoustical Backing (if used):
        1) Provide 2 percent of insulation or liner board used behind panels, if visible or exposed at removable areas.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Provide labels indicating brand name, style, size and thickness.
C. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.
D. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.08 FIELD CONDITIONS
A. Environmental Requirements:
1. Do not install ceiling panels until building is closed in and HVAC system is operational.
2. Locate materials onsite at least 72 hours before beginning installation to allow materials to reach temperature and moisture content equilibrium.
3. Maintain the following conditions in areas where acoustical materials are to be installed 72 hours before, during and after installation:
a. Relative Humidity: 25 - 85%.
b. Uniform Temperature: 32 - 120 degrees F (0 - 49 degrees C).

PART 2 - PRODUCTS

2.01 MANUFACTURERS
A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS
A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: Class A according to ASTM E1264.
2. Smoke-Developed Index: 50 or less.

2.03 ACOUSTICAL PANELS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Armstrong Ceiling & Wall Solutions.
2. Certainteed; SAINT-GOBAIN.
3. USG Corporation.
B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
C. Composition: wood fibers bonded with inorganic hydraulic cement
D. Color: White.
E. Size: Standard (23 ¾" x 48", 23 ¾" x 96", 47 ¾" x 96") Custom Sizes (width 23 ¾" – 48"; length 12" – 144" – Ceilings are limited to 12" -96" lengths if touching adjacent panels)
F. Thickness: Standard 1-1/2"
G. Edge Profile: Standard (long edge/short edge – Bevel/Square, long edge/short edge – Bevel/Bevel)
H. UL Classified Noise Reduction Coefficient (NRC): ASTM C 423; 1-1/2" thick panels mounting method: C-20(0.90) OR C-40(0.90) Classified with UL label.
I. UL Classified Flame Spread: ASTM E 1264; Class A. Product must be able to meet this criteria after being painted six times.
J. Light Reflectance (LR) White Panel: ASTM E 1477; (Light Reflectance)
K. Dimensional Stability/Mold Resistance: no significant mold growth when tested by ASTM D3273.

2.04 MOUNTING SYSTEM

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Armstrong Ceiling & Wall Solutions.
   2. Certainteed; SAINT-GOBAIN.
   3. USG Corporation.

B. Structural Performance:
Attachment devices, framing members, and anchors shall be designed to support five times the combined dead load of panels and supporting system, or as required by governing code, whichever is greater. Comply with ASTM C635/C635M, Table 1, "Direct Hung," as a minimum reference for load design and material strength, adapted for direct-attached ceiling assemblies.

C. Attachment to Structure:
   1. General:
      a. Provide a complete ceiling-mounted system including all framing members, attachment devices, anchors, fasteners, and accessories required to support Tectum acoustical panels and accommodate conduit, mechanical, and electrical components above the panel plane.
   2. Anchors in Concrete or Masonry:
      a. Type: Postinstalled expansion or adhesive anchors tested in accordance with ASTM E488/E488M or ASTM E1512, installed by qualified personnel.
   3. Corrosion Protection:
      a. Stainless steel (ASTM F593/F594, Type 304 or 316) for humid or exposed conditions.
      b. Zinc-plated carbon steel acceptable for dry, conditioned interiors.
      c. Anchors shall have minimum capacity to resist a load equal to five times the actual imposed load without failure.
   4. Attachment to Structural Steel:
      a. Use welded or bolted connections complying with AISC 360 and manufacturer's recommendations.
      b. Provide isolation washers or clips as required to prevent galvanic corrosion between dissimilar metals.
   5. Hat Channel Framing:
      a. Cold-formed galvanized steel hat channels, minimum 25 gauge (0.019 in. base metal thickness) unless otherwise noted.
      b. Install perpendicular to panel orientation, at spacing per manufacturer's structural data to support acoustical panel weight and resist deflection of L/360 or less.
      c. Provide continuous perimeter angle or track to secure channel ends and maintain ceiling plane.
      d. Allow clearance as indicated (typically 1-1/2 in. to 3-1/2 in.) for conduit or raceway passage above panel plane.
   6. Fasteners:
      a. Manufacturer-approved self-drilling screws or clips compatible with Tectum panel and substrate material.
      b. Conceal fasteners where possible; align visible fasteners consistently.
      c. Use corrosion-resistant coatings equivalent to ASTM B633, Type II, SC1 minimum.

D. Attachment to CMU Substrate:

1. General:
   a. Provide complete wall-mounted support system including all framing members, furring, attachment devices, and anchors required to support acoustical panels at specified offsets from the CMU substrate and to accommodate conduit or raceways behind panel plane.
2. Anchors:
   a. Type: Post-installed masonry anchors (expansion, screw, or adhesive type) tested in accordance with ASTM E488/E488M for both pull-out and shear.
   b. Material and Corrosion Resistance:
      1) Interior Dry Locations: Zinc-plated carbon steel complying with ASTM A510.
      2) High-Humidity or Exposed Locations: Stainless steel (ASTM F593/F594, Type 304 or 316).
      3) Capacity: Each anchor shall be capable of sustaining, without failure, five times the actual imposed load from panel and subframing assembly.
      4) Embedment: Minimum embedment depth per anchor manufacturer to achieve required pull-out and shear capacities in CMU.
3. Hat Channel or Z-Furring:
   a. Cold-formed galvanized steel channels, minimum 25 gauge (0.019 in.), unless otherwise noted.
   b. Space channels at 16 inches on center or as required to support panel weight and prevent deflection greater than L/360.
   c. Align furring vertically or horizontally as indicated to receive panel layout.
   d. Maintain specified clearance behind channels (typically 1-1/2 in. to 3-1/2 in.) for conduit routing.
4. Fasteners:
   a. Use self-drilling or self-tapping masonry screws, expansion bolts, or anchors as recommended by manufacturer for CMU substrate.
   b. Fastener heads shall be flush with or recessed into channels; provide corrosion protection per ASTM B633, Type II, SC1 minimum.
   c. Conceal fasteners from view where possible.
5. Isolation:
   a. Provide neoprene or EPDM isolation washers between steel furring and masonry to minimize vibration transfer where required for acoustical performance.

E. Coordination**:**
   1. Coordinate installation of furring and conduit. Ensure anchors and channels are located to avoid conflicts with embedded utilities, and maintain continuous support behind panel joints.

F. Inspection:
   1. Prior to panel installation, verify all anchors are torqued to manufacturer’s requirements and visually inspect for alignment and rigidity.

2.05 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
   1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E488/E488M or ASTM E1512 as applicable, conducted by a qualified testing and inspecting agency.

a. Type: Postinstalled expansion anchors.
b. Corrosion Protection: Stainless-steel components complying with ASTM F593 and ASTM F594, Group 1 Alloy 304 or 316.
c. Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B164 for UNS No. N04400 alloy.

2. Reveals, trims, and edge moldings to match panel finish.
3. Black scrim behind panel openings, where visible.
4. Touch-up coating kit for site repairs.

2.06 METAL EDGE MOLDINGS AND TRIM

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Armstrong Ceiling & Wall Solutions.
2. Certainteed; SAINT-GOBAIN.
3. USG Corporation.

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
1. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2.07 ACOUSTICAL SEALANT

A. Acoustical Sealant: As specified in Section 07 92 19 "Acoustical Joint Sealants."

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which wood fiber plank acoustical ceiling attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject wood fiber plank acoustical ceiling panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Measure each ceiling area and establish layout of wood fiber plank acoustical ceiling panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.03 INSTALLATION

A. General:
1. Install wood fiber plank acoustical ceiling panels and supporting furring system in accordance with the manufacturer’s written instructions, approved shop drawings, and requirements of ASTM C754 for installation of steel framing and furring. Coordinate

with mechanical and electrical work within ceiling or wall cavities to maintain required clearances.

B. Substrate Preparation:
   1. Verify substrates are plumb, level, and free of protrusions or debris that would interfere with installation.
   2. Where applied to concrete or CMU, verify surfaces are sound and anchors are properly located to receive furring.
   3. Confirm layout and conduit routing before beginning installation.

C. Furring and Hat Channel Installation:
   1. Install galvanized steel hat channels or Z-furring members at spacing not to exceed 16 inches (400 mm) o.c., unless otherwise indicated by manufacturer's structural data.
   2. Fasten channels securely to substrate using post-installed anchors, screws, or other approved fasteners capable of supporting five times the imposed load.
   3. Shim and align channels to maintain a flat plane with a tolerance of 1/8 inch in 10 feet (3 mm in 3 m).
   4. Provide clearance behind furring (typically 1-1/2 to 3-1/2 inches) to accommodate conduit and other utilities as indicated.
   5. Install perimeter channels or angles to form continuous support at terminations and changes in plane.

D. Panel Installation:
   1. Install panels perpendicular to hat channels unless otherwise indicated.
   2. Secure panels with manufacturer-approved fasteners; drive flush with surface without over-compressing material.
   3. Locate fasteners as recommended—typically 6 inches (150 mm) from panel edges and spaced not more than 24 inches (600 mm) along intermediate supports.
   4. Stagger end joints and align reveals or edges uniformly.
   5. Maintain consistent joint width as specified; fill or treat per manufacturer's finish recommendations.
   6. Cut panels accurately at borders, penetrations, and terminations to achieve tight, even joints.
   7. Touch up cut edges and field cuts with manufacturer's recommended finish coating to match panel color.

E. Perimeter and Edge Conditions:
   1. Install trim and moldings of type and finish indicated to conceal edges and terminations.
   2. Apply acoustical sealant behind trim flanges where indicated for air and sound isolation.
   3. Fasten trims at maximum 16 inches (400 mm) o.c.; miter and secure corners neatly.
   4. Do not use exposed mechanical fasteners on finished surfaces unless specifically approved.

F. Field Quality Control:
   1. Verify panel alignment and surface plane visually from typical viewing distance.
   2. Replace damaged or nonconforming panels.
   3. Confirm all anchors and furring connections are secure prior to project closeout.

3.04 ERECTION TOLERANCES

A. Alignment and Plane:
   1. Install hat channels and acoustical panels true to plane within the following tolerances:
      a. Flatness: Maximum deviation of 1/8 inch in 10 feet (3 mm in 3 m), non-cumulative.
      b. Alignment: Adjacent panel edges shall be flush within 1/16 inch (1.5 mm).
      c. Level (Ceilings Only): Finished ceiling surface shall not vary more than 1/8 inch in 12 feet (3 mm in 3.6 m) in any direction.

B. Joints and Reveals:
   1. Maintain consistent joint widths and reveal alignment within ±1/16 inch (1.5 mm) over continuous runs.

C. Moldings and Trim:
   1. Install perimeter moldings and trim straight, level, and in plane with adjoining panels within 1/8 inch in 12 feet (3 mm in 3.6 m) tolerance, non-cumulative.

D. Fasteners:
   1. Set fasteners flush with panel surface without over-driving or crushing fiber; misaligned or overdriven fasteners shall be replaced or repaired per manufacturer's recommendations.

3.05 CLEANING

A. Cleaning and Protection:
   1. Remove dust, fingerprints, and debris with clean, dry cloth or vacuum.
   2. Protect installed panels from impact, moisture, and construction damage until Substantial Completion.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 84 00

SECTION 09 90 00 – PROTECTIVE COATINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes coating of exterior and interior surfaces throughout the Project and which are listed in PART 2, with systems specified on "coating system" sheets at the end of this Section.

B. Coating systems include surface preparation, prime coat (first coat), finish coats (second and third coats), inspection, cleaning, and touch-up of surfaces and equipment. Shop preparation, prime coat, and finish coats to be shop-applied, may be specified elsewhere or referenced to this Section so that a complete system is specified and coordinated.

1. Where surface preparation and first (prime) coat are specified in other Sections to be shop-applied, such as for structural steel, hollow metal doors or equipment, only the touch-up and finish coats are a part of field painting. Surface preparation is the required degree of preparation prior to application of first (prime) coat regardless if done in shop or field.
2. If materials are provided without shop primer such as miscellaneous steel or sheet metal, then surface preparation, first, second, and third coats are a part of field painting.

1.03 RELATED REQUIREMENTS:

A. Shop Painting and Coatings: All applicable Divisions.

B. Factory Prefinished Items: All applicable Divisions.

1.04 REFERENCE STANDARDS:

A. Applicable Standards:

1. American National Standards Institute (ANSI):
   a. A13.1 - Scheme for the Identification of Piping Systems.
   b. Z53.1 - Safety Color Code for Marking Physical Hazards.
2. American Society for Testing and Materials (ASTM):
   a. D4259 - Abrading Concrete.
3. Society for Protective Coatings (SSPC) Surface Preparation Specifications:
   a. SP1 - Solvent Cleaning: Removes oil, grease, soil, drawing and cutting compounds, and other soluble contaminants.
   b. SP2 - Hand Tool Cleaning: Remove loose material. Not intended to remove adherent mill scale, rust, and paint.
   c. SP3 - Power Tool Cleaning: Removes loose material. Not intended to remove all scale or rust.
   d. SP5 - White Metal Blast Cleaning: Removes all scale, rust, foreign matter. Leaves surface gray-white uniform metallic color.
   e. SP6 - Commercial Blast Cleaning: Two-thirds of every nine square inches free of all visible residues; remainder only light discoloration.
   f. SP10 - Near-White Blast Cleaning: At least 95% of every nine square inches shall be free of all visible residues.
   g. SP11 - Power Tool Cleaning to Bare Metal.
   h. SP13 – Surface Preparation of Concrete.

1.05 SUBMITTALS:

A. Submit as specified in DIVISION 1.

B. Includes, but not limited to, the following:

1. Schedule of products and paint systems to be used. Schedule shall include the following information:
   a. Surfaces for system to be applied.
   b. Surface preparation method and degree of cleanliness.
   c. Product manufacturer, name, and number.
   d. Method of application.
   e. Dry film mil thickness per coat of coating to be applied.
2. Color charts for selection and acceptance.
3. Technical and material safety data sheets.
4. Certification(s) by coating manufacturer(s) that all coatings are suitable for service intended as stated on each coating system sheet. If manufacturer has an equivalent product as that specified, and it is suitable for the intended purpose, Contractor shall submit the recommended product for approval at no increase in cost, and state reasons for substitution.
5. Contractor shall certify in writing to the Engineer/Architect that applicators have previously applied all the systems in this Specification and have the ability and equipment to prepare the surfaces and apply the coatings correctly.

C. Submittals for industrial maintenance coatings shall be prepared by, or have assistance in preparation of, a corrosion engineer or industrial coatings technical representative of the coating manufacturer.

1.06 QUALITY ASSURANCE:

A. Include on label of container:

1. Manufacturer's name, product name, and number.
2. Type of paint and generic name.
3. Color name and number.
4. Storage and temperature limits.
5. Mixing and application instructions, including requirements for precautions which must be taken.
6. Drying, recoat, or curing time.

B. A coating report shall be completed daily by Contractor at each phase of the coating system starting with surface preparation. These shall be submitted on the form attached at end of this Section.

C. In the event a problem occurs with coating system, surface preparation, or application, Contractor shall require coating applicator and coating manufacturer's technical representative to promptly investigate the problem and submit results to Engineer/Architect.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. Delivery of Materials:

1. Deliver in sealed containers with labels and information legible and intact. Containers shall also have correct labels with required information.

1.08 REGULATORY REQUIREMENTS:

A. In addition to requirements specified elsewhere for environmental protection, provide coating materials that conform to the restrictions of the U.S. EPA and the local and regional

jurisdictions. Notify Engineer/Architect of any coating specified herein that fails to conform to the requirements for the location of the Project or location of application.

B. Lead Content: Use only coatings that are totally lead free.
C. Chromate Content: Do not use coatings containing zinc-chromate or strontium chromate.
D. Asbestos Content: Materials shall not contain asbestos.
E. Mercury Content: Materials shall not contain mercury or mercury compounds.

1.09 WARRANTY

A. The Manufacturer shall warrant that all protective coatings shall be free from defects caused by faulty material or workmanship for a minimum period of one (1) year from the date of Substantial Completion, unless otherwise specified.
B. Warranties shall comply with the requirements of Section 01 78 36.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Proprietary names and product numbers are specified in most systems for material identification from these manufacturers:
   1. Ameron Protective Coatings Systems Group, PPG.
   2. Carboline Company, Inc.
   3. Tnemec Company, Inc.
   4. Sherwin-Williams.

2.02 GENERAL:

A. Materials furnished for each coating system must be compatible to the substrate.
B. When unprimed surfaces are to be coated, entire coating system shall be by the same coating manufacturer to assure compatibility of coatings.
C. When shop-painted surfaces are to be coated, ascertain whether finish materials will be compatible with shop coating. Inform Engineer/Architect of any unsuitable substrate or coating conditions.

2.03 COATING SYSTEMS:

A. Specified on the "Protective Coating System" sheets at the end of this Section.

2.04 SURFACES TO BE COATED:

A. System A-5:
   1. Item: Steel Bollards and exterior exposed carbon steel
      a. Reference: DIVISION 05, Architectural, Civil and Structural Drawings
      b. Location: As indicated
B. System B-4:
   1. Item: New Galvanized Steel, Including: Doors and Frames, Veneer Lintels, and Hollowcore Support Angles.
      a. Reference: DIVISION 05, Architectural and Structural Drawings
      b. Location: As indicated
C. System E-1:
   1. Item: New Iron and Steel Process Piping, Valves, Motors, Pipe Supports, Pumps, Drains, Air Lines & Related Accessories. Interior Exposure, Exterior Surfaces & Non-Potable Liquid Immersion:

a. Reference: DIVISION 22, 33, 41 & 46
b. Location: As indicated

2. Item: Misc. Non-galvanized Steel Interior Exposure, including interior structural steel:
   a. Reference: DIVISION 05 & drawings
   b. Location: As indicated
3. Item: Steel Hangers & Supports for Mechanical Equipment and Piping. Interior Exposure:
   a. Reference: DIVISION 05 & Mechanical Drawings
   b. Location: As indicated

D. System F-3:
   1. Item: Interior CMU walls
      a. Reference: Architectural Drawings
      b. Location: As indicated

E. System J-2:
   1. Item: Interior Gypsum Board
      a. Reference: Architecural Drawings
      b. Location: As indicated

F. Item: Blower Piping
   1. Provide the following Tnemec system or engineer approved equal meeting the design criteria listed below:
      a. Coating System:
         (1) Fully protect, mask and seal off everything in the room that will not receive the coating system.
         (2) Surface preparation: New piping - SSPC-SP10 and profile depth of 1.5 to 2.5 mils
         (3) Prime with one coat of Tnemec Series 135 Chembuild @ 4.0-6.0 mils DFT.
         (4) Intermediate Coat(s): two coats Tnemec Series 971 Aerolon Acrylic at 30.0-50.0 mils DFT.
         (5) Topcoat with Tnemec series 1028-T Enduratone @ 2.0-3.0 mils DFT for a total of 66.0-109.0 mils DFT. Color as selected by the owner/engineer from all manufacturer's standard colors.
         (6) Thermal Conductivity of (ASTM C518 at 77°F): 0.0356 W/m-°K or 0.2468 BTU-in/ft²-hr-°F required.
      b. Reference: Architecural and Process Drawings
      c. Location: As indicated

G. Item: Interior Chemical Containment Area: Polymer
   1. Provide the following Tnemec system or approved Sherwin Williams or Carboline equal meeting the design criteria listed below:
      a. Coating System:
         (1) Surface Preparation: Allow new cast-in-place concrete to cure a minimum of 28 days at 75°F (24°C). Verify concrete dryness and prepare concrete surfaces in accordance with NACE No. 6/SSPC-SP13 Joint Surface Preparation Standards and ICRI Technical Guidelines. Moisture vapor transmission should not exceed three lbs. per 1,000 sq. ft. in a 24-hour period. Relative humidity should not exceed 80%. Abrasive blast, shot-blast or mechanically abrade concrete surfaces to remove laitance, curing compounds, hardeners, sealers and other contaminants and to provide a minimum ICRI-CSP 5 or greater surface profile. Large cracks, voids and

other surface imperfections should be filled with a recommended filler or surfacer.
(2) Primer: Series 251SC @ 6.0-8.0 mils D.F.T.
(3) Base Coat: Series 252SC Chembloc MCK System w/fiberglass mat reinforcement per manufacturer's direction @ 60.0 - 80.0 mils.
(4) Saturant Coat: Series 252SC Chembloc @ 6.0-8.0 mils.
(5) Top Coat: Series 252SC Chembloc @ 6.0-8.0 mils. System Total D.F.T. of 78.0-104.0 mils minimum.

b. Location: As indicated on drawings including walls and floors; interior concrete surfaces including walls, floor, tank pads, sumps, and top of wall.

H. Item: Influent Wet Well, Diversion Structure, Covered Sludge Holding Tank. Concrete Immersion: Raw sewage.
1. Provide the following Tnemec system or engineer approved equal meeting the design criteria listed below:
a. Coating System:
(1) Fully protect, mask and seal off everything in the space that will not receive the coating system.
(2) Surface Preparation: High pressure water blast all areas with a minimum 3000-5000 lbs. psi at the tip at a rate of 3-5 gallons/minute, utilizing an orbital tip and TSP detergent additive to remove chalk, loose paint and other contaminants, followed by a clean water rinse. ASTM D4258.
(3) Verify concrete dryness and prepare concrete surfaces in accordance with NACE No. 6/SSPC-SP13.
(4) Joint Surface Preparation Standards and ICRI Technical Guidelines. Moisture vapor transmission should not exceed three lbs. per 1,000 sq. ft. in a 24-hour period.
(5) Relative humidity should not exceed 80%.
(6) Abrasive blast, shot-blast or mechanically abrade concrete surfaces to remove laitance, curing compounds, hardeners, sealers and other contaminants and to provide a minimum ICRI-CSP 5 or greater surface profile.
(7) Large cracks, voids and other surface imperfections should be filled. Clean & Dry per ASTM D4258.
(8) Parge coat 1/16” - 1/4" thick with Tnemec Series 218
(9) Finish Coat: Apply one coat of Series G435 Perma-Glaze @ 30.0-40.0 mils DFT per coat for a total of 30.0-40.0 mils DFT. Color as selected by engineer from manufacturer’s standard colors.
(10) Field touch-up.
b. Location: As indicated on drawings including the interior face of concrete wall, concrete floor, and top of concrete wall.

I. Item: Resinous Floor and Base System
1. Provide the following Tnemec system or engineer approved equal meeting the design criteria listed below.
a. Provide resinous floor system 2’-0” by 2’-0” mock-up for approval before applying coating system.
b. Coating System:
(1) Fully protect, mask and seal off everything in the room that will not receive the coating system, including floor drains.

(2) Surface preparation: Prepare concrete surfaces in accordance with NACE No. 6/SSPC-SP13 Joint Surface Preparation Standards and ICRI Technical Guidelines. Abrasive blast, shot-blast, water jet or mechanically abrade concrete surfaces to remove laitance, curing compounds, hardeners, sealers and other contaminants to provide a minimum ICRI-CSP 4-5 surface profile. Large cracks, voids and other surface imperfections should be filled with a recommended filler or surfacer.
(3) Prime with Series 241 Ultra-Tread MVT @ 46.0-52.0 mils DFT w/first broadcast coat
(4) Coat with Series 222 Deco-Tread @ 1/16" minimum DFT w/ one broadcast application
(5) Topcoat with series 248 Everthane @ 2.0-3.0 mils DFT.
(6) Color as selected by the architect from manufacturer's full range of colors.

c. Physical Properties:
(1) Compressive Strength: Minimum 14,000 psi.
(2) Flexural Strength: Minimum 4,500 psi.
(3) Water Absorption: 0.2%.
(4) Chemical resistance of cured floor surfacing system as indicated below. Test to qualify coatings for chemical splash and fumes (NACE TM-01-74 Procedure B):
(5) No effect from the following: Acetic acid (100%), chromic acid (10%), citric acid (20%), formaldehyde (37%), heavyduty detergent, hydrochloric acid (37%), hydrogen peroxide (28%), lactic acid (85%), mineral spirits, nitric acid (40%), oleic acid, oxalic acid (10%), phosphoric acid (85%), potassium hydroxide (50%), sulfuric acid (75%), tannic acid (20%), tartaric acid (10%), urine.
(6) System Thickness: 1/8 inch (6.4 mm).
(7) Wearing surface: Anti-slip.
(8) Components:
(a) Primer.
(b) Chemical-resistant sealing or finish coats.

d. Reference: Architecural Drawings
e. Location: As indicated

J. Item: Resinous Wall System
1. Provide the following Tnemec system or approved equal meeting the design criteria listed below.
a. Provide resinous wall system 2'-0" by 2'-0" mock-up for approval before applying coating system.
b. Coating System:
(1) Coating system to be smooth with a glossy appearance.
(2) Fully protect, mask and seal off everything in the room that will not receive the coating system.
(3) Surface preparation: Prepare concrete surfaces in accordance with NACE No. 6/SSPC-SP13 Joint Surface Preparation Standards and ICRI Technical Guidelines. Abrasive blast, shot-blast, water jet or mechanically abrade concrete surfaces to remove laitance, curing compounds, hardeners, sealers and other contaminants to provide a minimum ICRI-CSP 2-3 surface profile. Large cracks, voids and other surface imperfections should be filled with a recommended filler or surfacer.

(4) Surfacer: Tnemec Series215 and Series 211 as required. Fill all holes and grout lines smooth.
(5) Glass Mat: Tnemec Series273 mat
(6) Saturate: Tnemec Series 273
(7) Grout Coat: Tnemec Series 280
(8) Finish Coat: Tnemec Series 297
(9) Color as selected by the architect from manufacturer's full range of colors.

c. Reference: Architecural Drawings
d. Location: As indicated

K. Item: Exterior Concrete Secondary Chemical Containment, all interior concrete surfaces at Containment Structures including walls, floor, tank pads, sumps, and top of wall.
1. Provide the following Tnemec system or engineer approved equal meeting the design criteria listed below:
a. Coating System:
(1) Fully protect, mask and seal off everything that will not receive the coating system.
(2) Surface Preparation: Allow new cast-in-place concrete to cure a minimum of 28 days at 75°F (24°C). Verify concrete dryness and prepare concrete surfaces in accordance with NACE No. 6/SSPC-SP13 Joint Surface Preparation Standards and ICRI Technical Guidelines. Moisture vapor transmission should not exceed three lbs. per 1,000 sq. ft. in a 24-hour period. Relative humidity should not exceed 80%. Abrasive blast, shot-blast or mechanically abrade concrete surfaces to remove laitance, curing compounds, hardeners, sealers and other contaminants and to provide a minimum ICRI-CSP 5 or greater surface profile. Large cracks, voids and other surface imperfections should be filled with a recommended filler or surfacer.
(3) Primer: Series 251SC @ 6.0-8.0 mils D.F.T.
(4) Base Coat: Series 252SC Chembloc MCK System w/fiberglass mat reinforcement per manufacturer's direction @ 60.0 - 80.0 mils.
(5) Saturant Coat: Series 252SC Chembloc @ 6.0-8.0 mils.
(6) Top Coat: Series 252SC Chembloc @ 6.0-8.0 mils. System Total D.F.T. of 78.0-104.0 mils minimum.
(7) Outdoor Chemical Containment Basins Top Coat: Series 290 CRU Aliphatic Urethane @ 2.0-3.0 mils D.F.T.
(a) Reference: Process and Structural Drawings.
(b) Location: As indicated.
(c) Top Coat Color: 31GR Slate Gray

2.05 SURFACES NOT TO BE COATED:

A. Do not field coat any of the following items unless specifically noted otherwise.
1. Copper, stainless steel, aluminum, FRP fabrications, Conduit, PVC piping.

2.06 COLOR CODING OF PIPING AND PHYSICAL HAZARDS:

A. Color Coding of Piping: Exterior and interior by color coding entire pipe.
1. General:
a. Coat piping with solid colors as specified below for entire length of pipe in exposed finished and unfinished areas. Exclude areas in pipe chases and furred areas.

b. Piping colors to be selected by Engineer/Architect.
c. Coat all other piping in colors matching adjacent surfaces. If adjacent area is unfinished, paint in color determined by Engineer/Architect.
d. After completion of finish coating, identify piping with band, legend and, arrows as specified below. Apply after completion of finish coating.
e. For most pipe labeling, refer to section 22 05 53. Where not applicable, refer to pipe stenciling parameters below.

2. Color Scheme:

Description	Color	Notes
Potable	Dark Blue	Ref Plumbing/Process Drawings.
Process Non-Potable Water	Purple	Ref Process Drawings. Identification required: "CAUTION: NONPOTABLE WATER – DO NOT DRINK"
Drain	Dark Gray	Ref Process Drawings.
Influent	Gray	Ref Process Drawings
Blower Piping	Light Green	Ref Process Drawings
RAS	Tan	Ref Process Drawings.
WAS	Brown	Ref Process Drawings.
Clarified Effluent	Light Gray	Ref Process Drawings.
Filter Effluent	Light Gray	Ref Process Drawings.
Gas	Yellow	Ref Mechanical Drawings.
Plumbing Non-Potable Water	Purple	Ref Plumbing Drawings. Identification required: "CAUTION: NONPOTABLE WATER – DO NOT DRINK"

3. Location of Legends and Arrows:
   a. Place on piping near connections to Equipment, adjacent to valves or fittings, on both sides of walls penetrated, and at intervals not to exceed 50 feet (15 meters).
   b. Place arrows adjacent to or below legends depending upon visibility. Place arrows in direction of flow. For dual-flow piping, indicate both directions.
   c. Locate legends to be visible from normal line of vision above floor level. Legend locations subject to approval of Engineer/Architect.
4. Letter Size:
   a. Block-style letters, all capitals, conforming to ANSI A13.1.

Outside Diameter of Pipe or Covering	Width of Banding	Size of Letters and Arrows
Less than 3/4" (19 mm)	6" (150 mm)	Approved metal tag or band
3/4" to 1-1/4" (19 mm to 32 mm)	8" (200 mm)	1/2" (13 mm)
1-1/2" to 2" (38 mm to 50 mm)	10" (250 mm)	3/4" (19 mm)
2-1/2" to 6" (64 mm to 150 mm)	12" (300 mm)	1-1/4" (32 mm)
8" to 10" (200 mm to 250 mm)	24" (600 mm)	2-1/2" (64 mm)
Over 10" (250 mm)	32" (800 mm)	3-1/2" (89 mm)

B. Color Coding Physical Hazards: Exterior and interior.

1. General:
   a. Paint areas indicated to identify physical hazard areas as required by ANSI Z53.1.
   b. All colors shall conform to Federal Safety Color Code requirements.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION:

A. Prepare surfaces for each coating system conforming to SSPC or ASTM surface preparation specifications listed.
   1. If grease or oils are present, SSPC-SP1 shall precede any other method specified for metal substrates.
   2. Remove surface irregularities such as weld spatter, burrs, or sharp edges prior to specified surface preparation.

B. Depth of profile will be as specified or as recommended by the manufacturer for each system, but in no instance shall it exceed one-third of the total dry film thickness of complete system.

C. Prepare only those areas which will receive the first coat of the system on the same day.
   1. On steel substrates, apply coating before rust bloom forms.

3.02 APPLICATION:

A. Apply coatings in accordance with coating manufacturer's recommendations.

B. Use properly designed brushes, rollers, and spray equipment for all applications.

C. On unprimed surfaces apply first coat of the system the same day as surface preparation.

D. Dry film thickness of each system shall meet the minimum specified. Maximum dry film thickness shall not exceed the minimum more than 20% or coating manufacturer's requirements if less. Where a dry film thickness range is specified, the range shall not be less than or exceeded.

E. Shop and field painting shall remain 3 inches (75mm) away from unprepared surface of any substrate such as areas to be welded or bolted.

F. Environmental Conditions:
   1. Atmospheric temperature must be 50°F (10°C) or higher during application, unless otherwise approved by coating manufacturer. Do not apply coatings when inclement weather or freezing temperature may occur within coating recoat cure times.
   2. Wind velocities for exterior applications shall be at a minimum to prevent overspray or fallout and not greater than coating manufacturer's limits.
   3. Relative humidity must be less than 85%. The ambient temperature and the temperature of the surface to be painted must be at least 5°F (2.8°C) above the dew point.
   4. Provide adequate ventilation in all areas of application to ensure that at no time does the content of air exceed the Threshold Limit Value given on the manufacturer's Material Safety Data Sheets for the specific coatings being applied.

G. Recoat Time: In the event a coating, such as an epoxy, has exceeded its recoat time limit, prepare the applied coating in accordance with manufacturer's recommendations.

H. Protection:
   1. Cover or otherwise protect surfaces not to be painted. Remove protective materials when appropriate.
   2. Mask, remove, or otherwise protect finish hardware, machined surfaces, grilles, lighting fixtures, and prefinished units as necessary.
   3. Provide cover or shields to prevent surface preparation media and coatings from entering orifices in electrical or mechanical Equipment. Where ventilation systems must be kept

in operation at time of surface preparation, take precautions to shield intakes and exhausts to prevent the materials from entering system or being dispersed.

4. Provide signs to indicate fresh paint areas.
5. Provide daily cleanup of both storage and working areas and removal of all paint refuse, trash, rags, and thinners. Dispose of leftover containers, thinners, rags, brushes, and rollers which cannot be reused in accordance with applicable regulations.
6. Do not remove or paint over Equipment data plates, code stamps on piping, or UL fire-rating labels.

3.03 INSPECTION:

A. Contractor shall provide and use a wet film gauges to check each application approximately every 15 minutes in order to immediately correct film thickness under or over that specified.
B. Contractor shall provide and use a dry film gauge to check each coat mil (mm) thickness when dry, and the total system mil (mm) thickness when completed.
C. Use holiday or pinhole detector on systems over metal substrates to detect and correct voids when indicated on system sheet.
D. Check air temperature and temperature of the substrate at regular intervals to be certain surface is 5°F (2.8°C) or more above the dew point.

3.04 CLEANING AND REPAIRS:

A. Remove spilled, dripped, or splattered paint from surfaces.
B. Touch up and restore damaged finishes to original condition. This includes surface preparation and application of coatings specified.
C. Provide remainder of open paint cans to owner for touch ups.

END OF SECTION 09 90 00

COATING REPORT

Contract Name: _____ Contract No.: _____
Coating Contractor: _____ Foreman: _____

Unit or Surface Identification: _____
Unit or Surface Location: Exterior: _____, Interior: _____

Surface Preparation:
Date _____; Air Temp _____°F; Relative Humidity _____%
Method of Surface Preparation: _____
Profile achieved _____ mils (if applicable).

Touch-Up:
Date _____; Time _____; Air Temp _____°F; Surface Temp _____°F
Relative Humidity _____%; Dew Point _____°F
Coating Used _____; Dry Film Obtained _____mils.

First Coat:
Date _____; Time _____; Air Temp _____°F; Surface Temp _____°F
Relative Humidity _____%; Dew Point _____°F
Coating Used _____; Dry Time Before Recoat _____ hrs.
Dry Film Obtained _____ mils.

Second Coat:
Date _____; Time _____; Air Temp _____°F; Surface Temp _____°F
Relative Humidity _____%; Dew Point _____°F
Coating Used _____; Dry Time Before Recoat _____ hrs.
Dry Film Obtained _____ mils.

Third Coat:
Date _____; Time _____; Air Temp _____°F; Surface Temp _____°F
Relative Humidity _____%; Dew Point _____°F
Coating Used _____; Dry Film Obtained _____mils.

BURNS McDONNELL	PROTECTIVE COATING SYSTEM **System: A-5**

SERVICE:	Steel - Moderate to Severe Exposure (Nonimmersion)
Surface Preparation:	Shop: SSPC-SP6 and profile depth 1.5 to 2.5 mils (38 to 63 microns). Field: SSPC-SP2/3. Clean and dry.
First Coat:	High solids polyamine or polyamide epoxy with minimum 67% solids by volume. Apply at 5.0 to 7.0 mils (125 to 175 microns) dry film thickness.
Second Coat:	High solids aliphatic acrylic polyurethane gloss enamel with minimum 52% solids by volume. Apply at 3.0 to 5.0 mils (75 to 125 microns) film thickness.
System Total:	Minimum 8.0 mils (200 microns) dry film thickness.
Volatile Organic Content:	Maximum 2.8 lb/gal (340 g/L)

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COATING MANUFACTURER	PRODUCT DESIGNATION		
	FIRST COAT	**TOUCH UP**	**SECOND COAT**
PPG	Amerlock 2 or 400	Same as first coat	Amercoat 450 H
Carboline	Carboguard 890	Same as first coat	Carbothane 134 HG
Tnemec	Hi-Build Epoxoline II, Series N69	Same as first coat	Endura-Shield 1094
Sherwin-Williams	Macropoxy 646 B58-600/B58V600	Same as first coat	HS Polyurethane B65-300 Series

BURNS McDONNELL	PROTECTIVE COATING SYSTEM **System: B-4**

SERVICE:	Nonferrous & Galvanized Metal — Moderate to Severe Exposure Exterior or Interior (Including Galvanized Handrail)
Surface Preparation:	Shop or field first coat: Remove oil or soap film with neutral detergent or emulsion cleaner.
First Coat:	Pretreat and/or allow to weather as recommended by coating manufacturer.
Second Coat:	High build polyamide or polyamidoamine epoxy with minimum 65% solids by volume. Apply at 4.0 - 6.0 mils (100 -150 microns) dry film thickness.
Third Coat:	High solids aliphatic acrylic polyurethane gloss enamel with minimum 60% solids by volume. Apply at 2.0 – 3.0 mils (50 – 75 microns) dry film thickness.
System Total:	Minimum 6.0 mils (150 microns) dry film thickness in addition to galvanizing.
Volatile Organic Content:	Maximum 2.8 lb/gal (340 g/L).

COATING MANUFACTURER	PRODUCT DESIGNATION			
	FIRST COAT	**TOUCH UP**	**SECOND COAT**	**THIRD COAT**
PPG	See above		Amercoat 385	Amercoat 450 H
Carboline	See above		Carboguard 893 SG	Carbothane 134 HG
Sherwin-Williams	See above		Macropoxy 646 B58-600 Series	HS Polyurethane B65-300 Series
Tnemec	See above		F.C. Typoxy Series 27	Endura-Shield 1094

BURNS McDONNELL

PROTECTIVE COATING SYSTEM

System: E-1

SERVICE: Steel & Iron – Nonpotable Liquid Immersion, Normal to Severe Exposure. Interior of Tank or Basin. Exterior of Steel, Piping, or Equipment in Tank or Basin.

Surface Preparation: Shop or Field First Coat: SSPC-SP10 and profile depth of 1.5 to 2.5 mils (38 to 63 microns).
Field Touch-Up (of Shop-applied first coat): Same as for First Coat.

First Coat: High solids amine, polyamidoamine, or polyamide epoxy coating with minimum 67% solids by volume. Apply at 5.0 to 7.0 mils (125 to 175 microns) dry film thickness.

Second Coat: Same as first coat.

System Total: Minimum 10.0 mils (250 microns) dry film thickness. Check for voids with holiday or pinhole detector.

Volatile Organic Content: Maximum 2.8 lb/gal (340 g/L).

COATING MANUFACTURER	PRODUCT DESIGNATION		
	FIRST COAT	**TOUCH UP**	**SECOND COAT**
PPG	Amerlock 2 or 400	Same as first coat	Same as first coat
Carboline	Carboguard 890	Same as first coat	Same as first coat
Sherwin-Williams	Macropoxy 646 FC B58W610/B58V600	Same as first coat	Same as first coat
Tnemec	Hi-Build Epoxoline II Series N69	Same as first coat	Same as first coat

BURNS McDONNELL	PROTECTIVE COATING SYSTEM **System: F-3**

SERVICE:	Concrete, Concrete Masonry Units (CMU) –Severe Exposure (Nonimmersion) Interior
Surface Preparation:	Concrete: ASTM D4258. Fill pits in concrete with patching compound as recommended by coating manufacturer. CMU: ASTM D4261, clean and dry.
First Coat:	Concrete: High solids epoxy with minimum 67% solids by volume. Apply at 5.0 to 8.0 mils (0.127 to 0.203 mm) dry film thickness. CMU: High solids epoxy block filler with minimum 60% solids by volume. Apply at 10.0 to 20.0 mils (0.254 to 0.508 mm) dry film thickness and as required to fill pores.
Second Coat:	Concrete & CMU: High solids epoxy with minimum 67% solids by volume. Apply at 5.0 to 8.0 mils (0.127 to 0.203 mm) dry film thickness. Semi gloss or gloss finish.
System Total:	Concrete: Minimum 10.0 mils (0.254 mm) dry film thickness. CMU: Minimum 15.0 mils (0.381mm) dry film thickness.
Volatile Organic Content:	Maximum 3.5 lb./gal (425 g/L).

COATING MANUFACTURER	PRODUCT DESIGNATION	
	FIRST COAT	**SECOND COAT**
Concrete		
Carboline	Carboguard 890	Carboguard 890
Sherwin-Williams	Macropoxy HS B58W400 Series	Macropoxy HS B58W 400 Series
Tnemec	Hi-Build Epoxoline II Series N69	Hi-Build Epoxoline II Series N69
CMU		
Carboline	Sanitile 600	Carboguard 890
Sherwin-Williams	Kem CatiCoat HS B42W400	Macropoxy HS B58W 400 Series
Tnemec	Epoxy Block Filler WB 1254	Hi-Build Epoxoline II Series N69

BURNS McDONNELL

PROTECTIVE COATING SYSTEM

System: J-2

SERVICE: Gypsum Board & Plaster – Normal Exposure Interior Walls

Surface Preparation: Clean and dry.

First Coat: Acrylic Sealer. Apply at 1.5 to 2.0 mils (0.038 to 0.051 mm) dry film thickness.

Second Coat: Water reducible acrylic coating with minimum 34% solids by volume, semi-gloss finish. Apply at 1.5 mils (0.038 mm) dry film thickness.

Third Coat: Same as second coat.

System Total: Minimum 4.5 mils (0.114 mm) dry film thickness.

Volatile Organic Content: Maximum 2.8 lb./gal (340 g/L).

COATING MANUFACTURER	PRODUCT DESIGNATION			
	FIRST COAT	**TOUCH UP**	**SECOND COAT**	**THIRD COAT**
Ameron	Amercoat 220		Amercoat 220	Same as second coat
Carboline	Carbocrylic 120		Carbocrylic 3359	Same as second coat
Sherwin-Williams	PrepRite 200 B28W200		ProMar 200 Latex B20W200 Series	Same as second coat
Tnemec	PVA Sealer 51-792		Enduratone Series 1029	Same as second coat

SECTION 10 14 16 - PLAQUES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Metal plaques.

B. Related Requirements:
   1. Section 10 14 23 "Panel Signage" and Section 10 14 23.16 "Room-Identification Panel Signage" for plaques or signs similar to metal plaques, with or without frames, except that they are made of materials other than solid metal.
   2. Section 22 05 53 "Identification for Plumbing Piping and Equipment" for labels, tags, and nameplates for plumbing systems and equipment.
   3. Section 23 05 53 "Identification for HVAC Piping and Equipment" for labels, tags, and nameplates for HVAC systems and equipment.
   4. Section 26 05 53 "Identification for Electrical Systems" for labels, tags, and nameplates for electrical equipment.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For plaques.
   1. Include fabrication and installation details and attachments to other work.
   2. Show plaque mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
   3. Show message list, typestyles, graphic elements, and layout for each plaque at least half size.

C. Samples for Initial Selection: For each type of plaque, exposed component, and exposed finish.
   1. Include representative Samples of available typestyles and graphic symbols.

D. Samples for Verification: For each type of plaque showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
   1. Plaques: Half-size Sample.
   2. Exposed Accessories: Full-size Sample of each accessory type.

E. Product Schedule: For plaques. Use same designations indicated on Drawings or specified.

1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Sample Warranty: For special warranty.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For plaques to include in maintenance manuals.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.06 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of plaques that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of finishes beyond normal weathering.

b. Deterioration of embedded graphic image.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 METAL PLAQUES

A. Cast Plaque: Cast-metal plaque with background texture, border, and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
   1. Plaque Material: Cast aluminum.
   2. Plaque Thickness: 0.50 inch (12.7 mm).
   3. Finishes:
      a. Integral Aluminum Finish: Anodized color as selected by Architect from full range of industry colors and color densities.
      b. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color as selected by Architect from manufacturer's full range.
      c. Overcoat: Manufacturer's standard baked-on clear coating.
   4. Background Texture: As selected by Architect from manufacturer's full range.
   5. Mounting: Projecting studs.
   6. Text and Typeface: Variable custom graphics and content as indicated on drawings.

B. Etched Plaque: Chemically etched or photochemically engraved metal sheet or plate with texture, border, and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
   1. Plaque Material: Sheet or plate aluminum.
   2. Plaque Thickness: 0.250 inch (6.35 mm).
   3. Finishes:
      a. Integral Aluminum Finish: Anodized color as selected by Architect from full range of industry colors and color densities.
      b. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color as selected by Architect from manufacturer's full range.
      c. Overcoat: Manufacturer's standard baked-on clear coating.
   4. Mounting: Projecting studs.
   5. Text and Typeface: Variable custom graphics and content as indicated on drawings.

2.02 MATERIALS

A. Aluminum Castings: ASTM B26/B26M, alloy and temper recommended by plaque manufacturer for casting process used and for type of use and finish indicated.

B. Aluminum Sheet and Plate: ASTM B209 (ASTM B209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

C. Aluminum Extrusions: ASTM B221 (ASTM B221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

2.03 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of plaques, noncorrosive and compatible with each material joined, and complying with the following:
   1. Use concealed fasteners and anchors unless indicated to be exposed.
   2. For exterior exposure, furnish stainless steel devices unless otherwise indicated.
   3. Plaque Mounting Fasteners:
      a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of plaque, screwed into back of plaque, or screwed into tapped lugs cast integrally into back of plaque unless otherwise indicated.

b. Through Fasteners: Exposed metal fasteners matching plaque finish, with type of head indicated, installed in predrilled holes.

B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.04 FABRICATION

A. General: Provide manufacturer's standard plaques according to requirements indicated.
1. Preassemble plaques in the shop to greatest extent possible. Disassemble plaques only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners.
5. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

B. Surface-Engraved Graphics: Machine-engrave characters and other graphic devices into indicated plaque surface to produce precisely formed copy, incised to uniform depth.
1. Engraved Metal: Fill engraved graphics with manufacturer's standard baked enamel.

2.05 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.06 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

B. Color Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Verify that plaque-support surfaces are within tolerances to accommodate plaques without gaps or irregularities between backs of plaques and support surfaces unless otherwise indicated.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF METAL PLAQUES

A. General: Install plaques using mounting methods indicated and according to manufacturer's written instructions.

1. Install plaques level, plumb, true to line, and at locations and heights indicated, with plaque surfaces free of distortion and other defects in appearance.
2. Install plaques so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that plaque surfaces are clean and free of materials or debris that would impair installation.
4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:
1. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.

3.03 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed plaques and plaques that do not comply with specified requirements. Replace plaques with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
B. Remove temporary protective coverings and strippable films as plaques are installed.
C. On completion of installation, clean exposed surfaces of plaques according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain plaques in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 16

SECTION 10 14 19 - DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Dimensional characters.
      a. Cast dimensional characters.

1.02 COORDINATION

A. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Shop Drawings: For signs.
   1. Include fabrication and installation details and attachments to other work.
   2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
   3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.
C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
   1. Include representative Samples of available typestyles and graphic symbols.
D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
   1. Dimensional Characters: Full-size Sample of each type of dimensional character.
   2. Exposed Accessories: Full-size Sample of each accessory type.
E. Product Schedule: For dimensional letter signs. Use same designations indicated on Drawings or specified.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.
B. Sample Warranty: For special warranty.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.07 FIELD CONDITIONS

A. Field Measurements: Verify locations of electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.08 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Deterioration of finishes beyond normal weathering.
   b. Separation or delamination of sheet materials and components.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Structural Performance: Signs and supporting elements shall withstand the effects of gravity and other loads within limits and under conditions indicated.
   1. Uniform Wind Load: As indicated on Drawings.
   2. Concentrated Horizontal Load: As indicated on Drawings.
   3. Other Design Load: As indicated on Drawings
   4. Uniform and concentrated loads need not be assumed to act concurrently.

2.02 DIMENSIONAL CHARACTERS

A. Cast Characters: Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ACE Sign Systems, Inc.
      b. ASI Sign Systems, Inc.
      c. Gemini Signage; Gemini, Inc.
   2. Character Material: Cast aluminum.
   3. Character Height: As indicated on Drawings.
   4. Thickness: Manufacturer's standard for size of character.
   5. Finishes:
      a. Integral Aluminum Finish: Anodized color as selected by Architect from full range of industry colors and color densities.
   6. Mounting: Projecting studs.
   7. Typeface: Helvetica Medium.

2.03 DIMENSIONAL CHARACTER MATERIALS

A. Aluminum Castings: ASTM B26/B26M, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.
B. Aluminum Sheet and Plate: ASTM B209 (ASTM B209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
C. Aluminum Extrusions: ASTM B221 (ASTM B221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
D. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.
E. Zinc Castings: ASTM B240, alloy and temper recommended by sign manufacturer for type of use and finish indicated.
F. Zinc Sheet: ASTM B69, alloy and temper recommended by sign manufacturer for type of use and finish indicated.
G. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.04 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
   1. Use concealed fasteners and anchors unless indicated to be exposed.
   2. For exterior exposure, furnish stainless steel devices unless otherwise indicated.
   3. Sign Mounting Fasteners:
      a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
      b. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.

B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.05 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
   1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
   2. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

2.06 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.07 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

B. Color Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF DIMENSIONAL CHARACTERS

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:
1. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.

3.03 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
B. Remove temporary protective coverings and strippable films as signs are installed.
C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 19

SECTION 10 14 23 - PANEL SIGNAGE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Panel signs.
   2. Hazardous Material Identification Signage.

B. Related Requirements:
   1. Section 01580 "Project Signs" for temporary Project identification signs and for temporary informational and directional signs.
   2. Section 22 05 53 "Identification for Plumbing Piping and Equipment" for labels, tags, and nameplates for plumbing systems and equipment.
   3. Section 23 05 53 "Identification for HVAC Piping and Equipment" for labels, tags, and nameplates for HVAC systems and equipment.
   4. Section 26 05 53 "Identification for Electrical Systems" for labels, tags, and nameplates for electrical equipment.
   5. Section 26 50 00 "Lighting" for illuminated, self-luminous, and photoluminescent exit sign units.

1.02 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.03 ACTION SUBMITTALS

A. Product Data:
   1. Panel signs.
   2. Hazardous Material Identification Signage.

B. Shop Drawings: For panel signs.
   1. Include fabrication and installation details and attachments to other work.
   2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
   3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
   4. Schedule of Hazardous Material Identification Signage indicating text and graphics.
      a. Provide shop drawings showing type and location of each sign.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
   1. Include representative Samples of available typestyles and graphic symbols.

D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
   1. Panel Signs: Full-size Sample.
   2. Variable Component Materials: Full-size Sample of each base material, character (letter, number, and graphic element) in each exposed color and finish not included in Samples above.
   3. Exposed Accessories: Full-size Sample of each accessory type.
   4. Full-size Samples, if approved, will be returned to Contractor for use in Project.

E. Product Schedule: For panel signs. Use same designations indicated on Drawings or specified.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Sample Warranty: For special warranty.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Variable Component Materials: 12 replaceable text inserts and interchangeable characters (letters, numbers, and graphic elements) of each type.
   2. Tools: One set of specialty tools for assembling signs and replacing variable sign components.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.08 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of finishes beyond normal weathering.
      b. Deterioration of embedded graphic image.
      c. Separation or delamination of sheet materials and components.
   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.
   1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

B. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

2.02 PANEL SIGNS

A. Panel Sign: For room identification and ADA signs with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide ASI Sign Systems, Inc.; SignEtch1 ADA–Ready Sign System or a comparable product by one of the following:
      a. Best Sign Systems, Inc.
      b. Intermarc Signage.
      c. inpro Corporation.
   2. Solid-Sheet Sign: Zinc sheet with finish specified in "Surface Finish and Applied Graphics" Subparagraph and as follows:
      a. Thickness: 0.25 inch (6.35 mm).
      b. Chemically Etched: Sign face chemically etched or routed to receive paint infill.
   3. Sign-Panel Perimeter: Finish edges smooth.

a. Edge Condition:
   1) Vertical Edges: Square cut.
   2) Horizontal Edges: Square cut.
b. Corner Condition in Elevation: Square.

4. Mounting: Surface mounted to wall with adhesive or two-face tape.
5. Surface Finish:
   a. Painted Finish and Graphics: Primer and urethane-based color coat, of type standard with manufacturer, in color as selected by Architect from manufacturer's full range.
   b. Overcoat: Special U.V. resistant clear urethane.
6. Text and Typeface: Accessible raised characters and Grade II Braille 1/32" minimum raised typeface as selected by Architect from manufacturer's full range and variable content as scheduled. Finish raised characters to contrast with background color, and finish Braille to match background color.
7. Flatness Tolerance: Sign is to remain flat or uniformly curved under installed conditions as indicated on Drawings and within a tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally from corner to corner.

2.03 DANGER IDENTIFICATION SIGNAGE:

A. Material: Exterior UV resistant Nonmetallic Signs
B. Fastener: Vinyl tape/adhesive
C. Signs
   1. Size: 7" by 14" minimum
   2. Copy: Ear protection symbol and words: DANGER EAR PROTECTION REQUIRED
   3. Location: Place at all doors to rooms labeled Blower or similar.

2.04 HAZARDOUS MATERIAL IDENTIFICATION SIGNAGE:

A. Material: Exterior UV resistant Nonmetallic Signs
B. Fastener: Vinyl tape/adhesive
C. NFPA Diamond signs per NFPA 704
   1. Size: 10" minimum.
   2. NFPA 704 Diamond hazard numbers: As appropriate for the Hazardous Material per the product's SDS and manufacturer's recommendations.
   3. Location: At the doors entering into the rooms with Hazardous Material and on the tanks or storage containers of Hazardous Materials.
D. Signs indicating Hazardous Material name, with concentration % where applicable
   1. Size: Letters to be 2 inches minimum.
   2. Hazardous Material name and concentration: As identified by the product's SDS and manufacturer's recommendations.
   3. Location: Directly below corresponding NFPA Diamond.
E. Polymer – Sludge Processing Building (stored inside solids processing building)
   1. Products: Seton Identifier NFPA 704 Hazard Rating Sign
   2. Sign Style: 10846b
   3. Health Hazard: 3
   4. Fire Hazard: 1
   5. Reactivity: 0
   6. Specific Hazard: None
F. Hydrogen Peroxide – IPS Odor Control (Stored and fed outside)
   1. Products: Seton Identifier NFPA 704 Hazard Rating Sign
   2. Sign Style: 10846b
   3. Health Hazard: 3

4. Fire Hazard: 0
5. Reactivity: 1
6. Specific Hazard: Ox

2.05 NON-POTABLE WATER IDENTIFICATION SIGNAGE:

A. Material: Aluminum.
B. Fastener: Exposed stainless steel at corners.
C. Signs
   1. Size: 10” wide by 7” high minimum.
   2. Text and Typeface: As selected by Architect from manufacturer's full range.
   3. Copy: NON-POTABLE WATER NOT FOR CONSUMPTION
   4. Pictogram: Do not drink
   5. Location: Place at all non-potable hydrants and hose-bibbs.

2.06 PANEL-SIGN MATERIALS

A. Aluminum Sheet and Plate: ASTM B209 (ASTM B209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
B. Aluminum Extrusions: ASTM B221 (ASTM B221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
C. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).
D. Polycarbonate Sheet: ASTM C1349, Appendix X1, Type II (coated, mar-resistant, UV-stabilized polycarbonate), with coating on both sides.
E. PVC Sheet: Manufacturer's standard, UV-light stable, PVC plastic.
F. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.07 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following unless otherwise indicated:
   1. Use concealed fasteners and anchors unless indicated to be exposed.
   2. For exterior exposure, furnish stainless steel devices unless otherwise indicated.
B. Adhesive: As recommended by sign manufacturer.
C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch (1.14 mm) thick, with adhesive on both sides.
D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.08 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
   1. Preassemble signs in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
   2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
   3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.

4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Internally brace signs for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
6. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

B. Surface-Engraved Graphics: Machine utilizing chemical etc process to produce raised numbers and letters with corresponding Grade II and pictograms, incised to uniform depth.
1. Engraved Metal: Fill engraved graphics with Factory applied baked-on-acrylic polyurethane enamel, UV inhibited.

C. Signs with Changeable Message Capability: Fabricate signs to allow insertion of changeable messages as follows:
1. For slide-in changeable inserts, fabricate slot without burrs or constrictions that inhibit function. Furnish initial changeable insert. Furnish two blank inserts for each sign for Owner's use.

2.09 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.010 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Accessible Signage: Install in locations on walls according to the accessibility standard.
C. Mounting Methods:
   1. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
   2. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position and push to engage tape adhesive.
D. Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign and two-face tape.

3.03 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 23

SECTION 10 22 39 - FOLDING PANEL PARTITIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Operable acoustical panel partitions.

B. Related Requirements:
   1. Section 05 50 00 "Metal Fabrications" for supports that attach supporting tracks to overhead structural system.
   2. Section 09 29 00 "Gypsum Board" for sound barrier construction above the ceiling at track.

1.02 DEFINITIONS

A. NIC: Noise Isolation Class.

B. NRC: Noise Reduction Coefficient.

C. STC: Sound Transmission Class.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.04 ACTION SUBMITTALS

A. Product Data:
   1. Operable acoustical panel partitions.
   2. Operable fire-rated panel partitions.

B. Shop Drawings: For operable panel partitions.
   1. Include plans, elevations, sections, and attachment details.
   2. Indicate stacking and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.
   3. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: For each type of exposed material, finish, covering, or facing.
   1. Include Samples of accessories involving color selection.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Partition track, track supports and bracing, switches, turning space, and storage layout.
   2. Suspended ceiling components.
   3. Structural members to which suspension systems will be attached.
   4. Size and location of initial access modules for acoustical tile.
   5. Items penetrating finished ceiling including the following:
      a. Lighting fixtures.
      b. HVAC ductwork, outlets, and inlets.
      c. Speakers.
      d. Sprinklers.
      e. Smoke detectors.
      f. Access panels.
   6. Plenum acoustical barriers.

B. Setting Drawings: For embedded items and cutouts required in other work, including support-beam, mounting-hole template.

C. Qualification Data: For Installer.
D. Product Certificates: For each type of operable panel partition.
   1. Include approval letter signed by manufacturer acknowledging Owner-furnished panel facing material complies with requirements.
E. Product Test Reports: For each operable panel partition, for tests performed by a qualified testing agency.
F. Field quality-control reports.
G. Sample Warranty: For manufacturer's special warranty.

1.06 CLOSEOUT SUBMITTALS
A. Operation and Maintenance Data: For operable panel partitions to include in maintenance manuals.
   1. In addition to items specified in Section 01021 "Operation and Maintenance Data," include the following:
      a. Panel finish facings and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.
      b. Seals, hardware, track, track switches, carriers, and other operating components.

1.07 MAINTENANCE MATERIAL SUBMITTALS
A. Furnish extra materials, from the same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Panel Finish-Facing Material: Furnish full width in quantity to cover both sides of two panels when installed.

1.08 QUALITY ASSURANCE
A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.09 DELIVERY, STORAGE, AND HANDLING
A. Protectively package and sequence panels in order for installation. Clearly mark packages and panels with numbering system used on Shop Drawings. Do not use permanent markings on panels.

1.010 WARRANTY
A. Special Warranty: Manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Faulty operation of operable panel partitions.
      b. Deterioration of metals, metal finishes, and other materials beyond normal use.
   2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS
A. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties in accordance with test methods indicated:
   1. Sound-Transmission Requirements: Operable panel partition assembly tested for laboratory sound-transmission loss performance in accordance with ASTM E90, determined by ASTM E413, and rated for not less than the STC indicated.

2. Noise-Reduction Requirements: Operable panel partition assembly, identical to partition tested for STC, tested for sound-absorption performance in accordance with ASTM C423, and rated for not less than the NRC indicated.
3. Noise-Isolation Requirements: Installed operable panel partition assembly, identical to partition tested for STC, tested for NIC in accordance with ASTM E336, determined by ASTM E413, and rated for 10 dB less than STC value indicated.

B. Fire-Test-Response Characteristics: Provide panels with finishes complying with one of the following as determined by testing identical products by a testing and inspecting agency acceptable to authorities having jurisdiction:
1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.
2. Fire Growth Contribution: Complying with acceptance criteria of local code and authorities having jurisdiction when tested in accordance with NFPA 265 Method B Protocol or NFPA 286.

2.02 OPERABLE ACOUSTICAL PANEL PARTITIONS

A. Operable Acoustical Panel Partitions: Partition system, including panels, seals, finish facing, suspension system, operators, and accessories.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Hufcor, Inc., 642 series
b. Moderco Inc., Signature 842
c. Modernfold, Inc.

B. Panel Operation: Manually operated, paired panels.

C. Panel Construction: As required to support panel from suspension components and with reinforcement for hardware attachment. Fabricate panels with tight hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.

D. Dimensions: Fabricate operable acoustical panel partitions to form an assembled system of dimensions indicated and verified by field measurements.
1. Panel Width: Equal widths.

E. STC: Not less than 52.

F. Panel Weight: 10 lb/sq. ft. (50 kg/sq. m) maximum.

G. Panel Thickness: Nominal dimension of 4 inches (102 mm).

H. Panel Materials:
1. Steel Frame: Steel sheet, 0.0641-inch (1.6-mm) nominal minimum thickness for uncoated steel.
2. Steel Face/Liner Sheets: Tension-leveled steel sheet, manufacturer's standard minimum nominal thickness for uncoated steel.
3. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use, corrosion resistance, and finish indicated; ASTM B221 (ASTM B221M) for extrusions; manufacturer's standard strengths and thicknesses for type of use.
a. Frame Reinforcement: Manufacturer's standard steel or aluminum.
4. Gypsum Board: ASTM C1396/C1396M.
5. Cement Board: ASTM C1288.
6. Particleboard: ANSI A208.1.
7. Medium-Density Fiberboard: ANSI A208.2.
8. Plywood: DOC PS 1.

I. Panel Closure: Manufacturer's standard unless otherwise indicated.
   1. Initial Closure: Resilient, bulb-shaped acoustical seal.
   2. Final Closure: Constant-force, lever-operated mechanical closure expanding from panel edge to create a constant-pressure acoustical seal.

J. Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.
   1. Hinges: Concealed (invisible).

K. Finish Facing: Steel markerboard.

2.03 SEALS

A. Description: Seals that produce operable panel partitions complying with performance requirements and the following:
   1. Manufacturer's standard seals unless otherwise indicated.
   2. Seals made from materials and in profiles that minimize sound leakage.
   3. Seals fitting tight at contact surfaces and sealing continuously between adjacent panels and between operable panel partition perimeter and adjacent surfaces, when operable panel partition is extended and closed.

B. Vertical Seals: Deep-nesting, interlocking astragals mounted on each edge of panel, with continuous, resilient acoustical seal.

C. Horizontal Top Seals: resilient, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on track when extended.

D. Horizontal Bottom Seals:
   1. Resilient, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on floor when extended, ensuring horizontal and vertical sealing and resisting panel movement.
      a. Automatically Operated for Acoustical Panels: Extension and retraction of bottom seal automatically operated by movement of partition, with operating range not less than 2 inches (50 mm) between retracted seal and floor finish.

2.04 PANEL FINISH FACINGS

A. Description: Finish facings for panels that comply with indicated fire-test-response characteristics and that are factory applied to operable panel partitions with appropriate backing, using mildew-resistant nonstaining adhesive as recommended by facing manufacturer's written instructions.
   1. Apply one-piece, seamless facings free of air bubbles, wrinkles, blisters, and other defects, with no gaps or overlaps. Horizontal seams are not permitted. Tightly secure and conceal raw and selvage edges of facing for finished appearance.
   2. Full height steel marker board Color/Pattern: As selected by Architect from manufacturer's full range.

B. Trimless Edges: Fabricate exposed panel edges so finish facing wraps uninterrupted around panel, covering edge and resulting in an installed partition with facing visible on vertical panel edges, without trim, for minimal sightlines at panel-to-panel joints.

2.05 SUSPENSION SYSTEMS

A. Tracks: Steel or aluminum with adjustable steel hanger rods for overhead support, designed for operation, size, and weight of operable panel partition indicated. Size track to support partition operation and storage without damage to suspension system, operable panel partitions, or adjacent construction. Limit track deflection to no more than 0.10 inch (2.54 mm) between bracket supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.

B. Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.
C. Aluminum Finish: Mill finish or manufacturer's standard, factory-applied, decorative finish unless otherwise indicated.
D. Steel Finish: Manufacturer's standard, factory-applied, corrosion-resistant, protective coating unless otherwise indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine flooring, floor levelness, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF OPERABLE PANEL PARTITIONS

A. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed in area of partition installation.
B. Install panels in numbered sequence indicated on Shop Drawings.
C. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.
D. Broken, cracked, deformed, or unmatched gasketing or gasketing with gaps at butted ends is not acceptable.
E. Light-Leakage Test: Illuminate one side of partition installation and observe vertical joints and top and bottom seals for voids. Adjust partitions for alignment and full closure of vertical joints and full closure along top and bottom seals.

3.03 ADJUSTING

A. Adjust operable panel partitions, hardware, and other moving parts to function smoothly, and lubricate as recommended by manufacturer.
B. Verify that safety devices are properly functioning.

3.04 MAINTENANCE SERVICE

A. Maintenance Service: Beginning at Substantial Completion, maintenance service is to include 12 months' full maintenance by manufacturer's authorized service representative. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operable-partition operation. Parts and supplies are to be manufacturer's authorized replacement parts and supplies.

END OF SECTION 10 22 39

SECTION 10 28 00 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Public-use washroom accessories.
   2. Public-use shower room accessories.
   3. Underlavatory guards.
   4. Custodial accessories.

1.02 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.03 ACTION SUBMITTALS

A. Product Data:
   1. Public-use washroom accessories.
   2. Public-use shower room accessories.
   3. Underlavatory guards.
   4. Custodial accessories.

B. Product Data Submittals: For each product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
   1. Identify locations using room designations indicated.
   2. Identify accessories using designations indicated.

1.04 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranties.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.06 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, visible silver spoilage defects.
   2. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Structural Performance: Design accessories and fasteners to comply with the following requirements:
   1. Grab Bars: Installed units are able to resist 250 lbf (1112 N) concentrated load applied in any direction and at any point.
   2. Shower Seats: Installed units are able to resist 360 lbf (1601 N) concentrated load applied in any direction and at any point.

2.02 PUBLIC-USE WASHROOM ACCESSORIES

A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.

B. Toilet Tissue (Roll) Dispenser RA11:
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. GP Pro; Georgia Pacific, LLC.
   2. Description: Quad-roll dispenser.
   3. Mounting: Surface mounted.
   4. Capacity: Designed for 4-1/2- or 5-inch- (114- or 127-mm-) diameter tissue rolls.
   5. Material and Finish: ABS plastic, black.

C. Automatic Paper Towel (Roll) Dispenser RA10:
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. GP Pro; Georgia Pacific, LLC.
   2. Description: Automatic motion-sensing mechanism with user-adjustable delay and paper towel length; battery powered.
   3. Mounting: Surface mounted.
   4. Minimum Capacity: 8-inch- (203-mm-) wide, 800-foot- (244-m-) long roll.
   5. Material and Finish: ABS plastic, black.
   6. Lockset: Tumbler type.

D. Waste Receptacle RA14:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ASI-American Specialties, Inc.
      b. Bobrick Washroom Equipment, Inc.
      c. Bradley Corporation.
   2. Mounting: Surface mounted.
   3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

E. Waste Receptacle RA16:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ASI-American Specialties, Inc.
      b. Bobrick Washroom Equipment, Inc.
      c. Bradley Corporation.
   2. Mounting: Undercounter.
   3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

F. Countertop-Mounted Circular Waste Chute RA15:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ASI-American Specialties, Inc.

b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.

2. OD: 6 inches (152 mm).
3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

G. Automatic Soap Dispenser RA12:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
a. GP Pro; Georgia Pacific, LLC.
2. Description: Automatic dispenser with infrared sensor to detect presence of hands; battery powered; designed for dispensing soap in liquid or lotion form.
3. Mounting: Surface mounted.
4. Refill Indicator: LED indicator.
5. Low-Battery Indicator: LED indicator.

H. Grab Bar RA1 & RA2:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. ASI-American Specialties, Inc.
b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.
a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin).
4. Outside Diameter: 1-1/2 inches (38 mm).
5. Configuration and Length: As indicated on Drawings.

I. Mirror Unit RA3 & RA4:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. ASI-American Specialties, Inc.
b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.
2. Frame: Stainless steel channel.
a. Corners: Welded and ground smooth.
3. Size: As indicated on Drawings.
4. Hangers: Manufacturer's standard rigid, tamper and theft resistant.

J. Hook RA6:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. ASI-American Specialties, Inc.
b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.
2. Description: Double-prong unit.
3. Mounting: Concealed.
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

2.03 PUBLIC-USE SHOWER ROOM ACCESSORIES

A. Source Limitations: Obtain public-use shower room accessories from single source from single manufacturer.

B. Shower Curtain Rod RA5:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. ASI-American Specialties, Inc.

b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.

2. Description: 1-1/4-inch- (32-mm-) outside diameter, straight rod.
3. Configuration: As indicated on Drawings
4. Mounting Flanges: Concealed fasteners; in material and finish matching rod.
5. Rod Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

C. Shower Curtain RA5:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. ASI-American Specialties, Inc.
b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.
2. Size: Minimum 12 inches (305 mm) wider than opening by 72 inches (1829 mm) high.
3. Material: Nylon-reinforced vinyl, minimum 9 oz. (255 g) or 0.008-inch- (0.2-mm-) thick vinyl, with integral antibacterial and flame-retardant agents.
4. Color: White.
5. Grommets: Corrosion resistant at minimum 6 inches (152 mm) o.c. through top hem.
6. Shower Curtain Hooks: Chrome-plated or stainless steel, spring wire curtain hooks with snap fasteners, sized to accommodate specified curtain rod. Provide one hook per curtain grommet.

D. Soap Dish RA17:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. ASI-American Specialties, Inc.
b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.
2. Description: Surface mounted, with the following features:
a. Washcloth bar.
3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

E. Robe Hook RA6:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. ASI-American Specialties, Inc.
b. Bobrick Washroom Equipment, Inc.
c. Bradley Corporation.
2. Description: Double-prong unit.
3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

2.04 UNDERLAVATORY GUARDS

A. Underlavatory Guard RA18:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Buckaroos, Inc.
b. Dearborn, an Oatey Company.
c. Plumberex Specialty Products, Inc.
d. Truebro; IPS Corporation.
2. Description: Soft Molded PVC insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
3. Material and Finish: Antimicrobial, molded plastic, white.

2.05 CUSTODIAL ACCESSORIES

A. Source Limitations: Obtain custodial accessories from single source from single manufacturer.

B. Custodial Mop and Broom Holder RA7:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ASI-American Specialties, Inc.
   b. Bobrick Washroom Equipment, Inc.
   c. Bradley Corporation.
2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
3. Length: 36 inches (914 mm).
4. Hooks: Four.
5. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
   a. Shelf: Not less than nominal 0.05-inch- (1.3-mm-) thick stainless steel.

2.06 MATERIALS

A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch- (0.8-mm-) minimum nominal thickness unless otherwise indicated.

B. Brass: ASTM B19, flat products; ASTM B16/B16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B30, castings.

C. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel), 0.036-inch- (0.9-mm-) minimum nominal thickness.

D. Galvanized-Steel Sheet: ASTM A653/A653M, with G60 (Z180) hot-dip zinc coating.

E. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.

F. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer or specified in this Section, and tamper and theft resistant where exposed, and of stainless or galvanized steel where concealed.

G. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.07 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install accessories in accordance with manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

1. Remove temporary labels and protective coatings.

B. Grab Bars: Install to comply with specified structural-performance requirements.

C. Shower Seats: Install to comply with specified structural-performance requirements.

3.02 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Clean and polish exposed surfaces in accordance with manufacturer's written instructions.

END OF SECTION 10 28 00

SECTION 10 44 13 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Fire-protection cabinets for the following:
      a. Portable fire extinguisher.

B. Related Requirements:
   1. Section 10 44 16 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets

1.02 PREINSTALLATION CONFERENCE

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to fire-protection cabinets, including, but not limited to, the following:
      a. Schedules and coordination requirements.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.

B. Shop Drawings: For fire-protection cabinets.
   1. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required.

D. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.05 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

2.03 FIRE-PROTECTION CABINET FE-1

A. Cabinet Type: Suitable for fire extinguisher.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Babcock-Davis.
   b. Guardian Fire Equipment, Inc.
   c. Larsens Manufacturing Company.
   d. Nystrom.

B. Cabinet Construction: Nonrated.

C. Cabinet Material: Aluminum sheet.

D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
   1. Square-Edge Trim: 1-1/4- to 1-1/2-inch (32- to 38-mm) backbend depth.

E. Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with no trim.

F. Cabinet Trim Material: Same material and finish as door.

G. Door Material: Aluminum sheet.

H. Door Style: Solid opaque panel with frame.

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
   1. Provide recessed door pull and friction latch.
   2. Provide continuous hinge, of same material and finish as trim,, permitting door to open 180 degrees.

J. Accessories:
   1. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.
      a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
         1) Location: Applied to cabinet door.
         2) Application Process: Pressure-sensitive vinyl letters.
         3) Lettering Color: Black.
         4) Orientation: Vertical.

K. Materials:
   1. Aluminum: ASTM B221 (ASTM B221M) for extruded shapes and aluminum sheet, with strength and durability characteristics of not less than Alloy 6063-T5 for aluminum sheet.
      a. Finish: Clear anodic.

2.04 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
   1. Weld joints and grind smooth.
   2. Miter corners and grind smooth.
   3. Provide factory-drilled mounting holes.
   4. Prepare doors and frames to receive locks.
   5. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (13 mm) thick.
   6. Miter and weld perimeter door frames and grind smooth.

B. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.05 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
C. Finish fire-protection cabinets after assembly.
D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semi-recessed cabinets will be installed.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prepare recesses for semi-recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.03 INSTALLATION

A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at height indicated below:
   1. Fire-Protection Cabinet Mounting Height: 42 inches (1067 mm) above finished floor to top of fire extinguisher.
B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
   1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semi-recessed fire-protection cabinets.
C. Identification:
   1. Apply vinyl lettering at locations indicated.

3.04 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
D. Touch up marred finishes or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 44 13

SECTION 10 44 16 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

B. Related Requirements:

1. Section 10 44 13 "Fire Protection Cabinets."

1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to fire extinguishers including, but not limited to, the following:

a. Schedules and coordination requirements.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.04 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.06 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.07 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10 when testing interval required by NFPA 10 is within the warranty period.

b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.02 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Amerex Corporation.
      b. Babcock-Davis.
      c. Kidde; Carrier Global Corporation.
      d. Larsen's Manufacturing Company.
      e. Nystrom, Inc.
   2. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.
   3. Valves: Nickel-plated, polished-brass body.
   4. Handles and Levers: Stainless steel.
   5. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type in Aluminum Container FE-1 & FE-2: UL-rated 2-A:10-B:C, 5-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-aluminum container.

C. Clean-Agent Type in Brass Container FE-3: UL-rated 2-A: 10-B:C, 15.5-lb nominal capacity, with HCFC Blend B agent and inert material in chrome-plated-brass container; with pressure-indicating gage.

2.03 MOUNTING BRACKETS FE-2

A. Mounting Brackets: Manufacturer's standard stainless steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
   1. Source Limitations: Obtain mounting brackets and fire extinguishers from single source from single manufacturer.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
   1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
      a. Orientation: Vertical.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.
   1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.

END OF SECTION 10 44 16

SECTION 10 51 13 - METAL LOCKERS

PART 1 - GENERAL

1.01 SUMMARY
- A. Section Includes:
  1. Welded athletic lockers.
  2. Locker benches.

1.02 PREINSTALLATION MEETINGS
- A. Preinstallation Conference: Conduct conference at Project site.

1.03 ACTION SUBMITTALS
- A. Product Data: For each type of product.
  1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker and bench.
- B. Shop Drawings: For metal lockers.
  1. Include plans, elevations, sections, and attachment details.
  2. Show locker trim and accessories.
  3. Include locker identification system and numbering sequence.
- C. Samples: For each color specified, in manufacturer's standard size.
- D. Product Schedule: For lockers. Use same designations indicated on Drawings.

1.04 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For Installer.
- B. Sample Warranty: For special warranty.

1.05 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS
- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. The following metal locker hardware items equal to 10 percent of amount installed for each type and finish installed, but no fewer than two units:
     a. Locks.
     b. Blank identification plates.
     c. Hooks.

1.07 DELIVERY, STORAGE, AND HANDLING
- A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

1.08 FIELD CONDITIONS
- A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.09 COORDINATION
- A. Coordinate sizes and locations of concrete bases for metal lockers.

B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.010 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures.
      b. Faulty operation of latches and other door hardware.
   2. Damage from deliberate destruction and vandalism is excluded.
   3. Warranty Period for Welded Metal Lockers: Lifetime from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain metal lockers and accessories from single source from single locker manufacturer.
   1. Obtain locks from single lock manufacturer.

2.02 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: For lockers indicated to be accessible, comply with applicable provisions in ICC A117.1.

2.03 WELDED ATHLETIC LOCKERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. ASI Storage Solutions.
   2. Lyon LLC.
   3. Penco Products, Inc.

B. Perforated Doors: One piece; fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet with manufacturer's standard diamond perforations; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges and latch point (bottom) and right-angle single bend at remaining edges for box lockers.
   1. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches (381 mm) wide; welded to inner face of doors.

C. Expanded-Metal Doors: Fabricated from 0.090-inch (2.28-mm) nominal-thickness expanded metal; welded to 0.105-inch (2.66-mm) nominal-thickness steel angle frame; with 0.090-inch (2.28-mm) nominal-thickness, steel sheet lock panel backed by 0.060-inch (1.52-mm) nominal-thickness, steel sheet retainer welded to door frame.

D. Body: Assembled by welding body components together. Fabricate from unperforated steel sheet with thicknesses as follows:
   1. Tops and Bottoms: 0.060-inch (1.52-mm) nominal thickness, with single bend at edges.
   2. Backs: 0.048-inch (1.21-mm) nominal thickness.
   3. Shelves: 0.060-inch (1.52-mm) nominal thickness, with double bend at front and single bend at sides and back.

E. Unperforated Sides: Fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet.

F. Frames: Channel formed; fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet or 0.097-inch (2.45-mm) nominal-thickness steel angles; lapped and factory welded at corners;

with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.

G. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.
   1. Continuous Hinges: Manufacturer's standard, steel; side or top mounted as required by locker configuration.

H. Recessed Door Handle and Latch: Stainless steel cup with integral door pull, recessed so locking device does not protrude beyond door face; pry and vandal resistant.
   1. Multipoint Latching: Finger-lift latch control designed for use with built-in combination locks, built-in cylinder locks, or padlocks; positive automatic latching and prelocking.
      a. Latch Hooks: Equip doors 48 inches (1219 mm) and higher with three latch hooks and doors less than 48 inches (1219 mm) high with two latch hooks; fabricated from 0.120-inch (3.04-mm) nominal-thickness steel sheet; welded to full-height door strikes; with resilient silencer on each latch hook.
      b. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.

I. Locks: Combination padlocks.

J. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch (9 mm) high.

K. Hooks: Manufacturer's standard ball-pointed, aluminum or steel; zinc plated. Minimum three per locker.

L. Continuous Sloping Tops: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet, with a pitch of approximately 20 degrees.
   1. Closures: Vertical-end type.

M. Filler Panels: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.

N. Boxed End Panels: Fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet.

O. Finished End Panels: Fabricated from 0.024-inch (0.61-mm) nominal-thickness steel sheet to cover unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

P. Materials:
   1. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with A60 (ZF180) zinc-iron, alloy (galvannealed) coating designation.
   2. Expanded Metal: ASTM F1267, Type II (flattened), Class I (uncoated), 3/4-inch (19-mm) steel mesh, with at least 70 percent open area.

Q. Finish: Baked enamel or powder coat.
   1. Color: As selected by Architect from manufacturer's full range.

2.04 LOCKS

A. Combination Padlock: Provided by Owner.

2.05 FABRICATION

A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.
   1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
   2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.

B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.
C. Equipment: Provide each locker with an identification plate and the following equipment:
   1. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.
D. Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections; with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds smooth and flush.
E. Accessible Lockers: Fabricate as follows:
   1. Locate bottom shelf no lower than 15 inches (381 mm) above the floor.
   2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches (1219 mm) above the floor.
F. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.
G. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.
H. Finished End Panels: Fabricated to conceal unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.
   1. Provide one-piece panels for double-row (back-to-back) locker ends.

2.06 ACCESSORIES
A. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.
B. Anchors: Material, type, and size required for secure anchorage to each substrate.
   1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts for corrosion resistance.
   2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

PART 3 - EXECUTION

3.01 EXAMINATION
A. Examine walls and floors or support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION
A. Install lockers level, plumb, and true; shim as required, using concealed shims.
   1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches (910 mm) o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
   2. Anchor single rows of metal lockers to walls near top and bottom of lockers.
   3. Anchor back-to-back metal lockers to floor.
B. Welded Lockers: Connect groups together with manufacturer's standard fasteners, with no exposed fasteners on face frames.
C. Equipment:
   1. Attach hooks with at least two fasteners.
   2. Attach door locks on doors using security-type fasteners.
   3. Identification Plates: Identify metal lockers with identification indicated on Drawings.

a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
b. Attach plates to upper shelf of each open-front metal locker, centered, with a least two aluminum rivets.

D. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
1. Attach recess trim to recessed metal lockers with concealed clips.
2. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings.
3. Attach sloping-top units to metal lockers, with closures at exposed ends.
4. Attach finished end panels using fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.

3.03 ADJUSTING

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.

3.04 PROTECTION

A. Protect metal lockers from damage, abuse, dust, dirt, stains, or paint. Do not permit use during construction.
B. Touch up marred finishes or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 10 51 13

SECTION 10 73 16 - CANOPIES

PART 1 - GENERAL

1.01 SUMMARY:

A. Freestanding, pre-engineered metal canopies including concrete foundation, steel framing, metal roof, roof drains and leaders, fascia components, metal ceiling and accessories.

B. Attached, pre-engineered aluminum canopies including framing, metal roof, roof drains and leaders, fascia components, metal ceiling and accessories.

1.02 RELATED SECTIONS:

A. Section 03 30 00 - Cast-In-Place Concrete: Concrete islands and curbing.

B. Division 5 - Steel.

C. Section 07 92 00 - Joint Sealants.

1.03 REFERENCES:

A. American Institute of Steel Construction, Inc. (AISC): AISC 360 - Specification for Structural Steel Buildings (copyrighted by AISC, ANSI approved).

B. American Society of Civil Engineers (ASCE): ASCE 7 - Minimum Design Loads for Buildings and Other Structures (copyrighted by ASCE, ANSI approved).

C. American Welding Society (AWS):

1. AWS D1.1 - Structural Welding Code - Steel (copyrighted by AWS, ANSI approved).
2. AWS D1.2 – Structural Welding Code – Aluminum

D. ASTM International (ASTM):

1. ASTM A 36/A 36M - Standard Specification for Structural Steel.

E. National Association of Architectural Metal Manufacturers (NAAMM): NAAMM MFM - Metal Finishes Manual.

F. National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code (copyrighted by NFPA, ANSI approved) - hereinafter referred to as NEC.

G. American Architectural Manufacturers Association (AAMA):

1. Aluminum finishes AAMA 2603 Powder Coat
2. Aluminum finishes AAMA 2605 Kynar
3. Aluminum finishes AAMA 611 Anodize

1.04 PERFORMANCE REQUIREMENTS:

A. Structural Performance: Provide pre-engineered canopies capable of withstanding the effects of gravity, wind, seismic, snow, thermal and other project specific load conditions as required by the current building code for the site-specific location where canopy is installed:

1. Minimum design loads per ACSE 7.
2. Project Specific design requirements refer to structural general notes.
3. Design shall provide for the effect of unbalanced , drift and sliding snow loads.

B. Thermal Movements: Provide pre-engineered canopies that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), material surfaces.

1.05 SUBMITTALS:

A. General: Submit under provisions of Section 01300 - Submittal Procedures.

B. Product Data: Submit manufacturer's data sheets on each product to be used, including:

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.

C. Shop Drawings: Submit shop drawings. Include plans, elevations, sections, details, and attachments to other work. Canopy supplier shall furnish complete canopy drawings signed and sealed by a professional engineer licensed in the state where the canopy shall be installed.

D. Samples:

1. Submit samples for initial color selection. Submit samples of each specified finish. Submit samples in form of manufacturer's color charts showing full range of colors and finishes available. Where finishes involve normal color variations, include samples showing the full range of variations expected.

E. Certificates: Submit product certificates signed by the manufacturer certifying material compliance with specified performance characteristics and criteria, and physical requirements.

F. Warranty Data: Submit warranty documents specified herein.

1.06 QUALITY ASSURANCE:

A. Manufacturer Qualifications: Company specializing in engineering and manufacturing pre-engineered canopies and with an in-house quality inspection program.

B. Welding: Qualify procedures and personnel according to the following:

1. Welding shall be in accordance with AWS D1.1 (with E70XX electrodes).
2. Steel shop connections shall be welded and field connections shall be bolted (unless otherwise noted on the Drawings). Shop welds may be changed to field welds with the approval of the project engineer.
3. Slag shall be cleaned from welds and inspected. Steel shall be painted with red oxide rust-inhibitive primer (unless galvanizing specified).

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Source Limitations: Obtain pre-engineered metal canopy through one source from a single manufacturer who shall manufacture and install the canopy.

E. Product:

1. Information on the Drawings and in the Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance. Do not modify intended aesthetic effects, as judged solely by the Architect, except with the Architect's approval. If modifications are proposed, submit comprehensive explanatory data to the Architect for review.
2. The Drawings indicate size, profiles, and dimensional requirements of pre-engineered metal canopies and are based on the specific system indicated. Do not modify intended aesthetic effects, as judged solely by the Architect, except with the Architect's approval. If modifications are proposed, submit comprehensive explanatory data to the Architect for review.

F. Coordination:

1. The Contractor to conduct site meetings to verify project requirements, substrate

conditions, utility connections, manufacturer's drawings and installation instructions. Comply with Division 1 section on project meetings.

2. The contractor shall prepare for and pour the concrete footers for the pre-engineered metal canopies. Manufacturer shall furnish recommended footing drawings as per IBC Section 18 07 .3 and prints and rebar details for concrete footings, as well as provide anchor bolts to be embedded in concrete footer. Such items shall be delivered to project site in time for installation.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Protect components and accessories from corrosion, deformation, damage, and deterioration when stored at job site. Keep materials free from dirt and foreign matter.

1.08 PROJECT CONDITIONS:

A. Field Measurements: Verify location and elevation of footings relative to finished grade, columns, and other construction contiguous with pre-engineered metal canopies by field measurements before fabrication and indicate measurements on shop drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the work, establish dimensions and proceed with fabricating metal canopies without field measurements. Contractor is responsible to coordinate footer locations and elevations with any interferences with or attachments to abutting structures.

1.09 WARRANTY:

A. Manufacturer warrantees the products to be free of defects in materials, leaks, and workmanship for 1 year from date of shipment.

1. 20-year limited warranty against peeling, flaking, chipping of canopy deck when properly maintained, and passes on manufacturer's warrantees for accessory items and replacement of materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS:

A. Acceptable freestanding canopy Manufacturer: Austin Mohawk and Company, Inc., or as approved by Architect.

B. Acceptable attached aluminum canopy Manufacturer: Architectural Fabrication, Inc. – Atlas Canopy, or as approved by Architect.

2.02 FREE STANDING CANOPY MATERIALS:

A. Structural Steel:

1. Material and work shall conform to the latest AISC 360.
2. Structural steel shall be hot-dip-galvanized.

B. Sheet Metal:

1. Decking: 3 inch (76 mm) by 16 inch (406 mm) by 20 gage smooth white, ASTM A 653/A 653M GR40, Fy = 40 ksi, galvanized steel with baked enamel finish.
2. Center and Tapered Gutter: 20 gage hot-dip galvanized steel baked enamel finish.
3. Perimeter Gutter: 20 gage hot-dip galvanized steel baked enamel finish.
4. Internal Downspout: 3 inch (76 mm) diameter PVC

C. General: Provide a complete, integrated set of manufacturer's standard design canopy components to form a pre-engineered canopy ready for installation on project site. Canopy steel framing consists of using stacked wide-flange roof beams which transfer loads to columns.

Columns are designed as fixed base elements to transfer vertical & lateral loads and moments to concrete foundations. Columns are typically located in an area of site protected from drive lane traffic. Pre-engineered metal canopy shall be designed to meet all site specific design loads per Section 1.4.A or project specific requirements.

D. Canopy Fascia:
   1. Aluminum Composite Panel (ACM): Available with a fluorocarbon paint finish, masked on one side. Shall be warranted for 10 years depending on color and finish selection.
   2. Fascia: Various custom fascia to meet design requirements such as architectural shingle, EIFS, standing seam panels.

E. Canopy Finishes: Comply with NAAMM MFM for recommendations for applying and designating finishes.
   1. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.

F. Fabrication: Fabricate pre-engineered canopies completely in factory.

2.03 FREE STANDING CANOPY MATERIALS:

A. Framing: Aluminum gutter beams

B. Soffits: Pac-Clad, Berridge or equal Pre-finished Kynar sheet metal. 12” wide panels attached to 18ga galvanized c-channel

C. Hanger Rods: Zinc steel and powder coat (Prime and paint are not acceptable)

D. Connections: Wall plates and canopy mounting brackets are to be aluminum.

E. Hardware and Fasteners: Nuts, bolts, washers, clevis pins, screws, anchors and pipe spacers to be zinc plated or galvanized steel required to suit application and per pre-engineered canopy load requirements.

F. Flashing: Shall be minimum 0.040 inch aluminum, fabricated to prevent leakage and sealed with Novaflex metal roof sealant in clear or color match. Other equivalent sealant is acceptable.

G. Fascia: Flat aluminum 5052 alloy sheet .063 to .125 thickness – depending on height. Finish:
   1. Anodize per AAMA 611
   2. Powder coat per AAMA 2603
   3. Kynar per AAMA 2605

H. Fabricate and preassemble canopies in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

PART 3 EXECUTION

3.01 EXAMINATION:

A. Verification of Conditions: Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Owner and the Architect, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
   1. Examine supporting foundations for compliance with manufacturer's requirements, including installation tolerances and other conditions affecting performance of supporting members.
   2. Verify the rough-in of required mechanical and electrical services prior to placement.

3.02 PREPARATION:

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION:

A. Set pre-engineered metal canopy plumb and aligned. Level base plates true to plane with full bearing on concrete bases.

B. Use concealed anchors where possible.

C. Fasten pre-engineered metal canopy columns to anchor bolts and/or foundation bolts.

D. Provide anchor bolts as follows:

1. Anchor bolts or foundation bolts will be set by the Owner in accordance with approved site-specific drawings. They must not vary from the size and dimensions shown on the erection drawings. Use of a plywood template is recommended. Remove template prior to column erection.
2. Anchor bolts shall conform to ASTM F1554 grade 55 and shall have a minimum of 7 inches (178 mm) of exposed thread and 23 inch (584 mm) minimum embedment with 1-1/4 inch (32 mm) nut and washer as embedment end.

E. Provide bolted connections as follows:

1. Structural erection bolts shall conform to ASTM A 325/A 325M.
2. Bolts shall be tightened to snug tight per latest RCSC specifications (unless otherwise specified).

F. Provide screws as follows:

1. Fastening shall be performed per installation prints provided by the manufacturer.
2. Self-drilling and self-tapping screws shall have a sufficient cut point and a 1/2 inch (13 mm) outside diameter dished metal-backed neoprene washer to be used in water sealing applications.

G. Provide pedestrian protection and warnings during construction which comply with local, Federal, and OSHA codes.

H. Prior to steel erection of any kind, the Contractor shall grade, backfill and otherwise prepare the job site to allow for rolling scaffold and ensure safe working conditions including the removal or relocation of overhead power lines.

I. Any grade or elevation situations which deviate from the approved manufacturer's plans shall be conveyed to the manufacturer prior to fabrication.

J. All anchor bolts and/or leveling plates shall be set within 1/4-inch (6 mm) tolerance on layout and grade level.

K. Temporary electrical power shall be provided.

L. Connect electrical power service to power distribution system according to requirements specified in Division 16 - Electrical.

M. Dumpster for trash and debris shall be provided by the Contractor.

3.04 ADJUSTING AND CLEANING:

A. After completing installation, inspect exposed finishes and repair damaged finishes.

3.05 PROTECTION:

A. Protect installed products until completion of project.

B. Touch-up, repair, or replace damaged products before Substantial Completion.

END OF SECTION 10 73 16

DIVISION 11 – EQUIPMENT

SECTION 11 24 29.17 – HORIZONTAL LIFELINE FALL PROTECTION SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY:

A. Section Includes:

1. Fall Protection Systems to allow users to walk uninterrupted the entire length of each system and provide secure anchorage to arrest a fall by the users. All components, including user equipment, shall be included, to provide a complete and fully operational system. The fall protection systems shall be supported by anchors which are permanently attached to structure. This system is not to be designed or utilized for suspended equipment operations.

1.02 REFERENCES:

A. American National Standards Institute (ANSI):

1. Z359 - Fall Protection Code most current edition

B. Occupational Health and Safety Administration (OSHA):

1. 1926.502 Fall Prevention Systems and Criteria and Practices most current edition.
2. 1910.140 Personal Fall Protection Systems
3. State Administrative Code Safety Standards for Fall Restraint and Fall Arrest

C. International Building Code

D. American Welding Society (AWS):

1. Structural specification D1.1

E. American Society for Testing and Materials (ASTM):

1. A36-05a: Standard Specification for Carbon Structural Steel.

1.03 PREINSTALLATION MEETINGS:

A. Preinstallation Conference: Conduct conference at Project site.

1.04 ACTION SUBMITTALS:

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles.

1. Horizontal Lifeline Fall Protection Systems.

B. Manufacturer's Instructions: Manufacturer's Instructions indicating the manufacturer's recommended method and sequence of installation shall be submitted for the following:

1. Energy absorbing devices
2. Horizontal Lifeline Cable and associated components

C. Shop Drawings: Provide pre-installation design drawings and system specifications, with each page stamped by the designing engineer.

1. A statement defining the type of system: fall arrest, fall restraint, etc.
2. A drawing showing the layout of the system, including where it is located on the structure and the complete assembly of all components. The drawings shall be specific to the site and location of the project.
3. A specification of the number, location and qualifications of workers using the system.
4. Specifications for all components, including sizes and minimum breaking strengths. The specifications shall reference applicable standards and/or fully specify the makes and models of the components.
5. A description of any proof testing required before the system may be put into use.

6. A specification of any environmental limitations on the use of the fall protection system, such as chemical, temperature, radiation or weather factors that may temporarily or permanently render the system unsafe to use.
7. Information on the expected performance of the system:
   a. Maximum arrest load unfactored
   b. Maximum loadings of all components unfactored
   c. Cable Sag
   d. Deflection of components contributing to fall distance where not otherwise accounted.
   e. Deployment of lanyard energy absorber(s) as applicable.
8. A description of the greatest required clearances for all permitted worker locations, connecting means, and full body harness combinations. Where a required clearance varies with environmental conditions, the worst-case value shall be specified.
9. A fall distance calculation drawing shall be provided for each system detailing the worst-case scenario.
10. Instructions for inspection, maintenance, and retirement of the system and all or its components, including how often inspection and maintenance are to be performed and a description of the qualifications required for persons performing these tasks.
11. Instructions for safe access to, egress from and use of the system.
12. For fall arrest systems, a rescue plan, or directions to the owner of the system or the employer of the workers using the system to develop and implement a rescue plan before the system is used. The engineer shall indicate the appropriate uses of the system or its anchorages during a rescue.
13. A statement specifying that the engineer who designed the system or an engineer with similar experience and qualifications shall be consulted before changing the design.
14. For permanent systems, "as-constructed" drawings shall be provided. The engineer shall state that the installation is in general accordance with the as-constructed drawings and specifications and shall indicated how often the anchorages shall be recertified by the engineer designing the system or an engineer with similar experience and qualifications.

D. Structural Review: The fall protection contractor shall provide the design loads to the engineer of record for the building. The engineer of record will verify that the supporting structure can withstand the potential loads imparted by the fall protection system.

E. Delegated Design Submittals: For Horizontal Lifeline Fall Protection Systems, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 INFORMATIONAL SUBMITTALS:

A. Proof of insurance, per contract requirements, for the design, installation, and certification of fall protection systems.

B. Test and Evaluation Reports:
   1. Product Test Reports: For each Horizontal Lifeline Fall Protection Systems, for tests performed by manufacturer and witnessed by a qualified testing agency.
   2. Research Reports: For Horizontal Lifeline Fall Protection Systems from an agency acceptable to authorities having jurisdiction showing compliance with.

C. Qualification Statements: For manufacturer, fabricator, and Installer.

D. Delegated design engineer qualifications.

1.06 CLOSEOUT SUBMITTALS:

A. Operation and Maintenance Data: For Horizontal Lifeline Fall Protection Systems.
   1. Maintenance Procedures: Including parts list and maintenance requirements for all equipment.

2. Operation Procedures: Indicating proper use of equipment for safe operation of the systems.
3. Test Certificate: Indicating completion of proof load testing on installed systems.
4. Manufacturer's Instructions: Instructions for use for the use of the supplied fall protection system and user equipment.

B. As-Built Drawings: A copy of as-built drawings and system specifications, with each page stamped by the designing engineer, shall also be included in the systems manual.

1.07 QUALITY ASSURANCE:

A. Qualifications:
1. Manufacturers: Company specializing in the design, production and installation and certification of the fall protection system.
2. Installers: Entity that employs installers and supervisors who are trained and approved by manufacturer.
3. Delegated Design Engineer: A professional engineer who is legally qualified to practice in the state where Project is located and who is experienced in providing engineering services of the type indicated.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Horizontal Lifeline Fall Protection Systems.
1. Basis-of-Design Product: Subject to compliance with requirements, provide 3M; DBI-Sala or comparable product.

2.02 SOURCE LIMITATIONS:

A. Obtain Horizontal Lifeline Fall Protection Systems from a single source from single manufacturer.

2.03 PERFORMANCE REQUIREMENTS:

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01400 "Quality Control," to design Horizontal Lifeline Fall Protection Systems.

2.04 HORIZONTAL LIFELINE FALL PROTECTION SYSTEM DESIGN:

A. The Fall Arrest Systems shall be designed to fully protect the user at all times while in the area of potential fall hazard.
B. The Fall Arrest Systems shall be designed for 2 simultaneous users.
C. Deceleration Device: Provide 4 appropriate length lanyards that meet or exceed applicable standards of ANSI Z 359.1 and OSHA 1926.104.
D. Harnesses: Provide 4 full body harnesses with single back D-ring that meet or exceed applicable standards of ANSI Z 359.1 and OSHA 1926.104.

2.05 SYSTEM DESCRIPTION:

A. System shall not have internal components that cannot be visually inspected.
B. Horizontal Lifeline Cable: Stainless Steel AISI 316L 8mm diameter 7x7 or 1x19 wire rope with a minimum breaking strength >37kN.
C. Anchorage fabrications: Carbon steel construction and designed to withstand the maximum fall arrest forces with a minimum safety factor of two. Steel shall be structural grade with material test certificates for full material traceability. The rooftop anchor posts shall not have internal components that cannot be visually inspected

D. Swaging: The cable shall be swaged in-line with the anchor point. Each swage is to be proof tested according to the manufacturer's requirements. Cable clamps shall not be utilized for termination of the engineered horizontal lifeline system.
E. Shock Absorber: When the engineering design dictates the use of load limiting in-line shock absorbers, the shock absorber shall visually display deployment in the event a fall has occurred on the system. In-line shock absorbers are utilized in systems where the loads may exceed the structural ability of the support structure. Shock Absorbers shall not have internal components that cannot be visually inspected.
F. Cable Trolley: Stainless Steel. The cable trolley shall allow for pass-through of intermediate support points without disconnecting from the system.
G. Tension Indicator: The system shall include a tension indicator that will allow the user to physically inspect that the correct inline cable tension is achieved.
H. Fasteners: The Fall Arrest Systems shall be attached to the supporting structure with appropriate fasteners. The fasteners shall be designed to support a load on the system of 2 times the maximum design load without failure.
I. Cable system components shall be of stainless-steel construction unless otherwise indicated. Exposed work shall be true to line and level with accurate angles, surfaces and with straight square edges.
J. All primary cable system components shall be of same material unless otherwise indicated. Exposed work shall be true to line and level with accurate angles, surfaces and with straight square edges. Coordinate anchorage system with supporting structure. Fabricate anchoring devices as recommended by the manufacturer to provide adequate support for intended use.
K. Fabricate Joints in a manner to discourage water accumulation. Provide weep holes to drain any water, which could accumulate in the exposed joints.

2.06 MATERIALS:

A. All materials shall be new and completed Fall Protection System shall be the product of one manufacturer or the manufacture's authorized installer regularly engaged in the design and production of such equipment.
B. Primary cable assembly components shall be manufactured from stainless steel. Fabricated supports required for additional support shall be carbon steel with a corrosion resistant finish.
C. Material Control: All critical cable assembly components shall contain batch numbers or serial numbers, permanently stamped or engraved, identifying the specific job and system they are used for.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of fall protection equipment.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 DELIVERY STORAGE AND HANDLING:

A. Store and stage materials in protective packaging at location specified. Prevent soiling, physical damage or wetting.

3.03 INSTALLATION OF HORIZONTAL LIFELINE FALL PROTECTION SYSTEMS:

A. Fall Protection Systems shall be installed by Fall Protection Contractor's authorized and trained personnel that have been certified by the manufacturer. Install anchorage and fasteners in accordance with the approved design drawings. If the installation of the anchor posts is not

performed by the fall protection contractor, then the posts installation shall be inspected, load tested and verified by the fall protection contractor.

B. Install engineered horizontal lifeline systems according to the approved design drawings and manufacturer's instructions. Do not load or stress the Fall Protection Systems until all materials and fasteners are properly installed and ready for service. Only an installation technician that is fully trained by manufacturer in the installation of the specific system shall perform the installation of the engineered lifeline system.

3.04 CLEANING:

A. Remove all loose materials, crating and packing materials from premises.

3.05 MAINTENANCE SERVICE:

A. Beginning at Substantial Completion, verify maintenance service includes 12 months' full maintenance by manufacturer's authorized service representative. Include one annual recertification per manufacturers' recommendation.

3.06 DEMONSTRATION:

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain Horizontal Lifeline Fall Protection Systems.

B. Demonstration: Demonstrate operation of system to Owner's personnel.
   1. Briefly describe function, operation, and inspection of each component.

C. Training: Train Owner's personnel on operation and inspection of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide a minimum of one hour of training.
   3. Location: Project site.

D. Training to take place at the completion of the installation.

E. Recertification: Coordinate annual recertification program per manufacturers' recommendation.

END OF SECTION 11 24 29.17

SECTION 11 30 00 - APPLIANCES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Cooking appliances.
   2. Refrigeration appliances.

1.02 ALLOWANCES

A. Furnish residential appliances as part of residential appliance allowance.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.04 ACTION SUBMITTALS

A. Product Data:
   1. Cooking appliances.
   2. Refrigeration appliances.
   3. Cleaning appliances.
B. Product Data Submittals: For each product.
   1. Include installation details, material descriptions, dimensions of individual components, and finishes for each appliance.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
C. Product Schedule: For appliances.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.
B. Product Certificates: For each type of appliance.
C. Field quality-control reports.
D. Sample Warranties: For manufacturers' special warranties.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintains a service center capable of providing training, parts, and emergency maintenance repairs.

1.08 WARRANTY

A. Special Warranties: Manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period except as qualified below:
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 SOURCE LIMITATIONS

A. Obtain residential appliances from single source.

2.02 PERFORMANCE REQUIREMENTS

A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design and ICC A117.1.

2.03 COOKING APPLIANCES

A. Microwave Oven:

1. Basis-of-Design Product: Subject to compliance with requirements, provide KitchenAid; Whirlpool Corporation; KMCC5015GSS or a comparable product by one of the following:
   a. GE Appliances; Haier Group.
   b. Maytag; Whirlpool Corporation.
2. Mounting: Counter-top.
3. Type: Convection.
4. Dimensions:
   a. Width: 24 inches (610 mm).
   b. Depth: 19-1/2 inches (495 mm).
   c. Height: 14 inches (356 mm).
5. Capacity: 1.5 cu. ft. (0.04 cu. m).
6. Oven Door: Door with observation window and pull handle.
7. Microwave Power Rating: 1000 W.
   a. Convection Element Power Rating: 1450 W.
8. Electric Power Supply: 120 V, 60 Hz, 1 phase, 15 A.
9. Controls: Digital panel controls and timer display.
10. Other Features: Turntable.
11. Material: Stainless steel.

2.04 REFRIGERATION APPLIANCES

A. Refrigerator/Freezer: Two-door refrigerator/freezer with freezer drawer on bottom and complying with AHAM HRF-1.

1. Basis-of-Design Product: Subject to compliance with requirements, provide KitchenAid; Whirlpool Corporation; KRFF507HPS or a comparable product by one of the following:
   a. GE Appliances; Haier Group.
   b. Maytag; Whirlpool Corporation.
2. Type: Freestanding.
3. Dimensions:
   a. Width: 36 inches (914 mm).
   b. Depth: 33-1/4 inches (845 mm).
   c. Height: 70 inches (1778 mm).
4. Storage Capacity:
   a. Refrigeration Compartment Volume: 15.6 cu. ft. (0.44 cu. m).
   b. Freezer Volume: 5.13 cu. ft. (0.15 cu. m).
   c. Shelf Area: Three adjustable glass shelves, 26 sq. ft. (2.42 sq. m).
5. General Features:

a. Door Configuration: Overlay.
b. Dispenser in door for ice and cold water with dispenser lock.
c. Built-in water-filtration system.
d. Separate touch-pad temperature controls for each compartment.

6. Refrigerator Features:
   a. Interior light in refrigeration compartment.
   b. Door Storage: Modular compartments 1 gal. (3.8 L) milk-container storage.
   c. Temperature-controlled meat/deli bin.
7. Freezer Features: Two freezer compartment(s) configured as pull-out drawer(s).
   a. Automatic defrost.
   b. Interior light in freezer compartment.
   c. Automatic icemaker and storage bin.
8. Energy Star: Provide appliances that qualify for the EPA/DOE Energy Star product-labeling program.
9. Front Panel(s): Stainless steel.
10. Appliance Color/Finish: Stainless steel.

B. Icemaker:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Hoshizaki America, Inc. AM-50BAJ or as approved by architect.
2. Description: Freestanding units.
   a. Production: Individual crescent cube.
   b. Capacity: 55 lb (25 kg) per 24-hour period.
   c. Storage Capacity: 22 lb (10 kg).
   d. Accessories:
      1) Water filter.

2.05 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install appliances according to manufacturer's written instructions.

B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.

C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

3.03 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
   2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
   3. Operational Test: After installation, start units to confirm proper operation.
   4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.

B. An appliance will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 11 30 00

SECTION 11 53 23 - LABORATORY REFRIGERATORS & FREEZERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Laboratory Refrigeration appliances.
B. Related Requirements:
   1. Division 27 “Communications” for connection of Refrigeration to monitoring systems.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include installation details, material descriptions, dimensions of individual components, and finishes for each appliance.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
B. Product Schedule: For appliances. Use same designations indicated on Drawings.

1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.
B. Product Certificates: For each type of appliance.
C. Field quality-control reports.
D. Sample Warranties: For manufacturers' special warranties.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintains a service center capable of providing training, parts, and emergency maintenance repairs.

1.06 WARRANTY

A. Refrigerator/Freezer, freezer and Refrigerator, Sealed System: Full warranty, including parts and labor, for on-site service on the product.
   1. Warranty Period for Sealed Refrigeration System: Five years from date of Substantial Completion.
   2. Warranty Period for Other Components: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain laboratory refrigeration from single source and each type of from laboratory refrigeration single manufacturer.
B. Basis-of-Design: Subject to compliance provide product designated on drawings by Thermo Scientific or comparable product.

2.02 PERFORMANCE REQUIREMENTS

A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.03 REFRIGERATOR

A. Refrigerator: Two-door refrigerator/freezer with freezer on top and complying with NEMA5-15R/5-15P.
   1. Type: Freestanding.
   2. Dimensions:
      a. Width: As indicated on Drawings.
      b. Depth: As indicated on Drawings.
      c. Height: As indicated on Drawings.
   3. General Features:
      a. Door Configuration: Overlay.
      b. Dual refrigeration systems.
      c. Touch-pad temperature controls.
      d. 2” Caster (2 Locking)
      e. 7 Day Graphic Chart Recorder.
      f. External monitor into owner’s system
      g. Interior LED lights
   4. Front Panel(s): Manufacturer's standard.

2.04 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of Laboratory Refrigeration.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install appliances according to manufacturer's written instructions.

B. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

C. Connect monitoring to Owner system and program notifications to the proper personnel.

3.03 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
   1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.

2. Operational Test: After installation, start units to confirm proper operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.

B. An appliance will be considered defective if it does not pass tests and inspections.
C. Prepare test and inspection reports.

3.04 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain residential appliances.

END OF SECTION 11 53 23

SECTION 12 24 13 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Manually operated, single-roller shades.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.
B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.
C. Samples: For each exposed product and for each color and texture specified, 10 inches (250 mm) long.

1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.
B. Product Certificates: For each type of shadeband material.
C. Product Test Reports: For each type of shadeband material, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

1.05 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than two units.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.08 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.01 SOURCE LIMITATIONS

A. Obtain roller shades from single source from single manufacturer.

2.02 MANUALLY OPERATED, SINGLE-ROLLER SHADES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Hunter Douglas, Inc.
   2. MechoShade Systems, LLC.
   3. Windowtex.

B. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
   1. Bead Chains: Stainless steel.
      a. Loop Length: Full length of roller shade.
      b. Limit Stops: Provide upper and lower ball stops.
      c. Chain-Retainer Type: Chain tensioner, jamb mounted.
   2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller shade weight and for lifting heavy roller shades.
      a. Provide for shadebands that weigh more than 10 lb (4.5 kg) or for shades as recommended by manufacturer, whichever criterion is more stringent.

C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
   1. Roller Drive-End Location: Right side of interior face of shade.
   2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
   3. Shadeband-to-Roller Attachment: Manufacturer's standard method.

D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

E. Shadebands:
   1. Shadeband Material: Light-filtering fabric.
   2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
      a. Type: Enclosed in sealed pocket of shadeband material.
      b. Color and Finish: As selected by Architect from manufacturer's full range.

F. Installation Accessories:
   1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
      a. Shape: L-shaped.
      b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open, but not less than 3 inches (76 mm).
   2. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.
      a. Height: Manufacturer's standard height required to enclose roller and shadeband assembly when shade is fully open, but not less than 3 inches (76 mm).
   3. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.03 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.
   1. Source: Roller shade manufacturer.
   2. Type: Woven polyester and PVC-coated polyester.
   3. Weave: Basketweave.
   4. Thickness: 0.036 inches (0.9144mm).
   5. Weight: 20 oz./sq. yd. (567 g/sq. m).
   6. Roll Width: 126 inches (3200 mm).
   7. Orientation on Shadeband: Up the bolt.
   8. Openness Factor: 3 percent.
   9. Color: As selected by Architect from manufacturer's full range.

2.04 ROLLER SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):
   1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch (6 mm) per side or 1/2-inch (13-mm) total, plus or minus 1/8 inch (3.1 mm). Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch (6 mm), plus or minus 1/8 inch (3.1 mm).

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:
   1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances,and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

B. Roller Shade Locations: At exterior windows.

3.03 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.04 CLEANING AND PROTECTION

A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 12 24 13

SECTION 12 35 53.13 - METAL LABORATORY CASEWORK

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Metal laboratory casework.
   2. Auxiliary cabinets.
   3. Countertops.
   4. Laboratory casework systems.
   5. Laboratory accessories.
   6. Water and laboratory gas service fittings.

B. Related Requirements:
   1. Section 09 65 13 "Resilient Base and Accessories" for resilient base applied to laboratory casework.

1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.03 COORDINATION

A. Coordinate layout and installation of framing and reinforcements for support of laboratory casework.

B. Coordinate installation of laboratory casework with installation of laboratory equipment.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For laboratory casework.
   1. Include plans, elevations, sections, and attachments to other work including blocking and reinforcements required for installation.
   2. Indicate types and sizes of casework.
   3. Indicate manufacturer's catalog numbers for casework.
   4. Show fabrication details, including types and locations of hardware.
   5. Indicate locations and types of service fittings.
   6. Include details of utility spaces showing supports for conduits and piping.
   7. Include details of support framing system.
   8. Include details of exposed conduits, if required, for service fittings.
   9. Indicate locations of and clearances from adjacent walls, doors, windows, other building components, and laboratory equipment.
   10. Include coordinated dimensions for laboratory equipment specified in other Sections.

C. Samples: For casework finishes and materials requiring color selection.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Test Reports:
   1. Casework: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating compliance of laboratory casework with requirements of specified product standard.
   2. Countertop Surface Material: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating compliance of laboratory countertop surface material with requirements specified for chemical and physical resistance.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish complete touchup kit for each type and color of casework finish provided. Include fillers, primers, paints, and other materials necessary to perform permanent repairs to damaged laboratory casework finish.

B. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Cabinet Mounting Clips and Related Hardware: Quantity equal to 5 percent of amount installed, but no fewer than 20 of each type.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that produces casework of types indicated for this Project that has been tested for compliance with SEFA 8 M.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or other suitable material.

1.09 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install laboratory casework until building is enclosed, utility roughing-in and wet-work are complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Field Measurements: Where laboratory casework is indicated to fit to existing construction, verify dimensions of existing construction by field measurements before fabrication and indicate measurements on Shop Drawings. Provide fillers and scribes to allow for trimming and fitting.

C. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before enclosing them, and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.01 SOURCE LIMITATIONS

A. Obtain laboratory casework from single source from single manufacturer unless otherwise indicated.

B. Product Designations: Drawings indicate sizes and configurations of laboratory casework by referencing designated manufacturer's catalog numbers. Other manufacturers' laboratory casework of similar sizes and similar door and drawer configurations and complying with Specifications may be considered.

2.02 PERFORMANCE REQUIREMENTS

A. System Structural Performance: Laboratory casework and support framing system shall withstand the effects of the following gravity loads and stresses without permanent deformation, excessive deflection, or binding of drawers and doors:

1. Support Framing System: 600 lb/ft. (900 kg/m).
2. Suspended Base Cabinets (Internal Load): 160 lb/ft. (240 kg/m).
3. Work Surfaces (Including Tops of Suspended Base Cabinets): 160 lb/ft. (240 kg/m).
4. Wall Cabinets (Upper Cabinets): 160 lb/ft. (240 kg/m).
5. Shelves: 40 lb/sq. ft. (200 kg/sq. m).

2.03 CASEWORK, GENERAL

A. Casework Product Standard: Comply with SEFA 8 M, "Laboratory Grade Metal Casework."

B. Flammable Liquid Storage: Where cabinets are indicated for solvent or flammable liquid storage, provide units that are listed and labeled as complying with requirements in NFPA 30 by a testing and inspecting agency acceptable to authorities having jurisdiction.

2.04 METAL LABORATORY CASEWORK

A. Steel Sheet: Cold-rolled, commercial steel (CS) sheet, complying with ASTM A1008/A1008M; matte finish; suitable for exposed applications.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Hamilton Laboratory Solutions, LLC.
   2. Kewaunee Scientific Corporation.
   3. Mott Manufacturing Ltd.

C. Nominal Metal Thickness:
   1. Sides, Ends, Fixed Backs, Bottoms, Tops, Soffits, and Items Not Otherwise Indicated: 0.048 inch (1.21 mm). Except for flammable liquid storage cabinets, bottoms may be 0.036 inch (0.91 mm) if reinforced.
   2. Back Panels, Doors, Drawer Fronts and Bodies, and Shelves: 0.036 inch (0.91 mm) except 0.048 inch (1.21 mm) for back panels and doors of flammable liquid storage cabinets and for unreinforced shelves more than 36 inches (900 mm) long.
   3. Intermediate Horizontal Rails, Table Aprons and Cross Rails, Center Posts, and Top Gussets: 0.060 inch (1.52 mm).
   4. Drawer Runners, Sink Supports, and Hinge Reinforcements: 0.075 inch (1.90 mm).
   5. Leveling and Corner Gussets: 0.105 inch (2.66 mm).

2.05 AUXILIARY CABINETS

A. Acid Storage-Cabinet Lining: 1/4-inch- (6-mm-) thick, polyethylene, polypropylene, epoxy, or phenolic-composite lining material.

B. Tempered Glass for Glazed Doors: Clear tempered glass complying with ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality-Q3; not less than 5.0 mm thick.

2.06 CABINET HARDWARE

A. General: Provide laboratory casework manufacturer's standard, commercial-quality, heavy-duty hardware complying with requirements indicated for each type.

B. Hinges: Stainless-steel, five-knuckle hinges complying with BHMA A156.9, Grade 1, with antifriction bearings and rounded tips. Provide two for doors 48 inches (1200 mm) high or less and three for doors more than 48 inches (1200 mm) high.

C. Recessed Pulls: Aluminum. Provide two pulls for drawers more than 24 inches (600 mm) wide.

D. Door Catches: Positive door latching mechanism is self-closing and prevents rebounding. Provide two catches on doors more than 48 inches (1200 mm) high.

E. Drawer Slides: ANSI/BHMA A156.9.
   1. Heavy Duty (Grade 1HD-100): Side mount.
      a. Type: Full extension.
      b. Material: Zinc-plated ball bearing slides.
      c. Motion Feature: Self-closing mechanism.
   2. General-purpose drawers; provide 100 lb (45 kg) load capacity.
   3. File drawers; provide 150 lb (45 kg) load capacity.

F. Label Holders: Stainless steel, aluminum, or chrome plated; sized to receive standard label cards approximately 1 by 2 inches (25 by 50 mm), attached with screws or rivets. Provide on drawers and cabinet doors.

G. Sliding-Door Hardware Sets: Laboratory casework manufacturer's standard, to suit type and size of sliding-door units.

2.07 COUNTERTOPS

A. General: Provide laboratory countertops with integral sink as indicated on Drawings.

B. Epoxy: Factory-molded, modified epoxy-resin formulation with smooth, nonspecular finish.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Durcon; a Wilsonart Company.
2. Physical Properties:
   a. Flexural Strength: Not less than 10,000 psi (70 MPa).
   b. Modulus of Elasticity: Not less than 2,000,000 psi (1400 MPa).
   c. Hardness (Rockwell M): Not less than 100.
   d. Water Absorption (24 Hours): Not more than 0.02 percent.
   e. Heat Distortion Point: Not less than 260 deg F (127 deg C).
3. Chemical Resistance: Epoxy-resin material has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:
   a. No Effect: Acetic acid (98 percent), acetone, ammonium hydroxide (28 percent), benzene, carbon tetrachloride, dimethyl formamide, ethyl acetate, ethyl alcohol, ethyl ether, methyl alcohol, nitric acid (70 percent), phenol, sulfuric acid (60 percent), and toluene.
   b. Slight Effect: Chromic acid (60 percent) and sodium hydroxide (50 percent).
4. Color: Black.

C. Stainless Steel Sheet: ASTM A240/A240M, Type 304.

2.08 METAL CABINET FABRICATION

A. General: Assemble and finish units at point of manufacture. Use precision dies for interchangeability of like-size drawers, doors, and similar parts. Perform assembly on precision jigs to provide units that are square. Reinforce units with angles, gussets, and channels. Except where otherwise specified, integrally frame and weld cabinet bodies to form dirt- and vermin-resistant enclosures. Where applicable, reinforce base cabinets for sink support. Maintain uniform clearance around door and drawer fronts of 1/16 to 3/32 inch (1.5 to 2.4 mm).

B. Flush Doors: Outer and inner pans that nest into box formation, with full-height channel reinforcements at center of door. Fill doors with noncombustible, sound-deadening material.

C. Glazed Doors: Hollow-metal stiles and rails of similar construction as flush doors, with glass held in resilient channels or gasket material.

D. Hinged Doors: Mortise for hinges and reinforce with angles welded inside inner pans at hinge edge.

E. Drawers: Fronts made from outer and inner pans that nest into box formation, without raw metal edges at top. Sides, back, and bottom fabricated in one piece with rolled or formed top of sides for stiffening and comfortable grasp for drawer removal.

F. Adjustable Shelves: Front, back, and ends formed down, with edges returned horizontally at front and back to form reinforcing channels.

G. Toe Space: Fully enclosed, 4 inches (100 mm) high by 3 inches (75 mm) deep, with no open gaps or pockets.

H. Tables: Welded tubing legs, not less than 2 inches (50 mm) square with channel stretchers as needed to comply with product standard. Weld or bolt stretchers to legs and cross-stretchers, and bolt legs to table aprons. Provide leveling device welded to bottom of each leg.

1. Leg Shoes: Black vinyl or rubber, open-bottom, slip-on type.

I. Utilities: Provide space, cutouts, and holes for pipes, conduits, and fittings in cabinet bodies to accommodate utility services and their support-strut assemblies.

1. Provide base cabinets with removable backs for access to utility space.

J. Utility-Space Framing: Steel framing units consisting of two steel slotted channels complying with MFMA-4, not less than 1-5/8 inches (41 mm) square by 0.105-inch (2.66-mm) nominal

thickness, that are connected at top and bottom by U-shaped brackets made from 1-1/4-by-1/4-inch (32-by-6-mm) steel flat bars. Framing units may be made by welding channel material into rectangular frames instead of using U-shaped brackets.

K. Filler and Closure Panels: Provide where indicated and as needed to close spaces between casework and walls, ceilings, and equipment. Fabricate from same material and with same finish as casework and with hemmed or flanged edges unless otherwise indicated.
   1. Provide knee-space panels (modesty panels) at spaces between base cabinets, where cabinets are not installed against a wall or where space is not otherwise closed. Fabricate from back-to-back panels or of hollow construction to eliminate exposed hemmed or flanged edges.
   2. Provide utility-space closure panels at spaces between base cabinets where utility space would otherwise be exposed, including spaces below countertops.
   3. Provide closure panels at ends of utility spaces where utility space would otherwise be exposed.

L. Undercabinet Task-Light Luminaires:
   1. Lamp Type: [LED] with switch and heavy-duty cord and plug.
   2. Finish: Baked enamel.
   3. Diffusers: Virgin acrylic with high resistance to yellowing and other changes from aging, heat, and UV radiation.

M. Countertops: Provide in modular lengths indicated, without seams.

2.09 METAL CABINET FINISH

A. General: Prepare, treat, and finish welded assemblies after assembling. Prepare, treat, and finish components that are to be assembled with mechanical fasteners before assembling. Prepare, treat, and finish concealed surfaces same as exposed surfaces.

B. Preparation: After assembly, clean surfaces of mill scale, rust, oil, and other contaminants. After cleaning, apply a conversion coating suited to organic coating to be applied over it.

C. Chemical-Resistant Finish: Immediately after cleaning and pretreating, apply laboratory casework manufacturer's standard two-coat, chemical-resistant, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).
   1. Chemical and Physical Resistance of Finish System: Finish complies with acceptance levels of cabinet surface finish tests in SEFA 8 M. Acceptance level for chemical spot test shall be no more than for Level 3 conditions.
   2. Colors for Metal Laboratory Casework Finish: As selected by Architect from manufacturer's full range.

2.10 COUNTERTOP FABRICATION

A. Countertops, General: Provide units with smooth surfaces in uniform plane, free of defects. Make exposed edges and corners straight and uniformly beveled. Provide front and end overhang of 1 inch (25 mm).

B. Sinks, General: Provide sizes indicated or laboratory casework manufacturer's closest standard size of equal or greater volume, as approved by Architect.
   1. Outlets: Provide with strainers and tailpieces, NPS 1-1/2 (DN 40), unless otherwise indicated.

C. Epoxy:
   1. Countertops: Fabricate with factory cutouts for sinks, holes for service fittings and accessories, and butt joints assembled with epoxy adhesive and concealed metal splines.
      a. Flat Configuration: 1 inch (25 mm) thick with continuous drip groove on underside 1/2 inch (13 mm) from overhang edge.
         1) Edges and Corners: Rounded.

2) Backsplash: Applied.

b. Marine-Edge Configuration: 1-inch (25-mm) minimum thickness, with integral or applied raised edge.
1) Edges and Corners: Rounded.
2) Backsplash: Applied.

c. Construction: Epoxy composition not less than 1/4 inch (6 mm) thick, laminated to backing.

2. Sinks: Molded in one piece with smooth surfaces, coved corners, and bottom sloped to outlet; 1/2-inch (13-mm) minimum thickness.
a. Provide with polypropylene strainers and tailpieces.
b. Provide integral sinks in epoxy countertops, bonded to countertops with invisible joint line.
c. Provide sinks for underside installation with manufacturer's recommended adjustable support system for table- and cabinet-type installations.

2.11 LABORATORY ACCESSORIES

A. Reagent Shelves: Provide as indicated, fabricated from same material as adjacent countertop unless otherwise indicated.

B. Plastic or Resin Pegboards: Polypropylene, epoxy, or phenolic-composite pegboards with removable polypropylene pegs and stainless steel drip troughs with drain outlet.

2.12 WATER AND LABORATORY GAS SERVICE FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Broen A/S.
2. Chicago Faucets; Geberit Group.
3. WaterSaver Faucet Co.

B. Service Fittings: Provide units that comply with SEFA 7, "Recommended Practices for Fixtures." Provide fittings complete with washers, locknuts, nipples, and other installation accessories. Include wall and deck flanges, escutcheons, handle extension rods, and similar items.

C. Materials: Fabricated from cast or forged red brass unless otherwise indicated.

D. Finish: Chromium plated.
1. Provide chemical-resistant powder coating in laboratory casework manufacturer's standard metallic brown, aluminum, white, or other color as approved by Architect.

E. Water Valves and Faucets: Provide units complying with ASME A112.18.1, with renewable seats, designed for working pressure up to 80 psig (550 kPa).
1. Vacuum Breakers: Provide ASSE 1035 vacuum breakers on water fittings with serrated outlets.
2. Aerators: Provide aerators on water fittings that do not have serrated outlets.
3. Self-Closing Valves: Provide self-closing valves where indicated.

F. Hand of Fittings: Furnish right-hand fittings unless fitting designation is followed by "L."

G. Handles: Provide three- or four-arm, forged-brass handles for valves unless otherwise indicated.
1. Provide lever-type handles for ground-key cocks. Lever handle aligns with outlet when valve is closed and is perpendicular to outlet when valve is fully open.
2. Provide lever-type handles for ball valves unless otherwise indicated. Lever handle aligns with outlet when valve is closed and is perpendicular to outlet when valve is fully open.

2.13 ELECTRICAL AND COMMUNICATION SERVICE FITTINGS

A. Service Fittings, General: Provide units complete with metal housings, receptacles, switches, pilot lights, data communication outlets, cover plates, accessories, and gaskets required for mounting on laboratory casework.

B. Electrical Wiring Devices: Comply with requirements in Section 26 27 26 "Wiring Devices" for receptacles, switches, pilot lights, cover plates, and accessories.

C. Twisted-Pair Copper Data Outlets: Comply with requirements in Section 27 15 13 "Communications Copper Horizontal Cabling."

D. Optical-Fiber Data Outlets: Comply with requirements Section 27 15 23 "Communications Optical Fiber Horizontal Cabling."

E. Cover Plates: Provide satin-finish, chrome-plated Type 304, stainless steel cover plates with formed, beveled edges.

F. Finishes for Service-Fitting Components: Provide housings or boxes for pedestal- and line-type fittings with manufacturer's standard baked-on, chemical-resistant enamel in color as selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of reinforcements, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF CABINETS

A. Comply with installation requirements in SEFA 2. Install level, plumb, and true in line; shim as required using concealed shims. Where laboratory casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical. Do not exceed the following tolerances:

1. Variation of Tops of Base Cabinets from Level: 1/16 inch in 10 feet (1.5 mm in 3 m).
2. Variation of Bottoms of Upper Cabinets from Level: 1/8 inch in 10 feet (3 mm in 3 m).
3. Variation of Faces of Casework from a True Plane: 1/8 inch in 10 feet (3 mm in 3 m).
4. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch (0.8 mm).
5. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch (1.5 mm).

B. Utility-Space Framing: Secure to floor with two fasteners at each frame. Fasten to partition partitions and to base cabinets.

C. Base Cabinets: Fasten cabinets to utility-space framing, partitions, or reinforcements in partitions, with fasteners spaced not more than 16 inches (400 mm) o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform.

1. Where base cabinets are installed away from walls, fasten to floor at toe space at not more than 24 inches (600 mm) o.c. and at sides of cabinets with not less than two fasteners per side.

D. Wall Cabinets: Fasten to hanging strips, masonry, partition framing, blocking, or reinforcements in partitions. Fasten each cabinet through back, near top, at not less than 16 inches (400 mm) o.c.

E. Install hardware uniformly and precisely.

F. Adjust operating hardware so doors and drawers align and operate smoothly without warp or bind and contact points meet accurately. Lubricate operating hardware as recommended by manufacturer.

3.3 INSTALLATION OF COUNTERTOPS

A. Comply with installation requirements in SEFA 2. Abut top and edge surfaces true in plane with flush hairline joints and with internal supports placed to prevent deflection. Locate joints where indicated on Shop Drawings.

B. Field Jointing: Where possible, make in same manner as shop-made joints, using dowels, splines, fasteners, adhesives, and sealants recommended by manufacturer. Shop prepare edges for field-made joints.

C. Fastening:

1. Secure countertops, except for epoxy countertops, to cabinets with Z-type fasteners or equivalent, using two or more fasteners at each cabinet front, end, and back.
2. Secure epoxy countertops to cabinets with epoxy cement, applied at each corner and along perimeter edges at not more than 48 inches (1200 mm) o.c.
3. Where necessary to penetrate countertops with fasteners, countersink heads approximately 1/8 inch (3 mm) and plug hole flush with material equal to countertop in chemical resistance, hardness, and appearance.

D. Provide holes and cutouts required for service fittings.

E. Provide scribe moldings for closures at junctures of countertop, curb, and splash with walls as recommended by manufacturer for materials involved. Match materials and finish to adjacent laboratory casework. Use chemical-resistant, permanently elastic sealing compound where recommended by manufacturer.

F. Dress joints smooth, remove surface scratches, and clean entire surface.

3.4 INSTALLATION OF SINKS

A. Comply with installation requirements in SEFA 2.

B. Underside Installation of Epoxy Sinks: Use laboratory casework manufacturer's recommended adjustable support system for table- and cabinet-type installations. Set top edge of sink unit in sink and countertop manufacturers' recommended chemical-resistant sealing compound or adhesive, and firmly secure to produce a tight and fully leakproof joint. Adjust sink and securely support to prevent movement. Remove excess sealant or adhesive while still wet and finish joint for neat appearance.

3.5 INSTALLATION OF LABORATORY ACCESSORIES

A. Install accessories in accordance with Shop Drawings, installation requirements in SEFA 2, and manufacturer's written instructions.

B. Securely fasten adjustable shelving supports, stainless steel shelves, and pegboards to partitions, or reinforcements in partitions.

C. Install shelf standards plumb and at heights to align shelf brackets for level shelves. Install shelving level and straight, closely fitted to other work where indicated.

D. Securely fasten pegboards to partitions, or reinforcements in partitions.

3.6 INSTALLATION OF SERVICE FITTINGS

A. Comply with requirements in other Sections for installing water and laboratory gas service fittings and electrical devices.

B. Install fittings in accordance with Shop Drawings, installation requirements in SEFA 2, and manufacturer's written instructions. Set bases and flanges of sink- and countertop-mounted fittings in sealant recommended by manufacturer of sink or countertop material. Securely anchor fittings to laboratory casework unless otherwise indicated.

3.7 CLEANING AND PROTECTING

A. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

B. Protect countertop surfaces during construction with 6-mil (0.15-mm) plastic or other suitable water-resistant covering. Tape to underside of countertop at a minimum of 48 inches (1200 mm) o.c.

3.8 SERVICE-FITTING SCHEDULE

A. As indicated on drawings

END OF SECTION 12 35 53.13

SECTION 12 36 61.16 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Solid surface material countertops.
   2. Solid surface material backsplashes.
   3. Solid surface material end splashes.

1.02 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
   1. Show locations and details of joints.
   2. Show direction of directional pattern, if any.

C. Samples for Initial Selection: For each type of material exposed to view.

D. Samples for Verification: For the following products:
   1. Countertop material, 6 inches square.
   2. One full-size solid surface material countertop, with front edge, 8 by 10 inches (200 by 250 mm), of construction and in configuration specified.

1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

1.06 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.07 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.01 SOLID SURFACE COUNTERTOP MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ISFA 2-01.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Formica Corporation.

b. Wilsonart LLC.
2. Type: Provide Standard type unless Special Purpose type is indicated.
3. Integral Sink Bowls: Comply with CSA B45.5/IAPMO Z124.
4. Colors and Patterns: As selected by Architect from manufacturer's full range.

2.02 FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
1. Grade: Custom.

B. Configuration:
1. Front: Straight, slightly eased at top.
2. Backsplash: Straight, slightly eased at corner.
3. End Splash: Matching backsplash.

C. Countertops:
1. 3/4-inch- (19-mm-) thick, solid surface material with front edge built up with same material.

D. Backsplashes: 3/4-inch- (19-mm-) thick, solid surface material.

E. Windowsills: 3/4-inch- (19-mm-) thick, solid surface material with front edge built up with same material.

F. Fabricate tops with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

G. Joints:
1. Fabricate countertops in sections for joining in field, with joints at locations as approved.
a. Joint Locations: Not within 18 inches (450 mm) of a sink or cooktop and not where a countertop section less than 36 inches (900 mm) long would result, unless unavoidable.

H. Cutouts and Holes:
1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch (5 mm) into fixture opening.
2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.03 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 07 92 00 "Joint Sealants."

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m), 1/4 inch (6 mm) maximum. Do not exceed 1/64-inch (0.4-mm) difference between planes of adjacent units.

B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
   1. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

D. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

E. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

F. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

G. Install windowsills adhering to wall. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

H. Apply sealant to gaps at walls; comply with Section 07 92 00 "Joint Sealants."

END OF SECTION 12 36 61.16

SECTION 124813 - ENTRANCE FLOOR MATS AND FRAMES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Entrance matting systems, including recessed and surface mounted aluminum foot grids

B. Related Requirements:
   1. Division 3 "Concrete" for depressed slab
   2. Section 08 11 19 - Steel Doors and Frames.
   3. Section 08 71 00 - Door Hardware.

1.02 COORDINATION

A. Coordinate size and location of recesses in concrete to receive floor mats and frames.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for floor mats and frames.

B. Shop Drawings:
   1. Items penetrating floor mats and frames, including door control devices.
   2. Divisions between mat sections.
   3. Perimeter floor frames.

C. Samples: For the following products, in manufacturer's standard sizes:
   1. Floor Mat: Assembled sections of floor mat.
   2. Tread Rail: Sample of each type and color.
   3. Frame Members: Sample of each type and color.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For floor mats and frames to include in maintenance manuals.

1.05 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Resilient-Tile Entrance Mats: Full-size tile units equal to 2 percent of amount installed, but no fewer than 10 units.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

A. Mats Inc.

B. Forbo Flooring Systems

C. Amarco Products

2.02 MATERIALS

A. Recessed Aluminum Foot Grid:
1. Thickness 7/16” linear mats.
2. Wiper Strip Colors: Unbuffed OR selected from manufacturer’s standard colors of buffed fibered reinforced rubber strip.
3. Scraper Bar Colors: Aluminum
4. Construction: Closed
5. Frame type: Ramp frame 7/16 inch depth only

2.03 ENTRANCE FLOOR MATS AND FRAMES, GENERAL

A. Structural Performance: Provide roll-up rail mats and frames capable of withstanding the following loads and stresses within limits and under conditions indicated:
1. Wheel load of 1,000 lbs per wheel.

B. Accessibility Standard: Comply with applicable provisions in the DOJ's "2010 ADA Standards for Accessible Design" .

2.04 FRAMES

A. Recessed Frames: Manufacturer's standard extrusion.
1. Extruded Aluminum: **ASTM B221**, Alloy 6061-T6 or Alloy 6063-T5, T6, or T52.
a. Color: Mill finish .

2.05 CONCRETE FILL AND GROUT MATERIALS

A. Provide concrete fill and grout equivalent in strength to cast-in-place concrete slabs for recessed mats and frames. Use aggregate no larger than one-third fill thickness.

2.06 FABRICATION

A. Floor Mats: Shop fabricate units to greatest extent possible in sizes indicated. Unless otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.

B. Recessed Frames: As indicated, for permanent recessed installation, complete with corner pins or reinforcement and anchorage devices.
1. Fabricate edge-frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.

C. Coat concealed surfaces of aluminum frames that contact cementitious material with manufacturer's standard protective coating.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and floor conditions for compliance with requirements for location, sizes, minimum recess depth, and other conditions affecting installation of floor mats and frames.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install recessed mat frames and mats to comply with manufacturer's written instructions so that tops of mats will be flush with adjoining finished flooring. Set mats with tops at height recommended by manufacturer for most effective cleaning action; coordinate tops of mat surfaces with bottoms of doors that swing across mats to provide clearance between door and mat.
   1. Install necessary shims, spacers, and anchorages for proper location, and secure attachment of frames.
   2. Install grout and fill around frames and, if required to set mat tops at proper elevations, in recesses under mats. Finish grout and fill smooth and level.
   3. Delay setting mats until construction traffic has ended.

3.03 PROTECTION

A. After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

END OF SECTION 12 48 13

SECTION 13 34 23 - FIBERGLASS BUILDINGS AND ENCLOSURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Freestanding, shop fabricated fiberglass reinforced plastic (FRP) composite buildings including the following:
      a. Doors and frames.
      b. Roof hatch.

B. Related Requirements:
   1. Section 03 30 00 - Concrete.
   2. Section 05 12 00 - Steel.
   3. Section 07 90 00 - Joint Sealants.
   4. Section 08 71 00 - Door Hardware.
   5. Division 23 - HVAC services and connections.
   6. Division 26 - Electrical; electrical power service and wiring connections.

1.02 REFERENCES

A. ASTM E 72 - Standard Test Method of Conducting Strength Tests of Panels for Building Construction

B. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   1. ASTM C 582 - Standard Specification for Contact Molded Reinforced Thermosetting Plastic (FRP) Laminates for Corrosion-Resistant Equipment

C. American Society of Civil Engineers (ASCE):
   1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

D. International Business Code (IBC).

1.03 DESIGN REQUIREMENTS

A. Buildings shall conform to dimensions shown on Drawings.

B. Waterproof, airtight, corrosion resistant, chemical resistant, lightweight, and environmentally aesthetic.

C. Code Requirements:
   1. IBC.
   2. Local authorities having jurisdiction.

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.05 ACTION SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Installation methods.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

D. Delegated Design Submittals: For structural design and engineering, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Project name.
   2. Manufacturer.
   3. Contractor.
   4. Dimensions of building.
   5. Governing building codes.
   6. Design loads.
   7. Load combinations.
   8. Building use categories.

1.06 INFORMATIONAL SUBMITTALS

A. Certificates:
   1. Welding certificates.
B. Test and Evaluation Reports:
   1. Material Test Reports: For each component of Fiberglass Buildings and Enclosures, by a qualified testing agency.
C. Delegated design engineer qualifications.
D. Sample warranties.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing FRP prefabricated structures.
B. Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in jurisdiction where Project is located.
C. Prefabricated Components: Comply with manufacturer's published literature for products meeting indicated design loads in accordance with state and local requirements as applicable.
D. Preconstruction and Preinstallation Meetings: Conduct meetings to verify project requirements, substrate conditions, utility connections, manufacturer's installation instructions, and warranty requirements. Comply with Division 01 requirements.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Shrink-wrap the completed structure or building components with protective plastic for shipment to and storage at the job site.
   1. Support structure for shipment and handling to prevent warping and fracturing.
B. Store products in manufacturer's unopened packaging until ready for installation.
C. Protect all components and accessories from corrosion, deformation, damage and deterioration when stored at job site. Keep materials free from dirt and foreign matter.

1.09 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.010 WARRANTY

A. Manufacturer's Warranties: Provide manufacturer's 1-year limited warranty on products of its manufacture to be free of leaks and defects in materials and workmanship from date of shipment.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: Mekco a division of ConceptWorks, or as approved by Architect.

2.02 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer to design fiberglass buildings and enclosures.

B. Design to sustain superimposed loads for load combinations in accordance with ASCE 7 and as applicable at the location of the project.

C. Design to withstand effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

1. Determine loads based on the following minimum requirements:
    a. Dead load of building.
    b. Mechanical equipment.
    c. Uniform pressure of 40 lbf per sq ft (1.92 kPa), acting inward or outward (standard).
    d. Wind Load: As determined by delegated design engineer.
    e. Snow Load: As determined by delegated design engineer.
    f. Live Load: As determined by delegated design engineer.

D. Design shall provide for the effect of unbalanced, drift and sliding snow loads.

E. Energy Code: Meet energy code requirements for state where structure resides.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F **(67 deg C)**, ambient; 180 deg F **(100 deg C)**, material surfaces.

2.03 FIBERGLASS REINFORCED PLASTIC (FRP) PANELS

A. Wall and Roof Building Panels: High gloss molded to desired structural architectural shapes.

1. Uninsulated FRP Laminate Panels: 3/16 inch (5 mm) thick.
    a. Isophthalic NPG Exterior Gel Coat: 18 mils (0.457 mm) minimum.
    b. Glass Fiber Chopped Roving: 1-1/4 inch (32 mm) random fiber (minimum glass content to be 35 percent by weight.
    c. Polyester structural laminating resin.
2. Insulated FRP Laminate Panels: Two, 1/8 inch (3 mm) thick skins sandwiching a core of insulation.
    a. Isophthalic NPG Exterior Gel Coat: 18 mils (0.457 mm) minimum.
    b. Glass Fiber Chopped Roving: 1-1/4 inch (32 mm) random fiber (minimum glass content to be 35 percent by weight.
    c. Polyester structural laminating resin.
    d. Core Insulation: Solid polyisocyanurate urethane insulation.
3. Panel Flanges: Minimum 1/4 inch (6 mm) FRP laminate.
4. Perimeter Anchoring Flanges: 1/4 inch (6 mm) minimum thickness FRP laminates.
    a. One layer of stitch mat laminated within the anchoring flange.
5. Roof Hatches: Bilco style roof hatch or equivalent.
    a. Hatch and Size 4 feet by 2 feet longer than ends of pump array

B. FRP Panel Properties:

1. Barcol Hardness: 35 minimum.
2. Laminates with Stitch Mat and Random Chopped Fibers Warp Direction: Minimum values.
    a. Tensile Strength: 61,400 psi (423338.1 kPa).

b. Tensile Modulus: 2.98 msi (20.54 gPa).
c. Compressive Strength: 44,500 psi (306816.7 kPa).
d. Compressive Modulus: 2.28 msi (15.72 gPa).
e. Flexural Strength: 73,700 psi (508143.6 kPa).
f. Flexural Modulus: 2.35 msi (16.20 gPa).

C. Fabrication:
1. Form individual segments on high gloss molds ensuring consistent dimensions of finished parts. Cast each segment in one piece.
2. Laminate shall consist of alternating layers of stitch mat and/or chopped roving impregnated with resin.
3. Form panel flanges and perimeter anchoring flanges to the interior of the building.
4. Insulation: Bonded to interior and exterior laminate with resin.
a. Panels without a continuous and consistent bond between insulation and laminate are not acceptable.
5. Interior Finish: White corrosion resistant FRP.
6. Exterior Finish: White.
7. Exterior Finish: White high gloss molded gel coat.
8. Exterior Finish: Color as selected by the Architect from manufacturer's standard selections.

2.04 DOORS AND FRAMES

A. Doors and Frames: (Grade I - Premium): FRP.
1. Manufacturer: FRP Doors and Frames shall be as manufactured by Tiger Door, 1181 Garden Street, Greensburg, PA 15601; Tel: 724-832-4416; www.tigerdoor.com.
2. Double Panel 6068.
3. Face Panels: Chemical resistant, using a fiberglass- reinforced polyester resin system with light stabilizing additives.
a. Thickness: 0.090 to 0.125 inch (2.29 to 3.2 mm).
4. Door Thickness: 1-3/4 inch (44 mm).
5. Finish: All surfaces shall have a textured, semi-gloss, seamless gel coat Finish. Gel Coat coverage shall be 12 to 18 mils (0.305 to 0.457 mm) thick.
6. Color: As selected by architect to match building exterior.
7. Internal Construction:
a. Stiles and Rails: Rectangular and square high modulus pultruded fiberglass tubes.
b. Core material: Rigid polyurethane foam laminated to interior of face panels.
1) Thickness: 1-1/2 inch (38 mm).
2) "R" factor: 11-12.
c. Internal Reinforcements for Full Mortise Hinges: Solid FRP blocking and for thru-bolted hardware to be high modulus pultrusions.
8. Fiberglass Reinforced Plastic Frames:
a. Head and Jamb: Pultruded fiberglass reinforced plastic, conforming to SDI requirements.
1) Wall Thickness: 1/4 inch (6 mm) wall minimum.
b. Frame Profile: Double rabbeted with 5/8 inch (16 mm) stop.
1) Face: 2 inch (51 mm).
2) Jamb Depth: 5-3/4 inch (146 mm).
c. Joint Connection: Jamb to Head joints will be neatly mitered at 45 degrees.
d. Finish: 12 to 18 mil (0.305 to 0.457 mm) gel coat.
e. Color: Match door unless otherwise indicated.
f. Frame Corner Reinforcements (WxDxLxT): 4 x 4 x 5-3/8 x 1/4 inch (102 x 102 x 135.5 x 6 mm) pultruded fiberglass angle.

9. Hardware and Fasteners: Highest grade corrosion resistant available.
    a. Hinges: Aluminum Continuous as specified in 08 71 00 Door Hardware.
    b. Closer: as specified in 08 71 00 Door Hardware.
    c. Lockset: as specified in 08 71 00 Door Hardware.
    d. Threshold: Solid FRP, 1/2 inch (13 mm) beveled profile.
    e. Weatherstrip and Sweep: Full perimeter sealing.

2.05 MISCELLANEOUS ITEMS

A. Concrete Stainless Steel Anchor Bolts: Minimum 3/8 inch (9 mm). Diameter.
    1. Oversized Stainless Steel Plate Washers: Used to prevent localized stressing of the base flange.
    2. Conform to requirements of Section 05 12 00 - Steel.
B. Connection of Building Panels:
    1. Permanently fused building assembly yielding a watertight one-piece structure.
C. Base Gasket:
    1. Soft, closed cell, neoprene foam gasket material.
    2. Suitable for exposure to weather conditions at building location.
    3. Suitable for exposure to sewage and sewage gases.
    4. Thickness: 3/8 inch (9 mm) minimum.

2.06 MATERIALS

A. Resin:
    1. COR61-AA-545 Resin as manufactured by Interplastic Corporation. or equivalent.
    2. Orthophthalic polyesters. Fillers and additives may be used to achieve chemical resistance and fire-retardant properties specified.
    3. Suitable for Service Temperature Range: Minus 30 to 140 degrees F (minus 1 to 60 degrees C).
B. Gel Coat: Isophthalic NPG, UV- stable, chalk resistant.
    1. Manufacturer: LHM-2900 Low Hap White HydroShield LITE, NPG/ISO Marine Gel Coat as manufactured and supplied by HK Research Corporation or equivalent
    2. Color: As selected by the Architect from manufacturer's standard selections.
C. Glass Fiber Reinforcing: Type E glass and treated with finish compatible to resin being used.
    1. Glass Fiber Chopped Roving: Manufactured by PPG, Owens Corning, or equivalent. Used for making random fibers 1-1/4 inch (32 mm) in length.
    2. Stitch Mat: Type CM-2415 or CDM-2415 manufactured by BTI, Knytex, or equivalent.
D. Insulation: Ridged polyisocyanurate urethane foam designed for permanent thermal insulation.
    1. Thickness: As indicated on the Drawings.

2.07 ASSEMBLY

A. Shop assemble complete building.
    1. Flanges between adjacent panels shall be factory bonded together with methyl methacrylate.
    2. Seal exterior edges of adjacent panels with color matched silicon sealant.
B. Fit and bond appurtenances, formed separately, into openings cut in finished panel or integrally mold into panel. Bond attachments with glass fibers and resin from interior of panel.
C. Resin seal cut all drilled edges.

2.08 EQUIPMENT BY OTHERS

A. Equipment Schedule: refer to drawings and other specification divisions. for equipment to be purchased and installed by other trades. Coordinate equipment to be installed.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine supporting foundations for compliance with manufacturer's requirements, including installation tolerances and other conditions affecting performance of supporting members.
B. Check installed anchor bolts for accuracy. Verify that bearing surfaces are ready to receive the work.
C. Verify the rough-in of required mechanical and electrical services prior to placement of the structure.

3.02 PREPARATION

A. Do not begin installation until substrates have been properly prepared.
B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions. Clean surfaces thoroughly prior to installation.
D. Commencement of installation constitutes acceptance of conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Install continuous neoprene gasket between perimeter anchoring flange and where panels rest on supporting structure.
C. Resin seal cut all drilled edges.
D. Repair damaged panels.
E. Minimum spacing and edge distances of concrete anchors shall conform to requirements of Section 05 12 00 - Steel.
F. Place on prepared concrete foundations and slabs provided as specified under Section 03 30 00 - Cast-in-Place Concrete.
G. Anchor securely in place, allowing for required movement, including expansion and contraction.

3.04 PROTECTION

A. Protect installed buildings until completion of project.
B. Touch-up, repair or replace damaged items before Substantial Completion.

END OF SECTION 13 34 23

SECTION 13 46 00 – LIGHTNING PROTECTION SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes the design, furnishing and installation of a complete lightning protection system, including below-grade ground grid systems.
   1. Air terminals.
   2. Roof conductors.
   3. Down conductors.
   4. All mounting accessories.

B. Furnish a Master Label Certificate issued by Underwriters' Laboratories, Inc. for each system and attach to the base of the appropriate structure.

C. Provide lightning protection for structures as indicated on plans:

1.03 RELATED REQUIREMENTS:

A. Section 26 05 17 - Wire, Cables, and Accessories.

B. Section 26 05 26 - Grounding.

1.04 REFERENCE STANDARDS:

A. American National Standards Institute (ANSI).

B. Underwriters' Laboratories, Inc. (UL):
   1. 96 - Lightning Protection Components.
   2. 96A - Installation Requirements for Lightning Protection Systems.
   3. 467 - Standard for Grounding and Bonding Equipment.

C. American Society for Testing and Materials (ASTM):
   1. B3 - Soft or Annealed Copper Wire.
   2. B8 - Concentric Lay Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
   3. B33 - Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes.

D. National Fire Protection Association (NFPA):
   1. 70 - National Electrical Code.
   2. 780 - Installation of Lightning Protection System.

E. Lightning Protection Institute (LPI):
   1. 175 - Standard of Practice for the Design - Installation - Inspection of Lightning Protection Systems.

1.05 DEFINITIONS:

A. Definitions provided by NPFA 780:
   1. Class I Materials: Lightning conductors, air terminals, grounding electrodes, and associated fittings required for the protection of structures not exceeding 75 feet in height.
   2. Class II Materials: Lightning conductors, air terminals, grounding electrodes, and associated fittings required for the protection of structures exceeding 75 feet in height.

1.06 SUBMITTALS:

A. Submit at specified in Division 01 and Section 26 05 10 – General Electrical Requirements for administrative and procedural requirements for submittals.
B. Product Data: For each type of product indicated.
C. Shop Drawings: For air terminals and mounting accessories.
   1. Layout of the lightning protection system, along with details of the components to be used in the installation.
   2. Include indications for use of raceway, data on how any concealments requirements will be met, and calculations required by NFPA 780 for bonding of grounded and isolated metal bodies.
   3. Mounting details for all components.
   4. Detailed layout drawings of lightning protection system, including air terminal locations, conductor routing and connections, and bonding and grounding provisions. Include indications for use of raceway and data on how concealment requirements will be met.

1.07 INFORMATIONAL SUBMITTALS:

A. Qualification Data: For qualified Installer and manufacturer. Include data on UL listing.
B. Material Certificates:
   1. Certification, signed by Contractor, that roof adhesive is approved by manufacturer of roofing material.
C. Field quality-control reports.
   1. Comply with recommendations in NPFA 780, Annex D, "Inspection and Maintenance of Lightning Protection Systems," for recommended inspection reports of the lightning protection system.
D. Plans showing dimensioned as-built locations of grounding features, including the following:
   1. Ground rods.
   2. Ground loop conductor.

1.08 QUALITY ASSURANCE:

A. Installer Qualifications: Certified by UL as a Master Installer/Designer, trained and approved for installation of units required for this Project.
B. System Certificate:
   1. UL Master Label.
C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 780, "Definitions" Article.

1.09 PROJECT SITE CONDITIONS:

A. The following areas are considered hazardous:
   1. Refer to Plan E101.

1.10 COORDINATION:

A. Coordinate installation of lightning protection system with the installation of other building systems and components including electrical wiring, supporting structures, building materials, roof, and metal components requiring interface with lightning protection systems.
B. Coordinate installation of air terminals attached to roof systems with roofing manufacturer and Installer.
C. Flashings of through-roof assemblies shall comply with roofing manufacturers' specifications.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Lightning Protection System Components:
   1. AC Lightning Security, Inc.
   2. Advanced Lightning Technology.
   3. Approved Lightning Protection Co., Inc.
   4. Bonded Lightning Protection.
   5. Independent Protection Co., Inc.
   6. Preferred Lightning Protection.
   7. Robbins Lightning Protection.
   8. Thompson Lightning Protection, Inc.
   9. Erico International Corporation.

B. Grounding Components:
   1. Burndy LLC.
   2. Erico International Corporation.
   3. Harger.
   4. Thomas & Betts.

C. Bare Ground Cable:
   1. Refer to Section 26 05 26.

D. Connection Materials:
   1. Exothermic Type Welding Process:
      a. Erico Products (CADWELD).
   2. Compression Type Connectors:
      a. Amp.
      b. Burndy.
      c. Thomas and Betts.

E. Ground Test Wells:
   1. Advanced Lightning Technology.
   2. Erico International Corporation.
   3. Synertech.
   4. Approved Equal.

F. Mastic:
   1. Sonneborn-Sonoshield Mastics.
   2. W.R. Meadows-Sealmastic.

2.02 PERFORMANCE/DESIGN CRITERIA:

A. Materials shall be in compliance with the following standards:
   1. UL96.
   2. NFPA 780.
   3. All materials used for the system installation shall comply in size, composition, and weight to all requirements of NFPA and UL for the class of system in which they are installed. All materials shall be labeled or listed by UL for use in Master Labeled Systems.
   4. Roof and down conductors shall be in compliance with ASTM B8.

2.03 LIGHTNING PROTECTION SYSTEM:

A. General Requirements:
   1. Material: All materials shall be aluminum, copper, or bronze.

2. Compatibility: All portions of the system shall be galvanically compatible to the building material to which they are to be attached. Connections between copper and aluminum portions of the system shall be made with appropriate bimetallic coupling devices. In all areas, the conductor shall be supported to maintain clearance from all galvanically incompatible materials or shall be of the same material.
3. All system components shall be, to the maximum extent possible, the product of a single manufacturer. All components shall be type Class I or Class II as required by NFPA 780.

B. Air Terminals:
1. For structures not exceeding 75 feet in height, use Class I materials.
2. For structures exceeding 75 feet in height, use Class II materials.
3. 1/2-inch diameter nickel-tipped solid copper rod. Length: 18 inches.
4. Copper mounting hardware supplied with mounting as required.
5. 1/2-inch diameter solid aluminum rod. Length: 18 inches.
6. Aluminum or bronze base for mounting as required.
7. Shall be equipped with the correct type of base for side, roof, or universal mounting.
8. Air terminals and interconnecting cable shall be provided for all roof-mounted equipment subject to a direct strike as required by NFPA 780.
9. All air terminal bases shall be securely mounted to the building structure by bases secured as specified.

C. Roof and Down Conductors:
1. Tin-plated Copper Conductors - Gage and weight shall meet the requirements of LP Class I and II.
2. Aluminum Conductors - Gage and weight shall meet the requirements of LP Class I and II.

D. Down Conductor Guards: Guards shall be of self-extinguishing, high-impact polyvinyl chloride or polyethylene.

E. Grounding Grid System: Refer to Section 26 05 26.

F. Ground Test Wells:
1. Concrete or high-density polymer concrete box or ring with bolted cover.
2. Cover shall be permanently marked as “Electrical” or “Ground Test Well.”
3. Refer to Section 26 05 26.

G. Bonding Plates, Connectors, Terminals, and Clamps: Provide electrical bonding plates, connectors, terminals, lugs, and clamps as recommended by bonding plate, connector, terminal, and clamp manufacturers for indicated applications.
1. Bolted Connectors for Pipes: Copper or copper-alloy, pressure type with at least two silicon bronze or stainless-steel bolts and lock washers.
2. Irreversible Compression Fittings: Pure wrought copper extrusion clamps and connectors, made to be held in the dies of an installation tool. Connectors must be factory filled with an oxide inhibitor.
3. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Lightning Protection System:
1. Install lightning protection systems as indicated, in accordance with equipment manufacturer's written instructions, and in compliance with UL 96A.
2. Suitably protect cable and air terminals from damage during construction.

3. Air Terminals:
    a. The structural steel framework of building may be used as the main conductor of a lightning protection system.
    b. Air terminals shall be installed within 2 feet of all ends, edges, and corners of the building.
    c. Place air terminals so that roof hatches fall within the zone of protection. Bond roof hatches to the lightning protection system with braided bonding jumpers.
4. Conductors:
    a. Protect down conductors from physical damage and displacement by installing guards.
    b. Install conductor with direct paths from air terminals to ground connections avoiding sharp bends (minimum radius - 8 inches and no bends shall be less than 90 degrees) and narrow loops. Where indicated, run conductors in nonmetallic PVC raceway Schedule 80 with a minimum elbow radius of 8 inches.
    c. Conceal the following conductors:
        (1) System conductors.
        (2) Down conductors.
        (3) Interior conductors.
    d. Do not install copper lightning protection materials on aluminum roofing, siding material, or other aluminum surfaces. On aluminum surfaces, use aluminum lightning protection materials.
5. Bonding: Install in accordance with UL 96A.

B. Connection Materials:
1. Cable-to-cable, cable-to-rod connection shall be exothermic-type welding process or irreversible compression type connectors. All compression-type connections shall be inspected for proper die index number.
2. Provide bimetallic or tin-plated copper connectors when joining copper to aluminum conductors.
3. Cable to structural steel:
    a. Use exothermic weld where possible.
    b. Where exothermic weld will damage structural steel, use bolted fittings if it can be field drilled.
    c. Use irreversible compression ground clamp with breakaway bolt head to building steel that cannot be altered.
    d. When structural steel is used as part of the lightning protection system, the structural steel shall be electrically continuous and shall be bonded to the lightning protection conductors at both the top and the bottom of the structural columns.
4. Cable to Equipment Ground Lugs:
    a. Copper alloy terminal with twin clamping element.
    b. Bolt to equipment housing with silicon bronze or stainless-steel bolts and lock washers.

C. Ground Grid System:
1. Wire and Cable:
    a. General:
        (1) Install using as few joints as possible.
        (2) Protect against unraveling, caging, and abrasion by several wrappings of plastic tape on all ends.
        (3) Install so as not to be entirely encircled or closely encircled by magnetic material.

(4) Suitably protect against damage during construction. Replace or repair cable at Owner's discretion if cable is damaged by anyone before final acceptance.
(5) Protect cable at all points where cable leaves concrete by wrapping rubber tape on 2 inches either side of the plane formed by the finished concrete surface.

b. Buried Installations:
(1) Install at locations and depths as specified or indicated. Otherwise install at least 18 inches below finished grade or deeper if necessary in order to be in contact with earth. Install outside of foundation or wall at a distance of not less than 2 feet.
(2) Maintain clearance of at least three feet from all underground metal piping or structures where possible, otherwise tape all ground conductors within this clearance.
(3) Backfill with excavated earth free from rocks or stones. Thoroughly compact backfill.

2. Ground Rods:
a. Install rods where indicated by driving and not by drilling or jetting.
b. Drive rods into unexcavated portion of the earth where possible.
c. Where rods must be installed in excavation areas, drive rods into earth after compaction of backfill is completed.
d. Drive to a depth such that top of rods will be approximately 18 inches below final grade, or subgrade, and connect to the buried grid ground conductors.

3. Connections:
a. Conform to manufacturer's instructions.
b. Chemically degrease and dry completely before welding or applying compression type connectors.
c. Apply coating to all exothermic-welded connections to be buried, at 15-mils dry film thickness.
d. Make up bolted connections clean and tight.
e. Low-resistance connections with resistance drop not exceeding 1 ohm.
f. Do not cover up connections before they are checked by Engineer.

4. Ground Test Wells:
a. Install at locations indicated on Drawings.
b. Use bolted connections at test wells.

5. The lightning protection system shall be permanently bonded to the grounding electrode system per NPFA 780.

D. Corrosion Protection:
1. Use no combination of materials that may form an electrolytic couple of such nature that corrosion is accelerated in the presence of moisture, unless moisture is permanently excluded from the junction of such metals.
2. Where unusual conditions exist that would cause deterioration or corrosion of conductors, use conductors with suitable protective coatings.
3. Aluminum down conductors shall not be used where contact with the earth is possible.

E. Sleeve and Sleeve Seal Installation for Electrical Penetrations:
1. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.02 FIELD QUALITY CONTROL:

A. Notify Engineer at least 48 hours in advance of inspection before concealing lightning protection components.

B. Provide inspection according to UL 96A and delivery of UL Master Label Certificate to Owner.

END OF SECTION 13 46 00

SECTION 220513 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.03 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
   1. Motor controllers.
   2. Torque, speed, and horsepower requirements of the load.
   3. Ratings and characteristics of supply circuit and required control sequence.
   4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.01 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.
B. Comply with IEEE 841 for severe-duty motors.

2.02 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 700 above sea level.
B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.03 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.
B. Efficiency: Premium efficient, as defined in NEMA MG 1.
C. Service Factor: 1.15.
D. Multispeed Motors: Variable torque.
   1. For motors with 2:1 speed ratio, consequent pole, single winding.
   2. For motors with other than 2:1 speed ratio, separate winding for each speed.
E. Multispeed Motors: Separate winding for each speed.
F. Rotor: Random-wound, squirrel cage.
G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.
I. Insulation: Class F.
J. Code Letter Designation:
    1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
    2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.
K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.04 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
    1. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.05 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
    1. Permanent-split capacitor.
    2. Split phase.
    3. Capacitor start, inductor run.
    4. Capacitor start, capacitor run.
B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
D. Motors 1/20 HP and Smaller: Shaded-pole type.
E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 220513

SECTION 22 05 17 – SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes:
   1. Sleeves without waterstop.
   2. Sleeves with waterstop.
   3. Stack-sleeve fittings.
   4. Sleeve-seal systems.
   5. Grout.

1.03 REFERENCE STANDARDS:

A. Applicable Standards (Latest Edition):
   1. ASTM International (ASTM):
      a. ASTM A53 - Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
      b. ASTM C1107 - Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

1.04 SUBMITTALS:

A. Product data: For each type of product indicated.

PART 2 - PRODUCTS

2.01 SLEEVES WITHOUT WATERSTOP:

A. Stainless-Steel Pipe Sleeves: ASME A112.3.1 drainage pattern seamless, Type 316L stainless steel, with plain ends.
B. Stainless-Steel Sheet Sleeves: ASTM A480/A480M, Type 316, 0.024-inch minimum thickness; round tube closed with welded longitudinal joint.
C. PVC Pipe Sleeves: ASTM D1785, Schedule 40.
D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.
E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.02 SLEEVES WITH WATERSTOP:

A. Description: Manufactured PVC/HDPE and stainless steel, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.

2.03 STACK-SLEEVE FITTINGS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Smith, Jay R. Mfg. Co.
   2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.
   3. Or Engineer Approved Equal.

B. Description: Manufactured, Dura-coated or Duco-coated galvanized cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.

2.04 SLEEVE-SEAL SYSTEMS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Metraflex Company (The).
   2. Link-Seal.
   3. Or Engineer Approved Equal.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
   1. Designed to form a hydrostatic seal of 20 psig minimum.
   2. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   3. Pressure Plates: Stainless steel, Type 316.
   4. Connecting Bolts and Nuts: Stainless steel, Type 316 of length required to secure pressure plates to sealing elements.

2.05 GROUT:

A. Standard: ASTM C1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5,000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 SLEEVE INSTALLATION:

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1 inch annular clear space between piping and concrete slabs and walls.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
   1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
   2. Cut sleeves to length for mounting flush with both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
   3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.
   1. Cut sleeves to length for mounting flush with both surfaces.
   2. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07.

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07.

3.02 SLEEVE WITH WATERSTOP INSTALLATION:

A. Install sleeve with waterstop as new walls and slabs are constructed.
B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
C. Secure nailing flanges to concrete forms.
D. Using grout, seal the space around outside of sleeves.

3.03 STACK-SLEEVE-FITTING INSTALLATION:

A. Install stack-sleeve fittings in new slabs as slabs are constructed.
   1. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Division 07.
   2. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
   3. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
   4. Using grout, seal the space around outside of stack-sleeve fittings.
B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07.

3.04 SLEEVE-SEAL-SYSTEM INSTALLATION:

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.05 SLEEVE AND SLEEVE-SEAL SCHEDULE:

A. Use sleeves and sleeve seals for the following piping-penetration applications:
   1. Exterior Concrete Walls above Grade:
      a. Molded-PE or -PP sleeve or sleeve with waterstop.
      b. Sleeve-seal system.
      c. Select sleeve size to allow for 1 inch (25 mm) annular clear space between piping and sleeve for installing sleeve-seal system .
   2. Exterior Concrete Walls below Grade:
      a. Molded-PE or -PP sleeve or sleeve with waterstop.
      b. Sleeve-seal system.
      c. Select sleeve size to allow for 1 inch (25 mm) annular clear space between piping and sleeve for installing sleeve-seal system.
   3. Concrete Slabs-on-Grade:
      a. Sleeve with waterstop.
      b. Sleeve-seal system.
      c. Select sleeve size to allow for 1 inch (25 mm) annular clear space between piping and sleeve for installing sleeve-seal system.
   4. Concrete Slabs above Grade:
      a. Sleave with waterstop or stack-sleeve fitting.

5. Interior Partitions:
   a. Sleeve without waterstop.

END OF SECTION 22 05 17

SECTION 22 05 18 – ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes:
   1. Escutcheons.
   2. Floor plates.

1.03 SUBMITTALS:

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.01 ESCUTCHEONS:

A. One-Piece, Stainless-Steel Type: With polished stainless-steel finish.
B. Split-Plate, Stainless-Steel Type: With polished, stainless-steel finish; concealed and exposed-rivet hinge; and spring-clip fasteners.

2.02 FLOOR PLATES:

A. Split Floor Plates: Stainless steel with concealed hinge.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
   1. Escutcheons for New Piping:
      a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
      b. Insulated Piping: One-piece stainless steel with polished stainless-steel finish.
      c. Bare Piping: One-piece stainless steel with polished stainless-steel finish.
C. Install floor plates for piping penetrations of equipment-room floors.
   1. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
   2. New Piping: One-piece, floor plate.

3.02 FIELD QUALITY CONTROL:

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 22 05 18

SECTION 22 05 19 – METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. Section Includes:
   1. Liquid-in-glass thermometers.
   2. Thermowells.
   3. Dial-type pressure gages.
   4. Gage attachments.

1.03 RELATED REQUIREMENTS:

1. Section 22 11 13 – Facility Water Distribution Piping for domestic water meters and combined domestic and fire-protection water-service meters outside the building.
2. Section 22 11 16 – Domestic Water Piping for water meters inside the building.

1.04 REFERENCE STANDARDS:

A. Applicable Standards (Latest Edition):
   1. ASME International (ASME):
      a. ASME B1.1 - Unified Inch Screw Threads, UN and UNR Thread Form.
      b. ASME B1.20.1 - Pipe Threads, General Purpose, Inch.
      c. ASME B40.100 - Pressure Gauges and Gauge Attachments.
      d. ASME B40.200 - Thermometers, Direct Reading, and Remote Reading.

1.05 SUBMITTALS:

A. Product Data: For each type of product indicated.
B. Product Certificates: For each type of meter and gage, from manufacturer.
C. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 LIQUID-IN-GLASS THERMOMETERS:

A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Trerice, H. O. Co.
      b. Or Engineer Approved Equal.
   2. Standard: ASME B40.200.
   3. Case: Cast aluminum; 6-inch nominal size.
   4. Case Form: Back angle, unless otherwise indicated.
   5. Tube: Glass with magnifying lens and blue organic liquid.
   6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in ºF.
   7. Window: Glass or plastic.
   8. Stem: Aluminum and of length to suit installation.

a. Design for Thermowell Installation: Bare stem.
9. Connector: 3/4 inch, with ASME B1.1 screw threads.
10. Accuracy: ±1% of scale range or one scale division, to a maximum of 1.5% of scale range.

2.02 THERMOWELLS:

A. Thermowells:
1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material: Stainless steel.
4. Type: Stepped shank, unless straight or tapered shank is indicated.
5. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
6. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
7. Bore: Diameter required to match thermometer bulb or stem.
8. Insertion Length: Length required to match thermometer bulb or stem.
9. Lagging Extension: Include on thermowells for insulated piping and tubing.
10. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.03 PRESSURE GAGES:

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. AMETEK, Inc.; U.S. Gauge.
b. Ashcroft, Inc.
c. Ernst Flow Industries.
d. Flo Fab, Inc.
e. Marsh Bellofram.
f. Miljoco Corporation.
g. Noshok.
h. Palmer Wahl Instrumentation Group.
i. REOTEMP Instrument Corporation.
j. Tel-Tru Manufacturing Company.
k. Trerice, H. O. Co.
l. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
m. Weiss Instruments, Inc.
n. WIKA Instrument Corporation - USA.
o. Winters Instruments - U.S.
p. Or Engineer Approved Equal.
2. Standard: ASME B40.100.
3. Case: Liquid-filled Sealed type(s);cast aluminum; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4, ASME B1.20.1 pipe threads and bottom-outlet type, unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.

10. Ring: Stainless steel.
11. Accuracy: Grade A, ±1% of middle half of scale range.

2.04 GAGE ATTACHMENTS:

A. Snubbers: ASME B40.100, stainless steel; with NPS 1/4, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.
B. Valves: Stainless-steel needle, with NPS 1/4, ASME B1.20.1 pipe threads.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install thermowells with socket extending one-third of pipe diameter and in vertical position in piping tees.
B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
C. Install thermowells with extension on insulated piping.
D. Fill thermowells with heat-transfer medium.
E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
G. Install valve and snubber in piping for each pressure gage for fluids.
H. Install thermometers in the following locations:
   1. Outlet of each water heater.
I. Install pressure gages in the following locations:
   1. Building water service entrance into building.
   2. Outlet of each pressure-reducing valve.

3.02 CONNECTIONS:

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.03 ADJUSTING:

A. Adjust faces of meters and gages to proper angle for best visibility.

3.04 THERMOMETER SCHEDULE:

A. Thermometers at outlet of each domestic water heater shall be the following:
   1. Industrial-style, liquid-in-glass type.
B. Thermometer stems shall be of length to match thermowell insertion length.

3.05 THERMOMETER SCALE-RANGE SCHEDULE:

A. Scale Range for Domestic Hot-Water Piping: 30 to 240ºF.

3.06 PRESSURE-GAGE SCHEDULE:

A. Pressure gages at discharge of each water service into building shall be the following:
   1. Liquid-filled, direct-mounted, metal case.
B. Pressure gages at outlet of each water pressure-reducing valve shall be the following:
   1. Liquid-filled, direct-mounted, metal case.

3.07 PRESSURE-GAGE SCALE-RANGE SCHEDULE:

A. Scale Range for Water Service Piping: 0 to 160 psi.

B. Scale Range for Domestic Water Piping: 0 to 100 psi.

END OF SECTION 22 05 19

SECTION 22 05 23 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01, Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes:
   1. CPVC ball valves.
   2. PVC ball valves.

B. Related Sections:
   1. Division 22 Plumbing Piping Sections for specialty valves applicable to those sections only.
   2. Section 22 05 53 - Identification for Plumbing Piping and Equipment for valve tags and schedules.
   3. Division 33 Water Distribution Piping Sections for general-duty and specialty valves for site construction piping.

1.03 REFERENCE STANDARDS:

A. Applicable Standards (Latest Edition):
   1. ASME International (ASME):
      a. ASME B1.20.1 - Pipe Threads, General Purpose (Inch).
      b. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
      c. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves.
      d. ASME B16.34 - Valves - Flanged, Threaded, and Welding End.
      e. ASME B31.9 - Building Services Piping.
   2. Manufacturers Standardization Society of The Valve and Fittings Industry, Inc. (MSS):
      a. MSS SP-45 - Bypass and Drain Connections.
      b. MSS SP-67 - Butterfly Valves.
      c. MSS SP-110 - Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
   3. NSF International (NSF):
      a. NSF 61 - Drinking Water System Components - Health Effects.
      b. NSF 372 - Drinking Water System Components - Lead Content.

1.04 DEFINITIONS:

A. CWP: Cold working pressure.
B. EPDM: Ethylene propylene copolymer rubber.
C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

1.05 SUBMITTALS:

A. Product Data: For each type of valve indicated.

1.06 QUALITY ASSURANCE:

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
B. ASME Compliance:
   1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

2. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 and NSF 372 for valve materials for potable-water service.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. Prepare valves for shipping as follows:
1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:
1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES:

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping, unless otherwise indicated.

D. Valve Actuator Types:
1. Handwheel: For valves other than quarter-turn types.
2. Hand lever: For quarter-turn valves NPS 6 and smaller.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

F. Valve-End Connections:
1. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.02 CPVC BALL VALVES:

A. CPVC Union Ball Valves, Full Port, Socket or Threaded Ends:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Boshart Industries LLC.
b. Hayward Industries, Inc.
c. NIBCO INC.
2. Description:
a. Standard: MSS SP-122.
b. Maximum Pressure/Temperature Rating: 125 psig at 73ºF.
c. Body Material: CPVC.
d. Body Design: Non-union type.

e. Ends: Detachable, socket or threaded.
f. Ball: CPVC.
g. Port: Full
h. Seals: PTFE or EPDM-rubber O-rings.
i. Handle: Tee shaped.

B. CPVC Non-Union Ball Valves, Full Port, Socket or Threaded Ends:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Boshart Industries LLC.
b. Hayward Industries, Inc.
c. NIBCO INC.
2. Description:
a. Standard: MSS SP-122.
b. Maximum Pressure/Temperature Rating: 125 psig at 73ºF.
c. Body Material: CPVC.
d. Body Design: Union type.
e. Ends: Detachable, socket or threaded.
f. Ball: CPVC.
g. Port: Full
h. Seals: PTFE or EPDM-rubber O-rings.
i. Handle: Tee shaped.

2.03 PVC BALL VALVES:

A. PVC Union Ball Valves, Full Port, Socket or Threaded Ends:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Boshart Industries LLC.
b. Hayward Industries, Inc.
c. NIBCO INC.
2. Description:
a. Standard: MSS SP-122.
b. Maximum Pressure/Temperature Rating: 125 psig at 73ºF.
c. Body Material: PVC.
d. Body Design: Union type.
e. Ends: Detachable, socket or threaded.
f. Ball: PVC.
g. Port: Full
h. Seals: PTFE or EPDM-rubber O-rings.
i. Handle: Tee shaped.

B. PVC Non-Union Ball Valves, Full Port, Socket or Threaded Ends:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Boshart Industries LLC.
b. Hayward Industries, Inc.
c. NIBCO INC.
2. Description:
a. Standard: MSS SP-122.
b. Maximum Pressure/Temperature Rating: 125 psig at 73ºF.
c. Body Material: PVC.

d. Body Design: Non-union type.
e. Ends: Detachable, socket or threaded.
f. Ball: PVC.
g. Port: Full
h. Seals: PTFE or EPDM-rubber O-rings.
i. Handle: Tee shaped.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
B. Operate valves in positions from fully open to fully close. Examine guides and seats made accessible by such operations.
C. Examine threads on valve and mating pipe for form and cleanliness.
D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
E. Do not attempt to repair defective valves; replace with new valves.

3.02 VALVE INSTALLATION:

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
B. Locate valves for easy access and provide separate support where necessary.
C. Install valves in horizontal piping with stem at or above center of pipe.
D. Install valves in position to allow full stem movement.

3.03 ADJUSTING:

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.04 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS:

A. If valve applications are not indicated, use the following:
   1. Shutoff Service: Ball.
   2. Throttling Service: Ball.
B. If valves with specified CWP ratings are not available, the same types of valves with higher CWP ratings may be substituted.

3.05 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE:

A. CPVC Pipe NPS 2 and Smaller:
   1. Where adjacent to a pump, backflow preventer, check valve, strainer, regulator, or other serviceable devices: CPVC union ball valve.
   2. Otherwise: CPVC non-union ball valve
B. PVC Pipe NPS 2 and Smaller:
   1. Where adjacent to a pump, backflow preventer, check valve, strainer, regulator, or other serviceable devices: PVC union ball valve.
   2. Otherwise: PVC non-union ball valve

END OF SECTION 22 05 23

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes:
   1. Metal pipe hangers and supports.
   2. Trapeze pipe hangers.
   3. Fiberglass pipe hangers.
   4. Thermal-hanger shield inserts.
   5. Fastener systems.
   6. Pipe positioning systems.

1.03 RELATED REQUIREMENTS:

1. Division 05 for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

1.04 REFERENCE STANDARDS:

A. Applicable Standards (Latest Edition):
   1. American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI):
      a. ASCE/SEI 7 - Minimum Design Loads for Buildings and Other Structures.
   2. American Welding Society (AWS):
      a. AWS D1.1 - Structural Welding Code - Steel.
   3. ASME International (ASME):
      a. ASME B31.9 - Building Services Piping.
      b. 2007 ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
   4. ASTM International (ASTM):
      a. ASTM A36 - Specification for Carbon Structural Steel.
      b. ASTM C533 - Specification for Calcium Silicate Block and Pipe Thermal Insulation.
      c. ASTM C552 - Specification for Cellular Glass Thermal Insulation.
      d. ASTM C591 - Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
      e. ASTM C1107 - Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
   5. The International Association of Plumbing and Mechanical Officials (IAPMO):
      a. IAPMO PS 42 - Pipe Alignment and Secondary Support Systems.
   6. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):
      a. MSS SP-58 - Pipe Hangers and Supports - Materials, Design and Manufacture.
      b. MSS SP-69 - Pipe Hangers and Supports - Selection and Application.
      c. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
   7. The Society for Protective Coatings (SSPC):
      a. SSPC-PA 1 - Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel.

1.05 DEFINITIONS:
- A. MSS: Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.

1.06 PERFORMANCE REQUIREMENTS:
- A. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
  1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

1.07 SUBMITTALS:
- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following: Include Product Data for components:
  1. Trapeze pipe hangers.

PART 2 - PRODUCTS

2.01 METAL PIPE HANGERS AND SUPPORTS:
- A. Stainless-Steel Pipe Hangers and Supports:
  1. Description: MSS SP-58, Types 1 through 58 (except as noted in PART 3 - EXECUTION), factory-fabricated components.
  2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.02 TRAPEZE PIPE HANGERS:
- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural stainless-steel shapes with MSS SP-58 stainless-steel hanger rods, nuts, saddles, and U-bolts.

2.03 FIBERGLASS PIPE HANGERS:
- A. Clevis-Type, Fiberglass Pipe Hangers:
  1. Description: Similar to MSS SP-58, Type 1, steel pipe hanger except hanger is made of fiberglass or fiberglass-reinforced resin.
  2. Hanger Rods: Continuous-thread rod, washer, and nuts made of stainless steel.
- B. Strap-Type, Fiberglass Pipe Hangers:
  1. Description: Similar to MSS SP-58, Type 9 or Type 10, steel pipe hanger except hanger is made of fiberglass-reinforced resin.
  2. Hanger Rod and Fittings: Continuous-thread rod, washer, and nuts made of stainless steel.

2.04 THERMAL-HANGER SHIELD INSERTS:
- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Carpenter & Paterson, Inc.
  2. PHS Industries, Inc.
  3. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.

4. Or Engineer Approved Equal.

B. Insulation-Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: ASTM C552, Type II cellular glass with 100-psig minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.05 FASTENER SYSTEMS:

A. Mechanical-Expansion Anchors: Insert-wedge-type or stainless-steel anchors, for use in hardened Portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.06 PIPE POSITIONING SYSTEMS:

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.07 MISCELLANEOUS MATERIALS:

A. Aluminum: ASTM B221.

B. Stainless Steel: ASTM A240/A240M.

C. Threaded Rods: Continuously threaded. stainless-steel for indoor and outdoor applications. Mating nuts and washers of similar materials as rods.

D. Grout: ASTM C1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5,000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.01 HANGER AND SUPPORT INSTALLATION:

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. The following figure types given in Figure 1 of MSS SP-69 will not be acceptable: Types 5, 6, 7, 9, 10, 11, 12, 16, 19, 20, 23, 25, 27, 28, 29, and 30. However, Types 7, 9, 10, 10, 11, 19, and 23 may be used for nonferrous and plastic piping systems 2 inches and smaller.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:

1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions. Do not use in lightweight concrete or in concrete slabs less than 4 inches thick. Powder actuated fasteners will not be permitted.

E. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. See Division 22 Plumbing Fixture Sections for requirements for pipe positioning systems for plumbing fixtures.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
H. Install lateral bracing with pipe hangers and supports to prevent swaying.
I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
L. Insulated Piping:
    1. Attach clamps and spacers to piping.
        a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
        b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
        c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
    2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
        a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
    3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
        a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
    4. Shield Dimensions for Pipe: Not less than the following:
        a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
        b. NPS 4: 12 inches long and 0.06 inch thick.
        c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
        d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
        e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
    5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
    6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.02 ADJUSTING:

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.03 PAINTING:

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

3.04 HANGER AND SUPPORT SCHEDULE:

A. Specific hanger and support requirements are in sections specifying piping systems and equipment.
B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system sections.
C. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.
D. Use padded hangers for piping that is subject to scratching.
E. Use thermal-hanger shield inserts for insulated piping and tubing.
F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system sections, install the following types:
   1. Exception: The following figure types given in Figure 1 of MSS SP-69 will not be acceptable: Types 5, 6, 7, 9, 10, 11, and 12. However, Types 7, 9, 10, and 11 may be used for nonferrous and plastic piping systems 2 inches and smaller.
   2. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
   3. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1,050ºF, pipes NPS 4 to NPS 24, requiring up to 4-inches of insulation.
   4. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4-inches of insulation.
   5. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
   6. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
   7. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
   8. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with stainlesss steel-pipe base stanchion support and stainless-steel plate.
   9. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and stainless steel floor flange or stainless-steel plate, and with U-bolt to retain pipe.
   10. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with stainless steel-pipe base stanchion support and stainless steel floor flange.
   11. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
   12. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
   13. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

14. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
15. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Stainless-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system sections, install the following types:
1. Exception: The following figure type given in Figure 1 of MSS SP-69 will not be acceptable: Type 16.
2. Stainless Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
3. Stainless Steel Clevises (MSS Type 14): For 120 to 450ºF piping installations.
4. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
5. Stainless Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450ºF piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system sections, install the following types:
1. Exception: The following figure types given in Figure 1 of MSS SP-69 will not be acceptable: 19, 20, 23, 25, 27, 28, 29, 30, and 34.
2. Stainless Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
4. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
5. Welded-Stainless Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
   a. Light (MSS Type 31): 750 pounds.
   b. Medium (MSS Type 32): 1,500 pounds.
   c. Heavy (MSS Type 33): 3,000 pounds.
6. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
7. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system sections, install the following types:
1. Stainless Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.

2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25% to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25% to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25% to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical type supports and one trapeze member.

L. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

M. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 22 05 29

SECTION 22 05 53 – IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes:
   1. Equipment labels.
   2. Warning signs and labels.
   3. Warning tape.
   4. Pipe labels.
   5. Valve tags.

1.03 REFERENCE STANDARDS:

A. Applicable Standards (Latest Edition):
   1. ASME International (ASME):
      a. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.04 SUBMITTALS:

A. Product Data: For each type of product indicated.
B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
C. Valve numbering scheme.
D. Valve Schedules: For each piping system to include in maintenance manuals.

1.05 COORDINATION:

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
B. Coordinate installation of identifying devices with locations of access panels and doors.
C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.01 EQUIPMENT LABELS:

A. Plastic Labels for Equipment:
   1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick and having predrilled holes for attachment hardware.
   2. Letter and Background Color: As indicated for specific application under Part 3.
   3. Maximum Temperature: Able to withstand temperatures up to 160ºF.
   4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch
   5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
   6. Fasteners: Stainless-steel rivets or self-tapping screws.
   7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
B. Label Content: Include equipment's Drawing designation and asset tag number.

2.02 LABELS:

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
B. Letter and Background Color: As indicated for specific application under Part 3.
C. Maximum Temperature: Able to withstand temperatures up to 160ºF.
D. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
E. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
F. Fasteners: Stainless-steel rivets or self-tapping screws.
G. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
H. Label Content: Include caution and warning information, plus emergency notification instructions.

2.03 PIPE LABELS:

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings. Also include:
    1. Pipe size.
    2. Flow-Direction Arrows: Include flow-direction arrows on distribution piping. Arrows may be either integral with label or applied separately.
    3. Lettering Size: Size letters in accordance with ASME A13.1 for piping.

2.04 VALVE TAGS:

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
    1. Tag Material: Stainless steel, 0.024 inch minimum thickness and having predrilled or stamped holes for attachment hardware.
    2. Fasteners: Stainless-steel S-hook.
B. Valve Schedules: For each piping system, on 8-1/2 by 11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
    1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.02 INSTALLATION, GENERAL REQUIREMENTS:

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.
D. Locate identifying devices so that they are readily visible from the point of normal approach.

3.03 INSTALLATION OF EQUIPMENT LABELS, WARNING SIGNS, AND LABELS:

A. Permanently fasten labels on each item of mechanical equipment.
B. Sign and Label Colors:
   1. White letters on an ANSI Z535.1 safety-blue background.
C. Locate equipment labels where accessible and visible.

3.04 INSTALLATION OF PIPE LABELS:

A. Piping Color Coding: Painting of piping is specified in Section 09 96 00 "High-Performance Coatings.":
B. Install pipe labels showing service and flow direction with permanent adhesive on pipes.
C. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
   1. Within 3 ft. of each valve and control device.
   2. At access doors, manholes, and similar access points that permit view of concealed piping.
   3. Within 3 ft. of equipment items and other points of origination and termination .
   4. Spaced at maximum intervals of 25 ft. along each run. Reduce intervals to 10 ft. in areas of congested piping, ductwork, and equipment .
D. Do not apply plastic pipe labels or plastic tapes directly to bare pipes conveying fluids at temperatures of 125 deg F or higher. Where these pipes are to remain uninsulated, use a short section of insulation or use stenciled labels.
E. Flow-Direction Arrows: Use arrows to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
F. Pipe-Label Color Schedule.
   1. Domestic Cold-Water Piping: White letters on an ANSI Z535.1 safety-green background.
   2. Domestic Hot-Water Piping: White letters on an ANSI Z535.1 safety-green background.
   3. Domestic Hot-Water Return Piping White letters on an ANSI Z535.1 safety-green background.
   4. Sanitary Waste and Storm Drainage Piping: White letters on a black background.

3.05 INSTALLATION OF VALVE-TAGS:

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule in the operating and maintenance manual.
B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:
   1. Valve-Tag Size and Shape:
      a. Domestic Cold Water: 2 inches, round.
      b. Domestic Hot Water: 2 inches, round.
      c. Domestic Hot-Water Return: 2 inches, round.

END OF SECTION 22 05 53

SECTION 22 07 19 – PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes requirements for insulating plumbing piping and devices.
   1. Indoor Domestic Hot, Cold, and Recirculated Water Piping.
   2. Indoor Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities.
   3. Indoor and outdoor aeration piping.

1.03 REFERENCE STANDARDS:

A. Applicable Standards (latest editions):
   1. ASTM International (ASTM):
      a. ASTM B209 - Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
      b. ASTM C534 - Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
      c. ASTM C795 - Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
      d. ASTM C871 - Test Methods for Chemical Analysis of Thermal Insulation Materials for Leachable Chloride, Fluoride, Silicate, and Sodium Ions.
      e. ASTM C921 - Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
      f. ASTM C1136 - Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
      g. ASTM D1644 - Test Methods for Nonvolatile Content of Varnishes.
      h. ASTM D1784 - Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
      i. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
      j. ASTM E96 - Test Methods for Water Vapor Transmission of Materials.
      k. ASTM F1249 - Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.
   2. Military Specifications:
      a. MIL-A-24179A - Adhesive, Flexible Unicellular-Plastic Thermal Insulation.
      b. MIL-A-3316C - Adhesives, Fire-Resistant, Thermal Insulation.
      c. MIL-PRF-19565C - Coating Compounds, Thermal Insulation, Fire- and Water-Resistant, Vapor Barrier.

1.04 SUBMITTALS:

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).
B. Qualification Data: For qualified Installer.
C. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation

materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

1.05 QUALITY ASSURANCE:

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
   1. All Insulation: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

B. Comply with the following applicable standards and other requirements specified for miscellaneous components:
   1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.07 COORDINATION:

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment.

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.08 SCHEDULING:

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS:

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Comply with ASTM C552.

1. Products: Subject to compliance with requirements, provide products by one of the following:
   a. Owens Corning
   b. Pittsburgh Corning
   c. Or Engineer approved equal.
2. Preformed Pipe Insulation, Type II, Class 2: With factory-applied ASJ jacket.
3. Fabricated shapes in accordance with ASTM C450, ASTM C585, and ASTM C1639.

G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534, Type I for tubular materials.
   1. Products: Subject to compliance with requirements, provide products by one of the following:
      a. Aeroflex USA, Inc.; Aerocel.
      b. Armacell LLC; AP Armaflex.
      c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

2.02 ADHESIVES:

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass Adhesive: One part acetoxy cure, silicone adhesive, sealant formulated for use at high temperatures. Cures to elastomeric solid at room temperature. Service temperature range minus 50 deg F to plus 400 deg F.

C. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
   1. Products: Subject to compliance with requirements, provide products by one of the following:
      a. Aeroflex USA, Inc.; Aeroseal.
      b. Armacell LLC; Armaflex 520 Adhesive.
      c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
      d. K-Flex USA; R-373 Contact Adhesive.
      e. Or Engineer Approved Equal.

D. PVC Jacket Adhesive: Compatible with PVC jacket.
   1. Products: Subject to compliance with requirements, provide products by one of the following:
      a. Dow Corning Corporation; 739, Dow Silicone.
      b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
      c. P.I.C. Plastics, Inc.; Welding Adhesive.
      d. Speedline Corporation; Polyco VP Adhesive.
      e. Or Engineer Approved Equal.

2.03 SEALANTS:

A. Joint Sealants:
   1. Products: Subject to compliance with requirements, provide products by one of the following:
      a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
      b. Eagle Bridges - Marathon Industries; 405.
      c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
      d. Mon-Eco Industries, Inc.; 44-05.

e. Pittsburgh Corning Corporation; Pittseal 444.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: +100 to +300ºF.
5. Color: White or gray.

B. PVC Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, provide products by one of the following:
a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
b. Or Engineer Approved Equal.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: +40 to +250ºF.
5. Color: White.

2.04 FIELD-APPLIED JACKETS:

A. Field-applied jackets shall comply with ASTM C921, Type I, unless otherwise indicated.
B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
1. Products: Subject to compliance with requirements, provide products by one of the following:
a. Johns Manville; Zeston.
b. P.I.C. Plastics, Inc.; FG Series.
c. Proto Corporation; LoSmoke.
d. Speedline Corporation; SmokeSafe.
e. Or Engineer Approved Equal.
2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

C. Metal Jacket:
1. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
a. Finish and thickness are indicated in field-applied jacket schedules.
b. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
c. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
d. Factory-Fabricated Fitting Covers:
(1) Same material, finish, and thickness as jacket.
(2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
(3) Tee covers.
(4) Flange and union covers.
(5) End caps.

(6) Beveled collars.
(7) Valve covers.
(8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.05 TAPES:

A. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
1. Products: Subject to compliance with requirements, provide products by one of the following:
a. ABI, Ideal Tape Division; 370 White PVC tape.
b. Compac Corporation; 130.
c. Venture Tape; 1506 CW NS.
d. Or Engineer Approved Equal.
2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500%.
6. Tensile Strength: 18 lbf./inch in width.

2.06 PROTECTIVE SHIELDING GUARDS:

A. Protective Shielding Pipe Covers:
1. Products: Subject to compliance with requirements, provide products by one of the following:
a. Engineered Brass Company.
b. Insul-Tect Products Co.; a subsidiary of MVG Molded Products.
c. McGuire Manufacturing.
d. Plumberex.
e. Truebro; a brand of IPS Corporation.
f. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
g. Or Engineer Approved Equal.
2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.
3. SECUREMENTS
a. Bands:
(1) Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.
b. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION:

A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
B. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.03 GENERAL INSTALLATION REQUIREMENTS:

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
E. Install multiple layers of insulation with longitudinal and end seams staggered.
F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
G. Keep insulation materials dry during application and finishing.
H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
I. Install insulation with least number of joints practical.
J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
K. Cut insulation in a manner to avoid compressing insulation more than 75% of its nominal thickness.
L. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
M. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, and seal patches similar to butt joints.
N. For above-ambient services, do not install insulation to the following:
    1. Vibration-control devices.
    2. Testing agency labels and stamps.
    3. Nameplates and data plates.
    4. Cleanouts.

3.04 PENETRATIONS:

A. Install insulation continuously through wall penetrations.
    1. Seal penetrations with flashing sealant.
    2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
    3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
    4. Seal jacket to wall flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
   1. Comply with requirements in Division 07 for firestopping and fire-resistive joint sealers.
D. Insulation Installation at Floor Penetrations:
   1. Pipe: Install insulation continuously through floor penetrations.
   2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07.

3.05 GENERAL PIPE INSULATION INSTALLATION:

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
   1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
   2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
   3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
   4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
   5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
   6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
   7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
   8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and

unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.06 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION:

A. Seal longitudinal seams and end joints with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.

2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.07 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
1. Install prefabricated pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as that of pipe insulation. Where voids are difficult to fill with block insulation, fill the voids with a fibrous insulation material suitable for the specific operating temperature.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered or routed sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
1. Install prefabricated sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.08 FIELD-APPLIED JACKET INSTALLATION:

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturers recommended adhesive.
1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.09 FINISHES:

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
B. Color: Final color as selected by Engineer. Vary first and second coats to allow visual inspection of the completed Work.
C. Do not field paint aluminum or stainless-steel jackets.

3.10 PLUMBING PIPING INSULATION SCHEDULE, GENERAL:

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
    1. Drainage piping located in crawl spaces.
    2. Underground piping.
    3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 PLUMBING PIPING INSULATION SCHEDULE:

A. Indoor Domestic Hot, Cold, and Recirculated Water:
    1. All Pipe Sizes: Insulation shall be the following:
        a. Flexible Elastomeric.
    2. Hot and Recirculated water 1 inch thick for pipe <1 1/2"; 1.5 inch thick for pipe =>1 1/2" pipe.
    3. Cold water 0.5" thick for pipe <1 1/2 inch think 1 inch thick for pipe =>1 1/2" pipe.
B. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
    1. All Pipe Sizes: Insulation shall be one of the following:
        a. Flexible Elastomeric: 1/2 inch thick.
C. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60ºF:
    1. All Pipe Sizes: Insulation shall be one of the following:
        a. Flexible Elastomeric: 1/2 inch thick.
D. Indoor and outdoor aeration piping:
    1. All Pipe Sizes: Insulation shall be one of the following:
        a. Cellular Glass: 1-1/2” thick.

3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE:

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
B. If more than one material is listed, selection from materials listed is Contractor's option.
C. Indoor or Outdoor Domestic Water Piping, Floor Drains and Traps, Exposed and less than 7’ above finished floor:
    1. PVC: 20 mils thick.
D. Indoor and outdoor aeration piping:
    1. Aluminum, Smooth or Stucco Embossed: 0.024 inch thick.

END OF SECTION 22 07 19

SECTION 22 11 16 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Ductile-iron pipe and fittings.
   2. CPVC piping.
   3. PVC pipe and fittings.
   4. Transition fittings.

1.02 ACTION SUBMITTALS

A. Product Data:
   1. Pipe and tube.
   2. Fittings.
   3. Joining materials.
   4. Transition fittings.

1.03 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.
B. Field quality-control reports.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

A. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372. Include marking "NSF-pw" on piping.

2.02 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe:
   1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless flanged ends are indicated.
   2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
B. Standard-Pattern, Mechanical-Joint Fittings:
   1. AWWA C110/A21.10, ductile or gray iron.
   2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
C. Compact-Pattern, Mechanical-Joint Fittings:
   1. AWWA C153/A21.53, ductile iron.
   2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
D. Push-on-Joint, Ductile-Iron Pipe:
   1. AWWA C151/A21.51.
   2. Push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
E. Standard-Pattern, Push-on-Joint Fittings:
   1. AWWA C110/A21.10, ductile or gray iron.
   2. Gaskets: AWWA C111/A21.11, rubber.
F. Compact-Pattern, Push-on-Joint Fittings:
   1. AWWA C153/A21.53, ductile iron.

2. Gaskets: AWWA C111/A21.11, rubber.

G. Plain-End, Ductile-Iron Pipe: AWA C151/A21.51.

2.03 CPVC PIPING

A. CPVC Pipe: ASTM F441/F441M, with wall thickness as indicated in "Piping Applications" Article.
   1. CPVC Socket Fittings: ASTM F439 for Schedule 80.
   2. CPVC Threaded Fittings: ASTM F437, Schedule 80.

2.04 PVC PIPE AND FITTINGS

A. PVC Pipe: ASTM D1785, with wall thickness as indicated in "Piping Applications" Article.
B. PVC Socket Fittings: ASTM D2467 for Schedule 80.
C. PVC Schedule 80 Threaded Fittings: ASTM D2464.

2.05 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:
   1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
   2. Full-face or ring type unless otherwise indicated.
B. Solvent Cements for Joining PVC Piping: ASTM D2564. Include primer according to ASTM F656.
   1. Solvent Cements for Joining PVC Piping: ASTM D2564. Include primer according to ASTM F656.
C. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.06 ENCASEMENT FOR PIPING

A. Standard: ASTM A674 or AWWA C105/A21.5.
B. Form: Sheet or tube.
C. Color: Black or natural.

2.07 TRANSITION FITTINGS

A. General Requirements:
   1. Same size as pipes to be joined.
   2. Pressure rating at least equal to pipes to be joined.
   3. End connections compatible with pipes to be joined.
B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
C. Sleeve-Type Transition Coupling: AWWA C219.
D. Plastic-to-Metal Transition Fittings:
   1. Description:
      a. CPVC or PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
      b. One end with threaded brass insert and one solvent-cement-socket or threaded end.
E. Plastic-to-Metal Transition Unions:
   1. Description:
      a. CPVC or PVC four-part union.
      b. Stainless steel threaded end.
      c. Solvent-cement-joint or threaded plastic end.
      d. Rubber O-ring.
      e. Union nut.

PART 3 - EXECUTION

3.01 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller, shall be the following:
   1. PVC, Schedule 80; socket fittings; and solvent-cemented joints.

D. Under-building-slab, domestic water, building-service piping, NPS 4 and larger, shall be the following:
   1. Ductile iron pipe.

E. Aboveground domestic water piping, NPS 3 and smaller, shall be one of the following:
   1. CPVC, Schedule 80; socket fittings; and solvent-cemented joints. Hot water pipe and hot water recirculation pipe.
   2. CPVC, Schedule 80 pipe; CPVC, Schedule 80 threaded fittings; and threaded joints. Hot water pipe and hot water recirculation pipe.
   3. PVC, Schedule 80; socket fittings; and solvent-cemented joints. Cold water pipe.

F. Aboveground domestic water piping, NPS 4 and larger, shall be the following:
   1. Mechanical-joint, ductile-iron pipe; standard- or compact-pattern, mechanical-joint fittings; and mechanical joints.

3.02 EARTHWORK

A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31.

3.03 INSTALLATION OF PIPING

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

C. Install underground ductile-iron pipe in PE encasement according to ASTM A674 or AWWA C105/A21.5.

D. Install valves according to the following:
   1. Section 220523.12 "Ball Valves for Plumbing Piping."

E. Install domestic water piping level without pitch and plumb.

F. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

G. Install piping exposed and at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

H. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

I. Install piping to permit valve servicing.

J. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

K. Install piping free of sags and bends.

L. Install fittings for changes in direction and branch connections.

M. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."

N. Install thermometers on outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."
O. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
P. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
Q. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.04 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
    1. Apply appropriate tape or thread compound to external pipe threads.
    2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
D. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
E. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:
    1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
    2. CPVC Piping: Join according to ASTM D2846/D2846M Appendix.
    3. PVC Piping: Join according to ASTM D2855.
F. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.05 INSTALLATION OF TRANSITION FITTINGS

A. Install transition couplings at joints of dissimilar piping.
B. Transition Fittings in Underground Domestic Water Piping:
    1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
    2. Fittings for NPS 2 and Larger: Sleeve-type coupling.
C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.06 INSTALLATION OF DIELECTRIC FITTINGS

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings, nipples, or unions.
C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges, flange kits, or nipples.
D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.07 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for hangers, supports, and anchor devices in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Install hangers for stainless steel tubing and piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
C. Install vinyl-coated hangers for CPVC and PVC piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
D. Support horizontal piping within 12 inches of each fitting.
E. Support vertical runs of stainless steel tubing and piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
F. Support vertical runs of CPVC and PVC piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.08 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.
B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
    1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
    2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
    3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.09 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

3.10 ADJUSTING

A. Perform the following adjustments before operation:
    1. Close drain valves, hydrants, and hose bibbs.
    2. Open shutoff valves to fully open position.
    3. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
        a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
    4. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
    5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
    6. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
    1. Piping Inspections:
        a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.

b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
   1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
   2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:
   a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
   b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
   c. Leave domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
   e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
   f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.
C. Prepare test and inspection reports.

3.12 CLEANING

A. Clean and disinfect potable domestic water piping as follows:
   1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
   2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
      a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
      b. Fill and isolate system according to either of the following:
         1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
         2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
      c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
      d. Repeat procedures if biological examination shows contamination.
      e. Submit water samples in sterile bottles to authorities having jurisdiction.
B. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 22 11 16

SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Vacuum breakers.
   2. Backflow preventers.
   3. Balancing valves.
   4. Temperature-actuated, water mixing valves.
   5. Strainers for domestic water piping.
   6. Hose bibbs.
   7. Wall hydrants.
   8. Water-hammer arresters.
   9. Flexible connectors.
   10. Outlet box (ice machine).

B. Related Requirements:
   1. Section 220519 "Meters and Gauges for Plumbing Piping" for thermometers, pressure gauges, and flow meters in domestic water piping.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For domestic water piping specialties.
   1. Include diagrams for power, signal, and control wiring.

1.03 INFORMATIONAL SUBMITTALS

A. Test and inspection reports.

B. Field quality-control reports.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Domestic water piping specialties intended to convey or dispense water for human consumption are to comply with the SDWA, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or to be certified in compliance with NSF 61 and NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

2.02 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.03 VACUUM BREAKERS

A. Hose-Connection Vacuum Breakers:
   1. Standard: ASSE 1011.
   2. Body: Stainless steel, nonremovable, with manual drain.
   3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.

4. Finish: Polished stainless steel.

2.04 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:
   1. Standard: ASSE 1013.
   2. Operation: Continuous-pressure applications.
   3. Pressure Loss: 12 psig maximum, through middle third of flow range.
   4. Size: As scheduled on drawings.
   5. Design Flow Rate: As scheduled on drawings.
   6. Pressure Loss at Design Flow Rate: 12 psig for sizes NPS 2 and smaller; 12psig for NPS 2-1/2 and larger.
   7. Body: Stainless steel for NPS 2 and smaller; stainless steel for NPS 2-1/2 and larger.
   8. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
   9. Configuration: Designed for horizontal, straight-through flow.
   10. Accessories:
      a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
      b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
      c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

B. Hose-Connection Backflow Preventers
   1. Standard: ASSE 1052.
   2. Operation: Up to 10-foot head of water back pressure.
   3. Inlet Size: NPS 3/4.
   4. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
   5. Capacity: At least 3-gpm flow.

2.05 BALANCING VALVES

A. Memory-Stop Balancing Valves.
   1. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
   2. Pressure Rating: 400-psig minimum CWP.
   3. Size: NPS 2 or smaller.
   4. Body: Copper alloy.
   5. Port: Standard or full port.
   6. Ball: Chrome-plated brass or stainless steel.
   7. Seats and Seals: Replaceable.
   8. End Connections: Solder joint or threaded.
   9. Handle: Vinyl-covered steel with memory-setting device.

2.06 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Water-Temperature Limiting Devices (Serving Lavatories, kitchen sink and hand sink):
   1. Standard: ASSE 1070.
   2. Pressure Rating: 125 psig.
   3. Type: Thermostatically controlled, water mixing valve.
   4. Material: Bronze body with corrosion-resistant interior components.
   5. Connections: Threaded inlets and outlet.
   6. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
   7. Tempered-Water Setting: 110°F.
   8. Valve Finish: Chrome plated.
   9. Wall box for sinks without a cabinet below.

B. Primary, Thermostatic, Water Mixing Valves (TMV-1):

1. Standard: ASSE/ISEA XZ 358.1.
2. Pressure Rating: 125 psig minimum unless otherwise indicated.
3. Type: Exposed-mounted, thermostatically controlled, water mixing valve.
4. Material: Bronze body with corrosion-resistant interior components.
5. Connections: Threaded inlets and outlet.
6. Accessories: Check stops on hot- and cold-water supplies, and adjustable.
7. Tempered-Water Setting: 85°F.
8. Tempered-Water Design Flow Rate: 23 gpm.
9. Valve Finish: Brass.
10. Positive Shut off when cold supply is lost.
11. Built in cold water bypass.
12. ASSE 1017..

2.07 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:
   1. Pressure Rating: 125 psig minimum unless otherwise indicated.
   2. Body: Stainless steel.
   3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
   4. Screen: Stainless steel with round perforations unless otherwise indicated.
   5. Perforation Size:
      a. Strainers NPS 2 and Smaller: 0.033 inch.
      b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
      c. Strainers NPS 5 and Larger: 0.10 inch.
   6. Drain: Factory-installed, hose-end drain valve.

2.08 HOSE BIBBS

A. Hose Bibbs:
   1. Standard: ASME A112.18.1 for sediment faucets.
   2. Body Material: Stainless steel.
   3. Seat: Stainless steel, replaceable.
   4. Supply Connections: NPS 3/4 threaded inlet.
   5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
   6. Pressure Rating: 125 psig.
   7. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
   8. Finish: Polished stainless steel.
   9. Operation: Wheel handle.

2.09 WALL HYDRANTS

A. Nonfreeze Vacuum Breaker Wall Hydrants:
   1. Standard: ASSE 1019, Type A or Type B.
   2. Type: Automatic draining with integral air-inlet valve.
   3. Classification: Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
   4. Pressure Rating: 125 psig.
   5. Operation: Wheel handle.
   6. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
   7. Inlet: NPS 1/2 or NPS 3/4.
   8. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

2.10 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:
   1. Standard: ASSE 1010 or PDI-WH 201.
   2. Type: Metal bellows, piston or diaphragm.
   3. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.11 FLEXIBLE CONNECTORS

A. Stainless Steel-Hose Flexible Connectors: Corrugated-stainless steel tubing with stainless steel wire-braid covering and ends welded to inner tubing.
   1. Working-Pressure Rating: Minimum 200 psig.
   2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
   3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

2.12 OUTLET BOX

A. High impact polystyrene.
B. ¼ turn shut-off valve.
C. Water hammer arrester.
D. Threaded connection.
E. Brass body assembly.
F. Complies with NSF 61, Section 9.

PART 3 - EXECUTION

3.01 INSTALLATION OF PIPING SPECIALTIES

A. Backflow Preventers: Install in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
   1. Locate backflow preventers in same room as connected equipment or system.
   2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
   3. Do not install bypass piping around backflow preventers.
B. Temperature-Actuated, Water Mixing Valves: Install with check stops or shutoff valves on inlets and with shutoff valve on outlet.
   1. Install cabinet-type units recessed in or surface mounted on wall as specified.
C. Y-Pattern Strainers: For water, install on supply side of each water pressure-reducing valve.
D. Outlet Boxes: Install boxes recessed in wall or surface mounted on wall. Install 1-1/2-by-3-1/2-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 06 10 00 "Rough Carpentry."
E. Hose Stations: Install with check stops or shutoff valves on inlets and with thermometer on outlet.
   1. Install cabinet-type units recessed in or surface mounted on wall as specified. Install 1-1/2-by-3-1/2-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."
F. Water-Hammer Arresters: Install in water piping in accordance with PDI-WH 201.

3.02 PIPING CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.

3.03 IDENTIFICATION

A. Plastic Labels for Equipment: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
   1. Vacuum breakers.
   2. Backflow preventers.
   3. Water pressure-reducing valves.
   4. Temperature-actuated, water mixing valves.
   5. Wall hydrants.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.04 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

C. Adjust each reduced-pressure-principle backflow preventer in accordance with manufacturer's written instructions, authorities having jurisdiction and the device's reference standard.

3.05 FIELD QUALITY CONTROL

A. Perform the following tests and inspections.
   1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.
   2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   3. Operational Test: After electrical circuitry has been energized, start units to confirm unit operation.
   4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 22 11 19

SECTION 22 11 23 – DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes:
   1. Recirculation Pump

1.03 DEFINITIONS:

A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50V or for remote-control, signaling power-limited circuits.

1.04 REFERENCE STANDARDS:

A. Applicable Standards (Latest Edition):
   1. ASTM International (ASTM):
      a. ASTM B 584 - Specification for Copper Alloy Sand Castings for General Applications.
      b. Application, Operation and Test (ANSI).
   2. National Electrical Manufacturers Association.
      a. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
   3. National Fire Protection Association (NFPA):
      a. NFPA 70 - National Electrical Code.
   4. Underwriters Laboratories Inc. (UL):
      a. UL 778 - Motor Operated Water Pumps.

1.05 SUBMITTALS:

A. Product Data: For each type of product indicated. Include materials of construction, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.
B. Operation and Maintenance Data: For domestic water pumps to include in operation and maintenance manuals.
C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
D. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. Retain shipping flange protective covers and protective coatings during storage.
B. Protect bearings and couplings against damage.
C. Comply with pump manufacturer's written rigging instructions for handling.

PART 2 - PRODUCTS

2.01 RECIRCULATION PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Armstrong Pumps, Inc.
   2. Bell & Gossett Domestic Pump; ITT Corporation.

3. Grundfos Pumps Corp.
4. Or Engineer Approved Equal.

B. Description: Hot water recirculation pump

C. Pump Construction:
1. Pump Body: stainless steel
2. Impeller: Stainless steel
3. Motor: ECM
4. Bearings: Carbon Steel
5. Gasket/O-ring: EPDM
6. Rotor: Permanent Magnet
7. Shaft: AISI 420 Stainless Steel
8. all other wetted parts: AISI 304 Stainless Steel
9. Insulation Class: F

D. Capacities and Characteristics:
1. Horse power: 1/12
2. Voltage: 120
3. Phase: 1
4. Hz: 60
5. Amp Range: 0.1-1.3
6. Enclousre: Class 2, NEMA Type 2
7. UL 778; YK 1004-1, 1004.7; and UL 60730-1
8. NSF/ANSI-372 certified
9. Provide for signal input from BAS BACnet for scheduling. Coordinate with controls contractor.
10. Onboard user interface.

2.02 CONTROLS:

A. Thermostats: Electric. Internal

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

3.02 PUMP INSTALLATION:

A. Comply with HI 1.4.

B. Install Recirculation pump in accordance with manufacturers recommendations.

3.03 CONNECTIONS:

A. Comply with requirements for piping specified in Section 22 11 16 - Domestic Water Piping. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pumps to allow service and maintenance.

C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.
1. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping

D. Comply with Division 26 Sections for electrical connections, and wiring methods.

3.04 IDENTIFICATION:

A. Comply with requirements for identification specified in Section 22 05 53 - Identification for Plumbing Piping and Equipment for identification of pumps.

3.05 STARTUP SERVICE:

A. Perform startup service.
   1. Complete installation and startup checks according to manufacturer's written instructions.
   2. Check piping connections for tightness.
   3. Clean strainers on suction piping.
   4. Perform the following startup checks for each pump before starting:
      a. Verify bearing lubrication.
      b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
      c. Verify that pump is rotating in the correct direction.
   5. Start motor.
   6. Open discharge valve slowly.
   7. Adjust temperature settings on thermostats.

3.06 ADJUSTING:

A. Adjust domestic water pumps to function smoothly, and lubricate as recommended by manufacturer.
B. Adjust initial temperature set points.
C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION 22 11 23

SECTION 22 13 16 – SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes:
   1. Pipe, tube, and fittings.
   2. Specialty pipe fittings.

B. Related Sections:
   1. Section 22 13 29 - Sanitary Sewerage Pumps for effluent and sewage pumps.

1.03 REFERENCES:

A. Applicable Standards (Latest Edition):
   1. American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI):
      a. ASCE/SEI 7 - Minimum Design Loads for Buildings and Other Structures.
   2. American Society of Sanitary Engineering (ASSE):
      a. ASSE 1079 - Dielectric Pipe Unions.
   3. American Water Works Association (AWWA):
      a. AWWA C219 - Bolted, Sleeve-Type Couplings for Plain-End Pipe.
   4. ASME International (ASME):
      a. ASME B1.20.1 - Pipe Threads, General Purpose, Inch.
      b. ASME B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges.
      c. ASME B18.2.1 - Square and Hex Bolts and Screws, Inch Series.
   5. ASTM International (ASTM):
      a. ASTM C564 - Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
      b. ASTM C1173 - Specification for Flexible Transition Couplings for Underground Piping Systems.
      c. ASTM D2321 - Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
      d. ASTM D2564 - Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
      e. ASTM D2665 - Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
      f. ASTM D2855 - Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
      g. ASTM D3311 - Specification for Drain, Waste, and Vent (DWV) Plastic Fittings Patterns.
      h. ASTM D5926 - Specification for Poly (Vinyl Chloride) (PVC) Gaskets for Plastic Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems.
      i. ASTM F402 - Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings.
      j. ASTM F477 - Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
      k. ASTM F656 - Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

l. ASTM F891 - Specification for Coextruded Poly (Vinyl Chloride) (PVC) Plastic Pipe with a Cellular Core.
m. ASTM F1476 - Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

6. Code of Federal Regulations (CFR):
   a. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings.
7. International Association of Plumbing and Mechanical Officials (IAPMO):
   a. IAPMO PS 66 - Dielectric Waterway Fittings.
8. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS):
   a. MSS SP-69 - Pipe Hangers and Supports - Selection and Application.
9. NSF International (NSF):
   a. NSF/ANSI 14 - Plastics Piping System Components and Related Materials.

1.04 PERFORMANCE REQUIREMENTS:

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
   1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.05 ACTION SUBMITTALS:

A. Product Data: For each type of product indicated.

1.06 QUALITY ASSURANCE:

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

1.07 PROJECT CONDITIONS:

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
   1. Notify Construction Manager no fewer than 2 days in advance of proposed interruption of sanitary waste service.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS:

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.02 PVC PIPE AND FITTINGS:

A. Solid-Wall PVC Pipe: ASTM D2665, drain, waste, and vent.
B. PVC Socket Fittings: ASTM D2665, made to ASTM D3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
C. Adhesive Primer: ASTM F656.
   1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
D. Solvent Cement: ASTM D2564.

1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.03 SPECIALTY PIPE FITTINGS:

A. Transition Couplings:
   1. General Requirements: Fitting or device for joining piping with small differences in ODs or of different materials. Include end connections same size as and compatible with pipes to be joined.
   2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
   3. Unshielded, Nonpressure Transition Couplings:
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         (1) Dallas Specialty & Mfg. Co.
         (2) Fernco, Inc.
         (3) Mission Rubber Company; a division of MCP Industries, Inc.
         (4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
         (5) Or Engineer Approved Equal.
      b. Standard: ASTM C1173.
      c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
      d. Sleeve Materials:
         (1) For Plastic Pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.
         (2) For Dissimilar Pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.
   4. Shielded, Nonpressure Transition Couplings:
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         (1) Cascade Waterworks Mfg. Co.
         (2) Mission Rubber Company; a division of MCP Industries, Inc.
         (3) Or Engineer Approved Equal.
      b. Standard: ASTM C1460.
      c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

2.04 FIRE WRAP

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. 3M
   2. Fire
   3. Master
B. Flexible wrap.
C. Meets ASTM E84, NFPA 262 (UL 910) and UL 1887.
D. Foil encapsulated scrim.
E. Fire Wrap all PVC pipe in plenum space.

PART 3 - EXECUTION

3.01 EARTH MOVING:

A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31.

3.02 PIPING INSTALLATION:

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited, unless specifically indicated otherwise.
D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
E. Install piping to permit valve servicing.
F. Install piping at indicated slopes.
G. Install piping free of sags and bends.
H. Install fittings for changes in direction and branch connections.
I. Install piping to allow application of insulation.
J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch, and 1/8-bend fittings if two fixtures are installed back-to-back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
K. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
L. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
    1. Building Sanitary Drain: 2% downward in direction of flow for piping NPS 3 and smaller; 1% downward in direction of flow for piping NPS 4 and larger.
    2. Horizontal Sanitary Drainage Piping: 2% downward in direction of flow.
    3. Vent Piping: 1% down toward vertical fixture vent or toward vent stack.
M. Install aboveground PVC piping according to ASTM D2665
N. Install underground PVC piping in accordance with ASTM D2321.
O. Install engineered soil and waste drainage and vent piping systems as follows:
    1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
P. Plumbing Specialties:
    1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with

requirements for cleanouts specified in Section 22 13 19 - Sanitary Waste Piping Specialties.

2. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section 22 13 19 - Sanitary Waste Piping Specialties.

Q. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 05 17 - Sleeves and Sleeve Seals for Plumbing Piping.

S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 05 17 - Sleeves and Sleeve Seals for Plumbing Piping.

T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 05 18 - Escutcheons for Plumbing Piping.

3.03 JOINT CONSTRUCTION:

A. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Piping: Join according to ASTM D2855 and ASTM D2665 Appendixes.

3.04 SPECIALTY PIPE FITTING INSTALLATION:

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Drainage Piping: Shielded, nonpressure transition couplings.

3.05 HANGER AND SUPPORT INSTALLATION:

A. Comply with requirements for pipe hanger and support devices and installation specified in Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment.

1. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
2. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
3. Vertical Piping: MSS Type 8 or Type 42 clamps.
4. Install individual, straight, horizontal piping runs:
   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
5. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
6. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support horizontal piping and tubing within 12 inches of each fitting and coupling.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

E. Install supports for vertical copper tubing every 10 feet.

F. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.

5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.

G. Install supports for vertical PVC piping every 48 inches.

H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.06 CONNECTIONS:

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.

3.07 IDENTIFICATION:

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 22 05 53 - Identification for Plumbing Piping and Equipment.

3.08 FIELD QUALITY CONTROL:

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections, and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into

piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.09 CLEANING AND PROTECTION:

A. Clean interior of piping. Remove dirt and debris as work progresses.
B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
C. Place plugs in ends of uncompleted piping at end of day and when work stops.
D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

3.10 PIPING SCHEDULE:

A. Soil and waste piping shall be the following:
   1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
   2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

END OF SECTION 22 13 16

SECTION 22 13 19 – SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01, Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes:
   1. Cleanouts.
   2. Floor drains.
   3. Channel drainage systems.
   4. Roof flashing assemblies.
   5. Through-penetration firestop assemblies.
   6. Miscellaneous sanitary drainage piping specialties.
   7. Flashing materials.
   8. Trap guard.

1.03 REFERENCES:

A. Applicable Standards (Latest Edition):
   1. American Society of Sanitary Engineering (ASSE):
      a. ASSE 1050 - Stack Air Admittance Valves for Sanitary Drainage Systems.
      b. ASSE 1051 - Individual and Branch Type Air Admittance Valves for Sanitary Drainage Systems.
   2. ASME International (ASME):
      a. ASME A112.1.2 - Air Gaps in Plumbing Systems.
      b. ASME A112.3.1 - Performance Standard and Installation Procedures for Stainless Steel Drainage Systems for Sanitary, Storm and Chemical Applications, Above and Below Ground.
      c. ASME A112.6.3 - Floor and Trench Drains.
      d. ASME A112.14.1 - Backwater Valves.
      e. ASME A112.36.2M - Cleanouts.
   3. ASTM International (ASTM):
      a. ASTM B152 - Specification for Copper Sheet, Strip, Plate, and Rolled Bar.
      b. ASTM B749 - Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.
      c. ASTM D4068 - Specification for Chlorinated Polyethylene (CPE) Sheeting for Concealed Water-Containment Membrane.
   4. NSF International (NSF):
      a. NSF 14 - Plastics Piping Components and Related Materials.
   5. SSPC: The Society for Protective Coatings:
      a. SSPC-Paint 12 - Paint Specification No. 12: Cold-Applied Asphalt Mastic (Extra Thick Film).
   6. Underwriters Laboratories, Inc. (UL):
      a. UL 1479 - Fire Tests of Through-Penetration Firestops.

1.04 DEFINITIONS:

A. PVC: Polyvinyl chloride plastic.

1.05 QUALITY ASSURANCE:

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.06 COORDINATION:

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.01 CLEANOUTS:

A. Exposed Metal Cleanouts :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products, Inc.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.
   g. Or Engineer Approved Equal.
   h. Josam Company; Blucher-Josam Div.
   i. Or Engineer Approved Equal.
2. Standard: ASME A112.3.1 for stainless steel for cleanout test tee.
3. Size: Same as connected drainage piping.
4. Body Material: Stainless-steel tee with side cleanout as required to match connected piping.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
6. Closure: Stainless-steel plug with seal.

B. Metal Floor Cleanouts :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Josam Company; Josam Div.
   b. Oatey.
   c. Sioux Chief Manufacturing Company, Inc.
   d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   e. Tyler Pipe; Wade Div.
   f. Watts Drainage Products, Inc.
   g. Zurn Plumbing Products Group; Light Commercial Operation.
   h. Zurn Plumbing Products Group; Specification Drainage Operation.
   i. Or Engineer Approved Equal.
2. Standard: ASME A112.3.1.
3. Size: Same as connected branch.
4. Housing: Stainless steel.
5. Closure: Stainless steel with seal.
6. Riser: Stainless-steel drainage pipe fitting to cleanout.

2.02 FLOOR DRAINS:

A. Stainless-Steel Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Josam Company; Josam Div.
   b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   c. Watts Drainage Products, Inc.
   d. Zurn Plumbing Products Group; Specification Drainage Operation.
   e. Or Engineer Approved Equal.
2. Standard: ASME A112.6.3.
3. Outlet: Bottom or side as indicated or schedule on Drawings or otherwise required.
4. Top or Strainer Material: Stainless-steel.
5. Top Shape: Round or Square as indicated or scheduled on Drawings.
6. Dimensions of Top or Strainer: As indicated or scheduled on Drawings .
7. Seepage (Membrane) Flange: Required with waterproof membrane, otherwise not required.
8. Anchor Flange: Not required with seepage flange for light-duty and medium-duty, otherwise required.
9. Clamping (Underdeck) Device: Not required where seepage flange or anchor flange is cast in concrete, otherwise required.
10. Trap-Primer Connection: Not required.
11. PVC.
12. Trap Pattern: Deep-seal P-trap.

2.03 CHANNEL DRAINAGE SYSTEMS:

A. FRP Channel Drainage Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ACO Polymer Products, Inc.
   b. Aquaduct, Inc.; an ACO Polymer Products, Inc. Company.
   c. Josam Company; Mea-Josam Div.
   d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   e. Zurn Plumbing Products Group; Flo-Thru Operation.
   f. Or Engineer Approved Equal.
2. Description: Modular system of channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.
   a. Channel Sections: Interlocking-joint, sloped-invert, FRP modular units, with end caps. Include flat, rounded, or inclined inside bottom, with outlets in number, sizes, and locations indicated.
      (1) Dimensions: As indicated on Drawings.
      (2) Frame: Stainless steel for grates.
   b. Grates: With slots or perforations and widths and thickness that fit recesses in channel sections.
      (1) Material: Fiberglass.
      (2) Locking Mechanism: Not required.
   c. Covers: Solid Fiberglass, of width and thickness that fit recesses in channel sections, and of lengths indicated.
   d. Supports, Anchors, and Setting Devices: Manufacturer's standard, unless otherwise indicated.

e. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

2.04 ROOF FLASHING ASSEMBLIES:

A. Roof Flashing Assemblies:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Acorn Engineering Company; Elmdor/Stoneman Div.
b. Thaler Metal Industries Ltd.
c. Or Engineer Approved Equal.

B. Description: Manufactured assembly made of 6.0 lb./sq. ft., 0.0938 inch thick, lead flashing collar and skirt extending at least 8 inches from pipe, with stainless-steel boot reinforcement and counterflashing fitting.
1. Open-Top Vent Cap: Without cap.
2. Low-Silhouette Vent Cap: With vandal-proof vent cap.
3. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.05 THROUGH-PENETRATION FIRESTOP ASSEMBLIES:

A. Through-Penetration Firestop Assemblies:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. ProSet Systems, Inc.
b. Or Engineer Approved Equal.
2. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
3. Size: Same as connected soil, waste, or vent stack.
4. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
5. Stack Fitting: ASTM A48, Stainless-steel, hubless-pattern, wye branch with neoprene O-ring at base and stainless-steel plug in thermal-release harness. Include PVC protective cap for plug.
6. Special Coating: Corrosion-resistant on interior of fittings.

2.06 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES:

A. Deep-Seal Traps:
1. Description: PVC, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.
a. NPS 2: 4-inch minimum water seal.
b. NPS 2-1/2 and Larger: 5-inch minimum water seal.

B. Air-Gap Fittings:
1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: PVC.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

C. Sleeve Flashing Device:

1. Description: Manufactured, stainless-steel fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include stainless-steel pipe extension in top of fitting that will extend 2 inches above finished floor and stainless-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

D. Stack Flashing Fittings:
1. Description: Counterflashing-type, stainless-steel fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

E. Vent Caps:
1. Description: Stainless-steel body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

F. Frost-Resistant Vent Terminals:
1. Description: Manufactured or shop-fabricated assembly constructed of stainless-steel.
2. Design: To provide 1-inch enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

G. Expansion Joints:
1. Standard: ASME A112.21.2M.
2. Body: Stainless-steel, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

2.07 FLASHING MATERIALS:

A. Elastic Membrane Sheet: ASTM D4068, flexible, chlorinated polyethylene, 40 mil minimum thickness.
B. Fasteners: Stainless-steel.
C. Metal Accessories: Stainless-steel strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
D. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

2.08 TRAP GUARD

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Jay R Smith
2. Zurn
3. Rectorseal

B. UV resistant ABS plastic frame.
C. Silicon rubber sealing flapper.
D. Tested and certified with IAPMO and I.P.C.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.
B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping, unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
   a. Radius, 30 Inches or Less: Equivalent to 1% slope, but not less than 1/4 inch total depression.
   b. Radius, 30 to 60 Inches: Equivalent to 1% slope.
   c. Radius, 60 Inches or Larger: Equivalent to 1% slope, but not greater than 1 inch total depression.
3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

F. Assemble FRP channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.

G. Install fixture air-admittance valves on fixture drain piping.

H. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

I. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

J. Install through-penetration firestop assemblies in plastic conductors and stacks at floor penetrations.

K. Assemble open drain fittings and install with top of hub 2 inches above floor.

L. Install deep-seal traps on floor drains and other waste outlets, if indicated.

M. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

N. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

O. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

P. Install vent caps on each vent pipe passing through roof.

Q. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

R. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

S. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

T. Install wood-blocking reinforcement for wall-mounting-type specialties.
U. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.02 CONNECTIONS:
A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
B. Install piping adjacent to equipment to allow service and maintenance.
C. Ground equipment according to Division 26.
D. Connect wiring according to Division 26.

3.03 FLASHING INSTALLATION:
A. Fabricate flashing from single piece, unless large pans, sumps, or other drainage shapes are required.
B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
C. Set flashing on floors and roofs in solid coating of bituminous cement.
D. Secure flashing into sleeve and specialty clamping ring or device.
E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07.
F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into Stainless-steel sleeve having calking recess.
G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.04 LABELING AND IDENTIFYING:
A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 22 05 53 - Identification for Plumbing Piping and Equipment.

3.05 FIELD QUALITY CONTROL:
A. Tests and Inspections:
1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.06 PROTECTION:
A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
B. Place plugs in ends of uncompleted piping at end of each day or when Work stops.

END OF SECTION 22 13 19

SECTION 22 13 29 – SANITARY SEWERAGE PUMPS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section Includes:
   1. Terminology and descriptions for pumps used in this Section are from HI 1.1-1.2 and HI 3.1-3.5.
   2. Packaged, submersible sewage pump units.

1.03 REFERENCES:

A. Applicable Standards (Latest Edition):
   1. ASME International (ASME):
      a. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
      b. ASME B16.4 - Gray Iron Threaded Fittings.
   2. ASTM International (ASTM):
      a. ASTM A48 - Specification for Gray Iron Castings.
      b. ASTM A53 - Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
      c. ASTM A532 - Specification for Abrasion-Resistant Cast Irons.
      d. ASTM B584 - Specification for Copper Alloy Sand Castings for General Applications.
   3. Hydraulic Institute (HI):
      a. HI 1.1-1.2 - Centrifugal Pumps for Nomenclature and Definitions.
      b. HI 1.3 - Centrifugal Pumps for Design and Application.
      c. HI 1.4 - Centrifugal Pumps for Installation, Operation and Maintenance.
      d. HI 3.1-3.5 - Rotary Pumps for Nomenclature, Definitions, Application and Operation.
   4. National Electrical Manufacturers Association (NEMA):
      a. NEMA 250 - Enclosures for Electrical Equipment (1,000V Maximum).
   5. NFPA:
      a. NFPA 70 - National Electrical Code.
   6. Submersible Wastewater Pump Association (1866 Sheridan Road, Suite 201, Highland Park, IL 60035-2545; 847-681-1868):
      a. Submersible Sewage Pumping Systems (SWPA) Handbook, 3rd ed., 2005.
   7. Underwriters Laboratories, Inc. (UL):
      a. UL 778 - Motor-Operated Water Pumps.

1.04 ACTION SUBMITTALS:

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Wiring Diagrams: For power, signal, and control wiring.

1.05 CLOSEOUT SUBMITTALS:

A. Operation and Maintenance Data: For pumps and controls, to include in operation and maintenance manuals.

1.06 QUALITY ASSURANCE:

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect bearings and couplings against damage.

C. Comply with pump manufacturer's written rigging instructions for handling.

1.08 COORDINATION:

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.01 PACKAGED, SUBMERSIBLE SEWAGE PUMP UNITS:

A. Packaged, Submersible, Grinder, Sewage Pump Units:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Liberty Pumps.
   b. Pentair Pump Group; Myers.
   c. Zoeller Company.
   d. Or Engineer Approved Equal.
2. Description: Factory-assembled and -tested, automatic-operation, basin-mounted, grinder, sewage pump unit.
3. Pump Type: Submersible, end-suction, single-stage, centrifugal pump.
4. Pump Casing: Epoxy coated cast iron.
5. Impeller: 440C Stainless-steel hardened to RC55-60 cutter plate.
6. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.
7. Control: Manufacturer's standard panel for one pump.
8. Controls: Automatic, with mechanical float switches.
9. Pump Discharge Piping: Factory or field fabricated, schedule 80 PVC.
10. Basin: Watertight plastic. Fiberglass and of size required for pumps, with inlet pipe connection and gastight steel cover with pump discharge and vent connections.
11. Stainless steel lifting chain and guide rails.
12. 304 stainless steel float switch brackets.

B. Capacities and Characteristics:

1. System Capacity: 50 gpm.
2. Number of Pumps: One.
3. Each Pump:
   a. Capacity: 50 gpm.
   b. Total Dynamic Head: 28 feet.
   c. Speed: 3,450 rpm.
   d. Discharge Pipe Size: 2".
   e. Motor Horsepower: 2.
   f. Electrical Characteristics:
      (1) Volts: 208.

(2) Phases: Single.
(3) Hertz: 60.

4. Unit Electrical Characteristics:
   a. Full-Load Amperes: 20.
5. Alternator Control Required: No.
6. Basin:
   a. Dimensions: 30” diameter.
   b. Inlet Size: 4.
   c. Bottom to Inlet Centerline: Contractor to field verify.
   d. Vent Size: 2”.

2.02 MOTORS:

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 22 05 13 - Common Motor Requirements for Plumbing Equipment.
   1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
   2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

B. Motors for submersible pumps shall be hermetically sealed.

PART 3 - EXECUTION

3.01 EARTHWORK:

A. Excavation and filling are specified in Division 31.

3.02 EXAMINATION:

A. Examine roughing-in for plumbing piping to verify actual locations of sanitary drainage and vent piping connections before sewage pump installation.

3.03 INSTALLATION:

A. Pump Installation Standards:
   1. Comply with HI 1.4 for installation of centrifugal pumps.
   2. Comply with HI 3.1-3.5 for installation of progressing-cavity sewage pumps.

B. Wiring Method: Comply with requirements in Division 26.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer’s limitations on bending radii. Provide and use lacing bars and distribution spools.

3.04 CONNECTIONS:

A. Comply with requirements for piping specified in Section 22 13 16 - Sanitary Waste and Vent Piping. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.05 FIELD QUALITY CONTROL:

A. Perform tests and inspections.
   1. Manufacturer’s Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:
   1. Perform each visual and mechanical inspection.
   2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
C. Pumps and controls will be considered defective if they do not pass tests and inspections.
D. Prepare test and inspection reports.

3.06 STARTUP SERVICE:
A. Engage a factory-authorized service representative to perform startup service.
   1. Complete installation and startup checks according to manufacturer's written instructions.

3.07 ADJUSTING:
A. Adjust pumps to function smoothly, and lubricate as recommended by manufacturer.
B. Adjust control set points.

3.08 DEMONSTRATION:
A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain controls and pumps.

END OF SECTION 22 13 29

SECTION 22 33 00 – ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes:
   1. Commercial, electric, storage, domestic-water heaters.
   2. Thermostat-control, electric, tankless, domestic-water heaters.
   3. Domestic-water heater accessories.

1.03 REFERENCES:

A. Applicable Standards (Latest Edition):
   1. American National Standards Institute/CSA International (ANSI/CSA):
      a. ANSI/CSA LC 3 - Appliance Stands and Drain Pans.
      b. ANSI Z21.22/CSA 4.4-M99 - Relief Valves for Hot Water Supply Systems.
   2. American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI):
      a. ASCE/SEI 7 - Minimum Design Loads for Buildings and Other Structures.
   3. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
      a. ASHRAE 90.2 - Energy Efficient Design of Low-Rise Residential Buildings (ANSI).
   4. American Society of Heating, Refrigerating and Air-Conditioning Engineers/Illuminating Engineering Society of North America (ASHRAE/IESNA):
      a. ASHRAE/IESNA 90.1 - Energy Standard for Buildings except Low-Rise Residential Buildings (ANSI).
   5. American Society of Sanitary Engineering (ASSE):
      a. ASSE 1003 - Water Pressure Reducing Valves.
      b. ASSE 1005 - Water Heater Drain Valves.
      c. ASSE 1010 - Water Hammer Arresters.
   6. ASME International (ASME):
      a. ASME B1.20.1 - Pipe Threads, General Purpose (Inch).
      b. ASME B1.20.7 - Hose Coupling Screw Threads, Inch.
      c. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through 24.
      d. ASME B16.24 - Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500, and 2500.
      e. 2007 ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," Division 1.
   7. NFPA:
      a. NFPA 70 - National Electrical Code.
   8. NSF International (NSF):
      a. NSF 5 - Water Heaters, Hot Water Supply Boilers, and Heat Recovery Equipment.
      b. NSF 61 - Drinking Water System Components - Health Effects.
   9. Plumbing & Drainage Institute (PDI):
      a. PDI-WH 201 - Water Hammer Arresters.
   10. Underwriters Laboratories, Inc. (UL):
      a. UL 174 - Household Electric Storage Tank Water Heaters.
      b. UL 499 - Electric Heating Appliances.

c. UL 1279 - Solar Collectors.
d. UL 1453 - Electric Booster and Commercial Storage Tank Water Heaters.

1.04 ACTION SUBMITTALS:

A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.05 INFORMATIONAL SUBMITTALS:

A. Product Certificates: For each type of commercial and tankless, electric, domestic-water heater, from manufacturer.
B. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
C. Source quality-control reports.
D. Field quality-control reports.
E. Warranty: Sample of special warranty.

1.06 CLOSEOUT SUBMITTALS:

A. Operation and Maintenance Data: For electric, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.07 QUALITY ASSURANCE:

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.
C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

1.08 COORDINATION:

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.09 WARRANTY:

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including storage tank and supports.
      b. Faulty operation of controls.
      c. Deterioration of metals, metal finishes, and other materials beyond normal use.
   2. Warranty Periods: From date of Substantial Completion.
      a. Commercial, Electric, Storage, Domestic-Water Heaters:
         (1) Storage Tank: 5 years.
         (2) Controls and Other Components: 1 year.
      b. Electric, Tankless, Domestic-Water Heaters: 1 year.

PART 2 - PRODUCTS

2.01 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS:

A. Commercial, Electric, Storage, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Water Heaters.
   b. Bradford White Corporation.
   c. Cemline Corporation.
   d. Electric Heater Company (The).
   e. GSW Water Heating.
   f. HESco Industries, Inc.
   g. Lochinvar Corporation.
   h. Precision Boilers, Inc.
   i. PVI Industries, LLC.
   j. RECO USA.
   k. Rheem Manufacturing Company.
   l. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
   m. State Industries.
   n. Vaughn Manufacturing Corporation.
   o. Or Engineer Approved Equal.
2. Standard: UL 1453.
3. Storage-Tank Construction: Non-ASME-code, steel vertical arrangement.
   a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.
      (1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
   b. Pressure Rating: 150 psig.
   c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
4. Factory-Installed Storage-Tank Appurtenances:
   a. Anode Rod: Replaceable magnesium.
   b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
   c. Insulation: Comply with ASHRAE/IESNA 90.1.
   d. Jacket: Steel with enameled finish.
   e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
   f. Temperature Control: Adjustable thermostat.
   g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
   h. Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

B. Capacity and Characteristics:

1. Capacity: 119 gal.
2. Recovery: 140 gph at 40ºF temperature rise.
3. Temperature Setting: 140ºF.
4. Power Demand: 13.5 kilowatts.

5. Heating Elements:
   a. Number of Elements: 3.
   b. Kilowatts Each Element: 4.5 kilowatts.
   c. Number of Stages: 1.
6. Electrical Characteristics:
   a. Volts: 480.
   b. Phases: 3.
   c. Hertz: 60.
   d. Full-Load Amperes: 16.2.

2.02 COMMERCIAL, LIGHT-DUTY, STORAGE, ELECTRIC, DOMESTIC-WATER HEATERS:

A. Source Limitations: Obtain domestic-water heaters from single source form single manufacturer.
B. Standard: UL 174.
C. Storage-Tank Construction: Steel, vertical arrangement.
   1. Tappings: ASME B1.20.1 pipe thread.
   2. Pressure rating: 150 psig,
   3. Interior Finish: Comply with NSF 61 and MSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.
D. Factory-Installed, Storage-Tank Appurtenances:
   1. Anode Rod: Replaceable magnesium.
   2. Dip Tube: Required unless cold-water inlet is near bottom of tank.
   3. Drain Valve: Corrosion-resistant metal with hose-end connection.
   4. Insulation: Comply with ASHRAE/IES 90.1.
   5. Jacket: Steel with enameled finish or high-impact composite material.
   6. Heat-Trap Fittings: Inlet type in cold-eater inlet and outlet type in hot water outlet.
   7. Heating Elements: Electric, screw-in immersion type.
   8. Temperature Control: Adjustable thermostat.
   9. Safety Control: High-temperature-limit cutoff device or system.
   10. Relief Valve: ASME rated and stamped for combination temperature-and-pressure releif valves. Include relieving capacity at least as great as heat input, and include pressure settng less than working-pressure rating of domestic-water heaster. Select relief valve with sensing element that extends into storage tank.
E. Capacity and Characteristics:
   1. Capacity: 30 gallon,
   2. Temperature Setting: 125 deg F.
   3. Power Demad: 4500 watts.
   4. Heating Elements:
      a. Number of Elements: two.
      b. Kilowatts Each Element: 4.5.
      c. Number of Stages: One.
   5. Electrical Characteristics:
      a. Volts: 240.
      b. Phases: Single.
      c. Hertz: 60 Hz.

2.03 ELECTRIC, TANKLESS, DOMESTIC-WATER HEATERS:

A. Thermostat-Control, Electric, Tankless, Domestic-Water Heaters (TWH-2):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Bradford White
   b. Bosch Water Heating.
   c. Chronomite Laboratories, Inc.
   d. E-Tankless Water Heaters Corp.
   e. Keltech, Inc.
   f. EeMax.
   g. Or Engineer Approved Equal.
2. Standard: UL 499 for electric, tankless, (domestic-water heater) heating appliance.
3. Construction: Copper piping or tubing complying with NSF 61 barrier materials for potable water, without storage capacity.
   a. Connections: Compression Fitting.
   b. Pressure Rating: 150 psig.
   c. Heating Element: Resistance heating system.
   d. Temperature Control: Thermostat.
   e. Safety Control: High-temperature-limit cutoff device or system.
   f. Jacket: Aluminum or steel with enameled finish or plastic.
4. Support: Bracket for wall mounting.
5. Capacity and Characteristics:
   a. Flow Rate: 0.5 gpm at 48°F temperature rise.
   b. Temperature Setting: 110ºF.
   c. Power Demand: 3.5 kilowatts.
   d. Electrical Characteristics:
      (1) Volts: 240.
      (2) Phases: Single.
      (3) Hertz: 60.
      (4) Full-Load Amperes: 30.

2.04 DOMESTIC-WATER HEATER ACCESSORIES:

A. Domestic-Water Compression Tanks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AMTROL, Inc.
   b. Flexcon Industries.
   c. Honeywell International, Inc.
   d. Pentair Pump Group (The); Myers.
   e. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
   f. State Industries.
   g. Taco, Inc.
   h. Or Engineer Approved Equal.
2. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
3. Construction:
   a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.

b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
c. Air-Charging Valve: Factory installed.

4. Capacity and Characteristics:
   a. Working-Pressure Rating: 150 psig.
   b. Capacity Acceptable: 6.3 gal..
   c. Air Precharge Pressure: Field determine.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.

D. Heat-Trap Fittings: ASHRAE 90.2.

E. Manifold Kits: Domestic-water heater manufacturer's factory-fabricated inlet and outlet piping for field installation, for multiple domestic-water heater installation. Include ball-, butterfly-, or gate-type shutoff valves to isolate each domestic-water heater and calibrated or memory-stop balancing valves to provide balanced flow through each domestic-water heater.
   1. Comply with requirements for ball-, butterfly-, or gate-type shutoff valves specified in Section 22 05 23 - General-Duty Valves for Plumbing Piping.
   2. Comply with requirements for balancing valves specified in Section 22 11 19 - Domestic Water Piping Specialties.

F. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

2.05 SOURCE QUALITY CONTROL:

A. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 for retesting and reinspecting requirements and Division 01 for requirements for correcting the Work.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.01 DOMESTIC-WATER HEATER INSTALLATION:

A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base. Comply with requirements for concrete bases specified in Division 03.
   1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
   2. Maintain manufacturer's recommended clearances.
   3. Arrange units so controls and devices that require servicing are accessible.
   4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
   5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.
8. Anchor domestic-water heaters to substrate.

B. Electric, Tankless, Domestic-Water Heater Mounting: Install electric, tankless, domestic-water heaters at least 18 inches above floor on wall bracket.
1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Anchor domestic-water heaters to substrate.

C. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 22 05 23 - General-Duty Valves for Plumbing Piping.

D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

E. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 22 11 19 - Domestic Water Piping Specialties.

F. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 22 05 19 - Meters and Gauges for Plumbing Piping.

G. Assemble and install inlet and outlet piping manifold kits for multiple electric, domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each electric, domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each electric, domestic-water heater outlet. Comply with requirements for valves specified in Section 22 05 23 - General-Duty Valves for Plumbing Piping, and comply with requirements for thermometers specified in Section 22 05 19 - Meters and Gauges for Plumbing Piping.

H. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.

I. Fill electric, domestic-water heaters with water.

J. Charge domestic-water compression tanks with air.

3.02 CONNECTIONS:

A. Comply with requirements for piping specified in Section 22 11 16 - Domestic Water Piping. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.03 IDENTIFICATION:

A. Identify system components. Comply with requirements for identification specified in Section 22 05 53 - Identification for Plumbing Piping and Equipment.

3.04 FIELD QUALITY CONTROL:

A. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
   2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
   4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 for retesting and reinspecting requirements and Division 01 for requirements for correcting the Work.

C. Prepare test and inspection reports.

3.05 DEMONSTRATION:

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial and tankless, electric, domestic-water heaters.

END OF SECTION 22 33 00

SECTION 22 42 13.13 – COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section Includes:
   1. Water closets.
   2. Flushometer valves.
   3. Toilet seats.

1.03 REFERENCES:

A. Applicable Standards (Latest Edition):
   1. American Society of Sanitary Engineering (ASSE):
      a. ASSE 1037 - Pressurized Flushing Devices (Flushometers) for Plumbing Fixtures.
   2. ASME International (ASME):
      a. ASME A112.4.3 - Plastic Fittings for Connecting Water Closets to the Sanitary Drainage System.
      b. ASME A112.6.1M - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use.
      c. ASME A112.19.5 - Trim for Water Closet Bowls, Tanks, and Urinals.
   3. ASME International/Canadian Standards Association (ASME/CSA):
      a. ASME A112.19.2/CSA B45.1 - Ceramic Plumbing Fixtures.
   4. ASTM International (ASTM):
      a. ASTM A1045 - Specification for Flexible Poly (Vinyl Chloride) (PVC) Gaskets Used in Connection of Water Closets to Sanitary Drainage Systems.
   5. International Association of Plumbing and Mechanical Officials/American National Standards Institute (IAPMO/ANSI):
      a. IAPMO/ANSI Z124.5 - Plastic Toilet (Water Closet) Seats.
   6. International Code Council/American National Standards Institute (ICC/ANSI):
      a. ICC/ANSI A117.1 - Accessible and Usable Buildings and Facilities.
   7. NFPA:
      a. NFPA 70 - National Electrical Code.
   8. Underwriters Laboratories, Inc. (UL):
      a. UL 1951 - Electric Plumbing Accessories.

1.04 ACTION SUBMITTALS:

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.05 CLOSEOUT SUBMITTALS:

A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 WALL-MOUNTED WATER CLOSETS:

A. Water Closets WC-1: Wall mounted, top spud, accessible.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Standard America.
      b. Briggs Plumbing Products, Inc.
      c. Capizzi.
      d. Crane Plumbing, LLC.
      e. Ferguson Enterprises, Inc.; ProFlo Brand.
      f. Gerber Plumbing Fixtures, LLC.
      g. Kohler Co.
      h. Mansfield Plumbing Products, LLC.
      i. Peerless Pottery Sales, Inc.
      j. TOTO USA, Inc.
      k. Zurn Industries, LLC; Commercial Brass and Fixtures.
      l. Or Engineer Approved Equal.
   2. Bowl:
      a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
      b. Material: Vitreous china.
      c. Type: Siphon jet.
      d. Style: Flushometer valve.
      e. Height: Standard.
      f. Rim Contour: Elongated.
      g. Water Consumption: 1.28 gal. per flush.
      h. Spud Size and Location: NPS 1-1/2; top.
   3. Support:
      a. Standard: ASME A112.6.1M.
      b. Description: Waste-fitting assembly as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture.
      c. Water Closet Mounting Height: Handicapped/elderly according to ICC/ANSI A117.1 for WC-2.

2.02 FLUSHOMETER VALVES:

A. Solenoid-Actuator, Diaphragm Flushometer Valves WC-1:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Coyne & Delany Co.
      b. Gerber Plumbing Fixtures, LLC.
      c. Sloan Valve Company.
      d. Zurn Industries, LLC; Commercial Brass and Fixtures.
      e. Or Engineer Approved Equal.
   2. Standard: ASSE 1037.
   3. Minimum Pressure Rating: 125 psig.
   4. Features: Include integral check stop and backflow-prevention device.
   5. Material: Brass body with corrosion-resistant components.
   6. Exposed Flushometer-Valve Finish: Chrome plated.

7. Panel Finish: Chrome plated or stainless steel.
8. Style: Exposed.
9. Actuator: Solenoid complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
10. Trip Mechanism: Battery-powered electronic sensor complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
11. Consumption: 1.28 gal. per flush.
12. Minimum Inlet: NPS 1.
13. Minimum Outlet: NPS 1-1/4.

2.03 TOILET SEATS:

A. Toilet Seats WC-1:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Standard America.
      b. Bemis Manufacturing Company.
      c. Centoco Manufacturing Corporation.
      d. Church Seats.
      e. Jones Stephens Corp.; Comfort Seat Brand.
      f. Kohler Co.
      g. Olsonite Seat Co.
      h. Sanderson Plumbing Products, Inc.
      i. Sperzel of Lexington.
      j. TOTO USA, Inc.
      k. Zurn Industries, LLC; Commercial Brass and Fixtures.
      l. Or Engineer Approved Equal.
   2. Standard: IAPMO/ANSI Z124.5.
   3. Material: Plastic.
   4. Type: Commercial (Standard).
   5. Shape: Elongated rim, open front.
   6. Hinge: Self-sustaining, check.
   7. Hinge Material: Noncorroding metal.
   8. Seat Cover: Not required.
   9. Color: White.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water closet installation.
B. Examine walls and floors for suitable conditions where water closets will be installed.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. Water Closet Installation:
   1. Install level and plumb according to roughing-in Drawings.
   2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.

3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:
1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
2. Use carrier supports with waste-fitting assembly and seal.
3. Install wall-mounted, back-outlet water closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

C. Flushometer Valve Installation:
1. Install flushometer valve, water supply fitting on each supply to each water closet.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install actuators in locations that are easy for people with disabilities to reach.
4. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

D. Install toilet seats on water closets.

E. Wall Flange and Escutcheon Installation:
1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 22 05 18 - Escutcheons for Plumbing Piping.

F. Joint Sealing:
1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water closet color.
3. Comply with sealant requirements specified in Division 07.

3.03 CONNECTIONS:

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

B. Comply with water piping requirements specified in Section 22 11 16 - Domestic Water Piping.

C. Comply with soil and waste piping requirements specified in Section 22 13 16 - Sanitary Waste and Vent Piping.

D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.04 ADJUSTING:

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.05 CLEANING AND PROTECTION:

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed water closets and fittings.

C. Do not allow use of water closets for temporary facilities, unless approved in writing by Owner.

END OF SECTION 22 42 13.13

SECTION 22 42 16.13 – COMMERCIAL LAVATORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes:
   1. Lavatories.
   2. Faucets.

1.03 REFERENCES:

A. Applicable Standards (Latest Edition):
   1. American National Standards Institute (ANSI):
      a. ANSI Z124.3 - Plastic Lavatories.
      b. ANSI Z124.6 - Plastic Sinks.
   2. American National Standards Institute/International Cast Polymer Association (ANSI/ICPA):
      a. ANSI/ICPA SS-1 - Performance Standard for Solid Surface Materials.
   3. ASME International (ASME):
      a. ASME A112.6.1M - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use.
      b. ASME A112.18.3 - Performance Requirements for Backflow Protection Devices and Systems in Plumbing Fixture Fittings.
      c. ASME A112.18.6 - Flexible Water Connectors.
   4. ASME International/Canadian Standards Association (ASME/CSA):
      a. ASME A112.18.1/CSA B125.1 - Plumbing Supply Fittings.
      b. ASME A112.18.2/CSA B125.2 - Plumbing Waste Fittings.
      c. ASME A112.19.1/CSA B45.2 - Enameled Cast Iron and Enameled Steel Plumbing Fixtures.
      d. ASME A112.19.2/CSA B45.1 - Ceramic Plumbing Fixtures.
   5. International Code Council/American National Standards Institute (ICC/ANSI):
      a. ICC/ANSI A117.1 - Accessible and Usable Buildings and Facilities.
   6. NSF International/American National Standards Institute (NSF/ANSI):
      a. NSF/ANSI 61 - Drinking Water System Components - Health Effects.
   7. Underwriters Laboratories, Inc. (UL):
      a. UL 1951 - Electric Plumbing Accessories.

1.04 ACTION SUBMITTALS:

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.05 INFORMATIONAL SUBMITTALS:

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.06 CLOSEOUT SUBMITTALS:

A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.
   1. In addition to items specified in Division 01, include the following:
      a. Servicing and adjustments of automatic faucets.

PART 2 - PRODUCTS

2.01 VITREOUS-CHINA, COUNTER-MOUNTED LAVATORIES:

A. Lavatory L-2: Oval, self-rimming, vitreous china, counter mounted.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Standard America.
      b. Crane Plumbing, LLC.
      c. Kohler Co.
      d. TOTO USA, Inc.
      e. Or Engineer Approved Equal.
   2. Fixture:
      a. Standard: ASME A112.19.2/CSA B45.1.
      b. Type: Self-rimming for above-counter mounting.
      c. Nominal Size: Rectangular, 21 by 19 inches.
      d. Faucet-Hole Punching: One hole.
      e. Faucet-Hole Location: Top.
      f. Color: White.
      g. Mounting Material: Sealant.
   3. Faucet: L-2.

2.02 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES:

A. Lavatory L-1: Wheelchair, vitreous china, wall mounted.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Standard America.
      b. Crane Plumbing, LLC.
      c. Ferguson Enterprises, Inc.; ProFlo Brand.
      d. Gerber Plumbing Fixtures, LLC.
      e. Kohler Co.
      f. Mansfield Plumbing Products, LLC.
      g. Peerless Pottery Sales, Inc.
      h. Or Engineer Approved Equal.
   2. Fixture:
      a. Standard: ASME A112.19.2/CSA B45.1.
      b. Type: Slab or wheelchair.
      c. Nominal Size: Rectangular, 27 by 20 inches.
      d. Faucet-Hole Punching: One hole.
      e. Faucet-Hole Location: Top.

f. Color: White.
g. Mounting: For concealed-arm carrier.
3. Faucet:
4. Support: ASME A112.6.1M, Type II, concealed-arm lavatory carrier with rectangular, steel uprights.

2.03 SOLID-BRASS, AUTOMATICALLY OPERATED LAVATORY FAUCETS:

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Lavatory Faucets L-1 and L-2: Automatic-type, battery-powered, electronic-sensor-operated, mixing, solid-brass valve.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Standard America.
   b. Bradley Corporation.
   c. Chicago Faucets.
   d. Gerber Plumbing Fixtures, LLC.
   e. Grohe America, Inc.
   f. Hydrotek International, Inc.
   g. Kohler Co.
   h. Moen, Incorporated.
   i. Sloan Valve Company.
   j. Speakman Company.
   k. T & S Brass and Bronze Works, Inc.
   l. TOTO USA, Inc.
   m. Zurn Industries, LLC; Commercial Brass and Fixtures.
   n. Or Engineer Approved Equal.
2. Standards: ASME A112.18.1/CSA B125.1 and UL 1951.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
5. Body Type: Single hole.
6. Body Material: Commercial, solid brass.
7. Finish: Polished chrome plate.
8. Maximum Flow Rate: 0.5 gpm.
9. Mounting Type: Deck, concealed.
10. Spout: Rigid type.
11. Spout Outlet: Aerator.
12. Drain: Solid brass, polished chrome plated, grid pattern.

2.04 LAMINAR-FLOW, FAUCET-SPOUT OUTLETS:

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet-spout-outlet materials that will be in contact with potable water.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AM Conservation Group, Inc.
2. Chronomite Laboratories, Inc.; a division of Acorn Engineering Company.

3. NEOPERL, Inc.
4. Or Engineer Approved Equal.

C. Description: Chrome-plated brass, faucet-spout outlet that produces non-aerating, laminar stream. Include external or internal thread that mates with faucet outlet for attachment to faucets where indicated and flow-rate range that includes flow of faucet.

2.05 SUPPLY FITTINGS:

A. NSF Standard: Comply with NSF/ANSI 61 and NSF 372, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.
B. Standard: ASME A112.18.1/CSA B125.1.
C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.
D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type, or compression valve with inlet connection matching supply piping.
E. Operation: Wheel handle.
F. Risers:
1. NPS 3/8.
2. Chrome-plated, rigid copper pipe and brass straight or offset tailpieces riser.

2.06 WASTE FITTINGS:

A. Standard: ASME A112.18.2/CSA B125.2.
B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.
C. Trap:
1. Size: NPS 1-1/2 by NPS 1-1/4.
2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch thick brass tube to wall; and chrome-plated, brass or steel wall flange.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.
B. Examine counters and walls for suitable conditions where lavatories will be installed.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. Install lavatories level and plumb according to roughing-in Drawings.
B. Install supports, affixed to building substrate, for wall-mounted lavatories.
C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.
D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 22 05 18 - Escutcheons for Plumbing Piping.
E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Division 07.

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 22 07 19 - Plumbing Piping Insulation.

3.03 CONNECTIONS:

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
B. Comply with water piping requirements specified in Section 22 11 16 - Domestic Water Piping.
C. Comply with soil and waste piping requirements specified in Section 22 13 16 - Sanitary Waste and Vent Piping.

3.04 ADJUSTING:

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.
B. Adjust water pressure at faucets to produce proper flow.
C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.05 CLEANING AND PROTECTION:

A. After completing installation of lavatories, inspect and repair damaged finishes.
B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
C. Provide protective covering for installed lavatories and fittings.
D. Do not allow use of lavatories for temporary facilities, unless approved in writing by Owner.

END OF SECTION 22 42 16.13

SECTION 22 42 16.16 – COMMERCIAL SINKS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes:
   1. Kitchen/utility sinks.
   2. Service basins.
   3. Sink faucets.

1.03 REFERENCES:

A. Applicable Standards (Latest Edition):
   1. ASME International (ASME):
      a. ASME A112.6.1M - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use.
      b. ASME A112.18.6 - Flexible Water Connectors.
      c. ASME B1.20.7 - Hose Coupling Screw Threads (Inch).
   2. ASME International/Canadian Standards Association (ASME/CSA):
      a. ASME A112.18.1/CSA B125.1 - Plumbing Supply Fittings.
      b. ASME A112.18.2/CSA B125.2 - Plumbing Waste Fittings.
      c. ASME A112.19.1/CSA B45.2 - Enameled Cast-Iron and Enameled Steel Plumbing Fixtures.
      d. ASME A112.19.2/CSA B45.1 - Ceramic Plumbing Fixtures.
      e. ASME A112.19.3/CSA B45.4 - Stainless-Steel Plumbing Fixtures.
   3. ASTM International (ASTM):
      a. ASTM C1107 - Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
   4. International Association of Plumbing and Mechanical Officials (IAPMO):
      a. IAPMO PS 99 - Terrazzo, Marble, Concrete, Granite, and Slate Plumbing Fixtures.
   5. International Association of Plumbing and Mechanical Officials/American National Standards Institute (IAPMO/ANSI):
      a. IAPMO/ANSI Z124.6 - Plastic Sinks.
   6. International Code Council/American National Standards Institute (ICC/ANSI):
      a. ICC/ANSI A117.1 - Accessible and Usable Buildings and Facilities.
   7. NSF International/American National Standards Institute (NSF/ANSI):
      a. NSF/ANSI 2 - Food Equipment.
      b. NSF/ANSI 61 - Drinking Water System Components - Health Effects.

1.04 ACTION SUBMITTALS:

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.05 CLOSEOUT SUBMITTALS:

A. Operation and Maintenance Data: For sinks and faucets to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 KITCHEN/UTILITY SINKS:

A. Kitchen/Utility Sinks, Counter Mounted - Stainless Steel: "KS-1"

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Advance Tabco
   b. Eagle Group
   c. Elkay
   d. Just Manufacturing
   e. Krowne
   f. Or Engineer Approved Equal.
2. Source Limitations: Obtain sinks from single source from single manufacturer.
3. Fixture:
   a. Standard: ASME A112.19.3/CSA B45.4.
   b. Type: Stainless steel, self-rimming, sound-deadened unit with ledge back.
   c. Number of Compartments: Two.
   d. Overall Dimensions: 32 x 22 x 6-5/16 Inch.
   e. Material: 20 gauge, Type 304 stainless steel.
   f. Each Compartment:
      (1) Drains: Grid with NPS 2 tailpiece and twist drain.
      (2) Drain Location: Centered in compartment.
      (3) Depth: Accessible in accordance with ICC A117.1.
4. Faucet(s): "KSF"
   a. Number Required: One.
   b. Mounting: On ledge.
5. Supply Fittings:
   a. Standard: ASME A112.18.1/CSA B125.1.
   b. Supplies: Chrome-plated brass compression stop with inlet connection matching water-supply piping type and size.
      (1) Operation: Loose key.
      (2) Risers: NPS 1/2, ASME A112.18.6/CSA B125.6, braided or corrugated stainless steel flexible hose.
6. Waste Fittings:
   a. Standard: ASME A112.18.2/CSA B125.2.
   b. Trap(s) Size: NPS 2.
   c. Trap(s) Material:
      (1) Chrome-plated, two-piece, cast-brass trap and ground-joint swivel elbow with 17-gauge brass tube to wall; and chrome-plated brass or steel wall flange.
      (2) Stainless steel, two-piece trap and swivel elbow with 0.012-inch- thick stainless steel tube to wall; and stainless steel wall flange.
7. Mounting: On counter with sealant.

B. Kitchen/Utility Sinks, Counter Mounted - Stainless Steel: “LS-1”
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Advance Tabco
      b. Eagle Group
      c. Elkay
      d. Just Manufacturing
      e. Krowne
      f. Or Engineer Approved Equal.
   2. Source Limitations: Obtain sinks from single source from single manufacturer.
   3. Fixture:
      a. Standard: ASME A112.19.3/CSA B45.4.
      b. Type: Stainless steel, self-rimming, sound-deadened unit with ledge back.
      c. Number of Compartments: One.
      d. Overall Dimensions: <Insert dimensions>.
      e. Material: 18 gauge, Type 304 stainless steel.
      f. Compartment:
         (1) Dimensions: <Insert dimensions>.
         (2) Drain: Grid with NPS 2 tailpiece and twist drain.
         (3) Drain Location: Centered in compartment.
         (4) Depth: Accessible in accordance with ICC A117.1.
   4. Faucet(s): <Insert sink faucet designation from "Sink Faucets, Manually Operated" or "Sink Faucets, Automatically Operated" Subparagraph>.
      a. Number Required: One.
      b. Mounting: On ledge.
   5. Supply Fittings:
      a. Standard: ASME A112.18.1/CSA B125.1.
      b. Supplies: Chrome-plated brass compression stop with inlet connection matching water-supply piping type and size.
         (1) Operation: Loose key.
         (2) Risers: NPS 1/2, ASME A112.18.6/CSA B125.6, braided or corrugated stainless steel flexible hose.
   6. Waste Fittings:
      a. Standard: ASME A112.18.2/CSA B125.2.
      b. Trap(s) Size: NPS 2.
      c. Trap(s) Material:
         (1) Chrome-plated, two-piece, cast-brass trap and ground-joint swivel elbow with 17-gauge brass tube to wall; and chrome-plated brass or steel wall flange.
         (2) Stainless steel, two-piece trap and swivel elbow with 0.012-inch- thick stainless steel tube to wall; and stainless steel wall flange.
   7. Mounting: On counter with sealant.

2.02 SERVICE BASINS:

A. Mop Basin: Terrazzo, floor mounted. “MB-1”
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Acorn Engineering Company.
      b. Crane Plumbing, LLC.

c. Florestone Products Co., Inc.
d. Stern-Williams Co., Inc.
e. Or Engineer Approved Equal.

2. Fixture:
a. Standard: IAPMO PS 99.
b. Shape: Square.
c. Nominal Size: 24 by 24 inches.
d. Height: 12 inches.
e. Tiling Flange: Not required.
f. Rim Guard: On all top surfaces.
g. Color: Not applicable.
h. Drain: Grid with NPS 2 outlet.

3. Faucet(s): "MBF"
4. Mounting: On floor and flush to wall.

2.03 SINK FAUCETS:

A. Sink Faucets, Manually Operated: Single control, mixing. "KSF"
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Central Brass Company; a Pioneer Industries, Inc. brand
b. Chicago Faucets; Geberit Group
c. Elkay
d. Gerber Plumbing Fixtures LLC.
e. Just Manufacturing
f. ProFlo; a Ferguson Enterprises, Inc. brand
g. T&S Brass and Bronze Works, Inc.
h. Or Engineer Approved Equal.

2. Source Limitations: Obtain sink faucets from single source from single manufacturer.
3. Standards:
a. ASME A112.18.1/CSA B125.1.
b. NSF 61.
c. NSF 372.

4. Description: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
5. Body Type: Centerset.
6. Body Material: Commercial, solid-brass, or die-cast housing with brazed copper and brass waterway.
7. Finish: Polished chrome plate.
8. Maximum Flow Rate: 1.5 gpm.
9. Mounting Type: Deck, exposed.
10. Valve Handle(s): Lever.
11. Spout Type: Swivel, gooseneck.
12. Spout Outlet: Aerator with Spray

B. Sink Faucets: Manual type, two-lever-handle mixing valve. "MBF"
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. American Standard America.
b. Bradley Corporation.
c. Chicago Faucets.

d. Or Engineer Approved Equal.
2. Maximum Flow Rate: 4.0 gpm.
3. Handle(s): Lever.
4. Mounting Type: Back/wall, exposed.
5. Spout Type: Rigid, solid brass with wall brace.
6. Vacuum Breaker: Required for hose outlet.
7. Spout Outlet: Hose thread according to ASME B1.20.7.

2.04 GROUT:

A. Standard: ASTM C1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
B. Characteristics: Nonshrink; recommended for interior and exterior applications.
C. Design Mix: 5,000 psi, 28-day compressive strength.
D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.
B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. Install sinks level and plumb according to roughing-in Drawings.
B. Install supports, affixed to building substrate, for wall-hung sinks.
C. Set floor-mounted sinks in leveling bed of cement grout.
D. Install water-supply piping with stop on each supply to each sink faucet.
1. Exception: Use ball, gate, or globe valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 22 05 23 - General-Duty Valves for Plumbing Piping.
2. Install stops in locations where they can be easily reached for operation.
E. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Division 07.
F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 22 05 18 – Escutcheons for Plumbing Piping.

3.03 CONNECTIONS:

A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
B. Comply with water piping requirements specified in Section 22 11 16 - Domestic Water Piping.
C. Comply with soil and waste piping requirements specified in Section 22 13 16 - Sanitary Waste and Vent Piping.

3.04 ADJUSTING:

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.
B. Adjust water pressure at faucets to produce proper flow.

3.05 CLEANING AND PROTECTION:

A. After completing installation of sinks, inspect and repair damaged finishes.
B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
C. Provide protective covering for installed sinks and fittings.
D. Do not allow use of sinks for temporary facilities, unless approved in writing by Owner.

END OF SECTION 22 42 16.16

SECTION 22 45 00 – EMERGENCY PLUMBING FIXTURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes:
   1. Emergency Shower
   2. Eyewash equipment.
   3. Combination units.
   4. Water-tempering equipment.

1.03 REFERENCES:

A. Applicable Standards (Latest Edition):
   1. American National Standards Institute (ANSI):
      a. ANSI Z358.1 - Emergency Eyewash and Shower Equipment.
   2. American Society of Mechanical Engineers/Canadian Standards Association (ASME/SCACSA):
      a. ASME A112.18.1/CSA B125.1 – Water-Supply Fittings.
      b. ASME A112.18.2/CSA B125.2 - Plumbing Waste Fittings.
   3. Federal Government:
      a. Public Law 90-480 - Architectural Barriers Act.
      b. Public Law 101-336 - Americans with Disabilities Act.
   4. International Code Council/American National Standards Institute (ICC/ANSI):
      a. ICC/ANSI A117.1 - Accessible and Usable Buildings and Facilities.
   5. NFPA:
      a. NFPA 70 - National Electrical Code.
   6. NSF International (NSF):
      a. NSF 61 and NSF 372 - Drinking Water System Components - Health Effects.

1.04 DEFINITIONS:

A. Accessible Fixture: Emergency plumbing fixture that can be approached, entered, and used by people with disabilities.
B. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.
C. Tepid: Between 60 and 100 deg. F.

1.05 ACTION SUBMITTALS:

A. Product Data: For each type of product indicated. Include flow rates and capacities, furnished specialties, and accessories.
B. Shop Drawings: Diagram power, signal, and control wiring.
   1. Plans. Elevations, sections, and mounting and/or attachment details.
   2. Details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

3. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
4. Diagram for power, signal, and control wiring.

1.06 INFORMATIONAL SUBMITTALS:

A. Field quality-control test reports.

1.07 CLOSEOUT SUBMITTALS:

A. Operation and Maintenance Data: For emergency plumbing fixtures to include in operation and maintenance manuals.

1.08 QUALITY ASSURANCE:

A. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."
B. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for fixture materials that will be in contact with potable water.
C. Regulatory Requirements: Comply with requirements in ICC/ANSI A117.1, "Accessible and Usable Buildings and Facilities" [; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act";] for plumbing fixtures for people with disabilities.

PART 2 - PRODUCTS

2.01 COMBINATION EMERGENCY SHOWER/EYEWASH:

A. Emergency Combination Shower with Eyewash or Eye/Face Wash, Freeze Resistant, Plumbed, ES/EW-1:
1. Subject to compliance with requirements, provide products by one of the following:
a. Bradley Corporation
b. Encon Safety Products
c. Guardian Equipment Co
d. Haws Corporation
e. Acorn Safety; a division of Acorn Engineering Company
f. Safety Manufacturing
g. Or Engineer Approved Equal.
2. Source Limitations: Obtain emergency combination showers with eye/face washes, freeze resistant, plumbed, from single manufacturer.
3. Standards:
a. ANSI/ISEA Z358.1.
b. ASME A112.18.1/CSA B125.1.
c. ASME A112.18.2/CSA B125.2.
4. Integral Supply Pipe Material: Galvanized steel.
a. Supply Connection: NPS 1-1/4 minimum.
5. Heating System: Electric, 120 V ac; insulation enclosed in a protective jacket with thermometer.
6. Shower:
a. Shower Capacity: Not less than 20 gpm for at least 15 minutes.
b. Supply Piping: NPS 1 with flow regulator and stay-open control valve.
c. Control Valve:
(1) Type: Stay-open type with flow regulator.

(2) Actuator: Pull rod , 60-inch.
d. Shower Head: 3-inch- minimum diameter, plastic.
e. Mounting: Pedestal.
7. Eye/Face Wash:
a. Capacity: Not less than 3 gpm for at least 15 minutes.
b. Control Valve:
(1) Type: Stay-open type with flow regulator.
(2) Actuator: Paddle.
8. Accessories:
a. Electric alarm with flashing light and horn.
b. Flow switch; single pole.

2.02 EYEWASH EQUIPMENT:

A. Standard, Freestanding, Plumbed Eyewash Units, EW-1:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Acorn Safety; a division of Acorn Engineering Company.
b. Bradley Corporation.
c. Encon Safety Products.
d. Guardian Equipment Co.
e. Haws Corporation.
f. Sellstrom Manufacturing Company.
g. Speakman Company.
h. WaterSaver Faucet Co.
i. Or Engineer Approved Equal.
2. Capacity: Not less than 0.4 gpm for at least 15 minutes.
3. Supply Piping: NPS 1/2 chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
4. Control-Valve Actuator: Paddle.
5. Spray-Head Assembly: Two receptor-mounted spray heads.
6. Receptor: Chrome-plated brass or stainless-steel bowl.
7. Drain Piping: NPS 1-1/4 minimum, chrome-plated brass, receptor drain, P trap, waste to wall, and wall flange complying with ASME A112.18.2/CSA B125.2.
8. Mounting: Pedestal.

2.03 WATER-TEMPERING EQUIPMENT:

A. Hot- and Cold-Water, Water-Tempering Equipment, TMV-1:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Acorn Safety; a division of Acorn Engineering Company.
b. Armstrong International, Inc.
c. Bradley Corporation.
d. Encon Safety Products.
e. Guardian Equipment Co.
f. Haws Corporation.
g. Lawler Manufacturing Co., Inc.
h. Leonard Valve Company.
i. Powers; a Division of Watts Water Technologies, Inc.
j. Speakman Company.

k. Or Engineer Approved Equal.

2. Description: Factory-fabricated equipment with thermostatic mixing valve.
   a. Thermostatic Mixing Valve: Designed to provide 85ºF tepid, potable water at emergency plumbing fixtures, to maintain temperature at ±5ºF throughout required 15-minute test period, and in case of unit failure to continue cold-water flow, with union connections, controls, metal piping, and corrosion-resistant enclosure.
   b. Supply Connections: For hot and cold water.

2.04 ACCESSORIES:

A. Flow Switches:
   1. Double Pole: double throw for alarm.
   2. Electrical 120 VAC
   3. Activation flowrate: Less than 3 GPM.
   4. Installation location: Install flow switches on outlet tepid water piping for each mixing valve.

2.05 INSTANTANEOUS TEPID WATER HEATER:

A. Tepid water heater equipment, TWH-1:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Eemax
      b. Bradford White
      c. Rheem
      d. Chronomite Laboratories, Inc
      e. Or Engineer Approved Equal.
   2. Description: tankless water heater for ANSIZ358.1 Safety emergency eyewash.
      a. Maximum outlet temperature 90 degrees F.
      b. Minimum flowrate 0.4 GPM.
      c. Electric power:
         (1) 120 volt
         (2) single phase
         (3) 3.5 kW
         (4) 29 amps
         (5) Temperature Rise 60 degrees F at 0.3 GPM.
         (6) On at 0.2 GPM.

B. Tepid water heater equipment, TWH-3:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Eemax
      b. Bradford White
      c. Rheem
      d. Chronomite Laboratories, Inc
      e. Or Engineer Approved Equal.
   2. Standards:
      a. ANSI/ISEA Z358.1.
      b. ASME A112.18.1/CSA B125.1.
   3. Description: tankless water heater for emergency shower/eyewash.
      a. Maximum outlet temperature 90 degrees F.

b. Minimum flowrate 23 GPM.
c. Electric power:
   (1) 480 volt
   (2) three phase
   (3) 77 kW
   (4) 93 amps
   (5) Temperature Rise 23 degrees F at 23 GPM.
   (6) On at 2.6 GPM.
d. Integral fused disconnect switch.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine roughing-in for water piping systems to verify actual locations of piping connections before plumbed emergency plumbing fixture installation.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 EMERGENCY PLUMBING FIXTURE INSTALLATION:

A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.
B. Install fixtures level and plumb.
C. Fasten fixtures to substrate.
D. Install shutoff valves in water-supply piping to fixtures. Use ball, gate, or globe valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Comply with requirements for valves specified in Section 22 05 23 - General-Duty Valves for Plumbing Piping.
   1. Exception: Omit shutoff valve on supply to group of plumbing fixtures that includes emergency equipment.
   2. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.
E. Install dielectric fitting in supply piping to emergency equipment if piping and equipment connections are made of different metals. Comply with requirements for dielectric fittings specified in Section 22 11 16 - Domestic Water Piping.
F. Install thermometers in supply and outlet piping connections to water-tempering equipment. Comply with requirements for thermometers specified in Section 22 05 19 - Meters and Gauges for Plumbing Piping.
G. Install trap and waste piping on drain outlet of emergency equipment receptors that are indicated to be directly connected to drainage system. Comply with requirements for waste piping specified in Division 22, Section "Sanitary Waste and Vent Piping."
H. Install indirect waste piping on drain outlet of emergency equipment receptors that are indicated to be indirectly connected to drainage system. Comply with requirements for waste piping specified in Division 22, Section "Sanitary Waste and Vent Piping."
I. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations. Comply with requirements for escutcheons specified in Division 22, Section "Escutcheons for Plumbing Piping."

3.03 CONNECTIONS:

A. Connect cold-water-supply piping to plumbed emergency plumbing fixtures not having water-tempering equipment. Comply with requirements for cold-water piping specified in Division 22, Section "Domestic Water Piping."

B. Connect hot- and cold-water-supply piping to hot- and cold-water, water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures. Comply with requirements for hot- and cold-water piping specified in Division 22, Section "Domestic Water Piping."

C. Connect cold water and electrical power to electric heating water-tempering equipment. Comply with requirements for cold-water piping specified in Division 22, Section "Domestic Water Piping."

D. Directly connect emergency plumbing fixture receptors with trapped drain outlet to sanitary waste and vent piping. Comply with requirements for waste piping specified in Division 22, Section "Sanitary Waste and Vent Piping."

E. Indirectly connect emergency plumbing fixture receptors without trapped drain outlet to sanitary waste or storm drainage piping.

F. Where installing piping adjacent to emergency plumbing fixtures, allow space for service and maintenance of fixtures.

3.04 IDENTIFICATION:

A. Install equipment nameplates or equipment markers on emergency plumbing fixtures and equipment and equipment signs on water-tempering equipment. Comply with requirements for identification materials specified in Section 22 05 53 - Identification for Plumbing Piping and Equipment.

3.05 FIELD QUALITY CONTROL:

A. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
5. Emergency plumbing fixtures and water-tempering equipment will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.06 ADJUSTING:

A. Operate and adjust emergency plumbing fixtures and controls. Replace damaged and malfunctioning fixtures and controls.

B. Adjust or replace fixture flow regulators for proper flow.

C. Adjust equipment temperature settings.

3.07 CLEANING AND PROTECTION

A. Clean emergency plumbing fixtures with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed emergency plumbing fixtures and fittings.

END OF SECTION 22 45 00

SECTION 22 47 13 – DRINKING FOUNTAIN

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes drinking fountains and related components.

1.03 REFERENCE STANDARDS:

A. Applicable Standards (Latest Edition):
   1. ASME International (ASME):
      a. ASME A112.6.1M - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use.
   2. ASME International/Canadian Standards Association (ASME/CSA):
      a. ASME A112.18.2/CSA B125.2 - Plumbing Waste Fittings.
      b. ASME A112.19.2/CSA B45.1 - Ceramic Plumbing Fixtures.
      c. ASME A112.19.3/CSA B45.4 - Stainless-Steel Plumbing Fixtures.
   3. International Code Council, Inc. (ICC):
      a. ICC A117.1 - Accessible and Usable Buildings and Facilities (ANSI).
   4. NSF International (NSF):
      a. NSF 61 - Drinking Water System Components - Health Effects (ANSI).

1.04 SUBMITTALS:

A. Product Data: For each type of drinking fountain.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   2. Include operating characteristics, and furnished specialties and accessories.

B. Maintenance Data: For drinking fountains to include in maintenance manuals.

PART 2 - PRODUCTS

2.01 WATER COOLERS:

A. Water Coolers - Surface Wall Mounted, Powder-Coated Metal (DF-1):
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Elkay Manufacturing Co.
      b. Filtrine Manufacturing Company.
      c. Halsey Taylor.
      d. Haws Corporation.
      e. Murdock-Super Secur; a division of Acorn Engineering Company.
      f. Stern-Williams Co., Inc.
      g. Tri Palm International, LLC; Oasis Brand.
      h. Tri Palm International, LLC; Sunroc Brand.
      i. Or Engineer Approved Equal.
   2. Source Limitations: Obtain surface wall-mounted, powder-coated-metal, water coolers from single source from single manufacturer.
   3. Standards:

a. NSF 61.
b. NSF 372.
c. ASHRAE 18.
d. UL 399.
e. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

4. Color: Gray.
5. Type: Vandal resistant.
6. Bubbler: One, with adjustable stream regulator, located on each cabinet deck.
7. Control: Push bar.
8. Bottle Filler: Sensor activation: Fill rate is 0.5 to 1.5 gpm.
9. Drain: Grid with NPS 1-1/4 tailpiece.
10. Supply: NPS 3/8 with shutoff valve.
11. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 brass P-trap.
12. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
13. Support: Fixture carrier.
14. Water-Cooler Mounting Height: High/low - standard/accessible in accordance with ICC A117.1.
15. Capacities and Characteristics:
    a. Cooled Water: 8 gph.
    b. Ambient-Air Temperature: 90 deg F.
    c. Inlet-Water Temperature: 80 deg F.
    d. Cooled-Water Temperature: 50 deg F.
    e. Electrical Characteristics:
        (1) Volts: 120 V ac.
        (2) Phase: Single.
        (3) Hertz: 60 Hz.
        (4) Full-Load Amperes: 15 A.
16. Support: ASME A112.6.1M.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.
B. Examine walls and floors for suitable conditions where fixtures will be installed.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.
B. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.
C. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 22 05 23 - General-Duty Valves for Plumbing Piping.

D. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
E. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 22 05 18 - Escutcheons for Plumbing Piping.
F. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 – Joint Sealants.

3.03 CONNECTIONS:
A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
B. Comply with water piping requirements specified in Section 22 11 16 - Domestic Water Piping.
C. Install ball, gate, or globe shutoff valve on water supply to each fixture. Comply with valve requirements specified in Section 22 05 23 - General-Duty Valves for Plumbing Piping.
D. Comply with soil and waste piping requirements specified in Section 22 13 16 - Sanitary Waste and Vent Piping.

3.04 ADJUSTING:
A. Adjust fixture flow regulators for proper flow and stream height.

3.05 CLEANING:
A. After installing fixtures, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.
C. Provide protective covering for installed fixtures.
D. Do not allow use of fixtures for temporary facilities, unless approved in writing by Owner.

END OF SECTION 22 47 13

SECTION 23 05 13 – COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.03 REFERENCE STANDARDS:

A. Applicable Standards (latest edition):
   1. The Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      a. IEEE 841-2009 - Standard for Petroleum and Chemical Industry - Severe Duty Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors - Up to and Including 370 kW (500 hp).
   2. National Electrical Manufacturers Association (NEMA):
      a. NEMA MG 1 - Motors and Generators.

1.04 COORDINATION:

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
   1. Motor controllers.
   2. Torque, speed, and horsepower requirements of the load.
   3. Ratings and characteristics of supply circuit and required control sequence.
   4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.01 GENERAL MOTOR REQUIREMENTS:

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.
B. Comply with NEMA MG 1 unless otherwise indicated.
C. Comply with minimum efficiency requirements in accordance with DOE 10 CFR 431.

2.02 MOTOR CHARACTERISTICS:

A. Duty: Continuous duty at ambient temperature of 40ºC and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.03 POLYPHASE MOTORS:

A. Description: NEMA MG 1, Design B, medium induction motor.
B. Efficiency: Energy efficient, as defined in NEMA MG 1.
C. Service Factor: 1.15.
D. Rotor: Random-wound, squirrel cage.
E. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
F. Temperature Rise: Class B.
G. Insulation: Class F.
H. Code Letter Designation:
   1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
   2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
I. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.04 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS:

A. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
   1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
   2. Bearing Protection: All motors operated on variable frequency drives shall be equipped with maintenance free, 360 degree circumferential conductive microfiber shaft grounding ring with a minimum two continuous rows of conductive micro fibers completely surrounding the motor shaft to discharge electrical shaft voltages away from the motor’s bearings to ground. Note: Friction/spring contact brushes shall not be acceptable.
   3. Application Note: Motors up to 100HP shall be provided with a minimum of one shaft grounding ring as described above installed by the manufacturer internally to the motor or externally on the drive end. Motors over 100HP shall be provided with an insulated bearing on the non-drive end and a shaft grounding ring on the drive end of the motor. Grounding rings shall be provided and installed by the motor manufacturer or contractor and shall be installed in accordance with the manufacturer’s recommendations.

4. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
5. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
6. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

B. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.05 SINGLE-PHASE MOTORS:

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
   1. Permanent-split capacitor.
   2. Split phase.
   3. Capacitor start, inductor run.
   4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 23 05 13

SECTION 23 05 53 – IDENTIFICATION FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes:
   1. Equipment labels.
   2. Warning signs and labels.

1.03 REFERENCE STANDARDS:

A. Applicable Standards (Latest Edition):
   1. ASME International (ASME):
      a. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.04 SUBMITTALS:

A. Product Data: For each type of product indicated.
B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

1.05 COORDINATION:

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
B. Coordinate installation of identifying devices with locations of access panels and doors.
C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.01 EQUIPMENT LABELS:

A. Plastic Labels for Equipment:
   1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
   2. Letter and Background Color: As indicated for specific application under Part 3.
   3. Maximum Temperature: Able to withstand temperatures up to 160ºF.
   4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inches.
   5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
   6. Fasteners: Stainless-steel rivets or self-tapping screws.
   7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
B. Label Content: Include equipment's Drawing designation and asset tag number.

2.02 LABELS:

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter and Background Color: As indicated for specific application under Part 3.
C. Maximum Temperature: Able to withstand temperatures up to 160ºF.
D. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inches.
E. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
F. Fasteners: Stainless-steel rivets or self-tapping screws.
G. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.02 INSTALLATION, GENERAL REQUIREMENTS:

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
B. Coordinate installation of identifying devices with locations of access panels and doors.
C. Install identifying devices before installing acoustical ceilings and similar concealment.
D. Locate identifying devices so that they are readily visible from the point of normal approach.

3.03 INSTALLATION OF EQUIPMENT LABELS, WARNING SIGNS, AND LABELS:

A. Permanently fasten labels on each item of mechanical equipment.
B. Sign and Label Colors:
   1. White letters on an ANSI Z535.1 safety-blue background.
C. Locate equipment labels where accessible and visible.

END OF SECTION 23 05 53

SECTION 23 05 93 – TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes:
   1. Balancing Air Systems:
      a. Constant-volume air systems.
      b. Variable-air-volume systems.
      c. Multizone systems.
   2. Other Systems/Equipment:
      a. Motors.
      b. Condensing units.
      c. Heat transfer coils.

1.03 REFERENCE STANDARDS:

A. Applicable Standards (latest edition):
   1. Air Movement and Control Association International Inc. (AMCA):
      a. 201 - Fans and Systems.
   2. American National Standards Institute (ANSI):
      a. S1.4 - Specification for Sound Level Meters.
      b. S1.11 - Specification for Octave Band and Fraction Octave Band Analog and Digital Filters.
      c. S1.13 - Methods for the Measurement of Sound Pressure Levels.
      d. S1.40 - Specification for Acoustical Calibrators.
   3. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
      a. 62.1 - Ventilation for Acceptable Indoor Air Quality (ANSI).
      b. 111 - Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
   4. Associated Air Balance Council (AABC):
      a. National Standards for Total System Balance.
   5. National Environmental Balancing Bureau (NEBB):
      a. Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.
   6. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
      a. HVAC Systems - Duct Design.
      b. HVAC Systems - Testing, Adjusting, and Balancing.

1.04 DEFINITIONS:

A. AABC: Associated Air Balance Council.
B. NEBB: National Environmental Balancing Bureau.
C. TAB: Testing, Adjusting, and Balancing.
D. TABB: Testing, Adjusting, and Balancing Bureau.
E. TAB Specialist: An entity engaged to perform TAB Work.
F. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

G. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.
H. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.
I. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin that is normally dissipated.
J. NC: Noise criteria.
K. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
L. RC: Room criteria.
M. Report Forms: Test data sheets for recording test data in logical order.
N. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
O. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.
P. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
Q. Test: A procedure to determine quantitative performance of systems or equipment.
R. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.

1.05 SUBMITTALS:

A. Submit as specified in Section 23 05 00 - Common Work Results for HVAC.
B. Qualification Data: Within 15 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
C. Contract Documents Examination Report: Within 15 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
D. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
E. Certified TAB reports.
F. Sample report forms.
G. Instrument calibration reports, to include the following:
    1. Instrument type and make.
    2. Serial number.
    3. Application.
    4. Dates of use.
    5. Dates of calibration.

1.06 QUALITY ASSURANCE:

A. AB Contractor Qualifications: Engage a TAB entity certified by AABC, NEBB, or TABB.
    1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC, NEBB, or TABB.
    2. TAB Technician: Employee of the TAB contractor and who is certified by AABC, NEBB, or TABB as a TAB technician.

B. TAB Conference: Meet with Construction Manager on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.
   1. Agenda Items:
      a. The Contract Documents examination report.
      b. The TAB plan.
      c. Coordination and cooperation of trades and subcontractors.
      d. Coordination of documentation and communication flow.

C. Certify TAB field data reports and perform the following:
   1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
   2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

D. TAB Report Forms: Use standard TAB contractor's forms approved by Engineer.

E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

F. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.
   1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

1.07 COORDINATION:

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.

B. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

C. Perform TAB after leakage and pressure tests on air distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Section 23 31 13 - Metal Ducts and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine Equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC Equipment when installed under conditions different from the conditions used to rate Equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality control testing, cleaning, and adjusting specified in individual Sections have been performed.
H. Examine test reports specified in individual system and equipment Sections.
I. Examine HVAC Equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible, and their controls are connected and functioning.
K. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
L. Examine operating safety interlocks and controls on HVAC Equipment.
M. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.
N. Examine automatic temperature system components to verify the following:
   1. Dampers, and other controlled devices are operated by the intended controller.
   2. Dampers are in the position indicated by the controller.
   3. Integrity of dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
   4. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
   5. Sensors are located to sense only the intended conditions.
   6. Sequence of operation for control modes in according to the Contract Documents.
   7. Controller set points are set at indicated values.
   8. Interlocked systems are operating.
   9. Changeover from heating to cooling mode occurs according to indicated values.

3.02 PREPARATION:

A. Prepare a TAB plan that includes strategies and step-by-step procedures.
B. Complete system-readiness checks and prepare reports. Verify the following:
   1. Permanent electrical-power wiring is complete.
   2. Automatic temperature-control systems are operational.
   3. Equipment and duct access doors are securely closed.
   4. Balance, smoke, and fire dampers are open.
   5. Isolating and balancing valves are open and control valves are operational.
   6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
   7. Windows and doors can be closed so indicated conditions for system operations can be met.

3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING:

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance", ASHRAE 111, NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing", and in this Section.
   1. Comply with requirements in ASHRAE 62.1, Section 7.2.2, "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
   1. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 23 33 00 - Duct Accessories.
   2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 23 07 00 - Mechanical Insulation.

C. Mark Equipment and balancing devices, including damper-control positions, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in [inch-pound (IP)] units.

3.04 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS:

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Section 23 31 13 - Metal Ducts.

3.05 PROCESURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
   1. Measure total airflow.
      a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
      b. Where duct conditions allow, measure airflow by main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses close to the fan and prior to any outlets, to obtain total airflow.
      c. Where duct conditions are unsuitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
   2. Measure fan static pressures as follows:
      a. Measure static pressure directly at the fan outlet or through the flexible connection.
      b. Measure static pressure directly at the fan outlet or through the flexible connection.

c. Measure static pressure across each component that makes up the air-handling system.
d. Report artificial loading of filters at the time static pressures are measured.

3. Review Contractor-prepared shop drawings and Record drawings to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
4. Obtain approval from Commissioning Authority for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate damper and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.
1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.
1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure and all final fan operating data, speed, volts, amps, and static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.

3.06 PROCEDURES FOR SINGLE-ZONE VARIABLE-AIR-VOLUME SYSTEMS:

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
1. Measure total airflow.
a. Where duct conditions allow, measure airflow by main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses close to the fan and prior to any outlets, to obtain total airflow.
b. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
2. Measure fan static pressures as follows to determine actual static pressure:
a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
b. Measure static pressure directly at the fan outlet or through the flexible connection.

c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
   a. Report the cleanliness status of filters and the time static pressures are measured.
4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using extractors and the dampers at air terminals.
   1. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.07 PROCEDURES FOR MULTI-ZONE VARIABLE-AIR-VOLUME SYSTEMS:

A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow with the remainder at maximum-airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.

B. Pressure-Dependent, Variable-Air-Volume Systems with Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
   1. Set system at maximum indicated airflow by setting the required number of terminal units at minimum airflow. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.
   2. Adjust supply fan to maximum indicated airflow with the variable-airflow controller set at maximum airflow.
   3. Set terminal units at full-airflow condition.
   4. Adjust terminal units starting at the supply-fan end of the system and continuing progressively to the end of the system. Adjust inlet dampers of each terminal unit to indicated airflow. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
   5. Adjust terminal units for minimum airflow.
   6. Measure static pressure at the sensor.
   7. Measure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.

3.08 PROCEDURES FOR MOTORS:

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.09 PROCEDURES FOR CONDENSING UNITS:

A. Verify proper rotation of fans.
B. Measure entering- and leaving-air temperatures.
C. Record compressor data.

3.10 TOLERANCES:

A. Set HVAC system's air flow rates flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans and Equipment with Fans: ±10%.
2. Air Outlets and Inlets: 0 to +10%.

3.11 REPORTING:

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.12 FINAL REPORT:

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:
1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
2. Name and address of the TAB contractor.

3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:
    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.
12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:
    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Fan drive settings including settings and percentage of maximum pitch diameter.
    e. Settings for supply-air, static-pressure controller.
    f. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Duct, outlet, and inlet sizes.
3. Pipe and valve sizes and locations.
4. Terminal units.
5. Balancing stations.
6. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data:
    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Discharge arrangement.
    h. Sheave make, size in inches, and bore.
    i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
    j. Number, make, and size of belts.
    k. Number, type, and size of filters.
2. Motor Data:
    a. Motor make, and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.

e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):
a. Total air flow rate in cfm.
b. Total system static pressure in inches w.g.
c. Fan rpm.
d. Discharge static pressure in inches w.g.
e. Filter static-pressure differential in inches w.g.
f. Preheat-coil static-pressure differential in inches w.g.
g. Cooling-coil static-pressure differential in inches w.g.
h. Heating-coil static-pressure differential in inches w.g.
i. Outdoor airflow in cfm.
j. Return airflow in cfm.
k. Outdoor-air damper position.
l. Return-air damper position.
m. Vortex damper position.

F. Apparatus-Coil Test Reports:
1. Coil Data:
a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in $ft.^2$
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):
a. Air flow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches w.g.
d. Outdoor-air, wet- and dry-bulb temperatures in ºF.
e. Return-air, wet- and dry-bulb temperatures in ºF.
f. Entering-air, wet- and dry-bulb temperatures in ºF.
g. Leaving-air, wet- and dry-bulb temperatures in ºF.
h. Refrigerant expansion valve and refrigerant types.
i. Refrigerant suction pressure in psig.
j. Refrigerant suction temperature in ºF.

G. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:
1. Unit Data:
a. System identification.
b. Location.
c. Coil identification.
d. Capacity in Btu/hr.
e. Number of stages.
f. Connected volts, phase, and hertz.
g. Rated amperage.

h. Air flow rate in cfm.
i. Face area in ft.²
j. Minimum face velocity in fpm.

2. Test Data (Indicated and Actual Values):
a. Heat output in Btu/hr.
b. Air flow rate in cfm.
c. Air velocity in fpm.
d. Entering-air temperature in ºF.
e. Leaving-air temperature in ºF.
f. Voltage at each connection.
g. Amperage for each phase.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:
1. Fan Data:
a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Motor Data:
a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):
a. Total airflow rate in cfm.
b. Total system static pressure in inches w.g.
c. Fan rpm.
d. Discharge static pressure in inches w.g.
e. Suction static pressure in inches w.g.

I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
1. Report Data:
a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in ºF.
d. Duct static pressure in inches w.g.
e. Duct size in inches.
f. Duct area in ft.²
g. Indicated air flow rate in cfm.
h. Indicated velocity in fpm.
i. Actual air flow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

J. Air-Terminal-Device Reports:
   1. Unit Data:
      a. System and air-handling unit identification.
      b. Location and zone.
      c. Apparatus used for test.
      d. Area served.
      e. Make.
      f. Number from system diagram.
      g. Type and model number.
      h. Size.
      i. Effective area in ft.²
   2. Test Data (Indicated and Actual Values):
      a. Air flow rate in cfm.
      b. Air velocity in fpm.
      c. Preliminary air flow rate as needed in cfm.
      d. Preliminary velocity as needed in fpm.
      e. Final air flow rate in cfm.
      f. Final velocity in fpm.
      g. Space temperature in ºF.

K. System-Coil Reports: For reheat coils of terminal units, include the following:
   1. Unit Data:
      a. System and air-handling-unit identification.
      b. Location and zone.
      c. Room or riser served.
      d. Coil make and size.
      e. Flowmeter type.
   2. Test Data (Indicated and Actual Values):
      a. Air flow rate in cfm.
      b. Entering-air temperature in ºF.
      c. Leaving-air temperature in ºF.

L. Compressor and Condenser Reports: For refrigerant side of unitary systems, stand-alone refrigerant compressors, or air-cooled condensing units, include the following:
   1. Unit Data:
      a. Unit identification.
      b. Location.
      c. Unit make and model number.
      d. Compressor make.
      e. Compressor model and serial numbers.
      f. Refrigerant weight in lb.
      g. Low ambient temperature cutoff in ºF.
   2. Test Data (Indicated and Actual Values):
      a. Inlet-duct static pressure in inches w.g.
      b. Outlet-duct static pressure in inches w.g.
      c. Entering-air, dry-bulb temperature in ºF.
      d. Leaving-air, dry-bulb temperature in ºF.
      e. Control settings.
      f. Unloader set points.
      g. Low-pressure-cutout set point in psig.
      h. High-pressure-cutout set point in psig.

i. Suction pressure in psig.
j. Suction temperature in ºF.
k. Condenser refrigerant pressure in psig.
l. Condenser refrigerant temperature in ºF.
m. Oil pressure in psig.
n. Oil temperature in ºF.
o. Voltage at each connection.
p. Amperage for each phase.
q. Kilowatt input.
r. Crankcase heater kilowatt.
s. Number of fans.
t. Condenser fan rpm.
u. Condenser fan airflow rate in cfm.
v. Condenser fan motor make, frame size, rpm, and horsepower.
w. Condenser fan motor voltage at each connection.
x. Condenser fan motor amperage for each phase.

M. Instrument Calibration Reports:
1. Report Data:
a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.13 INSPECTIONS:

A. Initial Inspection:
1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:
a. Measure airflow of at least 10% of air outlets.
b. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
c. Verify that balancing devices are marked with final balance position.
d. Note deviations from the Contract Documents in the final report.

B. Final Inspection:
1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Engineer.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Engineer.
3. Engineer shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10% of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

5. If the number of "FAILED" measurements is greater than 10% of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB work will be considered defective if it does not pass final inspections. If TAB work fails, proceed as follows:
   1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
   2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

3.14 ADDITIONAL TESTS:

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23 05 93

SECTION 23 07 13 – DUCT INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes requirements for insulating sheet metal ductwork.

1.03 REFERENCE STANDARDS:

A. Applicable Standards (Latest Edition):
   1. ASTM International (ASTM):
      a. ASTM A167 - Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
      b. ASTM A240 - Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
      c. ASTM B209 - Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
      d. ASTM C553 - Specification for Mineral Fiber Blanket and Thermal Insulation for Commercial and Industrial Applications.
      e. ASTM C612 - Specification for Mineral Fiber Block and Board Thermal Insulation.
      f. ASTM C795 - Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
      g. ASTM C871 - Test Methods for Chemical Analysis of Thermal Insulation Materials for Leachable Chloride, Fluoride, Silicate, and Sodium Ions.
      h. ASTM C1136 - Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
      i. ASTM D1644 - Test Methods for Nonvolatile Content of Varnishes.
      j. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
      k. ASTM E96 - Test Methods for Water Vapor Transmission of Materials.
      l. ASTM F1249 - Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.
   2. Military Specifications (MIL):
      a. MIL-A-3316C - Adhesives, Fire-Resistant, Thermal Insulation.
      b. MIL-PRF-19565C - Coating Compounds, Thermal Insulation, Fire- and Water Resistant, Vapor Barrier.
   3. NFPA:
      a. NFPA 90A - Installation of Air-Conditioning and Ventilating Systems.
      b. NFPA 90B - Installation of Warm Air Heating and Air-Conditioning Systems.

1.04 SUBMITTALS:

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and field-applied jackets (if any).

B. Qualification Data: For qualified Installer.

C. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

1.05 QUALITY ASSURANCE:

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. All Insulation Installed Indoors and Outdoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.07 COORDINATION:

A. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

B. Coordinate installation and testing of heat tracing.

1.08 SCHEDULING:

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS:

A. Comply with requirements in "Duct Insulation Schedule, General," "Aboveground Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C553, Type II and ASTM C1290, Type I unfaced and Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed Corp.; SoftTouch Duct Wrap.

b. Johns Manville; Microlite.
c. Knauf Insulation; Friendly Feel Duct Wrap.
d. Owens Corning; SOFTR All-Service Duct Wrap.
e. Or Engineer Approved Equal.

G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C612, Type IA or Type IB. For duct and plenum applications, provide insulation with FSK factory-applied jacket.
1. Products: Subject to compliance with requirements, provide products by one of the following:
a. CertainTeed Corp.; Commercial Board.
b. Fibrex Insulations, Inc.; FBX.
c. Johns Manville; 800 Series Spin-Glas.
d. Knauf Insulation; Insulation Board.
e. Owens Corning; Fiberglas 700 Series.
f. Or Engineer Approved Equal.

2.02 ADHESIVES:

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
B. Mineral-Fiber Board or Blanket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Products: Subject to compliance with requirements, provide products by one of the following:
a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
d. Mon-Eco Industries, Inc.; 22-25.
e. Or Engineer Approved Equal.
C. FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Products: Subject to compliance with requirements, provide products by one of the following:
a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
d. Mon-Eco Industries, Inc.; 22-25.
e. Or Engineer Approved Equal.

2.03 MASTICS:

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
1. Products: Subject to compliance with requirements, provide products by one of the following:
a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.

b. Vimasco Corporation; 749.
c. Or Engineer Approved Equal.

2. Water-Vapor Permeance: ASTM E96, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: -20 to +180ºF.
4. Solids Content: ASTM D1644, 58% by volume and 70% by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.
1. Products: Subject to compliance with requirements, provide products by one of the following:
a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
b. Eagle Bridges - Marathon Industries; 501.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
d. Mon-Eco Industries, Inc.; 55-10.
e. Or Engineer Approved Equal.
2. Water-Vapor Permeance: ASTM F1249, 0.05 perm at 35-mil dry film thickness.
3. Service Temperature Range: 0 to 180ºF.
4. Solids Content: ASTM D1644, 44% by volume and 62% by weight.
5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
1. Products: Subject to compliance with requirements, provide products by one of the following:
a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
b. Eagle Bridges - Marathon Industries; 570.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
d. Or Engineer Approved Equal.
2. Water-Vapor Permeance: ASTM F1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: -50 to +220ºF.
4. Solids Content: ASTM D1644, 33% by volume and 46% by weight.
5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
1. Products: Subject to compliance with requirements, provide products by one of the following:
a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
b. Eagle Bridges - Marathon Industries; 550.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
d. Mon-Eco Industries, Inc.; 55-50.
e. Vimasco Corporation; WC-1/WC-5.
f. Or Engineer Approved Equal.
2. Water-Vapor Permeance: ASTM F1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: -20 to +180ºF.
4. Solids Content: 60% by volume and 66% by weight.
5. Color: White.

2.04 SEALANTS:

A. FSK and Metal Jacket Flashing Sealants:
   1. Products: Subject to compliance with requirements, provide products by one of the following:
      a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
      b. Eagle Bridges - Marathon Industries; 405.
      c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
      d. Mon-Eco Industries, Inc.; 44-05.
      e. Or Engineer Approved Equal.
   2. Materials shall be compatible with insulation materials, jackets, and substrates.
   3. Fire- and water-resistant, flexible, elastomeric sealant.
   4. Service Temperature Range: -40 to +250ºF.
   5. Color: Aluminum.

B. PVC Jacket Flashing Sealants:
   1. Products: Subject to compliance with requirements, provide products by the following:
      a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
      b. Or Engineer Approved Equal.
   2. Materials shall be compatible with insulation materials, jackets, and substrates.
   3. Fire- and water-resistant, flexible, elastomeric sealant.
   4. Service Temperature Range: -40 to +250ºF.
   5. Color: White.

2.05 FACTORY-APPLIED JACKETS:

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
   1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with Kraft-paper backing; complying with ASTM C1136, Type II.
   2. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C1136, Type II.

2.06 FIELD-APPLIED JACKETS:

A. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
   1. Products: Subject to compliance with requirements, provide products by one of the following:
      a. Johns Manville; Zeston.
      b. P.I.C. Plastics, Inc.; FG Series.
      c. Proto Corporation; LoSmoke.
      d. Speedline Corporation; SmokeSafe.
      e. Or Engineer Approved Equal.
   2. Adhesive: As recommended by jacket material manufacturer.
   3. Color: White.

B. Metal Jacket:
   1. Products: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
b. ITW Insulation Systems; Aluminum Jacketing.
c. RPR Products, Inc.; Insul-Mate.
d. Or Engineer Approved Equal.

2. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
a. Finish and thickness are indicated in field-applied jacket schedules.
b. Moisture Barrier for Indoor Applications: 3-mil thick, heat-bonded polyethylene and Kraft paper or 2.5-mil thick polysurlyn.
c. Moisture Barrier for Outdoor Applications: 3-mil thick, heat-bonded polyethylene and Kraft paper or 2.5-mil thick polysurlyn.

2.07 TAPES:

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.
1. Products: Subject to compliance with requirements, provide products by one of the following:
a. ABI, Ideal Tape Division; 491 AWF FSK.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
c. Compac Corporation; 110 and 111.
d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
e. Or Engineer Approved Equal.
2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2%.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
1. Products: Subject to compliance with requirements, provide products by one of the following:
a. ABI, Ideal Tape Division; 370 White PVC tape.
b. Compac Corporation; 130.
c. Venture Tape; 1506 CW NS.
d. Or Engineer Approved Equal.
2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500%.
6. Tensile Strength: 18 lbf/inch in width.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Products: Subject to compliance with requirements, provide products by one of the following:
a. ABI, Ideal Tape Division; 488 AWF.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
c. Compac Corporation; 120.
d. Venture Tape; 3520 CW.

e. Or Engineer Approved Equal.
2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5%.
6. Tensile Strength: 34 lbf/inch in width.

2.08 SECUREMENTS:

A. Bands:
1. Products: Subject to compliance with requirements, provide products by one of the following:
a. ITW Insulation Systems; Gerrard Strapping and Seals.
b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
c. Or Engineer Approved Equal.
2. Stainless Steel: ASTM A167 or ASTM A240, Type 304; 0.015 inch thick, 1/2 inch wide with wing seal or closed seal.
3. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H 14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:
1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
a. Products: Subject to compliance with requirements, provide products by one of the following:
(1) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers.
(2) GEMCO; Perforated Base.
(3) Midwest Fasteners, Inc.; Spindle.
(4) Or Engineer Approved Equal.
b. Baseplate: Perforated, aluminum sheet, 0.030 inch thick by 2 inches square.
c. Spindle: Aluminum, fully annealed, 0.106-inch diameter shank, length to suit depth of insulation indicated.
d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
a. Products: Subject to compliance with requirements, provide products by one of the following:
(1) GEMCO; Nylon Hangers.
(2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.
(3) Or Engineer Approved Equal.
b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
c. Spindle: Nylon, 0.106-inch diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.

d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

3. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
   a. Products: Subject to compliance with requirements, provide products by one of the following:
      (1) AGM Industries, Inc.; Tactoo Self-Adhering Insul-Hangers.
      (2) GEMCO; Peel & Press.
      (3) Midwest Fasteners, Inc.; Self Stick.
      (4) Or Engineer Approved Equal.
   b. Baseplate: Aluminum-steel sheet, 0.030 inch thick by 2 inches square.
   c. Spindle: Aluminum, fully annealed, 0.106-inch diameter shank, length to suit depth of insulation indicated.
   d. Adhesive-backed base with a peel-off protective cover.
4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch thick, galvanized-steel, or stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
   a. Products: Subject to compliance with requirements, provide products by one of the following:
      (1) AGM Industries, Inc.; RC-150.
      (2) GEMCO; R-150.
      (3) Midwest Fasteners, Inc.; WA-150.
      (4) Nelson Stud Welding; Speed Clips.
      (5) Or Engineer Approved Equal.
   b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
5. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
   a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      (1) GEMCO.
      (2) Midwest Fasteners, Inc.
      (3) Or Engineer Approved Equal.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch wide, stainless steel or Monel.

D. Wire: 0.062-inch soft-annealed, stainless steel.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. C & F Wire.
      b. Or Engineer Approved Equal.

2.09 CORNER ANGLES:

A. PVC Corner Angles: 30 mils thick, minimum 1- by 1-inch PVC according to ASTM D1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch thick, minimum 1- by 1-inch aluminum according to ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
   1. Verify that systems to be insulated have been tested and are free of defects.
   2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION:

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.03 GENERAL INSTALLATION REQUIREMENTS:

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces, free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3 inch wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
      a. For below ambient services, apply vapor-barrier mastic over staples.
   4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.

5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75% of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.04 PENETRATIONS:

A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
1. Comply with requirements in Division 07.

D. Insulation Installation at Floor Penetrations:
1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07.

3.05 INSTALLATION OF MINERAL-FIBER INSULATION:

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.

c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
d. Do not overcompress insulation during installation.
e. Impale insulation over pins and attach speed washers.
f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1-inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50ºF at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6-inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
   a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16-inches o.c.
   b. On duct sides with dimensions larger than 18 inches, space pins 16-inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not overcompress insulation during installation.
   e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1-inch

o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
b. Install vapor stops for ductwork and plenums operating below 50ºF at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6-inches o.c.

3.06 FIELD-APPLIED JACKET INSTALLATION:

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturers recommended adhesive.
   1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12-inches o.c. and at end joints.

3.07 FINISHES:

A. Do not field paint PVC or aluminum jackets.

3.08 DUCT INSULATION SCHEDULE, GENERAL:

A. Plenums and Ducts Requiring Insulation:
   1. Indoor, supply ductwork in spaces with air conditioning.
   2. Outdoor, supply and return ductwork.
B. Items Not Insulated:
   1. Exhaust and odor-control ductwork.
   2. Factory-insulated flexible ducts.
   3. Factory-insulated plenums and casings.
   4. Flexible connectors.
   5. Vibration-control devices.
   6. Factory-insulated access panels and doors.

3.09 ABOVEGROUND INDOOR DUCT AND PLENUM INSULATION SCHEDULE:

A. Indoor air duct insulation shall be one of the following:
   1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb./cu. ft. nominal density. Minimum installed R-6, 3.
   2. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb./cu. ft. nominal density.

3.10 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE:

A. Aboveground outdoor rectangular duct insulation shall be the following:
   1. Mineral-Fiber Board: 2 ½ inches thick and 3-lb./cu. ft. nominal density. Minimum installed R-8 insulation value.

3.11 INDOOR, FIELD-APPLIED JACKET SCHEDULE:

A. Install jacket over insulation material where exposed in finished spaces and less than 8 foot above floor in utility spaces. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
B. Ducts and Plenums:
   1. PVC: 30 mils thick.

3.12 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE:

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
B. If more than one material is listed, selection from materials listed is Contractor's option.
C. Ducts and Plenums, Concealed:
   1. Aluminum, Smooth or Stucco Embossed: 0.024 inch thick.

END OF SECTION 23 07 13

SECTION 23 09 00 – INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

B. Related Sections include the following:

1.03 RELATED REQUIREMENTS

A. Section 23 05 19 – "Meters ang Gages for HVAC Piping" for measuring equipment that relates to this Section.

B. Section 23 09 93 – "Sequence of Operations for HVAC Controls" for requirements that relate to this Section.

1.04 REFERENCE STANDARDS:

A. Applicable Standards (Latest Edition):

1. Air Movement and Control Association International, Inc. (AMCA):
   a. AMCA 500D - Methods of Testing Dampers for Rating.
2. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
   a. ASHRAE 135 - BACnet - A Data Communication Protocol for Building Automation and Control Networks.
3. ASME International (ASME):
   a. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
   b. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
4. ASTM International (ASTM):
   a. ASTM A126 - Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
   b. ASTM A536 - Specification for Ductile Iron Casting.
   c. ASTM B88 - Specification for Seamless Copper Water Tube.
   d. ASTM B280 - Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
   e. ASTM D2737 - Specification for Polyethylene (PE) Plastic Tubing.
5. Electronic Industries Alliance/Canadian Electricity Association (EIA/CEA):
   a. EIA/CEA 709.1-B - Control Network Protocol Specification.
6. The Instrumentation, Systems, and Automation Society (67 Alexander Dr., Research Triangle Park, NC 27709; 919-549-8411) (ISA):
   a. ISA 50.00.01 - Compatibility of Analog Signals for Electronic Industrial Process Instruments.
7. National Electrical Manufacturers Association (NEMA):
   a. NEMA 250 - Enclosures for Electrical Equipment (100V Maximum).
   b. NEMA DC 3 - Residential Controls - Electrical Wall-Mounted Room Thermostats.
8. NFPA:
   a. NFPA 70 - National Electrical Code.

1.05 DEFINITIONS:

A. DDC: Direct digital control.
B. I/O: Input/output.
C. MS/TP: Master slave/token passing.
D. PC: Personal computer.
E. PID: Proportional plus integral plus derivative.
F. RTD: Resistance temperature detector.

1.06 SYSTEM PERFORMANCE:

A. Comply with the following performance requirements:
   1. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:
      a. Water Temperature: ±1ºF.
      b. Water Flow: ±5% of full scale.
      c. Water Pressure: ±2% of full scale.
      d. Space Temperature: ±1ºF.
      e. Ducted Air Temperature: ±1ºF.
      f. Outside Air Temperature: ±2ºF.
      g. Dew Point Temperature: ±3ºF.
      h. Temperature Differential: ±0.25ºF.
      i. Relative Humidity: ±5%.
      j. Airflow (Pressurized Spaces): ±3% of full scale.
      k. Airflow (Measuring Stations): ±5% of full scale.
      l. Airflow (Terminal): ±10% of full scale.
      m. Air Pressure (Space): ±0.01-inch wg.
      n. Air Pressure (Ducts): ±0.1-inch wg.
      o. Carbon Monoxide: ±5% of reading.
      p. Carbon Dioxide: ±50 ppm.
      q. Electrical: ±5% of reading.

1.07 SUBMITTALS:

A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
   1. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
   2. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
   3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.
B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
   2. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.

3. Wiring Diagrams: Power, signal, and control wiring.
4. Details of control panel faces, including controls, instruments, and labeling.
5. Written description of sequence of operation.
6. Schedule of dampers including size, leakage, and flow characteristics.
7. Schedule of valves including flow characteristics.
8. DDC System Hardware:
    a. Wiring diagrams for control units with termination numbers.
    b. Schematic diagrams and floor plans for field sensors and control hardware.
    c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.
9. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.
10. Controlled Systems:
    a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
    b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
    c. Written description of sequence of operation including schematic diagram.
    d. Points list.

C. Qualification Data: For Installer and manufacturer.

D. Software Upgrade Kit: For Owner to use in modifying software to suit future systems revisions or monitoring and control revisions.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01, include the following:
1. Maintenance instructions and lists of spare parts for each type of control device and compressed-air station.
2. Interconnection wiring diagrams with identified and numbered system components and devices.
3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
5. Calibration records and list of set points.

G. Software and Firmware Operational Documentation: Include the following:
1. Software operating and upgrade manuals.
2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.
5. Software license required by and installed for DDC workstations and control systems.

1.08 QUALITY ASSURANCE:

A. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.09 DELIVERY, STORAGE, AND HANDLING:

A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.

B. System Software: Update to latest version of software at Project completion.

1.10 COORDINATION:

A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.

B. Coordinate equipment with Division 26 to achieve compatibility with lighting controls, motor starters, VFDs, SCADA, and fire alarm systems.

C. Coordinate supply of conditioned electrical branch circuits for control units and operator workstation.

D. Coordinate equipment with Division 26 to achieve compatibility with motor starters and annunciation devices.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

2.02 CONTROL SYSTEM:

A. Manufacturers:
1. American Auto-Matrix.
2. Delta Controls Inc.
3. Honeywell International Inc.; Home & Building Control.
4. Johnson Controls, Inc.; Controls Group.
5. McQuay International.
6. Siemens Building Technologies, Inc.
7. Or Engineer Approved Equal.

B. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, and accessories to control mechanical systems.

C. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.

2.03 DDC EQUIPMENT

A. Operator Workstation: One PC-based microcomputer(s) with minimum configuration as follows:
1. Motherboard: With 6 integrated USB 2.0 ports, 2 integrated USB 3.0 ports, integrated Intel Pro 10/100/1000 (Ethernet), integrated audio, bios, and hardware monitoring.
2. Processor: Intel Core i9, 16 cores, 3.2 GHz.
3. Random-Access Memory: 16 GB.
4. Graphics: Video adapter, minimum 3,840 by 2,160 pixels, support for 4 monitors.
5. Monitor: Two, 28 inches, 3,840 by 2,160 pixels, 60 Hz, LED color.

6. Keyboard: QWERTY, 105 keys in ergonomic shape.
7. Solid-State Drive: 1 TB.
8. Mouse: Two button plus center wheel, optical.
9. Uninterruptible Power Supply: 2 kVa.
10. Operating System: Microsoft Windows 11 Professional.
    a. ASHRAE 135 Compliance: Workstation shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.
11. Application Software:
    a. I/O capability from operator station.
    b. System security for each operator via software password and access levels.
    c. Automatic system diagnostics; monitor system and report failures.
    d. Database creation and support.
    e. Automatic and manual database save and restore.
    f. Dynamic color graphic displays with up to 10 screen displays at once.
    g. Custom graphics generation and graphics library of HVAC equipment and symbols.
    h. Alarm processing, messages, and reactions.
    i. Trend logs retrievable in spreadsheets and database programs.
    j. Alarm and event processing.
    k. Object and property status and control.
    l. Automatic restart of field equipment on restoration of power.
    m. Data collection, reports, and logs. Include standard reports for the following:
        (1) Current values of all objects.
        (2) Current alarm summary.
        (3) Disabled objects.
        (4) Alarm lockout objects.
        (5) Logs.
    n. Custom report development.
    o. Utility and weather reports.
    p. Workstation application editors for controllers and schedules.
    q. Maintenance management.
12. Custom Application Software:
    a. English language oriented.
    b. Full-screen character editor/programming environment.
    c. Allow development of independently executing program modules with debugging/simulation capability.
    d. Support conditional statements.
    e. Contains predefined time variables.

B. Diagnostic Terminal Unit: Portable notebook-style, PC-based microcomputer terminal capable of accessing system data by connecting to system network with minimum configuration as follows:
1. System: With two integrated USB 3.0 port, integrated Intel Pro 10/100/1000 (Ethernet), integrated audio, bios, and hardware monitoring.
2. Processor: Intel Core i7, 10 cores, 1.7 GHz.
3. Random-Access Memory: 16 GB.
4. Graphics: Video adapter, minimum 3,840 by 2,160 pixels, Support for an external monitor.
5. Monitor: 14 inches, 2,240 by 1,400, LED color.
6. Keyboard: QWERTY, backlit.
7. Solid-State Drive: 1 TB.

8. Pointing Device: Touch pad or other internal device.

C. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.
   1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation or diagnostic terminal unit.
   2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
      a. Global communications.
      b. Discrete/digital, analog, and pulse I/O.
      c. Monitoring, controlling, or addressing data points.
      d. Software applications, scheduling, and alarm processing.
      e. Testing and developing control algorithms without disrupting field hardware and controlled environment.
   3. Standard Application Programs:
      a. Electric Control Programs: Demand limiting, duty cycling, automatic time scheduling, start/stop time optimization, night setback/setup, on-off control with differential sequencing, staggered start, antishort cycling, PID control, DDC with fine tuning, and trend logging.
      b. HVAC Control Programs: Optimal run time, supply-air reset, and enthalpy switchover.
      c. Chiller Control Programs: Control function of condenser-water reset, chilled-water reset, and equipment sequencing.
      d. Programming Application Features: Include trend point; alarm processing and messaging; weekly, monthly, and annual scheduling; energy calculations; run-time totalization; and security access.
      e. Remote communications.
      f. Maintenance management.
      g. Units of Measure: Inch-pound and SI (metric).
   4. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
   5. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.

D. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.
   1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.
   2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
      a. Global communications.
      b. Discrete/digital, analog, and pulse I/O.
      c. Monitoring, controlling, or addressing data points.
   3. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
   4. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.

E. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.

1. Binary Inputs: Allow monitoring of on-off signals without external power.
2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
3. Analog Inputs: Allow monitoring of low-voltage (0 to 10Vdc), current (4 to 20 mA), or resistance signals.
4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation with three-position (on-off-auto) override switches and status lights. Provide bifurcated contacts rated for at least 2 A and 120 V, unless application requires otherwise.
5. Analog Outputs: Provide modulating signal, either low voltage (0 to 10Vdc) or current (4 to 20 mA) with status lights, two-position (auto-manual) switch, and manually adjustable potentiometer.
6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
7. Universal I/Os: Provide software selectable binary or analog outputs.

F. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80% of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:
1. Output ripple of 5.0 mV maximum peak to peak.
2. Combined 1% line and load regulation with 100-mic.sec. response time for 50% load changes.
3. Built-in overvoltage and overcurrent protection and be able to withstand 150% overload for at least 3 seconds without failure.

G. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:
1. Minimum dielectric strength of 1,000V.
2. Maximum response time of 10 nanoseconds.
3. Minimum transverse-mode noise attenuation of 65 dB.
4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

2.04 UNITARY CONTROLLERS:

A. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.
1. Configuration: Local keypad and display; diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; and 72-hour battery backup.
2. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. Perform scheduling with real-time clock. Perform automatic system diagnostics; monitor system and report failures.
3. ASHRAE 135 Compliance: Communicate using read (execute and initiate) and write (execute and initiate) property services defined in ASHRAE 135. Reside on network using MS/TP datalink/physical layer protocol and have service communication port for connection to diagnostic terminal unit.
4. Enclosure: Dustproof rated for operation at 32 to 120ºF (0 to 50ºC).

2.05 ELECTRONIC SENSORS:

A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.

B. Corrosive Environment: All devices located outdoors or in areas other than the Administration building and electrical rooms shall be rated for exposure to elevated levels of hydrogen sulfide and sulfur dioxide.

C. Thermistor Temperature Sensors and Transmitters:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. BEC Controls Corporation.
      b. Ebtron, Inc.
      c. Heat-Timer Corporation.
      d. I.T.M. Instruments Inc.
      e. MAMAC Systems, Inc.
      f. RDF Corporation.
      g. Or Engineer Approved Equal.
   2. Accuracy: ±0.36ºF at calibration point.
   3. Wire: Twisted, shielded-pair cable.
   4. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft.
   5. Averaging Elements in Ducts: 72 inches long, flexible; use where prone to temperature stratification or where ducts are larger than 10 sq. ft..
   6. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.

D. RTDs and Transmitters:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. BEC Controls Corporation.
      b. MAMAC Systems, Inc.
      c. RDF Corporation.
      d. Or Engineer Approved Equal.
   2. Accuracy: ±0.2% at calibration point.
   3. Wire: Twisted, shielded-pair cable.
   4. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft..
   5. Averaging Elements in Ducts: 72 inches long, flexible; use where prone to temperature stratification or where ducts are larger than 9 sq. ft.; length as required.
   6. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.

E. Pressure Transmitters/Transducers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. BEC Controls Corporation.
      b. General Eastern Instruments.
      c. MAMAC Systems, Inc.
      d. ROTRONIC Instrument Corp.
      e. TCS/Basys Controls.
      f. Vaisala.
      g. Or Engineer Approved Equal.
   2. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
      a. Accuracy: 2% of full scale with repeatability of 0.5%.
      b. Output: 4 to 20 mA.
      c. Building Static-Pressure Range: 0- to 0.25-inch wg.

d. Duct Static-Pressure Range: 0- to 5-inch wg.

F. Room Sensor Cover Construction: Manufacturer's standard locking covers.
1. Set-Point Adjustment: Exposed, digital.
2. Set-Point Indication: Exposed, digital.
3. Thermometer: Exposed, digital.
4. Color: Match wall-mounted light switch covers.

G. Room sensor accessories include the following:
1. Insulating Bases: For sensors located on exterior walls.

2.06 FLOW MEASURING STATIONS:

A. Duct Airflow Station: Combination of air straightener and multiport, self-averaging pitot tube station.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Air Monitor Corporation.
b. Wetmaster Co., Ltd.
c. Or Engineer Approved Equal.
2. Corrosive Environment: All devices shall be rated for exposure to elevated levels of hydrogen sulfide and sulfur dioxide.
3. Casing: Aluminum or stainless-steel frame.
4. Flow Straightener: Aluminum honeycomb, 3/4-inch (20-mm) parallel cell, 3 inches (75 mm) deep.
5. Sensing Manifold: Stainless-steel manifold with bullet-nosed static pressure sensors positioned on equal area basis.

2.07 ACTUATORS:

A. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Belimo Aircontrols (USA), Inc.
b. Or Engineer Approved Equal.
2. Dampers: Size for running torque calculated as follows:
a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft. of damper.
d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. of damper.
e. Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1,000 to 2,500 fpm: Increase running torque by 1.5.
f. Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2,500 to 3,000 fpm: Increase running torque by 2.0.
3. Coupling: V-bolt and V-shaped, toothed cradle.
4. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
5. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
6. Power Requirements (Two-Position Spring Return): As scheduled on Drawings or otherwise required.
7. Power Requirements (Modulating): Maximum 10 VA at 24Vac or 8 W at 24Vdc.
8. Proportional Signal: 2 to 10Vdc or 4 to 20 mA, and 2 to 10Vdc position feedback signal.

9. Temperature Rating: -22 to +122ºF.
10. Temperature Rating (Smoke Dampers): -22 to +250ºF.
11. Run Time: As scheduled on Drawings or as otherwise required.

2.08 DAMPERS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Air Balance, Inc.
   2. Don Park, Inc.; Autodamp Div.
   3. TAMCO (T. A. Morrison & Co., Inc.).
   4. United Enertech Corp.
   5. Vent Products Company, Inc.
   6. Ruskin.
   7. Or Engineer Approved Equal.

B. Dampers: AMCA-rated, construction and design as scheduled on Drawings.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Verify that conditioned power supply is available to control units and operator workstation.

B. Verify that duct- and equipment-mounted devices are installed before proceeding with installation.

3.02 INSTALLATION:

A. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.

B. Connect and configure equipment and software to achieve sequence of operation specified.

C. Verify location of exposed control sensors with Drawings and room details before installation. Install devices at location and height as indicated on drawings.
   1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

D. Install automatic dampers according to Section 23 33 00 – "Air Duct Accessories."

E. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

F. Install labels and nameplates to identify control components according to Section 23 05 53 – "Identification for HVAC Piping and Equipment."

G. Install duct volume-control dampers according to Division 23 Sections specifying air ducts.

3.03 ELECTRICAL WIRING AND CONNECTION INSTALLATION:

A. Install raceways, boxes, and cabinets according to Division 26.

B. Install building wire and cable according to Division 26.

C. Install signal and communication cable according to Division 26.
   1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
   2. Install exposed cable in raceway.
   3. Install concealed cable in raceway.
   4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
   5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.

6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.

D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

E. Connect hand-off-auto selector switches to override automatic controls when switch is in hand position. However, hand position shall not override safety interlocks such as smoke detection shutdown of fans and closure of smoke dampers.

3.04 FIELD QUALITY CONTROL:

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:
1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
2. Test and adjust controls and safeties.
3. Test calibration of electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
4. Test each point through its full operating range to verify that safety and operating control set points are as required.
5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
6. Test each system for compliance with sequence of operation.
7. Test software and hardware interlocks.

C. DDC Verification
1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
2. Check instruments for proper location and accessibility.
3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
4. Check instrument tubing for proper fittings, slope, material, and support.
5. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
6. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
7. Check temperature instruments and material and length of sensing elements.
8. Check control valves. Verify that they are in correct direction.
9. Check DDC system as follows:
   a. Verify that DDC controller power supply is from emergency power supply, if applicable.
   b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
   c. Verify that spare I/O capacity has been provided.
   d. Verify that DDC controllers are protected from power supply surges.

D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

~~D.~~

3.05 ADJUSTING:

A. Calibrating and Adjusting:
   1. Calibrate instruments.
   2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
   3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
   4. Control System Inputs and Outputs:
      a. Check analog inputs at 0, 50, and 100% of span.
      b. Check analog outputs using milliampere meter at 0, 50, and 100% output.
      c. Check digital inputs using jumper wire.
      d. Check digital outputs using ohmmeter to test for contact making or breaking.
      e. Check resistance temperature inputs at 0, 50, and 100% of span using a precision-resistant source.
   5. Flow:
      a. Set differential pressure flow transmitters for 0 and 100% values with 3-point calibration accomplished at 50, 90, and 100% of span.
      b. Manually operate flow switches to verify that they make or break contact.
   6. Pressure:
      a. Calibrate pressure transmitters at 0, 50, and 100% of span.
      b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.
   7. Temperature:
      a. Calibrate resistance temperature transmitters at 0, 50, and 100% of span using a precision-resistance source.
      b. Calibrate temperature switches to make or break contacts.
   8. Stroke and adjust control dampers, following manufacturer's recommended procedure, so that and damper is 0, 50, and 100% closed.
   9. Provide diagnostic and test instruments for calibration and adjustment of system.
   10. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

B. Adjust initial temperature and humidity set points.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

3.06 DEMONSTRATION:

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Division 01.

END OF SECTION 23 09 00

SECTION 23 31 13 – METAL DUCTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes:
   1. Single-wall rectangular ducts and fittings.
   2. Single-wall round and flat-oval ducts and fittings.
   3. Sheet metal materials.
   4. Duct liner.
   5. Sealants and gaskets.
   6. Hangers and supports.

1.03 RELATED REQUIREMENTS:

A. Section 23 05 93 - Testing, Adjusting and Balancing for HVAC for testing, adjusting, and balancing requirements for metal ducts.

B. Section 23 33 00 - Air Duct Accessories for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.04 REFERENCE STANDARDS:

A. Applicable Standards (Latest Edition):
   1. American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI):
      a. ASCE/SEI 7 - Minimum Design Loads for Buildings and Other Structures.
   2. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
      a. ASHRAE 62.1 - Ventilation for Acceptable Indoor Air Quality (ANSI).
   3. American Society of Heating, Refrigerating and Air-Conditioning Engineers/Illuminating Engineering Society of North America (ASHRAE/IESNA):
      a. ASHRAE/IESNA 90.1 - Energy Standard for Buildings except Low-Rise Residential Buildings (ANSI).
   4. American Welding Society (AWS):
      a. AWS D1.1- Structural Welding Code - Steel.
      b. AWS D1.2- Structural Welding Code - Aluminum.
      c. AWS D9.1- Sheet Metal Welding Code.
   5. ASTM International (ASTM):
      a. ASTM A36 - Specification for Carbon Structural Steel.
      b. ASTM A480 - Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
      c. ASTM A492 - Specification for Stainless Steel Rope Wire.
      d. ASTM A603 - Specification for Zinc-Coated Steel Structural Wire Rope.
      e. ASTM A653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
      f. ASTM A1008 - Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
      g. ASTM B209 - Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

h. ASTM C518 - Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
i. ASTM C916 - Specification for Adhesives for Duct Thermal Insulation.
j. ASTM C920 - Specification for Elastomeric Joint Sealants.
k. ASTM C1071 - Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).
l. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
m. ASTM E488 - Test Methods for Strength of Anchors in Concrete and Masonry Elements.

6. Code of Federal Regulations (CFR):
   a. 40 CFR - Protection of Environment, Chapter I - Environmental Protection Agency, Part 59 - "National Volatile Organic Compound Emission Standards for Consumer and Commercial Products," Subpart D - "National Volatile Organic Compound Emission Standards for Architectural Coatings."
7. National Air Duct Cleaners Association (NADCA):
   a. NADCA 1992 - Mechanical Cleaning of Non-Porous Air Conveyance System Components.
   b. NADCA ACR - Assessment, Cleaning and Restoration of HVAC Systems.
8. NFPA:
   a. NFPA 90A - Installation of Air Conditioning and Ventilating Systems (ANSI).
   b. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems (ANSI).
   c. NFPA 96 - Ventilation Control and Fire Protection of Commercial Cooking Operations (ANSI).
9. The North American Insulation Manufacturers Association (NAIMA):
   a. NAIMA AH124 - Fibrous Glass Duct Liner Standard.
10. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
    a. HVAC Air Duct Leakage Test Manual.
    b. HVAC Duct Construction Standards - Metal and Flexible.
    c. IAQ Guidelines for Occupied Buildings under Construction - Appendix G, Duct Cleanliness for New Construction Guidelines.
    d. Seismic Restraint Manual: Guidelines for Mechanical Systems.
11. Underwriters Laboratories, Inc. (UL):
    a. UL 723 - Test for Surface Burning Characteristics of Building Materials.

1.05 PERFORMANCE/DESIGN CRITERIA:

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

1.06 SUBMITTALS:

A. Product Data: For each type of the following products:
   1. Liners and adhesives.
   2. Sealants and gaskets.
   3. Seismic-restraint devices.

B. Shop Drawings:
   1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
   2. Factory- and shop-fabricated ducts and fittings.
   3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
   4. Elevation of top of ducts.
   5. Dimensions of main duct runs from building grid lines.
   6. Fittings.
   7. Reinforcement and spacing.
   8. Seam and joint construction.
   9. Penetrations through fire-rated and other partitions.
   10. Equipment installation based on equipment being used on Project.
   11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
   12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Delegated-Design Submittal:
   1. Sheet metal thicknesses.
   2. Joint and seam construction and sealing.
   3. Reinforcement details and spacing.
   4. Materials, fabrication, assembly, and spacing of hangers and supports.

D. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
   2. Suspended ceiling components.
   3. Structural members to which duct will be attached.
   4. Size and location of initial access modules for acoustical tile.
   5. Penetrations of smoke barriers and fire-rated construction.
   6. Items penetrating finished ceiling including the following:
      a. Lighting fixtures.
      b. Air outlets and inlets.
      c. Speakers.
      d. Sprinklers.
      e. Access panels.
      f. Perimeter moldings.

E. Welding Procedure Specification (WPS) and Welder Performance Qualification Record (WPQR)

1.07 QUALITY ASSURANCE:

A. Welding Qualifications: Qualify welding procedures, welders, and welding operators according to the following:
   1. AWS D1.1, "Structural Welding Code - Steel," for hangers and supports.
   2. AWS D1.2, "Structural Welding Code - Aluminum," for aluminum supports.
   3. AWS D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

PART 2 - PRODUCTS

2.01 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS:

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class, unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.02 SINGLE-WALL ROUND DUCTS AND FITTINGS:

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class, unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Lindab, Inc.
   b. McGill AirFlow, LLC.
   c. SEMCO Incorporated.
   d. Sheet Metal Connectors, Inc.
   e. Spiral Manufacturing Co., Inc.
   f. Or Engineer Approved Equal.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.03 SHEET METAL MATERIALS:

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
B. Aluminum Sheets: Comply with ASTM B209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
C. Reinforcement Shapes and Plates: 6061-T6, aluminum plates, shapes, and bars.
D. Tie Rods: Stainless steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.04 SEALANT AND GASKETS:

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
B. Two-Part Tape Sealing System:
    1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
    2. Tape Width: 4 inches.
    3. Sealant: Modified styrene acrylic.
    4. Water resistant.
    5. Mold and mildew resistant.
    6. Maximum Static-Pressure Class: 10-inch w.g., positive and negative.
    7. Service: Indoor and outdoor.
    8. Service Temperature: -40 to +200ºF.
    9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
C. Water-Based Joint and Seam Sealant:
    1. Application Method: Brush on.
    2. Solids Content: Minimum 65%.
    3. Shore A Hardness: Minimum 20.
    4. Water resistant.
    5. Mold and mildew resistant.
    6. VOC: Maximum 75 g/L (less water).
    7. Maximum Static-Pressure Class: 10-inch w.g. positive and negative.
    8. Service: Indoor or outdoor.
    9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
D. Flanged Joint Sealant: Comply with ASTM C920.
    1. General: Single-component, acid-curing, silicone, elastomeric.
    2. Type: S.

3. Grade: NS.
4. Class: 25.
5. Use: O.

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

2.05 HANGERS AND SUPPORTS:

A. Hanger Rods: Stainless-steel rods and nuts.
B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
C. Steel Cables for Aluminum Ducts: Stainless steel complying with ASTM A492.
D. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
E. Trapeze and Riser Supports:
1. Supports for Aluminum Ducts: Aluminum.

PART 3 - EXECUTION

3.01 DUCT INSTALLATION:

A. Coordinate duct layout and duct accessory arrangement with Drawings. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated, unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," unless otherwise indicated.
C. Install round ducts in maximum practical lengths.
D. Install ducts with fewest possible joints.
E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
J. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 23 33 00 - Air Duct Accessories for fire and smoke dampers.
K. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.02 INSTALLATION OF EXPOSED DUCTWORK:

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.03 DUCTWORK EXPOSED TO WEATHER:

A. All external joints are to be welded. Seal all openings to provide weatherproof construction.
B. Construct ductwork to resist external loads of wind, snow, ice, and other effects of weather. Provide necessary supporting structures.
C. Single Wall:
    1. Ductwork is to be aluminum.
    2. Where ducts have external insulation, provide weatherproof aluminum jacket. See Section 230713 "Duct Insulation."

3.04 DUCT SEALING:

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
    1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
    2. Outdoor, Supply-Air Ducts: Seal Class B.
    3. Outdoor, Return-Air Ducts: Seal Class C.
    4. Heating-Only Space, Supply-Air Ducts: Not Sealed.
    5. Heating-Only Space, Exhaust Ducts: Not Sealed.
    6. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-inch w.g. and Lower: Seal Class C.
    7. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-inch w.g.: Seal Class B.
    8. Conditioned Space, Restroom and Locker Room Exhaust Ducts: Seal Class C.
    9. Conditioned Space, Laboratory Exhaust Ducts: Seal Class A.
    10. Conditioned Space, Return-Air Ducts: Seal Class C.

3.05 HANGER AND SUPPORT INSTALLATION:

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
B. Building Attachments: Concrete inserts or stainless-steel fasteners appropriate for construction materials to which hangers are being attached.
    1. Where practical, install concrete inserts before placing concrete.
    2. Install stainless-steel concrete anchors with epoxy after concrete is placed and completely cured.

3. Do not use powder-actuated concrete fasteners.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.06 CONNECTIONS:

A. Make connections to equipment with flexible connectors complying with Section 23 33 00 - Air Duct Accessories.

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.07 PAINTING:

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in DIVISION 09 Painting Sections.

3.08 START UP:

A. Air Balance: Comply with requirements in Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.

END OF SECTION 23 31 13

SECTION 23 33 00 – AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes:
   1. Backdraft and pressure relief dampers.
   2. Manual volume dampers.
   3. Control dampers.
   4. Combination fire and smoke dampers.
   5. Flange connectors.
   6. Turning vanes.
   7. Duct-mounted access doors.
   8. Flexible connectors.
   9. Flexible ducts.
   10. Duct accessory hardware.

1.03 RELATED DOCUMENTS:

A. Section 23 37 23 - HVAC Gravity Ventilators for roof-mounted ventilator caps.

1.04 REFERENCE STANDARDS:

A. Applicable Standards (Latest Edition):
   1. Air Movement and Control Association International, Inc. (AMCA):
      a. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating (ANSI).
   2. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
      a. ASHRAE 62.1 - Ventilation for Acceptable Indoor Air Quality (ANSI).
   3. American Society of Heating, Refrigerating and Air-Conditioning Engineers/Illuminating Engineering Society of North America (ASHRAE/IESNA):
      a. ASHRAE/IESNA 90.1 - Energy Standard for Buildings except Low-Rise Residential Buildings (ANSI).
   4. ASTM International (ASTM):
      a. ASTM A480 - Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
      b. ASTM A653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
      c. ASTM B209-07 - Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
      d. ASTM B221-07 - Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
      e. ASTM E84-09a - Test Method for Surface Burning Characteristics of Building Materials.
      f. ASTM E477-06a - Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.
   5. NFPA:
      a. NFPA 90A - Installation of Air Conditioning and Ventilating Systems (ANSI).

b. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems (ANSI).
c. NFPA 96 - Ventilation Control and Fire Protection of Commercial Cooking Operations.

6. North American Insulation Manufacturers Association (The) (NAIMA):
   a. NAIMA AH116 - Fibrous Glass Duct Construction Standards.
7. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
   a. HVAC Duct Construction Standards - Metal and Flexible
8. Underwriters Laboratories, Inc. (UL):
   a. UL 181 - Factory-Made Air Ducts and Air Connectors.
   b. UL 555 - Fire Dampers.
   c. UL 555C - Ceiling Dampers.
   d. UL 555S - Smoke Dampers.
   e. UL 1978 - Standard for Grease Ducts.
   f. Fire Resistance Directory.

1.05 SUBMITTALS:

A. Product Data: For each type of product.
   1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.
B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details, and attachments to other work.
   1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances, and method of field assembly into duct systems and other construction. Include the following:
      a. Special fittings.
      b. Manual volume damper installations.
      c. Control-damper installations.
      d. Combination fire- and smoke-damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.
D. Source quality-control reports.
E. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.
F. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Fusible Links: Furnish quantity equal to 10% of amount installed.

PART 2 - PRODUCTS

2.01 ASSEMBLY DESCRIPTION:

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.02 MATERIALS:

A. Stainless-Steel Sheets: Comply with ASTM A480, Type 304, and having a No. 2 finish for concealed ducts and exposed ducts.
B. Aluminum Sheets: Comply with ASTM B209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
C. Extruded Aluminum: Comply with ASTM B221, Alloy 6063, Temper T6.
D. Reinforcement Shapes and Plates: Compatible materials for aluminum ducts.
E. Tie Rods: Stainless steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.03 BACKDRAFT AND PRESSURE RELIEF DAMPERS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. American Warming and Ventilating; a division of Mestek, Inc.
   2. Greenheck Fan Corporation.
   3. Nailor Industries Inc.
   4. Pottorff.
   5. Ruskin Company.
   6. Or Engineer Approved Equal.
B. Description: Gravity balanced.
C. Maximum Air Velocity: As scheduled on Drawings or as otherwise required.
D. Maximum System Pressure: As scheduled on Drawings or as otherwise required.
E. Frame: Hat-shaped, 0.090 inch thick extruded aluminum, with welded corners or mechanically attached.
F. Blades: Multiple single-piece blades, end pivoted, maximum 6-inch width, 0.050 inch thick aluminum sheet with sealed edges.
G. Blade Action: Parallel.
H. Blade Seals: Extruded vinyl, mechanically locked.
I. Blade Axles:
   1. Material: Stainless steel.
   2. Diameter: 0.20 inch.
J. Tie Bars and Brackets: Aluminum.
K. Bearings: Synthetic pivot bushings.

2.04 MANUAL VOLUME DAMPERS:

A. Standard, Steel, Manual Volume Dampers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Warming and Ventilating; a division of Mestek, Inc.
      b. McGill AirFlow, LLC.
      c. Nailor Industries, Inc.
      d. Pottorff.
      e. Ruskin Company.
      f. Or Engineer Approved Equal.
   2. Standard leakage rating.
   3. Suitable for horizontal or vertical applications.
   4. Frames:
      a. Frame: Hat-shaped, 0.090 inch thick, aluminum.
      b. Mitered and welded corners.

c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:
   a. Multiple or single blade.
   b. Parallel- or opposed-blade design.
   c. Stiffen damper blades for stability.
   d. Aluminum, 0.064 inch thick.
6. Blade Axles: Stainless steel.
7. Bearings:
   a. Molded synthetic.
   b. Dampers in ducts with pressure classes of 3-inch w.g. or greater shall have axles full length of damper blades and bearings at both ends of operating shaft.
8. Tie Bars and Brackets: Stainless steel.

2.05 CONTROL DAMPERS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Arrow United Industries; a division of Mestek, Inc.
   2. Greenheck Fan Corporation.
   3. McGill AirFlow, LLC.
   4. Nailor Industries, Inc.
   5. Pottorff.
   6. Ruskin Company.
   7. Or Engineer Approved Equal.

B. Low-leakage rating and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

C. Frames:
   1. Hat shaped.
   2. 0.090-inch thick, aluminum.
   3. Mitered and welded corners.

D. Blades:
   1. Multiple blade with maximum blade width of 6 inches.
   2. Parallel- and opposed-blade design, as scheduled on Drawings.
   3. Aluminum.
   4. 0.064-inch thick single skin.
   5. Blade Edging: PVC.

E. Blade Axles: 1/2-inch diameter; stainless steel; blade-linkage hardware of stainless steel and brass; ends sealed against blade bearings.
   1. Operating Temperature Range: From -40 to +200ºF.

F. Bearings:
   1. Molded synthetic.
   2. Dampers in ducts with pressure classes of 3-inch w.g. or greater shall have axles full length of damper blades and bearings at both ends of operating shaft.
   3. Thrust bearings at each end of every blade.

2.06 COMBINATION FIRE AND SMOKE DAMPERS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Air Balance, Inc.; a division of Mestek, Inc.
   2. Greenheck Fan Corporation.

3. Nailor Industries, Inc.
4. Pottorff.
5. Ruskin Company.
6. Or Engineer Approved Equal.

B. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.
C. Closing rating in ducts up to 4-inch w.g. static pressure class and minimum 2,000-fpm velocity.
D. Fire Rating: 1-1/2.
E. Frame: Hat-shaped, 0.094 inch thick, stainless steel, with welded corners.
F. Heat-Responsive Device: Electric resettable device and switch package, factory installed, rated.
G. Blades: Roll-formed, horizontal, interlocking, 0.063 inch thick, stainless steel.
H. Leakage: Class II.
I. Rated pressure and velocity to exceed design airflow conditions.
J. Mounting Sleeve: Factory-installed, 0.05 inch thick, stainless steel; length to suit wall or floor application.
K. Accessories:
1. Auxiliary switches for signaling, fan control, or position indication.
2. Test and reset switches, remote mounted.

2.07 TURNING VANES:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ductmate Industries, Inc.
2. Duro Dyne, Inc.
3. Elgen Manufacturing.
4. METALAIRE, Inc.
5. SEMCO, Incorporated.
6. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
7. Or Engineer Approved Equal.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of aluminum; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."
D. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.08 DUCT-MOUNTED ACCESS DOORS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. American Warming and Ventilating; a division of Mestek, Inc.
2. Ductmate Industries, Inc.
3. Greenheck Fan Corporation.
4. McGill AirFlow, LLC.
5. Nailor Industries, Inc.
6. Pottorff.
7. Or Engineer Approved Equal.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:
   a. Double wall, rectangular.
   b. Aluminum with insulation fill and thickness as indicated for duct pressure class.
   c. Vision panel.
   d. Hinges and Latches: 1- by 1-inch butt or piano hinge and cam latches.
   e. Fabricate doors airtight and suitable for duct pressure class.
2. Frame: Aluminum, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:
   a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
   b. Access Doors up to 18 Inches Square: Two hinges or continuous and two sash locks.
   c. Access Doors up to 24 by 48 Inches: Three hinges or continuous and two compression latches with outside and inside handles.
   d. Access Doors Larger Than 24 by 48 Inches: Four hinges or continuous and two compression latches with outside and inside handles.

2.09 FLEXIBLE CONNECTORS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Ductmate Industries, Inc.
   2. Duro Dyne, Inc.
   3. Elgen Manufacturing.
   4. Ventfabrics, Inc.
   5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
   6. Or Engineer Approved Equal.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4 inches wide, 0.032 inch thick aluminum sheets. Provide metal compatible with connected ducts.

E. Flexible Connectors: Glass fabric with chemical-resistant coating.
   1. Minimum Weight: 14 oz./sq. yd.
   2. Tensile Strength: 450 lbf/inch in the warp and 340 lbf/inch in the filling.
   3. Service Temperature: -67 to +500ºF.

2.10 FLEXIBLE DUCTS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Flexmaster U.S.A., Inc.
   2. McGill AirFlow, LLC.
   3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
   4. Or Engineer Approved Equal.

B. Insulated, Flexible Duct: UL 181, Class 0, interlocking spiral of aluminum foil; fibrous-glass insulation; aluminized vapor-barrier film.
   1. Pressure Rating: 8-inch w.g. positive or negative.
   2. Maximum Air Velocity: 5,000 fpm.
   3. Temperature Range: -20 to +250ºF.
   4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

C. Flexible Duct Connectors:
   1. Clamps: Nylon strap in sizes 3 through 18 inches, to suit duct size.
   2. Non-Clamp Connectors: Liquid adhesive plus tape.

2.11 DUCT ACCESSORY HARDWARE:
   1. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
   2. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.01 EXAMINATION:
A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
C. Install backdraft dampers at exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
D. Install volume dampers for Administration Building at points on supply, return, and exhaust systems where branches extend from larger ducts.
E. Set dampers to fully open position before testing, adjusting, and balancing.
F. Install test holes at fan inlets and outlets and elsewhere as indicated.
G. Install fire and smoke dampers according to UL listing.
H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
   1. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
   2. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
   3. Upstream from turning vanes.
   4. Control devices requiring inspection.
   5. Elsewhere as indicated.
I. Install access doors with swing against duct static pressure.
J. Access Door Sizes:
   1. One-Hand or Inspection Access: 8 by 5 inches.
   2. Two-Hand Access: 12 by 6 inches.
   3. Head and Hand Access: 18 by 10 inches.
   4. Head and Shoulders Access: 21 by 14 inches.
   5. Body Access: 25 by 14 inches.
   6. Body plus Ladder Access: 25 by 17 inches.

   Label access doors according to Section 23 05 53 - Identification for HVAC Equipment to indicate the purpose of access door.
K. Install flexible connectors to connect ducts to equipment.

L. For fans developing static pressures of 5-inch w.g. and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
M. Connect terminal units to supply ducts directly.
N. Connect diffusers to ducts with maximum 60-inch lengths of flexible duct clamped or strapped in place.
O. Connect flexible ducts to metal ducts with liquid adhesive plus tape.
P. Install duct test holes where required for testing and balancing purposes.

3.02 FIELD QUALITY CONTROL:

A. Tests and Inspections:
1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 23 33 00

SECTION 23 34 23 – HVAC POWER VENTILATORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes:
   1. Side wall propeller fans.
   2. Ceiling mounted ventilators.
   3. Centrifugal ventilators – roof upblast or side wall.

1.03 REFERENCE STANDARDS:

A. American Bearing Manufacturers Association (ABMA):
   1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings (ANSI).
   2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

B. Air Movement and Control Association International, Inc. (AMCA):
   1. AMCA 99 - Standards Handbook.
   2. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
   3. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data (ANSI).

C. Air Movement and Control Association International, Inc./American Society of Heating, Refrigerating and Air-Conditioning Engineers (AMCA/ASHRAE):
   1. AMCA 210/ASHRAE 51 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating (ANSI).

D. NFPA:
   1. NFPA 70 - National Electrical Code.

E. Underwriters Laboratories, Inc. (UL):
   1. UL 705 - Power Ventilators.
   2. UL 762 - Outline of Investigation for Power Roof Ventilators for Restaurant Exhaust Appliances.

1.04 PERFORMANCE REQUIREMENTS:

A. Project Altitude: Base fan-performance ratings on actual Project Site elevations.

B. Operating Limits: Classify according to AMCA 99.

1.05 SUBMITTALS:

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:
   1. Certified fan performance curves with system operating conditions indicated.
   2. Certified fan sound-power ratings.
   3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
   4. Material thickness and finishes, including color charts.
   5. Dampers, including housings, linkages, and operators.
   6. Fan speed controllers.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

C. Field quality-control reports.
D. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.06 QUALITY ASSURANCE:

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

PART 2 - PRODUCTS

2.01 CEILING MOUNTED VENTILATORS:

A. Housing: aluminum, lined with acoustical insulation.
1. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel removable for service.
2. Back-draft damper: Integral.
3. Grille: Painted aluminum, louvered grille with flange on intake and thumbscrew or spring retainer attachment to fan housing.
4. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.
5. Accessories:
a. Manufacturer's standard roof jack or wall cap, and transition fittings.

2.02 CENTRIFUGAL VENTILATORS – ROOF UPBLAST OR SIDEWALL

A. Configuration: Centrifugal sidewall ventilator.
B. Housing: Removable spun aluminum; square, one-piece aluminum base with venturi inlet cone.
1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains.
C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades; spark-resistant construction classified in accordance with AMCA 99, Section 8, Type C.
D. Direct Drive:
1. Resiliently mounted to housing.
2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings; minimum ABMA.
E. Motor:
1. Rate for variable frequency drive control
F. Accessories:
1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted outside fan housing, factory wired through an internal aluminum conduit.
2. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

4. Spark-resistant, all-aluminum wheel construction.
5. Wall Mount Adapter: Attach wall-mounted fan to wall.

2.03 SIDEWALL PROPELLER FANS

A. Housing: Steel sheet with flanged edges and integral orifice ring, with baked-enamel finish coat applied after assembly.
B. Fan Wheels: Formed-steel blades riveted to heavy-gauge steel spider bolted to cast-iron hub.
C. Fan Wheel: Replaceable, steel, airfoil blades fastened to steel; factory set pitch angle of blades.
D. Fan Drive, Direct Drive:
   1. Resiliently mounted to housing.
   2. Statically and dynamically balanced.
   3. Selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
   4. Extend grease fitting to accessible location outside of unit.
   5. Service Factor Based on Fan Motor Size: 1.5.
   6. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
   7. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
   8. Pulleys: Cast iron with split, tapered bushing; dynamically balanced at factory.
E. Accessories:
   1. Dampers: Counterbalanced, parallel-blade, backdraft dampers factory set to close when fan stops.
   2. Motor-Side Back Guard: Steel, complying with OSHA specifications, removable for maintenance.
   3. Wall Sleeve: Steel to match fan and accessory size.
F. Weathershield Hood: Steel to match fan and accessory size.
G. Factory power coated baked epoxy on all steel.

2.04 MOTORS:

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 23 05 13 - Common Motor Requirements for HVAC Equipment.
   1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
   2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.
B. Enclosure Type: Totally enclosed, fan cooled.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install power ventilators level and plumb.
B. Support units using restrained spring isolators having a static deflection of 1 inch.
C. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
D. Support suspended units from structure using threaded steel rods and elastomeric hangers having a static deflection of 1 inch.
E. Install units with clearances for service and maintenance.
F. Label units according to requirements specified in Section 23 05 53 - Identification for HVAC Piping and Equipment.

3.02 CONNECTIONS:

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 23 33 00 - Air Duct Accessories.
B. Install ducts adjacent to power ventilators to allow service and maintenance.
C. Ground equipment according to Division 26.
D. Connect wiring according to Division 26.

3.03 FIELD QUALITY CONTROL:

A. Perform tests and inspections.
B. Tests and Inspections:
   1. Verify that shipping, blocking, and bracing are removed.
   2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
   3. Verify that cleaning and adjusting are complete.
   4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
   5. Adjust belt tension.
   6. Verify lubrication for bearings and other moving parts.
   7. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
   8. Disable automatic temperature-control operators, energize motor, and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
   9. Shut unit down and reconnect automatic temperature-control operators.
   10. Remove and replace malfunctioning units and retest as specified above.
C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
D. Prepare test and inspection reports.

3.04 ADJUSTING:

A. Adjust damper linkages for proper damper operation.
B. Adjust belt tension.
C. Comply with requirements in Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC for testing, adjusting, and balancing procedures.
D. Replace fan and motor pulleys as required to achieve design airflow.
E. Lubricate bearings.

END OF SECTION 23 34 23

SECTION 23 36 00 – AIR TERMINAL UNITS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes:
   1. Shutoff, single-duct air terminal units.

1.03 REFERENCE STANDARDS:

A. Applicable Standards (Latest Edition):
   1. Air-Conditioning & Refrigeration Institute (ARI):
      a. ARI 880 - Air Terminals.
   2. American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI):
      a. ASCE/SEI 7 - Minimum Design Loads for Buildings and Other Structures.
   3. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
      a. ASHRAE 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
      b. ASHRAE 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size (ANSI).
      c. ASHRAE 62.1 - Ventilation for Acceptable Indoor Air Quality (ANSI).
   4. ASTM International (ASTM):
      a. ASTM A492 - Specification for Stainless-Steel Rope Wire.
      b. ASTM A603 - Specification for Zinc-Coated Steel Structural Wire Rope.
      c. ASTM C1071 - Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).
      d. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
      e. ASTM E488 - Test Methods for Strength of Anchors in Concrete and Masonry Elements.
   5. National Electrical Manufacturers Association (NEMA):
      a. NEMA 250 - Enclosures for Electrical Equipment (1,000V Maximum).
   6. NFPA:
      a. NFPA 70 - National Electrical Code.
      b. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
   7. Sheet Metal and Air Conditioning Contractors' National Association:
      a. HVAC Duct Construction Standards - Metal and Flexible.
      b. Seismic Restraint Manual: Guidelines for Mechanical Systems.
   8. Underwriters Laboratories, Inc. (UL):
      a. UL 181 - Factory-Made Air Ducts and Air Connectors.

1.04 PERFORMANCE REQUIREMENTS:

A. Refer to Mechanical drawings for capacity performance.

1.05 SUBMITTALS:

A. Action Submittals:

1. Product Data: For each type of the following products, including rated capacities, furnished specialties, sound-power ratings, and accessories.
    a. Air terminal units.
    b. Liners and adhesives.
    c. Sealants and gaskets.
2. Shop Drawings: For air terminal units. Include plans, elevations, sections, details, and attachments to other work.
    a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
    b. Wiring Diagrams: For power, signal, and control wiring.
    c. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.
3. Delegated-Design Submittal:
    a. Materials, fabrication, assembly, and spacing of hangers and supports.

B. Informational Submittals:
1. Field quality control reports.

C. Closeout submittals:
1. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01, include the following:
    a. Instructions for resetting minimum and maximum air volumes.
    b. Instructions for adjusting software set points.

D. Maintenance Material Submittals:
1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.06 QUALITY ASSURANCE:

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.01 SHUTOFF, SINGLE-DUCT AIR TERMINAL UNITS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Krueger.
2. Nailor Industries, Inc.
3. Price Industries.
4. Titus.
5. Trane; a business of American Standard Companies.
6. Or Engineer Approved Equal.

B. Configuration: Volume-damper assembly inside unit casing with control components inside a protective metal shroud.

C. Casing: 0.032-inch aluminum, single wall.
1. Casing Lining: Adhesive attached, 1 inch thick, coated, fibrous-glass duct liner complying with ASTM C1071, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E84.

a. Cover liner with nonporous foil.
2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
3. Air Outlet: S-slip and drive connections.
4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.
5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. pressure, and shall be factory tested for leaks.

E. Volume Damper: Aluminum with peripheral gasket and self-lubricating bearings.
1. Maximum Damper Leakage: ARI 880 rated, 2% of nominal airflow at 3-inch w.g. inlet static pressure.
2. Damper Position: Normally closed.

F. Electric-Resistance Heating Coils: Nickel-chromium heating wire, free of expansion noise and hum, mounted in ceramic inserts in a aluminum housing; with primary automatic, and secondary manual, reset thermal cutouts. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware.
1. Access door interlocked disconnect switch.
2. Downstream air temperature sensor with local connection to override discharge-air temperature to not exceed a maximum temperature set point (adjustable.)
3. Nickel chrome 80/20 heating elements.
4. Airflow switch for proof of airflow.
5. Fan interlock contacts.
6. Fuses in terminal box for overcurrent protection (for coils more than 48 A).
7. Mercury contactors.
8. Pneumatic-electric switches and relays.

G. Direct Digital Controls: Bidirectional damper operators and microprocessor-based controller and room sensor. Control devices shall be compatible with temperature controls specified in Section 23 09 00 - Instrumentation and Control for HVAC and shall have the following features:
1. Damper Actuator: 24V, powered closed, powered open.
2. Terminal Unit Controller: Pressure-independent, variable-air-volume controller, approved or furnished by HVAC control contractor with electronic airflow transducer with multipoint velocity sensor at air inlet, factory calibrated to minimum and maximum air volumes, and having the following features:
a. Occupied and unoccupied operating mode.
b. Remote reset of airflow or temperature set points.
c. Communication with temperature-control system specified in Section 23 09 00 - Instrumentation and Control for HVAC.
3. Room Sensor: Wall mounted with temperature set-point adjustment and access for connection of portable operator terminal.

H. Control Sequence:
1. Suitable for operation with duct pressures between 0.25- and 3.0-inch w.g. inlet static pressure.
2. System-powered, wall-mounted thermostat.

2.02 SOURCE QUALITY CONTROL:

A. Factory Tests: Test assembled air terminal units according to ARI 880.
1. Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, and ARI certification seal.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

B. Install air terminal units' level and plumb. Maintain sufficient clearance for normal service and maintenance.

3.02 HANGER AND SUPPORT INSTALLATION:

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes and for slabs less than 4 inches thick.
3. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hangers Exposed to view: Threaded rod and angle or channel supports. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.03 CONNECTIONS:

A. Connect ducts to air terminal units according to Section 23 31 13 - Metal Ducts.

B. Make connections to air terminal units with flexible connectors complying with requirements in Section 23 33 00 - Air Duct Accessories.

3.04 IDENTIFICATION:

A. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Section 23 05 53 - Identification for HVAC Piping and Equipment for equipment labels and warning signs and labels.

3.05 FIELD QUALITY CONTROL:

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Air terminal unit will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.06 STARTUP SERVICE:

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.

3. Verify that controls and control enclosure are accessible.
4. Verify that control connections are complete.
5. Verify that nameplate and identification tag are visible.
6. Verify that controls respond to inputs as specified.

3.07 DEMONSTRATION:

A. Factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

END OF SECTION 23 36 00

SECTION 23 37 13 – DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes:
   1. Rectangular and square ceiling diffusers.
   2. Adjustable bar registers and grilles.
   3. Fixed face registers and grilles.

1.03 RELATED REQUIREMENTS:

A. Section 23 33 00 - Air Duct Accessories for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

B. Applicable Standards (Latest Edition):
   1. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
      a. ASHRAE 70 - Method of Testing for Rating the Performance of Air Outlets and Inlets (ANSI).

1.05 SUBMITTALS:

A. Action Submittals:
   1. Product Data: For each type of product indicated, include the following:
      a. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
      b. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Informational Submittals:
   1. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
      a. Ceiling suspension assembly members.
      b. Method of attaching hangers to building structure.
      c. Size and location of initial access modules for acoustical tile.
      d. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
      e. Duct access panels.
   2. Source quality-control reports.

PART 2 - PRODUCTS

2.01 DIFFUSERS, REGISTERS, AND GRILLES:

A. For all diffusers, registers, and grilles:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Krueger.
      b. Nailor Industries, Inc.
      c. Price Industries.
      d. Titus.
   2. All products shall conform to the schedules.

2.02 SOURCE QUALITY CONTROL:

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. Install diffusers, registers, and grilles level and plumb.
B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.03 ADJUSTING:

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 23 37 13

SECTION 23 37 23 - HVAC GRAVITY VENTILATORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Hooded ventilators.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product
B. Shop Drawings: For gravity ventilators.
   1. Include plans, elevations, sections, details, ventilator attachments to curbs, and curb attachments to roof structure.
   2. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Roof-framing plans and other details, drawn to scale, and coordinated with each other, based on input from installers of the items involved:

1.05 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Structural Performance: Ventilators shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of ventilator components, noise or metal fatigue caused by ventilator blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
   1. Wind Loads, Basis: Determine loads based on a uniform pressure of 30 lbf/sq. ft., acting inward or outward.
B. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1.
C. ASHRAE 62.1 Compliance: Section 5, "Systems and Equipment" and Section 7, "Construction and System Start-up."
D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.
   1. Temperature Change (Range):
      a. Ambient: 120 deg F.
      b. Material Surfaces: 180 deg F.
E. Water Entrainment: Limit water penetration through unit to comply with ASHRAE 62.1.
F. Capacities and Characteristics:
   1. See schedule

2.02 FABRICATION

A. Factory or shop fabricate gravity ventilators to minimize field splicing and assembly. Disassemble units to the minimum extent as necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.

B. Fabricate frames, including integral bases, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

C. Fabricate units with closely fitted joints and exposed connections accurately located and secured.

D. Fabricate supports, anchorages, and accessories required for complete assembly.

E. Perform shop welding by AWS-certified procedures and personnel.

2.03 HOODED VENTILATORS

A. Description: Hooded rectangular penthouse for intake air.

B. Source Limitations: Obtain hooded ventilators from single manufacturer.

C. Construction:

1. Material, Aluminum: Thickness required to comply with structural performance requirements, but not less than 0.063-inch- thick base and 0.050-inch- thick hood; suitably reinforced.
2. Bird Screening: Aluminum, 1/2-inch-square mesh or flattened, expanded aluminum,

D. Dampers:

1. Control: Motorized.

E. Roof Curbs: Aluminum sheet; with mitered and welded corners; 1-1/2-inch-thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to fit roof opening and ventilator base.

1. Configuration: Self-flashing without a cant strip, with mounting flange.
2. Overall Height: 12 inches.

2.04 SOURCE QUALITY CONTROL

A. AMCA Certification for Hooded Ventilators: Test, rate, and label gravity ventilators in accordance with AMCA 511.

2.05 MATERIALS

A. Aluminum Extrusions: ASTM B221, Alloy 6063-T5 or T-52.

B. Aluminum Sheet: ASTM B209, Alloy 3003 or 5005, with temper as required for forming or as otherwise recommended by metal producer for required finish.

C. Stainless Steel Sheet: ASTM A666, Type 304, with No. 4 finish.

D. Fasteners: Same basic metal and alloy as fastened metal or 300 Series stainless steel unless otherwise indicated. Do not use metals that are incompatible with joined materials.

1. Use types and sizes to suit unit installation conditions.
2. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.

E. Post-Installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors made from stainless-steel components, with capability to sustain without failure a load equal to 4 times the loads imposed for concrete, or 6 times the load imposed for masonry, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Install gravity ventilators level, plumb, and at indicated alignment with adjacent work.
B. Secure gravity ventilators to roof curbs with zinc-plated hardware, that comply with the wind fastening requirements. Use concealed anchorages where possible.
C. Install gravity ventilators with clearances for service and maintenance.
D. Install perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
E. Install concealed gaskets, flashings, joint fillers, and insulation as installation progresses. Comply with Section 07 92 00 "Joint Sealants" for sealants applied during installation.
F. Label gravity ventilators according to requirements specified in Section 23 05 53 "Identification for HVAC Piping and Equipment."
G. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
H. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes, so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

3.02 ADJUSTING

A. Adjust damper linkages for proper damper operation.

END OF SECTION 23 37 23

SECTION 23 74 13 – PACKAGED, OUTDOOR, CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes packaged, outdoor, central-station air-handling units (rooftop units) with the following components and accessories:
   1. Direct-expansion cooling.
   2. Electric heating coils.
   3. Economizer outdoor- and return-air damper section.

1.03 RELATED SECTIONS:

1. Section 23 73 33 - Indoor Indirect Fuel-Fired Heating and Ventilating Units for outdoor units providing 100% tempered outdoor air with heat exchangers.
2. Section 23 73 39 - Indoor Direct Gas-Fired Heating and Ventilating Units for outdoor units providing 100% tempered outdoor air without heat exchangers.
3. Division 23, Section "Packaged, Outdoor, Heating and Cooling Makeup Air-Conditioners" for outdoor equipment air conditioning 100% outdoor air to replace air exhausted from a building.

1.04 REFERENCES:

A. Applicable Standards (Latest Edition):
   1. Air-Conditioning & Refrigeration Institute (ARI):
      a. ARI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
      b. ARI 270 - Sound Rating of Outdoor Unitary Equipment.
      c. ARI 340/360 - Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.
      d. ARI Guideline B - Roof-Mounted Outdoor Air-Conditioning Installations.
   2. American National Standards Institute (ANSI):
      a. ANSI Z21.47 - Gas-Fired Central Furnaces.
   3. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
      a. ASHRAE 15 - Safety Standard for Refrigeration Systems.
      b. ASHRAE 33 - Methods of Testing Forced Circulation Air Cooling and Heating Coils (ANSI).
      c. ASHRAE 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter (ANSI).
      d. ASHRAE 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size (ANSI).
      e. ASHRAE 62.1 - Ventilation for Acceptable Indoor Air Quality (ANSI).
   4. American Society of Heating, Refrigerating and Air-Conditioning Engineers/Illuminating Engineering Society of North America (ASHRAE/IESNA):
      a. ASHRAE/IESNA 90.1 - Energy Standard for Buildings except Low-Rise Residential Buildings (ANSI).
   5. ASTM International (ASTM):
      a. ASTM C916 - Specification for Adhesives for Duct Thermal Insulation.

b. ASTM C1071 - Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).

6. National Roofing Contractors Association:
   a. Low-Slope Membrane Roofing Construction Details Manual Vol. 1.
7. NFPA:
   a. NFPA 54 - National Fuel Gas Code (ANSI).
   b. NFPA 70 - National Electrical Code.
   c. NFPA 90A - Installation of Air Conditioning and Ventilating Systems (ANSI).
   d. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems (ANSI).
8. Structural Engineering Institute/American Society of Civil Engineers (SEI/ASCE):
   a. SEI/ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
9. Underwriters Laboratories, Inc. (UL):
   a. UL 1995 - Heating and Cooling Equipment.

1.05 DEFINITIONS:

A. DDC: Direct-digital controls.
B. ECM: Electrically commutated motor.
C. Outdoor-Air Refrigerant Coil: Refrigerant coil in the outdoor-air stream to reject heat during cooling operations and to absorb heat during heating operations. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.
D. Outdoor-Air Refrigerant Coil Fan: The outdoor-air refrigerant coil fan in AHUs. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.
E. AHU: Air handling unit. As used in this Section, this abbreviation means packaged, outdoor, central-station air-handling units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.
F. Supply-Air Fan: The fan providing supply air to conditioned space. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.
G. Supply-Air Refrigerant Coil: Refrigerant coil in the supply-air stream to absorb heat (provide cooling) during cooling operations and to reject heat (provide heating) during heating operations. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.
H. VVT: Variable-air volume and temperature.

1.06 PERFORMANCE REQUIREMENTS:

A. Delegated Design: Design AHU supports to comply with wind performance requirements, including comprehensive engineering analysis by a qualified Professional Engineer, using performance requirements and design criteria indicated.
B. Wind-Restraint Performance:
   1. Basic Wind Speed: 100 miles per hour.
   2. Building Classification Category: II.
   3. Minimum 10 lb./ft.^{2} multiplied by the maximum area of the mechanical component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

1.07 ACTION SUBMITTALS:

A. Product Data: Include manufacturer's technical data for each AHU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

1.08 INFORMATIONAL SUBMITTALS:

A. Field quality control test reports.

B. Warranty: Special warranty specified in this Section.

1.09 CLOSEOUT SUBMITTALS:

A. Operation and Maintenance Data: For AHUs to include in emergency, operation, and maintenance manuals.

1.10 QUALITY ASSURANCE:

A. ARI Compliance:

1. Comply with ARI 210/240 and ARI 340/360 for testing and rating energy efficiencies for RTUs.
2. Comply with ARI 270 for testing and rating sound performance for AHUs.

B. ASHRAE Compliance:

1. Comply with ASHRAE 15 for refrigeration system safety.
2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.

C. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.

D. UL Compliance: Comply with UL 1995.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.11 WARRANTY:

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of AHUs that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
2. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AAON, Inc.
2. Engineered Air.
3. McQuay International.

2.02 CASING:

A. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.

B. Exterior Casing Material: Stainless steel with factory-painted finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.
   1. Exterior Casing Thickness: 18 gauge.

C. Inner Casing Fabrication Requirements:
   1. Inside Casing: Stainless steel, 22 gauge.

D. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
   1. Materials: ASTM C1071, Type I.
   2. Thickness: 2 inch, 1.5 lb/cu.ft..
   3. Liner materials shall have air stream surface coated with an erosion- and temperature-resistant coating or faced with a plain or coated fibrous mat or fabric.
   4. Liner Adhesive: Comply with ASTM C916, Type I.

E. Condensate Drain Pans: Formed sections of stainless-steel sheet, a minimum of 2 inches deep.
   1. Double-Wall Construction: Fill space between walls with foam insulation and seal moisture tight.
   2. Drain Connections: Threaded nipple both sides of drain pan.
   3. Pan-Top Surface Coating: Corrosion-resistant compound.

2.03 FANS:

A. Fan Motor: Comply with requirements in Section 23 05 13 - Common Motor Requirements for HVAC Equipment. Rated for VFD operation

2.04 COILS:

A. Supply-Air Refrigerant Coil:
   1. Aluminum-plate fin and seamless heresite coated copper tube in stainless steel casing with equalizing-type vertical distributor.
   2. Coil Split: Interlaced.
   3. Braze 56 on refrigerant piping
   4. Condensate Drain Pan: Stainless steel formed with pitch and drain connections.
   5. Here site coating.

B. Electric-Resistance Heating:
   1. Open Heating Elements: Resistance wire of stainless steel casing and tubular element NEMA 4x panel, supported and insulated by floating ceramic bushings recessed into casing openings, fastened to supporting brackets, and mounted in stainless-steel frame. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware.
   2. Overtemperature Protection: Disk-type, automatically reset, thermal-cutout, safety device; serviceable through terminal box.
   3. Overcurrent Protection: Manual-reset thermal cutouts, factory wired in each heater stage.
   4. Control Panel: Unit mounted with disconnecting means and overcurrent protection. Include the following controls:
      a. SCR Controller: Pilot lights operate on load ratio, a minimum of five steps.
      b. Time-delay relay.
      c. Airflow proving switch.

2.05 REFRIGERANT CIRCUIT COMPONENTS:

A. Compressor: Hermetic, scroll, mounted on vibration isolators; with internal overcurrent and high temperature protection, internal pressure relief, and crankcase heater.

B. Refrigeration Specialties:

1. Refrigerant: R-410A.
2. Expansion valve with replaceable thermostatic element.
3. Refrigerant filter/dryer.
4. Manual-reset high-pressure safety switch.
5. Automatic-reset low-pressure safety switch.
6. Minimum off-time relay.
7. Automatic-reset compressor motor thermal overload.
8. Stainless steel service valves installed in compressor suction and liquid lines.

2.06 AIR FILTRATION:

A. See schedule.

2.07 DAMPERS:

A. Aluminum, opposed blade, low leakage.

2.08 ELECTRICAL POWER CONNECTION:

A. Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

B. Electrical Data:

1. V/Ph/Hz: 480 V/ 3 phase / 60 hz.

2.09 CONTROLS:

A. Control equipment as specified in Section 23 09 00 - Instrumentation and Control for HVAC. Controllers shall be approved or furnished by HVAC controls contractor.

B. Provide manufacturer’s standard safety controls

2.10 CAPACITIES AND CHARACTERISTICS:

A. Refer to equipment schedules on Mechanical drawings.

2.11 OPTIONAL:

A. 304 stainless steel piano hinges and filter rack.

B. All aluminum rigid conduit and liquid tight flex.

C. NEMA 4X enclosed, disconnect, switches, panels.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of AHUs.

B. Examine roughing-in for AHUs to verify actual locations of piping and duct connections before equipment installation.

C. Examine roofs for suitable conditions where AHUs will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
   1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger than supported equipment and minimum 6 inches above finished ground elevation.
   2. Place and secure anchorage devices. Use supported equipment manufacturer's Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   3. Install anchor bolts to elevations required for proper attachment to supported equipment.
   4. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
   5. Use 3,000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03.

3.03 CONNECTIONS:

A. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.
B. Install piping adjacent to AHUs to allow service and maintenance.

3.04 FIELD QUALITY CONTROL:

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
B. Tests and Inspections:
   1. After installing AHUs and after electrical circuitry has been energized, test units for compliance with requirements.
   2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
   3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
C. Remove and replace malfunctioning units and retest as specified above.

3.05 STARTUP SERVICE:

A. Engage a factory-authorized service representative to perform startup service.
B. Complete installation and startup checks according to manufacturer's written instructions and do the following:
   1. Inspect for visible damage to unit casing.
   2. Inspect for visible damage to furnace combustion chamber.
   3. Inspect for visible damage to compressor, coils, and fans.
   4. Inspect internal insulation.
   5. Verify that labels are clearly visible.
   6. Verify that clearances have been provided for servicing.
   7. Verify that controls are connected and operable.
   8. Verify that filters are installed.
   9. Clean condenser coil and inspect for construction debris.
   10. Inspect operation of barometric relief dampers.
   11. Verify lubrication on fan and motor bearings.

12. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
13. Adjust fan belts to proper alignment and tension.
14. Start unit according to manufacturer's written instructions.
    a. Start refrigeration system.
    b. Do not operate below recommended low ambient temperature.
    c. Complete startup sheets and attach copy with Contractor's startup report.
15. Inspect and record performance of interlocks and protective devices; verify sequences.
16. Operate unit for an initial period as recommended or required by manufacturer.
17. Calibrate thermostats.
18. Adjust and inspect high temperature limits.
19. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
20. Start refrigeration system and measure and record the following when ambient is a minimum of 15ºF above return air temperature:
    a. Coil leaving air, dry and wet bulb temperatures.
    b. Coil entering air, dry and wet bulb temperatures.
    c. Outdoor air, dry bulb temperature.
    d. Outdoor air coil, discharge air, dry bulb temperature.
21. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
22. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
    a. Supply air volume.
    b. Return air volume.
    c. Relief air volume.
    d. Outdoor air intake volume.
23. Simulate maximum cooling demand and inspect the following:
    a. Compressor refrigerant suction and hot gas pressures.
    b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.
24. Verify operation of remote panel including pilot light operation and failure modes. Inspect the following:
    a. High temperature limit on gas-fired heat exchanger.
    b. Low temperature safety operation.
    c. Filter high-pressure differential alarm.
    d. Economizer to minimum outdoor-air changeover.
    e. Relief-air fan operation.
    f. Smoke and firestat alarms.
25. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.06 CLEANING AND ADJUSTING:

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to one visits to Site during other-than-normal occupancy hours for this purpose.

B. After completing system installation and testing, adjusting, and balancing AHU and air-distribution systems, clean filter housings and install new filters.

3.07 DEMONSTRATION:

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain AHUs. Refer to Division 01.

END OF SECTION 23 74 13

SECTION 23 74 33 – MAKEUP AIR UNITS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes factory-packaged units capable of supplying up to 100% outdoor air and providing heating.

1.03 REFERENCES:

A. Applicable Standards (Latest Edition):
   1. Air-Conditioning & Refrigeration Institute (ARI):
      a. ARI 410-2001 (Addendum 2) - Forced-Circulation Air-Cooling and Air-Heating Coils.
   2. Air Movement and Control Association International, Inc. (AMCA):
      a. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating (ANSI).
   3. American National Standards Institute (ANSI):
      a. ANSI Z21.47-2006/CSA 2.3 (Addendum 2) - Gas-Fired Central Furnaces.
      b. ANSI Z83.4-2003/CSA 3.7 (Addendum 2) - Non-Recirculating Direct Gas-Fired Industrial Air Heaters.
      c. ANSI Z83.18 - Recirculating Direct Gas-Fired Industrial Air Heaters.
   4. American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI):
      a. ASCE/SEI 7 - Minimum Design Loads for Buildings and Other Structures.
   5. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
      a. ASHRAE 15 - Safety Standard for Refrigeration Systems.
      b. ASHRAE 33 - Methods of Testing Forced Circulation Air Cooling and Air Heating Coils (ANSI).
      c. ASHRAE 34 - Designation and Safety Classification of Refrigerants (ANSI).
      d. ASHRAE 52.1 - Gravimetric and Dust Spot Procedures for Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter (ANSI).
      e. ASHRAE 52.2 - Method of Testing General Ventilation Air Cleaning Devices for Removal Efficiency by Particle Size (ANSI).
      f. ASHRAE 62.1 - Ventilation for Acceptable Indoor Air Quality (ANSI).
      g. ASHRAE 135 - BACnet - A Data Communication Protocol for Building Automation and Control Networks (ANSI).
   6. American Society of Heating, Refrigerating and Air-Conditioning Engineers/Illuminating Engineering Society of North America (ASHRAE/IESNA):
      a. ASHRAE/IESNA 90.1 - Energy Standard for Buildings except Low-Rise Residential Buildings (ANSI).
   7. ASTM International (ASTM):
      a. ASTM B88 - Specification for Seamless Copper Water Tube.
      b. ASTM C534 - Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
      c. ASTM C916 - Specification for Adhesives for Duct Thermal Insulation.
      d. ASTM C1071 - Fibrous Glass Duct Lining Insulation (Thermal and Sound-Absorbing Material).

e. ASTM D1785 - Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

8. Code of Federal Regulations (CFR):
   a. 40 CFR, Part 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings.
9. International Electrotechnical Commission (IEC):
   a. IEC 60947-4-1 (Amendment 2) - Part 4: Contactors and Motor Starters: Section 1, "Electromechanical Contactors and Motor Starters."
10. National Electrical Manufacturers Association (NEMA):
    a. NEMA 250 - Enclosures for Electrical Equipment (1,000V Maximum).
    b. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600V Maximum).
11. NFPA:
    a. NFPA 54 - National Fuel Gas Code.
    b. NFPA 70 - National Electrical Code.
    c. NFPA 90A - Installation of Air-Conditioning and Ventilating Systems.
12. National Roofing Contractors Association:
    a. The NRCA Roofing Manual.
13. Underwriters Laboratories, Inc. (UL):
    a. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
    b. UL 1995 - Heating and Cooling Equipment.

1.04 ACTION SUBMITTALS:

A. Product Data: For each type of product. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Shop Drawings:
   1. Include plans, elevations, sections, and attachment details.
   2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Prepare the following by or under the supervision of a qualified Professional Engineer:
      a. Include diagrams for power, signal, and control wiring.

1.05 INFORMATIONAL SUBMITTALS:

A. Startup service reports.

1.06 CLOSEOUT SUBMITTALS:

A. Operation and Maintenance Data: For units to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Captive-Air Sytems, Inc..
   2. Engineered Air.
   3. Greenheck Model.

4. Trane.

B. Cabinet Thermal Performance:
   1. Maximum Overall U-Value: Comply with requirements in ASHRAE/IESNA 90.1.
   2. Include effects of metal-to-metal contact and thermal bridges in the calculations.

C. Maximum Cabinet Leakage: 1% of the total supply-air flow at a pressure rating equal to the fan shut-off pressure.

D. Electrical components, devices, and accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   1. Capacities and Characteristics:
      a. As scheduled on Drawings.

2.02 CABINET:

A. Construction: Double wall.

B. Exterior Casing Material: Stainless steel.

C. Interior Casing Material: Stainless steel.

D. Lifting and Handling Provisions: Factory-installed shipping skids and lifting lugs.

E. Base Rails: Stainless-steel rails for mounting on roof curb or pad as indicated.

F. Access for Inspection, Cleaning, and Maintenance: Comply with requirements in ASHRAE 62.1.
   1. Service Doors: Hinged access doors with gaskets. Material and construction of doors shall match material and construction of cabinet in which doors are installed.

G. Roof: Standing seam or membrane; sloped to drain water.

H. Floor: Reinforced, metal surface; reinforced to limit deflection when walked on by service personnel. Insulation shall be below metal walking surface.

I. Cabinet Insulation:
   1. Type: Fibrous-glass duct lining complying with ASTM C1071, Type II.
   2. Thickness: 1 inch, 1.5 lb/cu. ft.
   3. Insulation Adhesive: Comply with ASTM C916, Type I.
   4. Mechanical Fasteners: Suitable for adhesive, mechanical, or welding attachment to casing without damaging liner and without causing air leakage when applied as recommended by manufacturer.

J. Surfaces in Contact with Airstream: Comply with requirements in ASHRAE 62.1 for resistance to mold and erosion.

2.03 SUPPLY FAN:

A. Air-Foil Fan Type: Centrifugal; statically and dynamically balanced.
   1. Fan Wheel Material: Aluminum steel, mounted on stainless-steel shaft.
   2. Bearings: Self-aligning, permanently lubricated ball bearings.

B. Service Factor for Belt Drive Applications: Multiple V-belt drive with matching fan pulley and adjustable motor sheaves and belt assembly with minimum 2.0 service factor.

C. Motors:
   1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 23 05 13 - Common Motor Requirements for HVAC Equipment.
   2. Enclosure: Severe-Duty.
   3. Enclosure Materials: Cast aluminum.
   4. Efficiency: Premium efficient.
   5. Service Factor: 1.15.

D. Mounting: Fan wheel, motor, and drives shall be mounted to fan casing with spring isolators.

2.04 ELECTRIC-RESISTANCE HEATING COIL:

A. UL Compliance: Comply with requirements in UL 1995, "Heating and Cooling Equipment."
B. Electric-Resistance Heating Elements:
   1. Coiled Resistance Wire: Stainless steel tubular sheath, stainless steel casing.
   2. Fins: Spiral-wound, copper-plated, steel fins continuously brazed to sheath.
   3. Safety Controls:
      a. Blower-motor interlock, air-pressure switch.
      b. Quiet mercury contactors.
      c. Time delay between steps.
      d. Integral, nonfused power disconnect switch.
   4. Heresite coating.
   5. Stainless steel casing.
   6. NEMA 4X Panel.

2.05 OUTDOOR-AIR INTAKE HOOD:

A. Type: Manufacturer's standard hood or louver.
B. Materials: Match cabinet.
C. Bird Screen: Comply with requirements in ASHRAE 62.1.
D. Configuration: Designed to inhibit wind-driven rain and snow from entering unit.

2.06 FILTERS:

A. As schedule of Drawings.

2.07 ELECTRICAL POWER CONNECTIONS:

A. General Electrical Power Connection Requirements: Factory-installed and -wired switches, motor controllers, transformers, and other necessary electrical devices shall provide a single-point field power connection to unit.
B. Enclosure: NEMA 250, Type 4X, mounted in unit with hinged access door in unit cabinet having a lock and key or padlock and key,
C. Wiring: Numbered and color-coded to match wiring diagram.
D. Wiring Location: Install factory wiring outside an enclosure in a raceway.
E. Power Interface: Field power interface shall be to NEMA KS 1, heavy-duty, nonfused disconnect switch.
F. Factory Wiring: Branch power circuit to each motor and to controls with one of the following disconnecting means:
   1. NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.
   2. NEMA KS 1, heavy-duty, nonfusible switch.
   3. UL 489, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
G. Factory-Mounted, Overcurrent-Protection Service: For each motor.
H. Transformer: Factory mounted with primary and secondary fuses and sized with enough capacity to operate electrical load plus spare capacity.
I. Controls: Factory-wire unit-mounted controls where indicated.
J. Receptacle: Factory-wire unit-mounted, ground fault interrupt (GFI) duplex receptacle. Provide required transformer.
K. Control Relays: Auxiliary and adjustable time-delay relays.
L. Aluminum wiring.
M. Aluminum rigid conduit and liquid tight flex.

2.08 CONTROLS:

A. Control equipment and sequence of operation are specified in Section 23 09 00 - Instrumentation and Control for HVAC. Controllers shall be approved or furnished by HVAC controls contractor.
B. Control Wiring: Factory-wire connection for controls' power supply.
C. Control Devices: Sensors, transmitters, relays, switches, detectors, operators, and actuators shall be manufacturer's standard items to accomplish indicated control functions.

2.09 ACCESSORIES:

A. Duplex Receptacle: Factory mounted in unit supply-fan section and refrigeration section, with 20 A, 120V GFI duplex receptacle and weatherproof cover.
B. Stainless steel fan flex connector.
C. NEMA 4X enclosures, switches, panels, disconnect.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Examine roughing-in for piping, ducts, and electrical systems to verify actual locations of connections before equipment installation.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. Comply with manufacturer's rigging and installation instructions for unloading units and moving to final locations.
B. Equipment Mounting: Install floor or on-grade mounted units on cast-in-place concrete equipment bases. Comply with requirements for equipment bases specified in Division 03.
    1. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases.
    2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
    3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete floor.
    4. Place and secure anchorage devices. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
    5. Install anchor bolts to elevations required for proper attachment to supported equipment.
    6. Install on 6-inch high concrete base.
C. Install separate devices furnished by manufacturer and not factory installed.
D. Install new filters at completion of equipment installation and before testing, adjusting, and balancing.

3.03 CONNECTIONS:

A. Where installing piping adjacent to units, allow space for service and maintenance.
B. Duct Connections:
    1. Comply with requirements in Section 23 31 13 - Metal Ducts.
    2. Drawings indicate the general arrangement of ducts.

3. Connect ducts to units with flexible duct connectors. Comply with requirements for flexible duct connectors in Section 23 33 00 - Air Duct Accessories.

C. Electrical Connections: Comply with requirements for power wiring, switches, and motor controls in Division 26 Sections.
   1. Install electrical devices furnished by unit manufacturer but not factory mounted.

3.04 STARTUP SERVICE:

A. Perform startup service.
   1. Complete installation and startup checks according to manufacturer's written instructions.
   2. Inspect casing insulation for integrity, moisture content, and adhesion.
   3. Verify that clearances have been provided for servicing.
   4. Verify that controls are connected and operable.
   5. Verify that filters are installed.
   6. Clean coils and inspect for construction debris.
   7. Inspect and adjust vibration isolators and seismic restraints.
   8. Verify bearing lubrication.
   9. Clean fans and inspect fan-wheel rotation for movement in correct direction without vibration and binding.
   10. Adjust fan belts to proper alignment and tension.
   11. Start unit.
   12. Inspect and record performance of interlocks and protective devices, including response to smoke detectors by fan controls and fire alarm.
   13. Operate unit for run-in period.
   14. Calibrate controls.
   15. Adjust and inspect high-temperature limits.
   16. Verify operational sequence of controls.
   17. Measure and record the following airflows. Plot fan volumes on fan curve.
      a. Supply-air volume.

B. After startup, change filters, verify bearing lubrication, and adjust belt tension.

C. Remove and replace components that do not properly operate and repeat startup procedures as specified above.

D. Prepare written report of the results of startup services.

3.05 ADJUSTING:

A. Adjust initial temperature and humidity set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.06 DEMONSTRATION:

A. Engage a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain Make-up Air Units. Refer to Division 1.

END OF SECTION 23 74 33

SECTION 23 81 13 – PACKAGED TERMINAL AIR-CONDITIONERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes packaged terminal air conditioners and their accessories and controls, in the following configurations:
   1. Through-the-wall air conditioners.
   2. Cooling units with electric heat.

1.03 REFERENCE STANDARDS:

A. Applicable Standards (Latest Edition):
   1. Air-Conditioning & Refrigeration Institute (AHRI):
      a. AHRI 300 - Sound Rating and Sound Transmission Loss of Packaged Terminal Equipment
   2. Air-Conditioning & Refrigeration Institute/CSA International (AHRI/CSA):
      a. AHRI 310/380/CSA C744 - Packaged Terminal Air-Conditioners and Heat Pumps.
   3. American National Standards Institute/CSA International (ANSI):
      a. ANSI Z21.86/CSA 2.32 - Vented Gas-Fired Space Heating Appliances.
   4. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
      a. ASHRAE 62.1 - Ventilation for Acceptable Indoor Air Quality (ANSI).
   5. American Society of Heating, Refrigerating and Air-Conditioning Engineers/Illuminating Engineering Society of North America (ASHRAE/IESNA):
      a. ASHRAE/IESNA 90.1 - Energy Standard for Buildings except Low-Rise Residential Buildings (ANSI).
   6. NFPA:
      a. NFPA 54 - National Fuel Gas Code.
      b. NFPA 70 - National Electrical Code.

1.04 SUBMITTALS:

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, furnished specialties, electrical characteristics, and accessories.

B. Shop Drawings: For packaged terminal air conditioners. Include plans, elevations, sections, details for wall penetrations, and attachments to other work.
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Wiring Diagrams: For power, signal, and control wiring.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for packaged terminal air conditioners.

D. Warranty: Sample of special warranty.

E. Operation and Maintenance Data: For packaged terminal air conditioners to include in emergency, operation, and maintenance manuals.

1.05 QUALITY ASSURANCE:

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4, "Outdoor Air Quality," Section 5, "Systems and Equipment," Section 6, "Ventilation Rate Procedures," and Section 7, "Construction and Startup."
C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.06 COORDINATION:
A. Coordinate layout and installation of packaged terminal air conditioners and wall construction with other construction that penetrates walls or is supported by them.

1.07 WARRANTY:
A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged terminal air conditioners that fail in materials or workmanship within specified warranty period.
1. Warranty Period for Sealed Refrigeration System: Manufacturer's standard, but not less than five years from date of Substantial Completion, including components and labor.
2. Warranty Period for Nonsealed System Parts: Manufacturer's standard, but not less than five years from date of Substantial Completion, including only components and excluding labor.
3. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Barb.
2. Carrier Corporation; a United Technologies company.
3. ClimateMaster, Inc.
4. Friedrich Air Conditioning Co.
5. General Electric Company; GE Consumer & Industrial - Appliances.
6. Daikin-McQuay.
7. Trane; a business of American Standard Companies.

2.02 MANUFACTURED UNITS:
A. Description: Factory-assembled and -tested, self-contained, packaged terminal air conditioner with room cabinet, electric refrigeration system, heating, and temperature controls; fully charged with refrigerant and filled with oil; with hardwired chassis.

2.03 CHASSIS:
A. Cabinet: 20 gauge thick stainless steel with removable front panel with concealed latches.
1. Mounting: Wall with wall sleeve.
2. Discharge Grille: Punched-louver discharge grille.
3. Finish: Baked enamel.
4. Access Door: Hinged door in top of cabinet for access to controls.
5. Cabinet Extension: Matching cabinet in construction and finish, allowing diversion of airflow to adjoining room; with grille.
6. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

7. Wall Sleeves: Molded fiberglass-reinforced polyester.

B. Refrigeration System: Direct-expansion indoor coil with capillary restrictor; and hermetically sealed scroll compressor with vibration isolation and overload protection.
   1. Indoor and Outdoor Coils: Seamless copper tubes mechanically expanded into aluminum fins.
   2. Accumulator.
   3. Constant-pressure expansion valve.
   4. Reversing valve.
   5. Charge: R-410A.
   6. Heresite coating.

C. Indoor Fan: Forward curved, centrifugal; with motor and positive-pressure ventilation damper with electric operator.

D. Filters: Washable polyurethane in molded plastic frame.

E. Condensate Drain: Drain pan to direct condensate to outdoor coil for re-evaporation.
   1. Comply with ASHRAE 62.1 for drain pan construction and connections.

F. Outdoor Fan: Forward curved, centrifugal type motor.
   1. Indoor and Outdoor Fan Motors: Five speed ECM; comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 23 05 13 - Common Motor Requirements for HVAC Equipment.
      a. Fan Motors: Permanently lubricated split capacitor.
      b. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
      c. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26.

2.04 HEATING:

A. Electric-Resistance Heating Coil: Nickel-chromium-wire, electric-resistance heating elements with contactor and high-temperature-limit switch. Heresite coating.

2.05 CONTROLS:

A. See controls and specifications.

2.06 CAPACITIES AND CHARACTERISTICS:

A. See schedule on Mechanical drawings.

2.07 SOURCE QUALITY CONTROL:

A. Sound-Power Level Ratings: Factory test to comply with AHRI 300, "Sound Rating and Sound Transmission Loss of Packaged Terminal Equipment."

B. Unit Performance Ratings: Factory test to comply with AHRI 310/380/CSA C744, "Packaged Terminal Air-Conditioners and Heat Pumps."

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install units level and plumb, maintaining manufacturer's recommended clearances and tolerances.

B. Install wall sleeves in finished wall assembly; seal and weatherproof. Joint-sealant materials and applications are specified in Division 07.

3.02 FIELD QUALITY CONTROL:

A. Tests and Inspections:
   1. Inspect for and remove shipping bolts, blocks, and tie-down straps.
   2. After installing packaged terminal air conditioners and after electrical circuitry has been energized, test for compliance with requirements.
   3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Packaged terminal air conditioners will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.03 STARTUP SERVICE:

A. Perform startup service.

B. After installation, verify the following:
   1. Unit is level on base and is flashed in exterior wall.
   2. Unit casing has no visible damage.
   3. Compressor, air-cooled condenser coil, and fans have no visible damage.
   4. Labels are clearly visible.
   5. Controls are connected and operable.
   6. Shipping bolts, blocks, and tie-down straps are removed.
   7. Filters are installed and clean.
   8. Drain pan and drain line are installed correctly.
   9. Electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 26.
   10. Installation. Perform startup checks according to manufacturer's written instructions, including the following:
      a. Lubricate bearings on fan.
      b. Check fan-wheel rotation for correct direction without vibration and binding.

C. After startup service and performance test, change filters.

3.04 ADJUSTING:

A. Adjust initial temperature set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3.05 DEMONSTRATION:

A. Engage a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain Make-up Air Units. Refer to Division 1.

END OF SECTION 23 81 13

SECTION 23 82 39 – ELECTRIC UNIT HEATERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes:
   1. Ceiling mounted unit heater with fan and electric resistance heating coils.
   2. Propeller unit heaters with electric-resistance heating coils.

1.03 REFERENCE STANDARDS:

A. Applicable Standards (Latest Edition):
   1. Air-Conditioning, Heating, & Refrigeration Institute (AHRI):
      a. AHRI 440 - Room Fan Coils.
   2. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
      a. ASHRAE 33 - Method of Testing Forced Circulation Air Cooling and Heating Coils (ANSI).
      b. ASHRAE 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter (ANSI).
      c. ASHRAE 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size (ANSI).
      d. ASHRAE 62.1 - Ventilation for Acceptable Indoor Air Quality (ANSI).
   3. American Society of Heating, Refrigerating and Air-Conditioning Engineers/Illuminating Engineering Society of North America (ASHRAE/IESNA):
      a. ASHRAE/IESNA 90.1 - Energy Standard for Buildings except Low-Rise Residential Buildings (ANSI).
   4. ASME International (ASME):
      a. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
   5. ASTM International (ASTM):
      a. ASTM A126 - Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
      b. ASTM B88 - Specification for Seamless Copper Water Tube.
      c. ASTM C411 - Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
      d. ASTM C534 - Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
      e. ASTM C916 - Specification for Adhesives for Duct Thermal Insulation.
      f. ASTM C1071 - Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).
      g. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
   6. NFPA:
      a. NFPA 70 - National Electrical Code.
      b. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
      c. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems (ANSI).
   7. Underwriters Laboratories, Inc. (UL):

a. UL 823 - Standard for Electric Heaters for Use in Hazardous (Classified) Locations.
b. UL 1995 - Heating and Cooling Equipment.
c. UL 2021 - Fixed and Location-Dedicated Electric Room Heaters.

1.04 DEFINITIONS:

A. CWP: Cold working pressure.
B. PTFE: Polytetrafluoroethylene plastic.
C. TFE: Tetrafluoroethylene plastic.

1.05 SUBMITTALS:

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each product indicated.
B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   1. Equipment schedules to include rated capacities, operating characteristics, furnished specialties, and accessories.
   2. Wiring Diagrams: Power, signal, and control wiring.
   3. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   4. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
C. Field quality-control test reports.
D. Operation and Maintenance Data: For cabinet unit heaters to include in emergency, operation, and maintenance manuals.

1.06 QUALITY ASSURANCE:

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

PART 2 - PRODUCTS

2.01 PROPELLER UNIT HEATERS:

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Berko Electric Heating; a division of Marley Engineered Products.
   2. Modine Manufacturing Company.
   3. QMark Electric Heating; a division of Marley Engineered Products.
   4. Or Engineer Approved Equal.
B. Description: An assembly including casing, coil, fan, and motor in vertical discharge configuration with adjustable discharge louvers,
   1. NEMA 4X Washdown.
C. Comply with UL 2021.
D. Comply with UL 823.
E. Cabinet material: 16-gauge 304 stainless steel.
   1. Stainless steel combination wall and ceiling swivel-type mounting bracket.

F. Discharge Louver: Adjustable fin diffuser for horizontal units and conical diffuser for vertical units.
G. Electrical-Resistance Heating Elements; 300 stainless steel sheathed with 316 stainless steel fins. Elements attached to junction box with leak resistant stainless steel.
H. Control center: Factor prewired tested and enclosed in NEMA 4X molded fiberglass control enclosure.
    1. Include Contactors.
    2. Automatic reset over-temperature protector.
    3. Fan delay relay.
    4. Motor contactor a fused 24V control circuit.
    5. Terminal blocks for remote thermostat connection.
I. Fan and motor assembly:
    1. Totally enclosed permanently lubricated ball bearing motor.
    2. Epoxy coated.
    3. Fan:
        a. Aluminum epoxy coated, directly connected to the motor.
        b. Dynamically balanced.
        c. Epoxy sealed thermal fan delay for fan shutoff.
J. Control Devices:
    1. Wall-mounting fan-speed switch.
K. Capacities and Characteristics: Refer to equipment schedules on Mechanical drawings.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine areas to receive unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance.
B. Examine roughing-in for electrical connections to verify actual locations before unit heater installation.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. Install wall boxes in finished wall assembly; seal and weatherproof. Joint-sealant materials and applications are specified in Division 07.
B. Install propeller unit heaters level and plumb.
C. Suspend propeller unit heaters from structure with manufacturer's mounting bracket.
D. Install wall-mounting thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

3.03 CFIELD QUALITY CONTROL:

A. Perform the following field tests and inspections and prepare test reports:
    1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
    2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
    3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
B. Remove and replace malfunctioning units and retest as specified above.

3.04 DEMONSTRATION:

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain cabinet unit heaters. Refer to Division 01.

END OF SECTION 23 82 39

DIVISION 26 - ELECTRICAL

SECTION 26 05 10 – GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section specifies general administrative and procedural requirements for electrical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 01:
   1. Submittals.
   2. Coordination drawings.
   3. Record documents.
   4. Maintenance manuals.
   5. Rough-ins.
   6. Electrical installations.
   7. Cutting and patching.
   8. Electrical Demolition.
   9. Touch-up Painting.

B. Furnish and install (including supports) all electrical equipment, wiring, and associated connections to Equipment specified in this and all other Specification Divisions, unless specified or indicated otherwise. Equipment and installation shall be as per the Contract Drawings and Specifications herein.

1.03 RELATED REQUIREMENTS:

A. Division 03 – Concrete.
B. Division 31 – Earthwork:
C. Section 01 0 19 – Closeout Procedures.
D. Section 09 96 00 - Protective Coatings for surface coatings.
E. Section 23 05 13 - Common Motors Requirements for HVAC Equipment for factory-installed motors, controllers, accessories, and connections.
F. Section 46 05 13 – Common Motor Requirements for Water and Wastewater Equipment.
G. Division 40 – Process Integration.
H. Division 46 – Water and Wastewater Equipment.

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of the date of the Contract Documents unless otherwise indicated.
B. National Electrical Contractors Association (NECA).
C. National Electrical Installation Standards (NEIS): Except where the NEIS requirements specifically deviate from specific requirements of the NEC, the NEC shall take precedence.
D. National Fire Protection Association (NFPA):
   1. NFPA 70 – National Electrical Code (NEC).
E. Institute of Electrical and Electronics Engineers (IEEE):

1. IEEE C2 – National Electrical Safety Code (NESC).

F. Underwriters Laboratories (UL).

1.05 DEFINITIONS:

A. When applied to Equipment and Materials, the words "furnish", "install", and "provide" shall mean the following:

B. The word "provide" shall mean to furnish, pay for, deliver, assemble, install, adjust, clean and otherwise make Equipment and Materials fit for their intended use.

C. The word "furnish" shall mean to secure, pay for, deliver to Site, unload and uncrate Equipment and Materials.

D. The word "install" shall mean to assemble, place in position, incorporate in the Work, adjust, clean, and make fit for use.

E. The phrase "furnish and install" shall be equivalent to the word "provide."

1.06 SUBMITTALS:

A. Submit as specified in Division 01 for administrative and procedural requirements for submittals.

B. Refer to each Section of this Division for specific Submittal requirements.

C. Provide Conforming to Construction Records schematic diagrams and wiring diagrams.

D. Provide product data on electrical material and products.

E. Prepare coordination drawings in accordance with Division 01, for equipment rooms, and other congested areas to a scale of 1/4 inch=1 foot-0 inch or larger if required. Detail major elements, components, and systems of electrical equipment and materials in relationship with other systems, installations, and building components. Drawings shall be prepared on 24-by-36-inch sheets. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of major raceway systems, equipment, and materials.
2. Clearances for servicing equipment, including space for equipment disassembly required for periodic maintenance.
3. Exterior wall and foundation penetrations.
4. Fire-rated wall and floor penetrations.
5. Equipment connections and support details.
6. Sizes and location of required concrete pads and bases.
7. Support details.
8. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
9. Prepare floor plans, elevations, and appropriate details to indicate penetrations in floors, walls, and ceilings, and their relationship to other penetrations and installations.
10. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets, air inlets, light fixtures, communications systems' components, sprinklers, heat detectors, smoke detectors, motion detectors, speakers, and other ceiling-mounted devices.
11. Coordinate chases, slots, inserts, sleeves, and openings with general construction work.

F. Prepare record documents in accordance with the requirements in Section 01019 - Closeout Procedures. In addition to the requirements specified in Division 01, indicate installed conditions for:

1. Major raceway systems, size and location for both exterior and interior; locations of control devices; distribution and branch electrical circuitry; fuse sizes, circuit breaker sizes and arrangements.

2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
3. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

G. Prepare operation and maintenance manuals in accordance with Section 010190 - Closeout Procedures. In addition to the requirements specified in Division 01, include the following information for equipment items:
1. Description of function, normal operating characteristics and limitations, performance curves, engineering data, tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; lockout/tagout procedures; and summer and winter operating instructions.
3. Maintenance procedures for routine preventive maintenance and troubleshooting; disassembly, repair, reassembly; aligning and adjusting instructions.
4. Servicing instructions, lubrication charts and schedules.
5. "Conforming to Construction Records" schematic and wiring diagrams.

1.07 QUALITY ASSURANCE:

A. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.

1.08 DELIVERY, STORAGE, AND HANDLING:

A. Deliver products to the Project Site properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

1.09 PROJECT SITE CONDITIONS:

A. Altitude = 700 feet above mean sea level.
B. Maximum Outdoor Ambient Temperature = 101 degrees F.
C. Minimum Outdoor Ambient Temperature = +2 degrees F.
D. Maximum Outdoor Relative Humidity = 100 percent.
E. Seismic Factors:
1. Seismic Design Category: B
2. S_S: 0.091
3. S_1: 0.067
4. S_{DS}: 0.097
5. S_{D1}: 0.106
6. Site Class: D
7. Importance Factor: Ie: 1.25

1.10 WARRANTY:

A. Provide a minimum one-year warranty (unless indicated in individual specifications as a longer period) on all electrical equipment. Warranty period shall begin when equipment is permanently energized or started unless specified otherwise. Contractor shall provide written notification to Owner's Representative prior to this warranty start date. Refer to specification 00700 Construction General Conditions for additional warranty requirements.

PART 2 - PRODUCTS

2.01 GENERAL:

A. Unless indicated otherwise, all equipment and material shall be new, undamaged and meet the requirements of Underwriters Laboratories, Inc. (UL). Where UL requirements are not applicable, equipment and material shall be identified as such by Contractor and approved by Owner before purchase and installation.

B. All Equipment and Materials shall be in accordance with the National Electrical Code (NEC).

C. All Equipment conductor termination shall be UL listed for 75°C unless specified otherwise.

2.02 ELECTRONIC EQUIPMENT COMPLIANCE:

A. Contractor warrants that all equipment, devices, items, systems, software, hardware, or firmware provided shall properly, appropriately, and consistently function and accurately process date and time data (including without limitation: calculating, comparing, and sequencing). This warranty supersedes anything in the Specifications or other Contract Documents which might be construed inconsistently. This warranty is applicable whether the equipment, device, item, system, software, hardware, or firmware is specified with or without reference to a manufacturer's name, make, or model number.

2.03 SYSTEMS TO BE INSTALLED:

A. This Contract includes, but is not limited to, the following systems:

1. 208Y/120 V, 3-phase, 60 hertz, 4 wire lighting, convenience power, and small power system.
2. 480Y/277 V, 3-phase, 60 hertz, 4 wire power system.
3. Grounding systems.
4. Conduit system for telephone service.
5. Control systems.
6. Underground conduit system, including handholes.
7. Temporary lighting and convenience power facilities during construction.
8. Paging systems.
9. Intercommunication system.
10. Industrial Ethernet networks.
11. Fire alarm system.
12. Underground duct banks, including handholes and manholes.
13. Instrumentation systems.
14. Security and access control systems, fire alarm systems, lightning protection systems.

2.04 FINISHES:

A. For equipment: Equipment manufacturer's paint selected to match installed equipment finish.

B. Galvanized surfaces: Zinc-rich paint recommended by item manufacturer.

C. Provide finishes in accordance with Section 09 96 00 - Protective Coatings.

PART 3 - EXECUTION

3.01 ERECTION, INSTALLATION, APPLICATION, AND COORDINATION:

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. All electrical work and material shall comply with the following requirements:

1. NFPA 70 - The National Electrical Code (NEC).

2. IEEE C2, National Electrical Safety Code, Federal Information Processing Standards Publication (FIPS).

C. NECA National Electrical Installation Standards (NEIS) (all except Table 1 of NECA 1).

D. Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment with the established construction schedule.

E. Equipment motor horsepower sizes and kilowatt sizes shown are approximate. If equipment of a different size is furnished by Contractor, Contractor shall furnish and install the proper support equipment, motor starter, switchgear, feeders, fuses, circuit breaker, disconnect switch, wire, and conduit required for the equipment furnished, at no additional cost to Owner.

F. Verify all existing dimensions by field measurements.

G. Arrange for chases, slots, and openings in other building components during progress of construction to allow for electrical installations.

H. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components as they are constructed.

I. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building. Coordinate concrete pads, bases, roof curbs, and related items.

J. Coordinate with all other building trades.

K. Where mounting heights are not specifically detailed, specified, or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.

L. Coordinate connection of electrical systems with exterior underground utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

M. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Should coordination requirements conflict with individual system requirements, refer conflict to Owner's Representative in writing. Design based on ABB, Eaton, and SquareD for large equipment. It is Contractor’s responsibility to coordinate provided equipment meeting design intent. Any deviation will be at the cost of Contractor.

N. Install systems, materials, and equipment level, plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.

O. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting with minimum of interference with other installations.

P. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

Q. All equipment conductor termination provisions and equipment lugs shall be UL listed for 75ºC.

R. All electrical equipment and installations shall be of adequate strength to withstand, without failure, forces encountered in defined Seismic conditions.

S. Install raceways, cables, wireways, cable trays and busways clear of obstructions and clear of the required working space of equipment.

T. Concrete work for all electrical equipment pads, foundations, duct banks and other Division 26 applications shall conform to Division 03 – Concrete.

U. Refer to each Section of this Division for specific performance requirements.

3.02 WORK ON EXISTING EQUIPMENT:

A. Do not remove any equipment from service without obtaining permission from Owner and Engineer.
B. Perform work that requires taking equipment out of service at times designated by Owner so as to cause minimum interruption in plant operation.
C. Continue work with as many workmen as can be efficiently utilized from the time any equipment is removed from service until equipment is tested and back in service.
D. Connect electrical Equipment to provide same phasing as existing equipment, unless otherwise specified or indicated.

3.03 TESTING:

A. Test all electrical Equipment upon completion of installation to ensure that the Equipment operates satisfactorily and conforms to Contract Documents.
B. Furnish temporary power sources of proper type for testing purposes when normal supply is not available at the time of testing.

3.04 DEMOLITION:

A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.
B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.
C. Abandoned Work: Cut and remove buried raceway and wiring indicated to be abandoned in place, 2 inches below surface of adjacent construction. Cap raceways and patch surface to match existing surface finish.
D. Remove demolished material from Project Site.
E. Remove, store, clean, re-install, reconnect and make operational components indicated for relocation.

3.05 CUTTING AND PATCHING:

A. General: Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of the trades involved.
    1. Perform cutting and patching for electrical equipment and materials required to:
        a. Uncover work to provide for installation of ill-timed work.
        b. Remove and replace defective work.
        c. Remove and replace work not conforming to requirements of the Contract Documents.
        d. Remove samples of installed work as specified for testing.
        e. Install equipment and materials in existing structures.
        f. Upon written instructions from Engineer, uncover and restore work to provide for Engineer's observation of concealed work if installed without using the proper specified procedures.
B. For work in existing installations, the Contractor shall cut, remove, and legally dispose of selected electrical equipment, components, and materials as indicated, including, but not limited to, removal of electrical items indicated to be removed and items made obsolete by the new work.
C. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

D. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
E. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
F. All penetrations through fire-rated walls, ceilings and floors shall be sealed with a UL listed and FM Global approved sealant system that matches the fire rating of the surface penetrated.
G. Patch existing finished surfaces and building components that must be cut for the electrical installation or are damaged by Contractor using new materials matching existing materials.
H. Patch finished surfaces and building components using new materials specified for the original installation.
I. All cutting, patching, and repairing shall be subject to the supervision and the approval of Owner's Representative.
J. Repair and re-finish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fire proofing where existing fireproofing has been disturbed. Repair and re-finish materials and other surfaces by skilled mechanics of trades involved.

3.06 FINISHES:

A. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit degree of damage at each location.
B. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
C. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
D. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.
E. Repair damage to protective coatings in accordance with Section 09 96 00 - Protective Coatings.

3.07 CLEANING:

A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

3.08 PROTECTION:

A. Protect equipment and installations and maintain conditions to ensure that coatings, finishes and cabinets are without damage or deterioration at time of Substantial Completion.

3.09 CLOSEOUT:

A. Instructions, training, and manufacturer’s service representative:
    1. Provide on-site instructions and training of Owner's personnel as specified.
    2. Provide on-site services of a manufacturer's authorized service representative as specified.

END OF SECTION 26 05 10

SECTION 26 05 19 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes the requirements for furnishing and installing (including terminations) all low-voltage electrical conductors, cable, and accessories.

1.03 RELATED REQUIREMENTS:

A. Section 26 05 26 – Grounding and Bonding for Electrical Systems.
B. Section 26 05 33 – Raceways, Boxes, Seals and Fittings for Electrical Systems.
C. Section 26 05 53 –Identification for Electrical Systems.
D. Section 26 50 00 – Lighting.

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of the date of the Contract Documents unless otherwise indicated.
B. American Society for Testing and Materials (ASTM):
C. ASTM B3 – Standard Specification for Soft or Annealed Copper Wire.
D. ASTM B8 – Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
E. ASTM B33 – Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes.
F. ASTM B172 – Rope-Lay Stranded Copper Conductors Having Bunch-Stranded Members, for Electrical Conductors.
G. ASTM B189 – Standard Specification for Lead-Coated and Lead-Alloy-Coated Soft Copper Wire for Electrical Purposes.
H. Insulated Cable Engineers Association (ICEA):
I. ANSI/ICEA S-81-570 – 600Volt Rated Cables of Ruggedized Design for Direct Burial Installations as Single Conductors or Assemblies of Single Conductors.
J. ANSI/ICEA S-105-692 – 600Volt Single Layer Thermoset Insulated Utility Underground Distribution Cables.
K. ICEA T-29-520 – Vertical Cable Tray Flame Tests at 210,000 Btu.
L. Institute of Electrical and Electronics Engineers (IEEE):
M. IEEE 1202 – Flame-Propagation Testing of Wire and Cable.
N. InterNational Electrical Testing Association (NETA):
O. ANSI/NETA ATS – Acceptance Testing Specifications for Electrical Power Equipment and Systems.
P. National Electric Manufacturers Association (NEMA) and Insulated Cable Engineers Association (ICEA):
Q. NEMA WC57/ ICEA S-73-532 – Standard for Control, Thermocouple Extension, and Instrumentation Cables.
R. NEMA WC70/ ICEA S-95-658 – Power Cables Rates 2000 V or Less For The Distribution of Electrical Energy.
S. National Fire Protection Association (NFPA):
T. NFPA 70 – National Electrical Code (NEC).
U. Underwriters Laboratories, Inc. (UL):

V. UL 44 – Thermoset Insulated Wires and Cables.
W. UL 83 – Thermoplastic-Insulated Wires and Cables.
X. UL 854 – Service Entrance Cables.
Y. UL 1277 – Standard for Electrical Power and Control Tray Cables with Optional Optical Fiber Members.

1.05 DEFINITIONS:

A. Burns & McDonnell type designations, such as SE2, CEV1, and BC2 indicated or specified, are for identification purposes only and are not intended to correspond to any trade designation. Burns & McDonnell type designations are defined by the Wire and Cable Specification Sheets located at the end of this section.

1.06 SUBMITTALS:

A. Submit ats specified in Division 01 and Section 26 05 10 – General Electrical Requirements for administrative and procedural requirements for submittals.
B. Product Data: For each type of product including:
C. Data sheets for each wire and cable type specified.
D. Data sheets for wire and cable accessories.
E. Cable manufacturer's approval of splicing and terminating materials.
F. Cable manufacturer's approval of pulling compounds.
G. Cable manufacturer's installation requirements such as maximum pulling tensions, sidewall pressures, minimum bending radii, and other considerations.
H. Other Equipment and Materials to be used.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. Packing and shipping: Cable shall be shipped on reels such that it is protected from mechanical injury. Each end of each length of cable shall be hermetically sealed with manufacturer’s end caps and securely attached to the reel. Cable reels shall be delivered vertically to allow for easy unloading. There shall be a minimum of six (6) inches between the top of the cable and the edge of the reel. Any cable reels that are not shipped vertically may be rejected upon delivery.
B. Storage and protection: Cable stored and/or cut on site shall have the ends turned down, and sealed with cable manufacturer’s standard cable end seals, or field-installed heat-shrink cable end seals.
C. Cable shall be stored on-site in a fashion that will prevent mechanical damage to the cable. Cable shall be stored away from areas that may have splashing or airborne debris. If necessary, cable shall be protected from hazards by visqueen, tarps, or similar materials. Store at secured and insured warehouse location.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Wire and Cable: Acceptable manufacturers for each wire and cable type will be manufacturers that meet all the requirements listed on the Wire and Cable Specification Sheets.
B. Cable Connectors for Control and Instrument Cable:
C. TE Connectivity Ltd.
D. Hollingsworth Solderless Terminal Company.
E. Panduit Corporation.
F. 3M Company.

G. Thomas and Betts Company, Inc.
H. Cable Connectors for Power Cable:
I. TE Connectivity Ltd.
J. Thomas and Betts Company, Inc.
K. 3M Company.
L. Panduit Corporation.
M. Termination and Splice Kits:
N. 3M Company.
O. Raychem.
P. Shielded VFD Power Cable Termination Kits:
    1. Service Wire Company.
    2. Southwire Company LLC.
    3. Engineer approved equal.
Q. Tape and Insulation Putty:
    1. 3M Company.
R. Cable Ties:
    1. TE Connectivity Ltd.
    2. Avery-Dennison Corporation.
    3. Panduit Corporation.
    4. 3M Company.
    5. Thomas and Betts Company, Inc.
S. Cable Supports:
    1. Emerson - O. Z./ Gedney Company.
    2. Hubbell, Kellems Grips.
T. Terminal Blocks:
    1. Allen Bradley.
    2. Buchanan.
    3. Phoenix Contact.
    4. Square D Company.
    5. Weidmuller.
U. Cable Identification Tags:
    1. Allen Marking Products.
    2. Panduit.
    3. Specialty Products Company.
    4. Thomas and Betts.
    5. Brady Corporation.
V. Cable Fire and Smoke Stop Fittings:
    1. Crouse Hinds.
    2. Nelson Electric.
    3. Emerson – O. Z./Gedney Company.

2.02 WIRE AND CABLE:

A. Wire and cable shall be furnished in accordance with the specification sheets at the end of this Section.

2.03 CONNECTORS:

A. General Requirements:
    1. Designed and sized for specific cable being connected.

2. Solderless, pressure type connectors constructed of non-corrodible tin plated copper.
3. Application tooling for connectors shall contain die or piston stops to prevent over crimping and cycling or pressure relief to prevent under crimping. Dies of all application tooling shall provide dot or wire size coding for quality control verification. All tooling shall be manufactured by the connector manufacturer.

B. Power Connectors (10 AWG and Smaller) 600V and Below:
1. "Scotchlok" pre-insulated spring wire connectors.
2. Buchanan open end copper splicing caps, applied with "Lok Seal" tool, with nylon snap on insulators.

C. Power Connectors (sizes 8 to 4 AWG) 600V and Below:
1. Non-insulated ring tongue type.
2. Ring tongue sized to match terminal stud size.
3. Brazed barrel seam.
4. Application tooling designed to crimp the wire barrel (conductor grip) with a one-step crimp.

D. Power Connectors (sizes 2 AWG to 750 MCM) 600V and Below:
1. Non-insulated one hole rectangular tongue for sizes 2 AWG through 3/0 AWG and two hole rectangular tongue for 4/0 AWG through 750 MCM.
2. Acceptable manufacturers' cross reference chart is listed at end of this Section.

E. Power Connectors (sizes 2 AWG to 750 MCM) above 600V:
1. Non-insulated one hole rectangular tongue for sizes 2 AWG through 3/0 AWG and two hole rectangular tongue for 4/0 AWG through 750 MCM.
2. Voltage rating equal or greater than that of the cable being used.
3. Application tooling shall be hydraulically operated.

F. Control, Instrument, and Specialty Cable Connectors:
1. Tin plated copper.
2. Vinyl or nylon pre-insulated ring tongue type. Spade lugs will not be permitted.
3. Vinyl pre-insulated spring type spade terminals. (Hollingsworth "Mini Spring Spades"; Thomas and Betts "Locking Fork"; Panduit "Locking Fork.")
4. Sized to match terminal stud size.
5. Have insulation grip sleeve to firmly hold to cable insulation.
6. Insulation grip sleeve shall be funneled to facilitate wire insertion and prevent turned back strands.
7. Application tooling designed to crimp the wire barrel (conductor grip) and the insulation grip sleeve with a one-step crimp.

2.04 MOTOR LEAD TERMINATION/SPLICE (LOW VOLTAGE, 600 V AND BELOW, POWER CABLE):

A. Splices shall be made using compression type connectors bolted together. The compression type connectors shall be properly sized for the cables. Reference acceptable connector manufacturer's cross reference chart.

B. Splice to be covered with heat shrinkable tubing connector insulators or slip-on rubber boot or sleeve.

C. Splicing shall be done in accordance with the instructions provided with the Raychem brand MCK Motor Connector Kit or 3M Company 5300 Series Motor Lead Splice Kit.

2.05 VFD CABLE TERMINATION KITS:

A. Provide termination kit designed for terminating VFD cable shield.

B. Flat tinned copper braid with woven tinned copper construction conforming to ASTM B-33, constant force spring clamp, and adhesive-backed copper foil tape for EMI/RFI shielding conforming to UL 510 for flame retardancy.
C. Conform to requirements of ASTM B-33 and UL 510.
D. Termination kit shall be designed for use with VFD cable and approved by the cable manufacturer.

2.06 CABLE SUPPORTS:
A. Cable supports for cables in vertical conduit risers shall be Emerson – O.Z. Gedney Type "R" wedging plug type or approved equal.
B. Kellems stainless steel basket type wire mesh grip for cables in vertical cable tray.
C. Stainless steel cable clamps every 12 inches in non-horizontal ladder type cable tray.

2.07 CABLE TIES:
A. Nylon self-locking type.
B. Have a normal service temperature range of 40°C to 85°C.
C. Be weather resistant type for outdoor use.
D. TE Connectivity "AMP TY," Avery-Dennison "BAR LOK," Panduit Corporation "PAN TY," Thomas & Betts "TY RAP," or 3M Brand cable ties.

2.08 TERMINAL BLOCKS:
A. For mounting in terminal boxes (TBs):
1. Designed and sized for the cables being terminated.
2. Block rated 600V.
3. Binding screw type terminals for power cables and spring-cage terminals for control and instrument cables.
4. Rated current carrying capacity equal to or greater than the cable being terminated.
5. Marking strip.
B. For Mounting in Cabinets, Panels, Control Boards, etc.:
1. Designed and sized for the cables being terminated.
2. Block rated 600V.
3. Binding screw type terminals for power cables and current transformer circuits and spring-cage terminals for control and instrument cables.
4. Rated current carrying capacity equal to or greater than the cable being terminated.
5. Marking strip on blocks for power cables and control and instrument cables.
6. Short circuit strips with one shorting screw for each terminal for current transformer circuits.
7. Shorting type terminal blocks rated for 10 AWG shall be used for all cables connected to current transformers (CTs).

2.09 CABLE IDENTIFICATION TAGS:
A. Designed to provide a permanent wire and cable identification system.
B. Show complete cable number. Cable numbers are defined in the Cable Schedule and/or Contract Drawings.
C. Cable numbers may be typed or printed and shall be legible and permanent.
D. Character size for cable numbers shall be a minimum of 1/8 inch.
E. Material shall be vinyl-cloth or other non-metallic material and shall be impervious to moisture.

F. Be securely attached to cables and accessible for inspection.
G. Cable identification tags, marking and attachment methods shall be subject to approval of Engineer.
H. Coordinate with the requirements of Section 26 05 53 – Identification for Electrical Systems.

2.10 CABLE FIRE AND SMOKE STOP FITTINGS:
A. Rating shall equal or exceed the fire rating of the fire wall, floor, or ceiling penetrated.
B. Fitting shall be sized for cable diameter and quantity of cable installed.
C. Fitting shall be UL labeled.

PART 3 - EXECUTION

3.01 INSTALLATION:
A. General Requirements:
1. Install in conduit, tray, duct system, or direct burial as indicated.
2. Cable shall not be subjected to pulling tensions or sidewall pressures in excess of the manufacturer's recommendations.
3. Attach pulling grips over the cable sheath to prevent slipping of the insulation.
4. Do not subject cable to bending radius less than those recommended by the cable manufacturer or as noted below (whichever is greater) during or after installation:
a. Eight times the cable outside diameter for 600V or lower rated cables.
5. Install intermediate pull boxes as indicated or as required to avoid subjecting cable to excessive pulling tension or sidewall pressures.
6. Support cables at connections or termination points such that any strain on cable will not be transmitted to the connection or termination.
7. Install cable supports in vertical runs of tray or conduit, at boxes and at terminations in equipment, and as required to meet intermediate support requirements of National Electrical Code (NEC).
8. All pulling compounds shall be approved by wire and cable manufacturer as being compatible with cable materials.
9. Attach a cable identification tag to each cable at all termination or end points.
10. Install fire and smoke stop fittings at all cable penetrations of fire rated walls, floors, and ceilings.
B. Power (600V and Below), Control, Instrument, and Specialty Cable:
1. Install metallic barrier in all tray and boxes to separate power, control, and instrumentation from low level signal (50V or less) instrumentation circuits where run in the same tray or box.
2. Secure with cable ties in cable tray risers at intervals not to exceed 3 feet.
3. Tie together with cable ties all single conductor cable on each individual circuit in each junction box, equipment or manhole, and in cable tray, at intervals not to exceed 6 feet.
4. Attach a cable identification tag to each cable.
a. Tag shall be applied at each terminal to identify the circuit and cable.
(1) Multi conductor control cable identification tags shall include the cable circuit number and corresponding color letter at each termination.
b. Attach fiber tags with cable ties.
c. Use nylon ties and identification tabs color coded as follows:
(1) 480V circuits – Red.
(2) 277, 240, or 208Vac circuits – Orange.

(3) 120V circuits – White.
(4) Control cables – Natural Nylon.

5. Insulation Color Coding for Phase Identification:
   a. Color code 600-volt insulated, service entrance, feeder, and branch circuit conductors with factory-applied colored insulation for No. 8 AWG and smaller (except: No. 6 AWG and smaller for green ground wire); 1-inch band of colored tape at all splices and terminations for No. 6 AWG and larger (except: No. 4 AWG and larger for green ground wire) as follows:

Phase	208Y/120 Volts	480Y/277 Volts
A	Black	Brown
B	Red	Orange
C	Blue	Yellow
Neutral	White	Gray
Ground	Green	Green

   b. Tag each individual conductor or wire with wire markers as follows:
      (1) With terminal designation indicated on schematic diagrams or given on manufacturer's equipment drawings.
      (2) At each terminal.
      (3) In addition to specified circuit tags.
   c. Terminate and ground, control, instrument, and specialty cable shields as indicated and recommended by the manufacturer of the equipment being connected. In general, ground the shields at the control panels.
   d. Terminate shields for VFD cables at both the source and load using VFD cable termination kit.
   e. Intermediate cable splices shall not be allowed when installing power, control, and instrument wiring except when spicing to lead wires provided with the equipment or device, or unless approved by the Engineer prior to cable installation.
   f. Control and instrument and thermocouple cable splices shall be as follows:
      (1) Made only in junction or terminal boxes.
      (2) Made on terminal blocks with marking strips.
      (3) Conductor color coding shall be maintained.
      (4) For shielded cables, shield continuity and isolation shall be maintained.
      (5) Thermocouple cable splices to be made only on terminal blocks which correspond to thermocouple type used.
   g. Power cable (600V or below) splices and motor terminations shall be as follows:
      (1) Made only in junction or terminal boxes.
      (2) Splices shall be made using compression type connectors bolted together.
      (3) Splice to be covered with a heat shrinkable connector insulator.
   h. High-Temperature Wiring:
      (1) Install from device to a terminal box for all devices which by their location have the body of the device or electrical connection subject to ambient temperatures in excess of 185°F. Typical locations are feed water heaters, burner fronts, boiler penthouse, and deaerator.
      (2) Locate terminal box far enough from the source of heat so that the temperature does not exceed 175°F. This distance generally is between 3 and 5 feet.

(3) Replace with high-temperature wire any wiring installed by this Contract that is damaged by excessive heat.

6. Lighting Cable: Install as specified in Division 26.
7. Ground Cable: Install as specified in Division 26.
8. Control and Instrument Cable: Install as specified this Section and Division 40.
9. Communications Cable: Install as specified in this Section and Section 40 66 00 – Process Control Networks.

C. Direct buried cables:
1. Excavation and backfilling shall be as specified in Division 31.
2. Installation:
a. Install in trenches at least 36 inches below finished grade, except at railroad crossings and under roads or other paved areas exceeding 5 feet in width.
b. Where direct burial cable crosses under railroad tracks, roads, or other paving exceeding 5 feet in width, install cable in concrete encased Schedule 40 PVC conduit. If railroad tracks or paving are in place when the cable is to be installed, a wrought iron pipe driven under the tracks or paving may be used in lieu of the nonmetallic conduit. Extend conduit or pipe at least 5 feet beyond each side of railroad tracks and at least 1 foot beyond the edge of paving.
c. The bottom of the trench shall be smooth and free of stones and sharp objects. Where bottom of trench comprises material other than sand or earth, place a 3 inch layer of sand- or stone free earth on the bottom of the trench and compact to the approximate density of the surrounding firm soil.
d. Unreel the cables in place along the side of or in the trench and carefully place on the sand or earth bottom. Prereeling cables into the trench from a fixed reel position will not be permitted, except as required to pull the cables through conduits under railroad tracks or paving.
e. Where cables cross, provide a separation of at least 3 inches, unless the cables are protected by nonmetallic sleeves at the crossing.
f. The radius of bends in cables shall be not less than 10 times the diameter of the cable. In no case shall cables be left under longitudinal tension.
g. The first layer of backfill shall be of sand- or stone free earth.
h. Place a 1 inch treated plank, not less than 8 inches wide, or approved equal protection, approximately 3 inches above the cable.
i. Place a 6 inch wide yellow Mylar marking tape approximately 12 inches above the buried cable. The tape shall have the following wording printed at intervals along the tape: "Caution Electrical Lines Buried Below." Tape shall be as manufactured by Allen Marking Products.
j. Where cuts are made in paving, restore the paving and subbase to original condition.
k. Center direct burial cable in an entrance to a conduit or duct line. An approved waterproof non-hardening mastic compound shall be used to facilitate the centering.
3. Locate cable markers:
a. Locate as indicated.
b. Place approximately 2 feet to the right of the cable when facing the longitudinal axis of the cable and in the direction of the electrical load.
c. The marker shall be Class B concrete, 6 inch square or round section by 3 feet long. The top edge of the marker shall have a 1/2 inch chamfer all around. The letter "C" with two arrows shall be impressed or cast on top of the marker. One arrow shall

be located below the letter and shall point toward the cable. When pointing toward a splice, the circle shall be impressed in the shaft of the arrow. The second arrow shall be located adjacent to the letter and shall point in a direction parallel to the cable. The letter and arrow adjacent to it shall each be approximately 3 inches long. The arrow under the letter shall be approximately 2 inches long. The letter and arrows shall be V shaped and shall have a width of stroke at least 1/4 inch at the top and depth of 1/4 inch.

d. Where the cable changes direction, the arrow located adjacent to the letter shall be cast or impressed with an angle in the arrow approximately the same as the angular change of the cable run. The top of the marker shall protrude not more than 2 inches above finished grade.

D. Cable Connections and Terminations:
1. Make up clean and tight to assure a low-resistance joint.
2. Make only in terminal boxes, equipment, or other accepted enclosures and not in conduit or cable tray.
3. Install all connectors with tooling manufactured by the connector manufacturer and as specified.

3.02 FIELD QUALITY CONTROL:

A. Perform tests and inspections and prepare test reports. Submit test reports as specified.

B. General Requirements:
1. Test all wire, cable, and electrical equipment installed or connected by Contractor to assure proper installation, setting, connection, and functioning as indicated or to conform to Contract Documents and manufacturer's instructions.
2. Conduct all tests except megger insulation testing in the presence of Engineer and/or Owner and under the supervision of Equipment manufacturer's field engineer.
3. Include all tests recommended by the Equipment manufacturer unless specifically waived by Engineer.
4. Include all additional tests issued by Engineer that he deems necessary because of field conditions to determine that Equipment and Material and systems meet requirements of Contract Documents.
5. Include all tests recommended by the NETA Acceptance Testing Specifications.
6. The contractor shall be responsible for all damage to Equipment or Material due to improper test procedures or test apparatus handling.

C. Cable Testing Requirements:
1. Megger all 600V insulated power cable with a 1000Vdc megger for one minute, and values must not be less than 50 megohms per NETA ATS 7.3. Determine the values with all switchboards, panelboards, fuse holders, switches, and overcurrent devices in place. Do not connect motors and transformers during meggering. Megger wire and cable after installation and not on the cable reel.
2. Cables with conductors failing this test shall be removed and replaced.
3. Provide all phasing tests and make all changes necessary to assure proper rotation of all motors, the correct phasing and phase sequence of all circuits susceptible to being paralleled, the proper polarity on all instrument transformer wiring, and such other phasing tests as may be required for the equipment being connected under this Contract.

D. 600V Control Cable:
1. Check all control cable for rightness of terminal contacts.

2. Megger the specific control cables selected by Resident Project Representative. The quantity of cables required to be meggered will not exceed 10% of the control cable installed by this Contract. Megger as described for 600V power cable after installation, but with cables disconnected from control panels and other equipment.
3. All control cables shall have a continuity check performed on each conductor to ensure the conductance of each wire before the wires are terminated.
4. Cables with conductors failing this test shall be removed and replaced.

E. 300V Instrument Cable:
1. Megger the specific instrument cables selected by Resident Project Representative. The quantity of cables required to be meggered will not exceed 10% of the instrument cable installed by this Contract. Insulation resistance shall be a minimum of 1,000 megohms per 1,000 feet.
2. All instrument cables shall have a continuity check performed on each conductor and shield to ensure the conductance of each wire and shield before the wires are terminated.
3. Cables with conductors or shields failing this test shall be removed and replaced.

F. Quality Assurance:
1. Test Reports:
   a. Submit as specified in Division 01.
   b. Maintain a written record of all tests showing date, personnel making tests, equipment used, Equipment or Material tested, tests performed, and results.
   c. Notify Engineer two weeks prior to commencement of all testing except for megger tests.

END OF SECTION 26 05 19

Burns & McDonnell Engineering Company Engineers – Architects – Consultants Kansas City, Missouri	WIRE AND CABLE SPECIFICATION SHEET	
	BC2	
	B&McD TYPE:	**NEC TYPE:**

BARE COPPER GROUND CABLE

GENERAL REQUIREMENTS:

Annealed, tin-coated, bare copper (ASTM B33)

SPECIFIC REQUIREMENTS:

1. Solid in sizes 4 AWG and smaller.

2. Class B stranded in sizes 2 AWG and larger (ASTM B8)

Burns & McDonnell Engineering Company Engineers – Architects – Consultants Kansas City, Missouri	WIRE AND CABLE SPECIFICATION SHEET	
	CEV1 **B&McD TYPE:**	**TC** **NEC TYPE:**

600 VOLT – UNSHIELDED MULTI-CONDUCTOR CONTROL CABLE

GENERAL REQUIREMENTS:

CONDUCTOR: Class B or C stranded annealed copper (NEMA WC57/ICEA S-73-532 Section 2). Conductor shall be tin-coated.

INSULATION: Cross-linked polyethylene "XLPE" (NEMA WC57/ICEA S-73-532 Section 3) and rated as Type XHHW-2. Color coding shall be Method 1 (NEMA WC57/ICEA S-73-532 Appendix E, Paragraph. E3.1) using color pigmented compounds with colors as designated by Table E-2 (K-2).

CABLE JACKET: Polyvinyl chloride "PVC" (NEMA WC57/ICEA S-73-532 Section 4.2) and rated for outdoor use.

IDENTIFICATION: Surface printing on the cable shall show manufacturer's name, cable type (TC), insulation type (XHHW-2), number and size of conductors, voltage rating, and Underwriters Laboratories label (UL).

SPECIFIC REQUIREMENTS:

TEMPERATURE RATING: Cable shall be suitable for operation under the following maximum conductor temperatures:

90°C --- Continuous, wet or dry locations

CONDUCTOR SIZE: #14 AWG

INSULATION THICKNESS:

Conductor Size (AWG)	Insulation Thickness (Mils) (NEMA WC57 / ICEA S-73-532 Table 3-1)
14 - 11	30

JACKET THICKNESS:

Calculated Diameter Of Cable Under Jacket (inches)	Jacket Thickness (Mils) (NEMA WC57 / ICEA S-73-532 Table 4-1)
0.425 or less	45
0.426 - 0.700	60
0.701 - 1.500	80
1.501 - 2.500	110
2.501 or larger	140

FACTORY TESTS: All cable shall be tested in accordance with requirements of NEMA WC57/ICEA S-73-532 Section 6, ICEA 210,000 BTU flame test (ICEA T-29-520), and UL1277.

CERTIFICATION: Cables shall be certified to be in conformance with all applicable requirements of NEMA WC57/ICEA S-73-532, ICEA T-29-520, and UL1277.

Burns & McDonnell Engineering Company Engineers – Architects – Consultants Kansas City, Missouri	WIRE AND CABLE SPECIFICATION SHEET	
	IVV1 **B&McD TYPE:**	**TC** **NEC TYPE:**

600 VOLT – SHIELDED INSTRUMENT CABLE (WITH SHIELDED TWISTED PAIRS/TRIADS)

GENERAL REQUIREMENTS:

CONDUCTOR:	Class B stranded annealed copper (NEMA WC57/ICEA S-73-532 Section 2). Conductor shall be tin-coated.
INSULATION:	Polyvinyl chloride "PVC" (NEMA WC57/ICEA S-73-532 Section 3). Color coding shall use pigmented compounds as follows; one conductor coded white, the second conductor coded black, and if the cable is for a triad, the third conductor shall be coded red. Each pair or triad will be sequentially numbered by surface printing.
CONDUCTOR JACKET:	Nylon (NEMA WC57/ICEA S-73-532 Section 3)
PAIR SHIELD:	Aluminized mylar or polyester tape with tinned copper drain wire.
SHIELD ISOLATION TAPE:	Mylar or polyester tape.
CABLE SHIELD:	Aluminized mylar or polyester tape with tinned copper drain wire.
CABLE JACKET:	Polyvinyl chloride "PVC" (NEMA WC57/ICEA S-73-532 Section 4.2).
IDENTIFICATION:	Surface printing on the cable jacket shall show manufacturer's name, cable type (TC), insulation type, conductor type, conductor size, voltage rating, and Underwriters Laboratories label (UL).

SPECIFIC REQUIREMENTS:

TEMPERATURE RATING	Cable shall be suitable for operation under the following maximum conductor temperatures: 90°C --- Continuous dry locations 75°C --- Continuous wet locations
CONDUCTOR SIZE:	#18 AWG
INSULATION THICKNESS:	All conductors to have 15 mils of PVC and 4 mils nylon insulation. (NEMA WC57/ICEA S-73-532, Table 3-1).

JACKET THICKNESS:

Calculated Diameter Of Cable Under Jacket (Inches)	Thickness (Mils) (NEMA WC57 / ICEA S-73-532 Table 4-1)
0.425 or less	45
0.426 - 0.700	60
0.701 - 1.500	80
1.501 - 2.500	110
2.501 or larger	140

FACTORY TESTS:	All cable shall be tested in accordance with requirements of NEMA WC57/ICEA S-73-532 Section 6, ICEA 210,000 BTU flame test (ICEA T-29-520), and UL1277.
CERTIFICATION:	Cables shall be certified to be in conformance with all applicable requirements of NEMA WC57/ICEA S-73-532, ICEA T-29-520, and UL1277.

Burns & McDonnell Engineering Company Engineers – Architects – Consultants Kansas City, Missouri	WIRE AND CABLE SPECIFICATION SHEET	
	SE2 **B&McD TYPE:**	**XHHW-2** **NEC TYPE:**

600 VOLT – SINGLE CONDUCTOR POWER CABLE

GENERAL REQUIREMENTS:

CONDUCTOR: Class B stranded annealed copper (NEMA WC70/ICEA S-95-658 Section 2). Conductor shall be tin-coated.

INSULATION: Cross-linked Polyethylene "XLPE" (NEMA WC70/ICEA S-95-658 Section 3).

IDENTIFICATION: Surface printing on the cable shall show manufacturer's name, insulation type (XHHW-2), conductor size, conductor type, voltage rating, and Underwriters Laboratories label (UL).

SPECIFIC REQUIREMENTS:

TEMPERATURE RATING: Cable shall be suitable for operation under the following maximum conductor temperatures:

90°C --- Continuous, wet or dry locations

MATERIAL THICKNESS:

Conductor Size (AWG or MCM)	Insulation Thickness (Mils) (NEMA WC70 / ICEA S-95-658 Table 3-4)
14 - 9	30
8 - 2	45
1 - 4/0	55
250 - 500	65
550 - 1000	80
1100 - 2000	95

FACTORY TESTS: All cable shall be tested in accordance with requirements of NEMA WC70/ICEA S-95-658 Section 6, and UL44.

CERTIFICATION: Cables shall be certified to be in conformance with all applicable requirements of NEMA WC70/ICEA S-95-658, and UL44.

Burns & McDonnell Engineering Company
Engineers – Architects – Consultants
Kansas City, Missouri

WIRE AND CABLE SPECIFICATION SHEET

SE3	**XHHW-2**
B&McD TYPE:	**NEC TYPE:**

600 VOLT – SINGLE CONDUCTOR POWER CABLE – FOR FEEDERS FROM EVERGY TRANSFORMERS TO SWITCHBOARD AND FROM SWITCHBOARD TO MCCS

GENERAL REQUIREMENTS:

CONDUCTOR: Class B stranded AA-8000 series aluminum alloy per ASTM B800, B801 and B836 (NEMA WC70/ICEA S-95-658 Section 2).

INSULATION: Cross-linked Polyethylene "XLPE" (NEMA WC70/ICEA S-95-658 Section 3).

IDENTIFICATION: Surface printing on the cable shall show manufacturer's name, insulation type (XHHW-2), conductor size, conductor type, voltage rating, and Underwriters Laboratories label (UL).

SPECIFIC REQUIREMENTS:

TEMPERATURE RATING: Cable shall be suitable for operation under the following maximum conductor temperatures:

90°C --- Continuous, wet or dry locations

MATERIAL THICKNESS:

Conductor Size (AWG or MCM)	Insulation Thickness (Mils) (NEMA WC70 / ICEA S-95-658 Table 3-4)
14 - 9	30
8 - 2	45
1 - 4/0	55
250 - 500	65
550 - 1000	80
1100 - 2000	95

FACTORY TESTS: All cable shall be tested in accordance with requirements of NEMA WC70/ICEA S-95-658 Section 6, and UL44.

CERTIFICATION: Cables shall be certified to be in conformance with all applicable requirements of NEMA WC70/ICEA S-95-658, and UL44.

Burns & McDonnell Engineering Company Engineers – Architects – Consultants Kansas City, Missouri	WIRE AND CABLE SPECIFICATION SHEET	
	SEV1 **B&McD TYPE:**	**TC** **NEC TYPE:**

600 VOLT – MULTI-CONDUCTOR POWER CABLE

GENERAL REQUIREMENTS:

CONDUCTOR: Class B or C stranded annealed tinned-copper (NEMA WC70/ICEA S-95-658 Section 2).

GROUND CONDUCTOR: Class B stranded bare copper ground conductor sized in accordance with Table 5-2 NEMA WC70/ICEA S-95-658.

INSULATION: Cross-linked polyethylene "XLPE" (NEMA WC70/ICEA S-95-658 Section 3) and rated as Type XHHW-2. Color coding shall be Method 4 (NEMA WC57/ICEA S-73-532) using a neutral or single color compound with surface printing of numbers.

CABLE JACKET: Polyvinyl chloride "PVC" (NEMA WC70/ICEA S-95-658 Section 4) oil resistant jacket, rated for outdoor use.

IDENTIFICATION: Surface printing on the cable shall show manufacturer's name, cable type (TC), insulation type (XHHW-2), conductor size, conductor type, voltage rating, and Underwriters Laboratories label (UL).

SPECIFIC REQUIREMENTS:

TEMPERATURE RATING: Cable shall be suitable for operation under the following maximum conductor temperatures:

90°C --- Continuous, wet or dry locations

INSULATION THICKNESS:

Conductor Size (AWG or MCM)	Insulation Thickness (Mils) (NEMA WC70 / ICEA S-95-658 Table 3-4)
14 - 9	30
8 - 2	45
1 - 4/0	55
225 - 500	65
525 - 1000	80

JACKET THICKNESS:

Calculated Diameter Of Cable Under Jacket (inches)	Minimum Thickness (Mils) (NEMA WC70 / ICEA S-95-658 Table 4-5)	Nominal Thickness (Mils) (NEMA WC70 / ICEA S-95-658 Table 4-5)
0.425 or less	40	45
0.426 - 0.700	50	60
0.701 - 1.500	70	80
1.501 - 2.500	95	110
2.501 or larger	120	140

FACTORY TESTS: All cable shall be tested in accordance with requirements of NEMA WC70/ICEA S-95-658 Section 6, ICEA T-29-520 (210,000 BTU flame test), IEEE 1202 (70,000 BTU flame test), UL 1685 and UL1277.

CERTIFICATION: Cables shall be certified to be in conformance with all applicable requirements of NEMA WC70/ICEA S-95-658, ICEA T-29-520, IEEE 1202, UL 1685, UL1277, and UL44. Suitable for use in NEC Class 1, Division 2 locations.

Burns & McDonnell Engineering Company Engineers – Architects – Consultants Kansas City, Missouri	WIRE AND CABLE SPECIFICATION SHEET	
	SEV5 **B&McD TYPE:**	**TC** **NEC TYPE:**

600 VOLT (1000 VOLT UL) – SHIELDED MULTI-CONDUCTOR POWER (VFD) CABLE

GENERAL REQUIREMENTS:

CONDUCTOR: Class B or C stranded tinned-copper (NEMA WC70/ICEA S-95-658 Section 2).

GROUND CONDUCTOR: Three symmetrical Class B stranded bare copper ground conductors sized to have an equivalent area of the conductor size identified in Table 5-2 NEMA WC70/ICEA S-95-658.

INSULATION: Cross-linked polyethylene "XLPE" (NEMA WC70/ICEA S-95-658 Section 3).

CABLE SHIELD: Copper tape shields with 100% coverage.

CABLE JACKET: Polyvinyl chloride "PVC" (NEMA WC70/ICEA S-95-658 Section 4) oil resistant jacket, rated for outdoor use.

IDENTIFICATION: Surface printing on the cable shall show manufacturer's name, cable type (TC), insulation type (XHHW-2), conductor size, conductor type, voltage rating, and Underwriters Laboratories label (UL).

SPECIFIC REQUIREMENTS:

TEMPERATURE RATING: Cable shall be suitable for operation under the following maximum conductor temperatures:

90°C --- Continuous, wet or dry locations

INSULATION THICKNESS:

Conductor Size (AWG or MCM)	Insulation Thickness (Mils) (NEMA WC70 / ICEA S-95-658 Table 3-4)
14 - 9	45
8 - 2	55
1 - 4/0	65
225 - 500	75

JACKET THICKNESS:

Calculated Diameter Of Cable Under Jacket (inches)	Minimum Thickness (Mils) (NEMA WC70 / ICEA S-95-658 Table 4-5)	Nominal Thickness (Mils) (NEMA WC70 / ICEA S-95-658 Table 4-5)
0.425 or less	40	45
0.426 - 0.700	50	60
0.701 - 1.500	70	80
1.501 - 2.500	95	110
2.501 or larger	120	140

FACTORY TESTS: All cable shall be tested in accordance with requirements of UL 1685 and IEEE 1202 Vertical Tray Flame Test (70,000 BTU/hr).

CERTIFICATION: Cables shall be certified to be in conformance with all applicable requirements of NEMA WC70/ICEA S-95-658. Suitable for use in NEC Class 1, Division 2 hazardous locations.

Burns & McDonnell Engineering Company Engineers – Architects – Consultants Kansas City, Missouri	WIRE AND CABLE SPECIFICATION SHEET	
	SVN3 **B&McD TYPE:**	**THHN/THWN** **NEC TYPE:**

600 VOLT – SINGLE CONDUCTOR POWER CABLE

GENERAL REQUIREMENTS:

CONDUCTOR: Class B stranded annealed copper (NEMA WC70/ICEA S-95-658 Section 2). Conductor shall be tin-coated.

INSULATION: Polyvinyl chloride "PVC" (NEMA WC70/ICEA S-95-658 Section 3) and rated as Type THHN/THWN.

CONDUCTOR JACKET: Nylon (NEMA WC70/ICEA S-95-658 Section 4).

IDENTIFICATION: Surface printing on the cable shall show manufacturer's name, insulation type (XHHW-2), conductor size, conductor type, voltage rating, and Underwriters Laboratories label (UL).

SPECIFIC REQUIREMENTS:

TEMPERATURE RATING: Cable shall be suitable for operation under the following maximum conductor temperatures:

90°C --- Continuous, dry locations
75°C --- Continuous, wet locations

MATERIAL THICKNESS:

Conductor Size (AWG or MCM)	Insulation Thickness (Mils) (UL83-Table 21.5)	Jacket Thickness (Mils) (UL83-Table 21.5)
14-11	15	4
10, 9	20	4
8-5	30	5
4-2	40	6
1-4/0	50	7
250-500	60	8

FACTORY TESTS: All cable shall be tested in accordance with requirements of NEMA WC70/ICEA S-95-658 Section 6, and UL44.

CERTIFICATION: Cables shall be certified to be in conformance with all applicable requirements of NEMA WC70/ICEA S-95-658, and UL44.

SECTION 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section specifies electrical grounding and bonding as indicated on Drawings and schedules and as specified herein. Grounding and bonding Work is defined to encompass systems, circuits, and equipment.

B. Type of electrical grounding and bonding Work specified in this Section includes the following:
   1. Solidly grounded. Grounded through a ground connection in which no impedance has been intentionally inserted.

C. Applications of electrical grounding and bonding Work in this Section include the following:
   1. Underground metal piping.
   2. Underground metal water piping.
   3. Underground metal structures.
   4. Metal building frames.
   5. Electrical power systems.
   6. Grounding electrodes.
   7. Ground test wells.
   8. Counterpoise grounding loops.
   9. Separately derived systems.
   10. Raceways.
   11. Service equipment.
   12. Boxes and enclosures.
   13. Equipment.
   14. Lighting standards and poles.
   15. Lightning protection systems.
   16. Cable tray.
   17. Chain-link fences and gates.

D. Refer to other Division 26 Sections for wires/cables, electrical raceways, boxes and fittings, and wiring devices which are required in conjunction with electrical grounding and bonding Work; not Work of this Section.

1.03 RELATED REQUIREMENTS:

A. Section 26 05 33 - Raceways, Boxes, and Supports for Electrical Systems.
B. Section 26 05 53 - Identification for Electrical Systems.
C. Section 13 46 00 - Lightning Protection Systems.
D. Section 26 43 13 - Surge Protection Devices.
E. Section 31 20 50 – Site Preparation and Earthwork.

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

B. American Society for Testing and Materials (ASTM):
   1. ASTM B3 - Soft or Annealed Copper Wire.

2. ASTM B8 - Concentric Lay Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
3. ASTM B33 - Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes.

C. Institute of Electrical and Electronic Engineers (IEEE): Comply with applicable requirements and recommended installation practices of the following IEEE Standards pertaining to grounding and bonding of systems, circuits, and equipment:
1. IEEE 80 - Guide for Safety in Substation Grounding.
2. IEEE 81 - Guide for Measuring Ground Resistance, and Potential Gradient in the Earth.
3. IEEE 141 - Recommended Practice for Electric Power Distribution for Industrial Plants.
4. IEEE 142 - Recommended Practice for Grounding Industrial and Commercial Power Systems.

D. National Electrical Contractors Association (NECA) Installation Standards.

E. National Fire Protection Association (NFPA):
1. NFPA 70 - National Electrical Code (NEC): Comply with applicable local electrical code requirements of the authority having jurisdiction, and NEC as applicable to electrical grounding and bonding, pertaining to systems, circuits, and equipment.
2. NFPA 780 - Lightning Protection Code.

F. Underwriters Laboratories (UL): Comply with applicable requirements of the following standards. Provide grounding and bonding products which are UL-listed and labeled for their intended usage.
1. UL 96A - Installation Requirements for Lightning Protection Systems.
2. UL 467 - Electrical Grounding and Bonding Equipment.
3. UL 486A - Wire Connectors and Soldering Lugs for Use with Copper Conductors.
4. UL 869 - Electrical Service Equipment.
5. UL 891 - Switchboards.

1.05 SUBMITTALS:

A. Refer to Division 01 and Section 26 05 10 - General Electrical Requirements for administrative and procedural requirements for Submittals.

B. Includes, but not limited to, the following:
1. Product Data: Submit manufacturer's data on all grounding and bonding components and associated accessories.
2. Qualification Data: For Qualified Testing Agency and testing agency's field Supervisor.
3. All field test reports.

1.06 QUALITY ASSURANCE:

A. Testing Agency Qualifications: Must be a member company of NETA or an NRTL.
1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Subject to compliance with requirements, provide grounding and bonding products of one of the following (for each type of product):
1. Grounding Products:
a. Compression Connectors:

(1) FCI Burndy.
(2) Thomas & Betts.

b. Exothermic Connectors:
(1) Burndy Weld.
(2) Erico.
(3) Harger.

c. Ground Rods:
(1) Conex.
(2) Erico.
(3) Harger.

d. Ground Cable:
(1) Harger.
(2) Nehring.
(3) Southwire.

e. Precast Ground Well Box:
(1) Brooks Products Model: 3-RT Valve Box.
(2) Christy Concrete Products Model: G12 Valve Box.

2.02 GROUNDING AND BONDING:

A. Materials and Components:

1. General: Except as otherwise indicated, provide electrical grounding and bonding systems indicated; with assembly of materials, including, but not limited to, cables/wires, connectors, solderless lug terminals, grounding electrodes, bonding jumper braid, surge arresters, and additional accessories needed for a complete installation. Where more than one type component product meets indicated requirements, selection is Contractor's code-compliance option. Where materials or components are not indicated, provide products which comply with NEC, UL, and IEEE requirements and with established industry standards for those applications.
2. Conductors:
   a. Unless otherwise indicated, provide insulated electrical grounding conductors for equipment grounding conductor connections that match power supply wiring materials and as a minimum are sized according to the NEC.
   b. Provide annealed, tin-coated, bare copper cable for ground electrode conductors. Size as indicated.
   c. Provide annealed, tin-coated, bare copper cable for buried ground system conductors.
   d. Provide annealed, tin-coated, bare copper cable for exposed ground system conductors.
   e. Tin-coated ground conductors shall meet ASTM B8 and B33.
   f. Bare copper ground conductors shall meet ASTM B3 and B8.
3. Service Surge Protection: Refer to Section 26 43 13 - Surge Protection Devices. Ground according to manufacturer’s instructions.
4. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600V. Lexan or PVC, impulse tested at 5,000V.
5. Bonding Plates, Connectors, Terminals, and Clamps: Provide electrical bonding plates, connectors, terminals, lugs, and clamps as recommended by bonding plate, connector, terminal, and clamp manufacturers for indicated applications.

a. Bolted Connectors for Conductors and Pipes: Copper or copper-alloy, pressure type with at least two silicon bronze or stainless-steel bolts and lock washers.
b. Bolted Service Connectors for Structural Steel: Shall have high-conductivity bronze alloy bolts and corrosion-resistant copper alloy nuts.
c. Irreversible Compression Fittings: Pure wrought copper extrusion clamps and connectors, made to be held in the dies of an installation tool. Connectors must be factory filled with an oxide inhibitor.
d. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
e. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless exothermic-type wire terminals and long-barrel, two-bolt connection to ground bus bar.

6. Ground Rods or Ground Electrodes:
   a. Ground Rods or Grounding Electrodes: Copper-clad steel or copper-alloy, sectional type rods. One end pointed to facilitate driving, 3/4-inch diameter by 10 feet unless noted otherwise on plans.
7. Electrical Grounding Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories manufacturers for type service required or indicated.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install electrical grounding and bonding systems as indicated, in accordance with manufacturer's instructions and applicable portions of NEC, NECA's "Standards of Installation," and in accordance with recognized industry practices to ensure that products comply with requirements.

B. A grounding electrode shall be installed at each building or structure as indicated.
   1. Grounding electrodes shall consist of the following:
      a. Ground rod and cable system.
      b. Concrete-encased electrode.
      c. Grounded metal frame of the building or structure.
      d. Metal underground water pipe.
      e. Other systems or structures as indicated.

C. Ground Rods:
   1. Install rods as indicated by driving and not by drilling or jetting.
   2. Drive rods into unexcavated portion of the earth where possible.
   3. Where rods must be installed in excavated areas, drive rods into earth after compaction of backfill is completed.
   4. Drive to a depth such that top of rods will be approximately 18 inches below final grade or subgrade, and connect main grid ground cable thereto.
   5. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
   6. Separation between ground rods shall be equal to or greater than the length of the rods.
   7. The ground electrode conductor shall not contain splices between the ground electrode and the service entrance equipment.
   8. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Counterpoise Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.
   1. Install a ground conductor for the ground ring and for taps to building steel.
   2. Bury ground ring not less than 24 inches (600 mm) from building's foundation.

E. Test Wells: Test well handholes shall be at least 12 inches (300 mm) deep, with cover.
   1. Ground rod driven through drilled hole in bottom of handhole.
   2. Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance.
   3. Set top of test well flush with finished grade or floor.

F. Grounding Conductors:
   1. Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
   2. Install using as few joints as possible. Route along shortest and straightest paths possible unless otherwise indicated or required by Code.
   3. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage. Suitably protect cable against damage during construction.
   4. Replace or suitably repair cable if damaged by anyone before final acceptance.
   5. In Exposed Installations:
      a. Route runs as indicated.
      b. Route along the webs of columns and beams, and in corners where possible for maximum physical protection.
      c. Where physical protection is required, install in PVC conduit unless indicated otherwise.
      d. Support at intervals of 3 feet or less with nonmagnetic clamp-type supports.
   6. In Buried Installations:
      a. Conductor sizes shall be as indicated for specific connections. For required connections not indicated, use conductor size not less than No. 3/0 AWG if buried in the earth or cast in concrete, or No. 6 AWG at other locations.
      b. Lay in bottom of trench or in other excavations at the depth of the top of the ground rod.
      c. Bury at least 30 inches (600 mm) below grade.
      d. Maintain clearance of at least 12 inches from all underground metal piping or structures, except where connections thereto are specifically indicated.
      e. Ground cable shall enter the bottom of electrical gear or panels sitting on a slab through a PVC sleeve.
   7. Backfill as specified in Division 31.
   8. Duct-Bank Grounding Conductor: Bury in duct bank as indicated as part of duct-bank installation.

G. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

H. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96A when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

I. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

J. Conductor Terminations and Connections:
1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors with silicon bronze or stainless-steel bolts and lock washers.
2. Underground Connections: Provide exothermic welded connections where grounding conductors connect to underground grounding conductors and underground grounding electrodes.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel:
   a. Exothermically welded connectors where allowed by the structural steel.
   b. Bolted fittings where structural steel cannot be welded, but can be field drilled.
   c. Irreversible compression ground clamp with breakaway bolt head to building steel that cannot be altered.
5. Clean metal contact surfaces of clamp-on connectors to ensure electrical conductivity and circuit integrity.
6. Exothermic terminations:
   a. Conform to manufacturer's instructions.
   b. Chemically degrease and dry completely before welding.
   c. Apply one coat of mastic coating to all exothermic-welded connections to be buried.

K. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70; use a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 3/0 AWG for a grounding conductor.
1. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel matte in at least four locations using compression fittings designed for the intended purpose.
3. The grounding connection to the supplemental electrode shall be bonded by either exothermic welding or irreversible compression fittings.
4. Extend a bonding conductor from concrete-encased electrode, below grade and out to building's grounding grid and bond.
5. Extend a bonding conductor from at least one concrete-encased electrode out of the concrete and bond to the grounding electrode.
6. Welding Ufer grounding conductor directly to the structural steel is prohibited.
7. Bond Ufer ground to the metal frame of the building or structure:
   a. A concrete-encased electrode shall be exothermically welded or connected with an irreversible compression fitting to the hold-down bolts securing the structural steel column to the support footing or foundation.
   b. A pig-tail of copper from the concrete-encased electrode shall penetrate the foundation and be mechanically bonded using an approved bonding plate or lug to the structural steel.

L. Grounding for Steel Building Structure:

1. Install a driven ground rod – part of the counterpoise system - at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.
2. Extend a bonding conductor from the counterpoise system to the structural steel and exothermically weld or connect with an irreversible compression fitting to the hold-down bolts securing the structural steel column to the support footing or foundation.
3. Exothermically weld to connect the counterpoise system to the steel building column.
4. Extend a bonding conductor from the counterpoise system to the structural steel as indicated. Drill and tap a preinstalled, grounding plate welded to the structural steel and secure the bonding conductor to the building steel with a service post.

M. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
1. Install bus horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down to specified height above floor; connect to horizontal bus.
3. Insulate and support grounding bus at intervals not to exceed 2 feet on centers or as indicated.

N. Grounding and Bonding of Metal Underground Water Pipe:
1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes. Use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Gas Piping: If installed in, or attached to, a building or structure, bond each aboveground portion of gas piping system downstream from equipment shutoff valve. Metal underground gas piping systems shall NOT be used as a grounding electrode.
4. Metal Process Water Pipes:
   a. For a small or medium-sized pipe, connect the pipe to the ground system at an exposed location using a mechanical bolted clamp connector with silicon bronze hardware.
   b. Follow manufacturer’s instructions for cleaning pipe and applying oxide inhibiting compound around perimeter of connector.

O. Grounding Manholes and Handholes:
1. Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches (100 mm) will extend above finished floor.
2. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG minimum bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall.
3. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete.
4. Seal floor opening with waterproof, non-shrink grout.

P. Grounding Connections to Manhole Components:

1. Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor.
2. Make connections with No. 4 AWG minimum stranded, hard-drawn copper bonding conductor.
3. Train conductors level or plumb around corners and fasten to manhole walls.
4. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

Q. All grounding system components shall be bonded to form one continuous grounding electrode.
R. Ground electrical service system neutral at service entrance equipment to grounding electrodes.
S. Ground each separately derived system neutral to the main building ground system:
T. Bond the system neutral to service entrance equipment enclosures.
U. Ground all exposed noncurrent carrying metal parts of electrical equipment, metal raceway systems, grounding conductors in raceways and cables, receptacle ground conductors, and metallic plumbing systems.
V. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torqueing requirements are not indicated, tighten connections to comply with tightening torque values specified in UL 486A to assure permanent and effective grounding.
W. Apply mastic coating to field connections, buried metallic grounding and bonding products, and places where factory applied protective coatings have been destroyed, which are subjected to corrosive action.

3.02 INSTALLATION - EQUIPMENT GROUNDING:

A. Install insulated equipment grounding conductors with all feeders and branch circuits.
B. Terminate feeder and branch circuit insulated equipment grounding conductors with grounding lug on substation, switchgear, switchboard, motor control center, or panelboard ground bus. When conduit enters from below and is not connected to the enclosure, ground equipment grounding conductor on conduit grounding bushing and then bond to ground bus (or grounded enclosure if there is no ground bus).
C. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
   1. Feeders and branch circuits.
   2. Lighting circuits.
   3. Receptacle circuits.
   4. Single-phase motor and appliance branch circuits.
   5. Three-phase motor and appliance branch circuits.
   6. Flexible raceway and power cords runs.
   7. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
   8. Computer and Rack-Mounted Electronic Equipment circuits.
D. Ground wireway at least once and at 10-foot intervals.
E. Ground all continuous runs of metallic cable tray and all isolated sections of metallic cable tray at each end. Install NEC sized bare copper equipment ground conductor in all cable tray. Clamp equipment ground conductor to cable tray at 20-foot intervals.
F. Bond cable trays routed parallel to each other with an NEC sized, bare copper tray bonding jumper ground conductor (based on highest ampacity circuit) at 100 foot intervals.

G. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches (150 mm) from the foundation.

H. Bonding Interior Metal Ducts: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120V and more, including air cleaners, heaters, blowers, fans, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping. Install tinned copper bonding jumper to bond across flexible duct connections to achieve continuity.

I. Water Heater and Heat-Tracing Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

J. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

K. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

L. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J STD-607-A.

1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4- by 4- by 12-inch (6.3- by 100- by 300-mm) grounding bus.
3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

M. Metal and Wood Poles Supporting Outdoor Lighting Fixtures: Install a separate grounding conductor with branch-circuit conductors.

N. Ground fence enclosures at each post with Burndy Type GK and GAR connectors. Install flexible braid straps across all hinge points and gates for fence enclosures. Bond fence posts, gates, and fence material to ground where crossed above by a utility line.

O. Bond all motors and equipment to the grounding electrode system with a minimum No. 6 AWG bare copper wire.

P. Bond all motors with “identified” equipment grounding conductor. Route in conduit with phase conductors.

Q. Enclosure Grounds: Bond all enclosures by direct copper connection to the grounding electrode system.

R. Building Grounding Conductors: Support at intervals not to exceed 3 feet on center or as indicated.

3.03 LABELING:

A. Comply with requirements in Section 26 05 53 - Identification for Electrical Systems for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.

1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.04 INSPECTION:

A. Do not cover up connections before they are inspected by Engineer.

B. Compression-type connections shall be inspected for embossment of proper die index per manufacturer's instructions.

3.05 FIELD QUALITY CONTROL:

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. All compression-type connections shall be inspected for proper die index number.
4. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81 for the following:
        (1) Testing and commissioning of new grounds, not yet connected to the utility power supply.
        (2) Testing complex ground systems that include a metallic loop.
    c. A clamp-on ground tester may only be used if the Owner does not require strict adherence to IEEE 81 and for the following situations:
        (1) To test installed grounds without disconnecting them from the utility.
        (2) To test a grounding electrode configuration where the return path includes the earth. (This does not include a ground system that includes a metallic loop.)
        (3) To test the resistance of a single rod in a series or array.
        (4) To check errant current flow to ground for operator safety.
5. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

D. Grounding system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

F. Report measured ground resistances that exceed the following values:
   1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
   2. Power and Lighting Equipment or System with Capacity of 500 to 1,000 kVA: 5 ohms.
   3. Power and Lighting Equipment or System with Capacity More Than 1,000 kVA: 3 ohms.
   4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
   5. Substations and Pad-Mounted Equipment: 5 ohms.
   6. Manhole Grounds: 10 ohms.

G. Excessive Ground Resistance: If resistance to ground exceeds specified values, add additional ground rod and retest. If test fails, notify Engineer promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26

SECTION 26 05 33 – RACEWAYS, BOXES, SEALS, AND FITTINGS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section specifies the following:
   1. Conduit.
   2. Wireway.
   3. Outlet and device boxes.
   4. Pull and junction boxes.
   5. Fittings.
   6. Bushings and ground bushings.
   7. Locknuts.
   8. Knockout closures.
   9. Telephone terminal cabinets.
   10. Seal fittings.
   11. Inground pull boxes.
   12. Firestopping and duct seal.
   13. Underground plastic line marker.
   14. Hangers, supports, anchors and accessories.
   15. Grout.
   16. Silicone sealants.

1.03 RELATED REQUIREMENTS:

A. Division 07 – Penetration Firestopping for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.
B. Division 31 – Trenching and Backfilling.
C. Section 26 05 10 – General Electrical.
D. Section 26 05 26 – Grounding and Bonding for Electrical Systems.
E. Section 26 05 43 – Underground Duct Banks and Manholes.
F. Section 26 05 53 – Identification for Electrical Systems.

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
B. American National Standards Institute (ANSI):
   1. ANSI C80.1 - Electrical Rigid Steel Conduit (ERSC).
   2. ANSI C80.3 - Electrical Metallic Tubing – Steel (EMT-S).
   3. ANSI C80.5 - Electrical Rigid Metal Conduit – Aluminum (ERMC-A).
   4. ANSI C80.6 - Electrical Intermediate Metal Conduit (EIMC).
C. American Welding Society (AWS):
   1. AWS D1.1/D1.1M - Structural Welding Code - Steel.
D. ASTM International:
   1. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

2. ASTM A153/A153M. - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
3. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
4. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
5. ASTM B117 -Standard Practice for Operating Salt Spray (Fog) Apparatus.
6. ASTM C1107/C1107M REV A - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).
7. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.
8. ASTM D3917 REV A - Standard Specification for Dimensional Tolerance of Thermosetting Glass-Reinforced Plastic Pultruded Shapes.
9. ASTM D4385 - Standard Practice for Classifying Visual Defects in Thermosetting Reinforced Plastic Pultruded Products.
10. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
11. ASTM E814 - Test Method for Fire Tests of Penetration Firestop Systems.
12. ASTM F2160 - Standard Specification for Solid Wall High Density Polyethylene (HDPE) Conduit Based on Controlled Outside Diameter (OD).

E. Joint Industrial Council (J.I.C.):
1. Comply with standards for Oil and Dust Tight Lay-In Wireway.

F. National Fire Protection Association (NFPA):
1. NFPA 70 - National Electrical Code (NEC).

G. National Electrical Contractor's Association (NECA):
1. NECA NEIS 1 - Standard for Good Workmanship in Electrical Construction.

H. National Electrical Manufacturers Association (NEMA):
1. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
2. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit.
3. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
4. NEMA TC 6 and 8 - Polyvinyl Chloride (PVC) Plastic Utilities for Underground Installation.
5. NEMA TC 14.AG - Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
6. NEMA TC 14.BG - Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
7. NEMA TC 14.XW - Extra Heavy Wall Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
8. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports.
9. NEMA OS 2 - Nonmetallic Outlet Boxes, Covers, and Box Supports.
10. NEMA 250 - Enclosures for Electrical Equipment (1,000V Maximum).

I. Society of Protective Coatings (SSPC):
1. SSPC-PA 1 - Shop, Field and Maintenance Painting of Steel.
2. SSPC-SP3 - Power Tool Cleaning.

J. Underwriters' Laboratories, Inc. (UL):
1. Provide all devices, components, and equipment that are UL listed and labeled.

2. UL 1 - UL Standard for Safety Flexible Metal Conduit.
3. UL 5 - UL Standard for Safety Surface Metal Raceways and Fittings.
4. UL 5C - UL Standard for Safety Surface Raceways and Fittings for Use with Data, Signal, and Control Circuits.
5. UL 6 - UL Standard for Safety Electrical Rigid Metal Conduit – Steel.
6. UL 6A - UL Standard for Safety Electrical Rigid Metal Conduit - Aluminum, Red Brass and Stainless Steel.
7. UL 50 - UL Standard for Safety Enclosures for Electrical Equipment, Non-Environmental Considerations.
8. UL 50E - UL Standard for Safety Enclosures for Electrical Equipment, Environmental Considerations.
9. UL 360 - UL Standard for Safety Liquid-Tight Flexible Metal Conduit.
10. UL 514A - UL Standard for Safety Metallic Outlet Boxes.
11. UL 514B - UL Standard for Safety Conduit, Tubing, and Cable Fittings.
12. UL 514C - UL Standard for Safety Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers.
13. UL 651 - UL Standard for Safety Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings.
14. UL 651A - UL Standard for Safety Schedule 40 and 80 High Density Polyethylene (HDPE) Conduit.
15. UL 797 - UL Standard for Safety Electrical Metallic Tubing – Steel.
16. UL 797A - UL Standard for Safety Electrical Metallic Tubing – Aluminum and Stainless Steel.
17. UL 870 - UL Standard for Safety Wireways, Auxiliary Gutters, and Associated Fittings
18. UL 1203 - UL Standard for Safety Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations
19. UL 1242 - UL Standard for Safety Electrical Intermediate Metal Conduit - Steel
20. UL 2515 - UL Standard for Safety Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.

1.05 SUBMITTALS:

A. Submit as specified in Division 01 and Section 26 05 10 - General Electrical Requirements for administrative and procedural requirements for submittals.

B. Submittals shall include, but not be limited to, the following:

1. Product Data:
   a. Submit manufacturer's technical product data, including specifications and installation instructions, for each type of product required. Include data substantiating that materials comply with requirements.
   b. Submit manufacturer's data on supporting devices including catalog cuts, specifications, and installation instructions, for each type of support, anchor, sleeve, and seal.
2. Certifications:
   a. Submit certifications for personnel responsible for installing conduit and fittings with PVC coated jackets.

1.06 QUALITY ASSURANCE:

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, Structural Welding Code - Steel.

B. Comply with NFPA 70.
C. Installations shall follow standard practices of NECA NEIS 1.
D. Installers of the PVC-coated galvanized rigid conduit system shall be certified by the manufacturer and be able to present a valid, unexpired certified installer card prior to starting installation. All clamping, cutting, threading, bending, and assembly instructions given during the manufacturer's certified installation training shall be followed.

1.07 COORDINATION:
A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete specifications.
B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:
A. Rigid Steel Conduit and Fittings with Bonded Polyvinyl Chloride (PVC) Jacket:
1. OCAL, Thomas & Betts, ABB Group.
2. Robroy Industries.
B. Rigid Aluminum Conduit:
1. Allied Tube and Conduit, Atkore International.
2. Patriot Aluminum Products
3. Republic Conduit, Tenaris.
4. Wheatland Tube Company, JMC Steel Group.
C. Rigid Aluminum Conduit Fittings:
1. Appleton, Emerson Electric Company.
2. Crouse-Hinds, Eaton.
3. Killark, Division of Hubbell, Inc.
4. Thomas & Betts, ABB Group.
D. Rigid Polyvinyl Chloride (PVC) Conduit and Fittings:
1. Carlon, Thomas & Betts, ABB Group.
2. Cantex Inc.
3. Triangle Conduit and Cable.
E. Wireway:
1. Hoffman, nVent Electric, plc.
2. Schneider Electric.
F. Surface Metal Raceway:
1. Hubbell Wiring Systems.
2. MonoSystems, Inc.
3. Panduit.
4. Wiremold; Legrand.
G. Liquid-Tight Flexible Metal Conduit:
1. AFC Cable Systems, Atkore International.
2. Anaconda.
3. Electri-Flex Company.
4. Southwire Company, LLC.
H. Flexible Metal Conduit:
1. AFC Cable Systems, Atkore International.
2. Southwire Company, LLC.

I. Outlet and Device Boxes:
   1. Appleton, Emerson Electric Company.
   2. Crouse-Hinds, Eaton.
   3. Killark, Division of Hubbell, Inc.
   4. Leviton Manufacturing Company, Inc.
   5. O-Z/Gedney, Emerson Electric Company.
   6. Thomas & Betts, ABB Group.

J. Pull and Junction Boxes:
   1. Metallic Indoor and Outdoor Boxes:
      a. B-Line, Eaton.
      b. Hoffman, nVent Electric, plc.
      c. Wiegmann, Hubbell Inc.

K. Conduit Hubs and Bodies:
   1. Appleton, Emerson Electric Company.
   2. Calbond.
   3. Carlon.
   4. Crouse-Hinds, Eaton.
   5. Ocal, Inc.
   6. O-Z/Gedney, Emerson Electric Company.
   7. Robroy Industries.

L. Wall Entrance Seals:
   1. O.Z./Gedney Model: Type WSK.
   2. O.Z./Gedney Model: Type CSM.

M. Fittings:
   1. Crouse-Hinds, Eaton.
   2. Appleton, Emerson Electric Company.
   3. Thomas & Betts, ABB Group.

N. Bushings, Grounding Bushings, and Locknuts:
   1. Arrow Hart, Eaton.
   2. Appleton, Emerson Electric Company.
   3. O-Z/Gedney, Emerson Electric Company.
   4. Raco, Hubbell, Inc.
   5. Steel City, Thomas & Betts, ABB Group.

O. Electrical Enclosures:
   1. Custom Control Mfr.
   2. Eaton/Cutler-Hammer.
   3. General Electric.
   4. PTMW.

P. Telephone Terminal Cabinets:
   1. Hoffman, nVent Electric, plc.
   2. Schneider Electric.

Q. Anchor Manufacturers: Subject to compliance with requirements, provide anchors of one of the following manufacturers.
   1. Aickinstrut.
   2. Cooper B-line.
   3. Power-Strut.
   4. Robroy.

5. Thomas & Betts.
6. Unistrut, Atkore International.

R. Metal Channel System Manufacturers: Subject to compliance with requirements, provide channel system of one of the following manufacturers.
1. B-line, Eaton
2. Erico, nVent Electric, plc.
3. Kindorf, Thomas & Betts, ABB Group.
4. Power-Strut, Atkore International.
5. Superstrut, Thomas & Betts, ABB Group.
6. Unistrut, Atkore International.

S. Inground Pull Boxes:
1. Hubbell Power Systems.
2. Engineer-approved equal.

T. Firestopping:
1. 3M Company.
2. Engineer-approved equal.

U. Duct Seal:
1. Appleton.
2. Crouse-Hinds.
3. O-Z/Gedney.

V. Underground Type Plastic Line Marker:
1. Brady.
2. Engineer approved equal.

2.02 DESIGN REQUIREMENTS:

A. Conduit:
1. Each length of threaded conduit furnished with coupling on one end and metal or plastic thread protector on other end.
2. UL listed and labeled conduit, on each length, fittings, and accessories.
3. Sizes of conduit, fittings, and accessories as indicated, specified, or as required by Electrical Codes and Standards.

B. Supports:
1. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

2.03 RIGID STEEL CONDUIT AND FITTINGS WITH BONDED POLYVINYL CHLORIDE (PVC) COATING:

A. General:
1. The PVC coated conduit system is specifically designed to prevent corrosive conditions from causing early replacement of the conduit. All the conduit, fittings, and supporting products shall be provided by a single manufacturer.
2. Installers of the PVC-coated galvanized rigid conduit system shall be certified by the manufacturer and be able to present a valid, unexpired certified installer card prior to

starting installation. All clamping, cutting, threading, bending, and assembly instructions given during the manufacturer's certified installation training shall be followed.

B. Raceway:
   1. Conform to hot-dipped galvanized rigid steel conduit as specified in RIGID STEEL CONDUIT, this Section, and as follows. Shall comply with NEMA RN1.
   2. PVC coating bonded to the conduit. Extruded PVC jackets are unacceptable.
   3. Coated externally with PVC to a nominal 40 mils, 0.035 inch to 0.045 inch.
   4. Uniformly coated around outside diameter and full length of the conduit.
   5. Pre-threaded ends coated with a urethane coating having a nominal thickness of 2 mils (0.002 inch).
   6. Interior surfaces of all conduits and feed-through fittings coated (except where prohibited by design) with a two-part, chemically cured, urethane coating having a nominal thickness of 2 mils (0.002 inch).
   7. The bond strength between the metal and coating must exceed the tensile strength of the coating.

C. Couplings, Elbows, and Fittings:
   1. Couplings, elbows, and other conduit fittings, boxes, cover plates, supports, hardware, and related items shall be treated and coated with the same process as conduit.
   2. Each coupling and fitting to include a PVC sleeve that overlaps the conduit.
   3. Length of the overlapping sleeve equals diameter of the conduit or 2 inches, whichever is least.
   4. Final cured PVC coating capable of withstanding a minimum electrical potential of 2,000V.
   5. All conduit accessories, clamps, and hardware that are uncoated shall be stainless steel.
   6. All fittings intended for wet, outdoor, or wash-down application shall carry a NEMA 4X water-tight rating or have an equivalent v-seal design.
   7. Form 8 bodies and covers.

2.04 RIGID ALUMINUM CONDUIT:

A. Raceway:
   1. Fabricated from ASTM B241 alloy GS 10A, identical to Aluminum Association Alloy 6063. Shall meet UL 6A.
   2. All scale, dirt, grease, burrs, and other foreign matter removed prior to applying coating.
   3. Entire length coated with a special silicone lubricating compound compatible with wire and cable coverings to minimize wire drag.
   4. Each length threaded at both ends.
   5. Threads protected with a homogenized zinc dust petroleum lubricating compound to prevent seizure.
   6. Coupling and elbows fabricated from the same material as conduit and each treated as required for conduit.
   7. Couplings may use alloy 3003 in lieu of 6063.

B. Fittings:
   1. Heavy-duty cast, copper-free aluminum (less than 0.4%).
   2. Full threaded hubs.
   3. Rubber-gasketed covers of pressed or cast aluminum.
   4. Cadmium-plated or bronze hardware bolts and screws.
   5. LBD or roller action type LB for right-angle fittings for conduit sizes 2 inches and larger.
   6. Standard and junction fittings.

7. Form 85 or Mark 9 bodies and covers.
8. Conduit Expansion Fittings:
   a. Aluminum expansion fittings for rigid aluminum conduit movement up to 4 inches.
   b. Insulated metal bushing on ends of the conduit, bonding jumper, and with expansion head sealed with a high-grade graphite packing.
   c. O-Z/Gedney, Type AX with Type ABJ bonding jumper or equal.

2.05 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT:

A. Fabricated from self-extinguishing high-impact polyvinyl chloride designed for aboveground and underground installations.
B. Shall meet NEMA TC2, TC6 and TC8, and UL 651.
C. Type EPC Schedule 40 heavy-wall rigid conduit.
D. Fittings and accessories fabricated from same material as conduit. Shall meet NEMA TC3.
E. Solvent-cement-type joints as recommended by manufacturer.

2.06 WIREWAY:

A. General: Provide electrical wireways of types, grades, sizes, and number of channels for each type of service as indicated or required. Provide complete assembly of raceway including, but not limited to, couplings, offsets, elbows, expansion joints, adapters, holddown straps, end caps, and other components and accessories as required for complete system.
B. Lay-in Wireways
   1. NEMA (Rating per enironment requirements) Enclosure. Provide 2-1/2-by 2-1/2-inch, 4- by 4-inch, 6- by 6-inch, 8- by 8-inch and 12- by 12-inch sizes as indicated or required.
   2. NEMA 1 wireways in the 2-1/2-inch, 4-inch and 6-inch sizes shall be provided with knockouts unless indicated otherwise.
   3. Hinged covers, in accordance with UL 870 and with components UL listed, including lengths, connectors, and fittings. Wireways shall allow fastening hinged cover closed without use of parts other than standard lengths, fittings, and connectors.
   4. The 2-1/2-inch, 4-inch and 6-inch wireways shall be constructed with 16-gauge stainless steel. The 8-inch and 12-inch wireways shall be constructed with 14-gauge stainless steel.
   5. Units shall be capable of sealing cover in closed position with screws.
   6. Connectors: Provide wireway connectors suitable for lay-in conductors, with connector covers permanently attached such that removal is not necessary to utilize the lay-in feature.
   7. Finish: Brushed stainless steel.
   8. Protect screws installed toward inside of wireway with spring nuts to prevent wire insulation damage. Use stainless-steel hardware.

2.07 WIRING TROUGHS:

A. Provide electrical wiring troughs of types, grades, sizes, and number of channels for each type of service as indicated or required.
B. NEMA 12 for interior electrical rooms.
C. NEMA 4X stainless steel for all other locations.
D. Provide 2-1/2-by 2-1/2-inch, 4- by 4-inch, 6- by 6-inch, 8- by 8-inch and 12- by 12-inch sizes as indicated or required for application.
E. Hinged covers, in accordance with UL 870 and with components UL listed.
F. Wiring trough covers and bodies shall be constructed with 14-gauge stainless steel minimum.

G. Shall not include holes or knockouts.
H. Units shall be capable of sealing cover in closed position with screws or screw clamps.
I. Finish: Painted sheet metal parts shall have rust-inhibiting coating and baked enamel finish.
J. Use stainless-steel hardware.

2.08 SURFACE METAL RACEWAYS:

A. Surface Metal Raceways shall comply with UL 5 and UL 5C and be UL labeled.
   1. Type 1 Raceway: Multi-outlet assembly for prewired outlets, lengths as indicated. Provide 3-wire, single circuit with outlets on 18-inch centers. Provide green insulated ground as third wire.
   2. Type 2 Raceway: Multi-outlet assembly for prewired outlets, lengths as indicated. Provide 4-wire, double circuit with outlets on 18-inch centers. Provide green insulated ground as fourth wire.
   3. Type 3 Raceway: Two-piece type with single compartment, lengths as indicated. Provide nominal 2-3/4 inch by 1-7/16 inch with flush, snap-on cover. Install devices as indicated in raceway.
   4. Type 4 Raceway: Two-piece type, divided for power and communication use, lengths as indicated. Provide nominal 4-3/4 inch by 1-3/4 inch with two 2-3/8-inch compartments.
   5. Type 5 Raceway: Surface-mounted type for power use, lengths as indicated. Provide nominal 3/4 inch wide, depth as required, single-piece type.
   6. Type 6 Raceway: Two-piece type with single compartment, length as indicated. Provide nominal 4-3/4 inch by 3-9/16 inch with flush, snap-on cover. Install devices as indicated in raceway.
   7. Boxes for Surface Raceways: Designed, manufactured, and supplied by raceway manufacturer for use with specified raceway.

2.09 LIQUID-TIGHT FLEXIBLE METAL CONDUIT:

A. Liquid-tight conduit with flexible aluminum core and a synthetic rubber, polyvinyl chloride, or thermoplastic covering.
B. Shall comply with UL 360.
C. Spiral encased copper bonding conductors for conduit in sizes 1-1/4 inches and smaller.
D. External grounding jumper as required.
E. Provide hot-dipped galvanized fittings for connections to rigid steel conduit, and aluminum- or PVC-coated fittings for connections to aluminum and PVC-coated rigid steel conduit.
F. Fittings for liquid-tight flexible metal conduit shall comply with UL 514B.

2.10 OUTLET AND DEVICE BOXES:

A. Surface Mounted:
   1. Cast hub device boxes for receptacles and switches.
   2. Cast aluminum. Metallic boxes shall meet UL 514A and NEMA OS 1.
   3. PVC boxes for PVC conduit. PVC boxes shall meet UL 514C and NEMA OS 2.
   4. FS or FD single boxes as required.
   5. Outlet boxes intended for use in classified areas shall be UL 886 listed.
B. Flush Mounted in Plaster Walls:
   1. Stainless sheet-steel nongangable device boxes.
   2. Conduit knockout openings in bottom and sides.
   3. Threaded screw holes for fastening devices and box covers.
   4. Corrosion-resistant screws for equipment grounding.

5. Include mounting brackets, device extensions plaster ears, and plaster board expandable grip fasteners (for existing plaster walls) compatible with box.
6. Shall meet UL 514A and NEMA OS 1.

2.11 PULL AND JUNCTION BOXES:

A. Stainless Steel Boxes – Indoor and Outdoor:
1. Type 316 stainless steel with stainless-steel cover and stainless-steel clamps and screws. Minimum 16 gauge for boxes with no dimension exceeding 6 inches and minimum 14 gauge for all other boxes.
2. Continuously welded seams shall be ground for a smooth finish.
3. Seamless gasket for cover.
4. Conform to NEMA Type 4X.
5. Provide continuous hinge, gasketed cover, and interior mounting plate when used for enclosing terminal blocks and control relays.
6. Provide rigid weatherproof conduit hubs for all boxes.

B. Rigid Aluminum Conduit Boxes – Indoor and Outdoor:
1. For use with aluminum raceway systems.
2. Self-oxidizing, self-renewing aluminum alloy that is "copper-free" - less than 0.3 of 1% to assure resistance to corrosion, with a minimum wall thickness of 3/32 inch.
3. Threaded conduit entrance with thread lubricant.
4. Thoroughly cleaned to eliminate grease and other contaminates.
5. Rubber or neoprene gasket for cover.
6. Conform to NEMA Type 4X enclosures in all outdoor installations and process areas unless indicated otherwise.
7. Conform to NEMA Type 12 for indoor electrical rooms and similar conditioned spaces.
8. Interior mounting panel when used for enclosing terminal blocks and control relays.
9. Box size as required by NEC or as indicated for each particular installation.
10. Include provisions for mounting cable supports as indicated, specified or as required by NEC.
11. Provide where indicated for cable pulling, junctions, terminals and for mounting of switches, outlets, and control devices.

C. Metallic Barriers:
1. Designed not to separate phases of a power circuit.
2. Provide as indicated for the isolation of power circuits from other type circuits

D. Bushings: Provide threaded, nylon-insulated metallic bushings. Provide steel bushings for conduit sizes 1-1/2 inches and smaller. Provide malleable iron bushings for conduit sizes 2 inches and larger.

E. Grounding Bushings: Provided where required by NEC. Provide threaded, insulated, malleable iron bushing with lay-in screw clamp lug.

F. Locknuts: Provide locknuts for conduit sizes 2 inches and smaller. Provide malleable aluminum for conduit sizes 2.5 inches and larger. Locknut material shall match conduit type.

G. Sealing Hub: Provide watertight, threaded, insulated sealing hub connectors for all outdoor and indoor wet locations where conduit enters into enclosures. Sealing hub threaded lengths shall be adequate to allow installation of bushing.

H. Knockout Closures: Provide steel press-in knockout seals for all unused punched out knockouts 2 inches and smaller. Provide metal two-piece bolt on knockout seals for all unused punched out knockouts 2-1/2 inches and larger.

I. Compression Fittings: Provide all threaded nipples, insulated short elbows, offset nipples, offset connectors, enlargers and reducers as required.

J. Telephone Terminal Cabinets: Provide telephone terminal cabinets of sizes indicated, constructed of code gauge steel painted gray, concealed hinge door, keyed flush lock (all locks shall be keyed identically, provide one key per lock) and with 3/4-inch plywood backing. Plywood backing shall be finished with black paint.

K. Hinged-Cover Enclosures:
1. Comply with UL 50 and NEMA 250, Type 12 for indoor and Type 4X stainless steel for outdoor.
2. Provide with continuous-hinge cover with flush latch unless otherwise indicated.
3. Metal Enclosures: Stainless-Steel.
4. Metal barriers to separate wiring of different systems and voltage.
5. Gasketed enclosures shall meet UL 50E.

2.12 CONDUIT WALL ENTRANCE SEALS:

A. Provide where required or indicated.
B. Use O-Z/Gedney Type FSK for new walls.
C. Use O-Z/Gedney Type CSM for penetration in existing walls.

2.13 SEAL FITTINGS AND COUPLINGS FOR RIGID STEEL, ALUMINUM AND PVC-COATED RIGID STEEL CONDUIT:

A. Fittings:
1. Cast aluminum, copper free fittings for aluminum conduit.
2. PVC coated where PVC-coated conduit is used.
3. Explosionproof.
4. Threaded cover to conform to NEC.
5. Full thread hubs.
6. Seal Fittings:
a. Shall be designed to allow for 40% cable fill.
b. Provide sealing compound (“Chico”) and packing fiber for all sealing fittings.
c. Provide with seal drains where required to provide a continuous automatic drain of water.

B. Couplings:
1. Explosionproof.
2. Flexible.
3. Conform to NEC.
4. Threaded aluminum end fittings securely fastened to the core and braided to ensure electrical continuity.
5. PVC coated in corrosive areas where PVC-coated conduit is used.

2.14 STAINLESS STEEL SUPPORT SYSTEM:

A. General: Provide supporting devices which comply with manufacturer's standard materials, design, and construction in accordance with published product information, as required for complete installation, and as herein specified. All supports shall be designed for the support of the maximum number of conduits and their maximum conductor weights for maximum conduit loading. Where more than one type of supporting device meets indicated requirements, selection is Contractor's option. Do not use perforated metal straps for supports.

B. Fabricated from structural steel or manufactured framing members equal to "Unistrut" P-3000 (1-5/8 inch by 1-3/8 inch) series as manufactured by Unistrut Corporation, Kindorf B-995 (11/2 inch by 1-1/2 inch) series as manufactured by Thomas and Betts, or Superstrut A-1200 (1-5/8 inch by 1-5/8 inch) series as manufactured by Thomas and Betts.
C. Minimum 12 gauge.
D. Construct as required to rigidly support all conduit runs, boxes, and equipment.
E. Post bases shall include four (4) mounting holes for anchors and two (2) holes for channel-mount.
F. Stainless-Steel Supports:
   1. Channel Type 304 stainless steel conforming to ASTM A240.
   2. Stainless-steel conduit clamps and hangers, sized for the specific conduit diameter.
   3. Provide stainless-steel rods, anchors, inserts, bolts, washers, nuts, and support hardware.
G. Anchors: Anchors of types, sizes, and materials indicated, with the following construction features.
   1. Stainless-steel Expansion Anchors: 1/2, 5/8, or 3/4 inch as required.
   2. Toggle Bolts: Springhead, 3/16 by 4 inch or larger size as required.

2.15 INGROUND PULL BOXES:

A. Boxes and cover shall be made of polymer concrete.
B. Material shall be sunlight resistant, chemical resistant, moisture resistant, and non-conductive.
C. The boxes shall be stable type for extra depth.
D. The covers shall be heavy-duty and designed for 15,000 pounds over a 10-inch square with a minimum test load of 22,000 lbs. The covers shall be made of non-skid materials.
E. Shall be designed for outdoor inground installation.
F. Size shall be as required by the National Electrical Code. Minimum size shall be 12 inches wide by 24 inches deep by 12 inches high.
G. All mounting hardware shall be 316 stainless steel.
H. Install where indicated and required.

2.16 FIRESTOPPING AND DUCT SEAL:

A. Firestopping:
   1. Weather-resistant silicone sealant.
   2. Provide 4-hour fire rating.
   3. Provide flexible re-enterable and repairable seal around conduit.
   4. ASTM E814 tested system.
   5. Provide 3M® Fire Barrier 2000+ Silicone Sealant or Engineer-approved equal.
B. Duct Seal:
   1. Noncorrosive, permanently soft compound.
   2. Nontoxic.
   3. Provide flexible re-enterable and repairable seal around cables in conduits.
   4. Prevent air movement and drafts through conduits.
   5. Provide Ideal Industries Duct Seal, 3M® Moldable Putty, or Engineer-approved equal.

2.17 UNDERGROUND PLASTIC LINE MARKER:

A. Permanent, traceable, bright-colored, continuous-printed plastic tape marker, intended for marking below grade utilities.
B. Provide tape marker with printing which most accurately indicates type of utility such as “Fiber Optic Cable Below” or “Electric Below.”

C. Provide with continuous metal strip or core to allow nonmetallic conduits or fiber optic cables to be located.
D. Manufactured by Brady or Engineer-approved equal.

2.18 GROUT:
A. Description: Non-shrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
C. Design Mix: 5,000-psi (34.5-MPa), 28-day compressive strength.
D. Packaging: Premixed and factory packaged.

2.19 SILICONE SEALANTS:
A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

PART 3 - EXECUTION

3.01 PREPARATION:
A. Provide suitable protection for conduit risers against damage during construction.
B. Cap ends of all conduits before concrete is poured.
C. Cap all conduits after cleaning where conduits are to be left empty by this Contract.
D. Carefully ream ends of all conduit lengths after cutting to eliminate sharp burrs.
E. Clean out all conduits before pulling wire.
F. Clean out all conduits immediately after concrete work is finished.

3.02 RACEWAYS AND BOX INSTALLATION:
A. General Requirements:
1. Location:
a. Install conduit as near as possible to the routing indicated.
b. Shift locations as required to avoid interference with other equipment and piping being installed.
c. Where routing of conduit is not indicated, such as for lighting home run circuits and other systems requiring small conduit runs, route conduit as specified subject to approval by Engineer.
2. Do not use conduit in sizes smaller than 3/4 inch, except 1/2 inch may be used for connections to control devices and thermocouples where necessary.
3. Holes and Sleeves:
a. Provide through floors, walls, and roofs as necessary for conduit runs, including approved flashing and weather proofing at outside walls and on roofs.
b. Install sleeves or forms for all openings in new Work.
c. Provide the required inserts and holes, completely sleeved, bonded, curbed, flashed, and finished off in an approved manner, whether in concrete, steel grating, metal panels, or roofs.

d. Core-drill all holes required in existing building work using a dustless method.
e. Place non-shrinking grout or Dow Corning 3-6548 Silicone RTV or equivalent General Electric RTF 762 sealant as specified, in the following locations:
   (1) All holes in concrete, walls, floor, and roof slabs after installation of conduit.
   (2) All unused holes and sleeves as approved by Engineer.
f. Install wall entrance seals where conduit enters the building or vaults from exterior underground.

4. Install firestopping at all conduit penetration of fire-rated walls, ceilings, and floors. Firestopping system shall equal or exceed fire rating of wall, ceiling, or floor in which it is installed. Install duct seal in conduits around cables at all conduit terminations at control panels and boxes containing terminations and splices.
5. Make connections to boxes, panels, and other equipment as follows:
   a. Indoor Dry Locations: Double locknuts, one inside and one outside.
   b. Outdoor and Damp Locations: Rigid weatherproof conduit hubs.
   c. Bushings:
      (1) Threaded malleable metal.
      (2) Insulated with Bakelite, molded and bonded into the bushing.
      (3) Placed on end of conduit in addition to locknuts.
      (4) Install with integral grounding connector and conductor where all conduits pass through multiple concentric panel knockouts and where the conduit must be bonded to equipment it is not attached to.
6. Running threads will not be permitted.
7. Coat all field cut threads in galvanized conduit with cold galvanizing paint.
8. Comply with applicable requirements of NEC pertaining to installation of conduit systems.
9. Place drainage fittings or weep holes at unavoidable low points where moisture can collect.
10. Install an entire conduit system that is electrically continuous with bonding jumpers provided as necessary to conform to NEC.
11. Install expansion fittings at all building expansion joints and every 100 feet of continuous conduit.

B. PVC-Coated Rigid Steel Conduit:
1. Install at 90 degree sweeps from below grade to above grade.
2. Installers of PVC Coated Conduit must be certified by the manufacturer and be able to present a valid, unexpired Certified installer card prior to installation of conduit system.
3. Coat field cut threads with manufacturer's standard product in accordance with manufacturer's recommendations.
4. Use bender one size larger for conduit sized 1 inch or less and conventional bender for conduit sized above 1 inch.
5. Use strap wrench to tighten conduit. Repair damaged coating with liquid patching compound recommended by conduit manufacturer.
6. Buried:
   a. Bury conduits a minimum of 36 inches below finish grade unless indicated otherwise.
   b. Slope conduit away from conduit risers where possible.
   c. Maintain 6-inch separation from underground piping.
   d. Use long radius elbows for all feeders unless indicated otherwise.
   e. Use for conduit risers where routed through concrete slabs.

f. After trench bottom has been finished to grade, lay conduit. Backfilling shall be as specified in Division 31.
g. Cap ends of all conduit risers before backfilling.

C. Rigid Aluminum Conduit:
1. Install at interior and exposed locations,
2. Do not install underground or cast in concrete.
3. Use anti-seize compound on conduit threads.
4. Use bender one size larger than nominal up through 1 inch and conventional size bender for conduit over 1 inch in size.
5. Exposed:
a. Group parallel runs in neatly aligned banks where possible with a minimum of 1-inch clearance between conduits.
b. Run conduit parallel or perpendicular to walls, ceiling, beams, and columns unless indicated otherwise.
c. Route to clear all doors, windows, access walls, and openings.
d. Maintain 6-inch clearance between conduit and coverings on all hot lines; steam, hot water, and similar pipes.
e. Do not exceed a distance of 8 feet between supports on horizontal or vertical runs.
f. Install horizontal runs as high above floor as possible, and in no case lower than 7 feet above floor, walkway, or platform in passage area.
g. When terminating at cable tray, firmly attach conduit to tray and electrically bond conduit with ground wire to cable tray.
6. Concealed:
a. Conceal conduit for lighting, convenience outlets, and other circuits for finished office spaces in walls and above suspended ceiling where possible.
7. For short runs, the use of flat steel tapes is prohibited. Polyethylene fish tapes and round, flexible, speedometer-type steel cables are recommended.

D. Non-concrete Encased Rigid PVC Conduit:
1. Install below grade. Non-concrete encased.
2. Make all joints watertight with cement compound furnished by the conduit manufacturer.
3. Buried:
a. Install in as straight a run as possible between termination points of exact routing to be determined in the field and subject to approval by Engineer.
b. Bury conduits a minimum of 36 inches below finish grade unless indicated otherwise.
c. Slope conduit away from conduit risers where possible.
d. Maintain 6-inch separation from underground piping.
e. Use PVC-coated rigid steel elbows at all risers and at any bend greater than 45 degrees unless indicated otherwise.
f. Use long radius elbows for all primary feeders unless indicated otherwise.
g. All risers shall be PVC-coated rigid steel conduit.
h. After trench bottom has been finished to grade, lay conduit. Backfilling shall be as specified in Division 31.
i. Cap ends of all conduit risers before backfilling.

E. Liquid-Tight Flexible Metal Conduit.
1. Use between rigid conduit and motor terminal boxes except where conduit runs down from above and cannot be conveniently supported by a floor flange.

2. Place between rigid conduit or conduit box and control device cases where direct connection is not desirable for reasons of equipment movement, vibration, or for ease of maintenance.
3. Install at all points of connection to equipment mounted on supports to allow for expansion and contraction.
4. Conform to NEC with installation of conductors.
5. Install at locations where rigid conduit connections are impractical.
6. Use minimum length consistent with manufacturer's standard lengths, the acceptable bending radius, and with required movement of equipment.
7. Maximum length of 3 feet unless otherwise approved by Engineer.
8. Install an external bonding jumper to conform to NEC on conduit sized 1-1/2 inches and larger.

F. Flexible Metal Conduit:
1. Use for installation of luminaires only.
2. Do not use with vapor-tight fixtures. Use in accordance with the National Electrical Code Article 350.
3. Use minimum length consistent with manufacturer's standard lengths and acceptable bending radius.
4. Maximum length of 3 feet unless otherwise approved by Engineer.

G. Compression Conduit Fittings:
1. Installations of special fittings are indicated.
2. Use aluminum fittings for joining aluminum to steel conduit.
3. Install as required.

3.03 SURFACE METAL RACEWAYS AND WIREWAYS:

A. Mechanically assemble metal enclosures and surface metal raceways for conductors to form continuous electrical conductor, and connect to electrical boxes, fittings, and cabinets to provide effective electrical continuity and rigid mechanical assembly.
B. Provide only where indicated. Avoid use of dissimilar metals throughout system to eliminate possibility of galvanic corrosion. Where dissimilar metals are in contact, coat all surfaces with corrosion-inhibiting compound before assembling.
C. Install expansion fittings in all raceways, surface metal raceways, and wireways wherever structural expansion joints are crossed.
D. Make changes in direction of surface metal raceway and wireway with proper fittings supplied by raceway manufacturer. No field bends of surface metal raceway or wireway sections will be permitted.
E. Properly support and anchor surface metal raceways for their entire length with structural materials. Surface metal raceways are not to span any space unsupported.
F. Use boxes as supplied by surface metal raceway manufacturer wherever junction, pull or devices boxes are required. Standard electrical "handy" boxes, etc., shall not be permitted for use with surface metal raceway installations.
G. Provide identification of all raceways as specified in Section 26 05 53 - Identification for Electrical Systems.
H. Provide tap location nameplates for wireways when used as auxiliary gutters as specified in Section 26 05 53 - Indetification for Electrical Systems.
I. Ground wireways at 10-foot intervals per Section 26 05 26 - Grounding and Bonding for Electrical Systems.

3.04 BOXES AND FITTINGS:

A. Install electrical boxes, bushings, locknuts, nipples, connectors, sealing hubs, and fittings as required, indicated, in accordance with applicable requirements of NEC and in accordance with recognized industry practices to fulfill Project requirements.
B. Coordinate installation of electrical boxes and fittings with wire/cable, wiring devices, and raceway installation work.
C. Provide weatherproof boxes for interior and exterior locations exposed to weather or moisture.
D. All boxes containing emergency power and lighting circuits shall be identified as specified in Section 26 05 53 - Identification for Electrical Systems.
E. Provide (oil-tight) knockout closures to cap unused knockout holes where blanks have been removed.
F. Install electrical boxes in only those locations which ensure ready accessibility to enclosed electrical wiring.
G. Maximum box size in a fire-rated wall shall be 4 inches by 4 inches square. Do not install boxes back-to-back in walls. In walls that are not fire-rated or acoustic- rated, provide not less than 6 inches (150 mm) horizontal separation between boxes installed in opposite sides of wall. Provide not less than 24 inches (610 mm) horizontal separation between boxes installed in opposite sides of fire-rated and acoustic-rated walls.
H. Do not install aluminum products in concrete.
I. Position recessed outlet boxes accurately to allow for surface finish thickness.
J. Set floor boxes level and flush with finish flooring material.
K. Fasten electrical boxes firmly and rigidly to the surfaces to which attached, structural surfaces to which attached, or solidly embed them in concrete or masonry.
L. Provide electrical connections for installed boxes.
M. Properly ground metallic electrical boxes in compliance with the NEC. Bond all non-isolated equipment grounding conductors to all electrical boxes.
N. Subsequent to installation of boxes, protect boxes from construction debris and damage.
O. Install special boxes as indicated of size required for conduits and cables entering and leaving box.
P. Explosionproof Fittings:
    1. Install explosionproof fittings in the conduit system as required by NEC.
    2. Install necessary fittings where not indicated but required by code.

3.05 SUPPORTS:

A. Construct with sufficient rigidity to hold all mounted equipment and material in permanent and neat alignment.
B. Design to provide 1/4-inch space between equipment housings and walls or columns upon which they are mounted.
C. Do not exceed load requirements in NEC and NEMA standards.
D. Use aluminum supports, clamps, and straps to support aluminum conduit.
E. Use stainless-steel conduit straps to support PVC-coated rigid steel conduit. Use stainless-steel clamps for supporting PVC coated rigid steel conduit on stainless-steel supports.
F. Use nonmagnetic conduit clamps to support nonmagnetic conduit.

3.06 CONCRETE BASES:

A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3,000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 - Concrete.
C. Anchor equipment to concrete base.
   1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   2. Install anchor bolts to elevations required for proper attachment to supported equipment.
   3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.07 INGROUND PULL BOXES:
A. Install a minimum of 6 inches of compacted granular material below pull box.
B. Install top of pull box flush with finished grade.
C. Bring conduit up from below box or make conduit penetration in boxes per manufacturer's recommendations.

3.08 SEAL FITTINGS:
A. Install seal fittings in the rigid steel or aluminum conduit system as required by NEC.
B. Install necessary fittings where not indicated but required by code.

3.09 UNDERGROUND PLASTIC LINE MARKER:
A. Install underground traceable line marker 12-inches below grade above all conduits.

3.10 PAINTING:
A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

END OF SECTION 26 05 33

SECTION 26 05 36 - CABLE TRAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes:
   1. Ladder cable trays.
   2. Basket cable trays.

1.03 RELATED REQUIREMENTS:

A. Section 26 05 26 – Grounding and Bonding for Electrical Systems.
B. Section 26 05 53 – Identification for Electrical Systems.

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

A. American National Standards Institute (ANSI):
   1. ANSI H35.1/H35.1M - Alloy and Temper Designation Systems for Aluminum.

B. American Society of Civil Engineers/Structural Engineering Institute.
   1. ASCE/SEI 7 - Minimum Design Loads for Buildings and Other Structures.

C. ASTM International:
   1. ASTM A123/A123M - Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   2. ASTM A510/A510M - Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel.
   3. ASTM A653/A653M - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   4. ASTM A1008/A1008M - Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
   5. ASTM A1011/A1011M - Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
   6. ASTM B633 - Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
   7. ASTM D769 - Specification for Black Synthetic Iron Oxide.
   8. ASTM F593: Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
   9. ASTM F594 - Specification for Stainless Steel Nuts.
   10. ASTM F1136 - Specification for Zinc/Aluminum Corrosion Protective Coatings for Fasteners.

D. National Electrical Manufacturers Association:
   1. NEMA VE 1 - Metal Cable Tray Systems.
   2. NEMA VE 2 - Cable Tray Installation Guidelines.

E. National Fire Protection Association (NFPA):
   1. NFPA 70 – National Electrical Code (NEC).

1.05 SUBMITTALS:

A. Submit as specified in Division 01 and Section 26 05 10 – General Electrical Requirements for administrative and procedural requirements for submittals.

B. Product Data: For each type of product.

1. Include data indicating dimensions and finishes for each type of cable tray indicated.

C. Shop Drawings: For each type of cable tray.

1. Show fabrication and installation details of cable trays, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.

D. Seismic Qualification Certificates: Submit certification that switchboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Section 26 05 48 – Vibration and Seismic Controls for Electrical Systems.

1.06 WARRANTY

A. The equipment Manufacturer shall warrant that all equipment shall be free from defects caused by faulty material or workmanship for a minimum period of two (2) years from the date of Substantial Completion, unless otherwise specified.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Ladder Cable Tray:

1. B-Line, Eaton.
2. Chalfant Manufacturing Company.
3. PW Industries, Legrand.
4. MP Husky.

B. Basket Cable Tray:

1. B-Line, Eaton.
2. Cablofil, Legrand.
3. Chalfant Manufacturing Company.
4. Cope, Unistrut.
5. MP Husky.

2.02 GENERAL REQUIREMENTS FOR CABLE TRAYS:

A. Cable Trays and Accessories: Identified as defined in NFPA 70 and marked for intended location, application, and grounding.

1. Source Limitations: Obtain cable trays and components from single manufacturer.

B. Sizes and Configurations: See the Cable Tray Schedule on Contract Drawings for specific requirements for types, materials, sizes, and configurations.

C. Structural Performance: See articles on individual cable tray types for specific values for the following parameters:

1. Uniform Load Distribution: Capable of supporting a uniformly distributed load on the indicated support span when supported as a simple span and tested according to NEMA VE 1.
2. Load and Safety Factors: Applicable to both side rails and rung capacities.

2.03 LADDER CABLE TRAYS:

A. Description:

1. Aluminum Tray.
2. Configuration: Two I-beam side rails with transverse rungs welded to side rails.
3. Rung Spacing: 9 inches
4. Radius-Fitting Rung Spacing: 9 inches at center of tray's width.
5. Structural Performance of Each Rung: Capable of supporting a maximum cable load, with a safety factor of 1.5, plus a 200-lb (90-kg) concentrated load, when tested according to NEMA VE 1.
6. Straight Section Lengths: 20 feet except where shorter lengths are required to facilitate tray assembly.
7. Depth and Width: Refer to Contract Drawings.
8. Fitting Minimum Radius: 12 inches.
9. Class Designation: Comply with NEMA VE 1, Class 20C.
10. Splicing Assemblies: Bolted type using serrated flange locknuts.
11. Hardware and Fasteners: ASTM F593 and ASTM F594 stainless steel, Type 316.
12. Splice Plate Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.

2.04 BASKET CABLE TRAYS:

A. Provide wire basket cable tray of types and sizes indicated with connector assemblies, clamp assemblies, connector plates, splice plates and splice bars. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards.
B. All straight section longitudinal wires shall be constructed with a continuous top wire safety edge. Safety edge must be kinked and T-welded on all tray sizes.
C. Wire basket cable tray shall be made of high strength aluminum wires and formed into a standard 2 inch by 4 inch wire mesh pattern with intersecting wires welded together. All mesh sections must have at least one bottom longitudinal wire along entire length of straight section.
D. Wire mesh cable tray fittings shall be field fabricated from straight tray sections, in accordance with manufacturer instructions.
E. Shall be constructed of aluminum.
F. Basket cable tray shall consist of continuous, rigid, welded steel wire mesh cable management system, to allow continuous ventilation of cables and maximum dissipation of heat.
G. Basket cable tray shall be grounded using UL Listed splicing methods per manufacturer recommendations.
H. UL Classified splices where tray acts as Equipment Grounding Conductor (EGC). Wire mesh cable tray will have continuous welded top side wire to protect cable insulation from being damaged.
I. Basket cable tray supports and mounting hardware shall be hot dipped galvanized. Support locations and mounting hardware shall be per manufacturer recommendations.
J. Wire basket sizes shall conform to widths and usable depths as indicated on the Drawings. Where specific dimensions are not called out, cable tray shall be sized for all cables designed to be in cable tray plus 20%.

2.05 CABLE TRAY ACCESSORIES:

A. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.
B. Barrier Strips: Same materials and finishes as for cable tray.
C. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

2.06 WARNING SIGNS:

A. Lettering: 1-1/2-inch high, black letters on yellow background with legend "Warning! Not To Be Used as Walkway, Ladder, or Support for Ladders or Personnel."

B. Comply with requirements in Section 26 05 53 –Electrical Identification.

2.07 SOURCE QUALITY CONTROL:

A. Testing: Test and inspect cable trays according to NEMA VE 1.

PART 3 - EXECUTION

3.01 CABLE TRAY INSTALLATION:

A. Install cable trays according to NEMA VE 2 and TIA/EIA-560-A-7.

B. Install cable trays as a complete system, including fasteners, hold-down clips, support systems, barrier strips, adjustable horizontal and vertical splice plates, elbows, reducers, tees, crosses, cable dropouts, adapters, covers, and bonding.

C. Install cable trays so that the tray is accessible for cable installation and all splices are accessible for inspection and adjustment.

D. Remove burrs and sharp edges from cable trays.

E. Join aluminum cable tray with splice plates; use four square-neck carriage bolts and locknuts.

F. Fasten cable tray supports to building structure and steel supports as shown on Contract Drawings.

G. Place supports so that spans do not exceed maximum spans on schedules and provide clearances shown on Drawings. Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.

H. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.

I. Locate and install supports according to NEMA VE 2. Do not install more than one cable tray splice between supports.

J. Make changes in direction and elevation using manufacturer's recommended fittings.

K. Make cable tray connections using manufacturer's recommended fittings.

L. Basket Cable Tray:

1. Cutting: Field-fabricate changes in direction & elevation by cutting & bending cable tray.
2. Cut cable tray wires in accordance with manufacturer's instructions.
3. Cable tray wires must be cut with side-action bolt cutters with offset head to ensure integrity of protective galvanic layer.
4. Remove burrs and sharp edges from cable trays.
5. Installers shall have completed the manufacturer certified installation training prior to installation.

M. Install all 600V power and control cables in power cable trays. Install all shielded analog cables, 24V discrete signal cables, data and communications in the instrumentation tray.

N. Install warning signs in visible locations on or near cable trays after cable tray installation.

3.02 CABLE TRAY GROUNDING:

A. Ground cable trays according to NFPA 70 unless additional grounding is specified. Comply with requirements in Section 26 05 26 – Grounding and Bonding for Electrical Systems.

B. Cable trays with electrical power conductors shall be bonded together with splice plates UL listed for grounding purposes or with UL listed bonding jumpers.

C. All grounding clamps shall be UL listed.

3.03 CABLE INSTALLATION:

A. Install cables only when each cable tray run has been completed and inspected.
B. Fasten cables on horizontal runs with cable clamps or cable ties according to NEMA VE 2. Tighten clamps only enough to secure the cable, without indenting the cable jacket. Install cable ties with a tool that includes an automatic pressure-limiting device.
C. Fasten cables on vertical runs to cable trays every 18 inches.

3.04 CONNECTIONS:

A. Connect raceways to cable trays according to requirements in NEMA VE 2.
B. Install UL listed conduit clamps for all conduit connections to cable tray.

3.05 FIELD QUALITY CONTROL:

A. Perform the following tests and inspections:
    1. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements.
    2. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable trays, vibrations, and thermal expansion and contraction conditions, which may cause or have caused damage.
    3. Verify that the number, size, and voltage of cables in cable trays do not exceed that permitted by NFPA 70. Verify that communications or data-processing circuits are installed in separate cable trays from power circuits.
    4. Verify that there are no intruding items such as pipes, hangers, or other equipment in the cable tray.
    5. Remove dust deposits, industrial process materials, trash of any description, and any blockage of tray ventilation.
    6. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorque in suspect areas.
    7. Check for improperly sized or installed bonding jumpers.
    8. Check for missing, incorrect, or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
    9. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable trays. Test entire cable tray system for continuity. Maximum allowable resistance is 1 ohm.
B. Prepare test and inspection reports.

3.06 PROTECTION:

A. Protect installed cable trays and cables.
    1. Install temporary protection for cables in open trays to safeguard exposed cables against falling objects or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials and shall remain in place until the risk of damage is over.
    2. Repair damage to galvanized finishes with zinc-rich coating.
    3. Repair damage to paint finishes with matching touchup coating recommended by cable tray manufacturer.

END OF SECTION 26 05 36

SECTION 26 05 43 – UNDERGROUND DUCT BANKS AND HANDHOLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes the following:
   1. Complete underground duct systems consisting of banks of nonmetallic ducts encased in reinforced concrete, and precast concrete handholes and manholes.
   2. All necessary earth and rock excavation and backfill.
   3. Removal and disposal of all excess excavation material.

1.03 RELATED REQUIREMENTS:

A. Section 26 05 26 – Grounding and Bonding for Electrical Systems.
B. Section 26 05 33 – Raceways, Boxes, Seals, and Fittings for Electrical Systems.
C. Earthwork: Division 31.
D. Concrete: Division 03.

1.04 REFERENCE STANDARDS:

A. American Concrete Institute (ACI):
   1. 318-14 – Building Code Requirements for Structural Concrete.
B. American Society for Testing and Materials (ASTM):
   1. ASTM A48 – Standard Specification for Gray Iron Castings.
   2. ASTM C857 – Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
   3. ASTM C858 – Standard Specification for Underground Precast Concrete Utility Structures.
   4. ASTM C979/C979M – Pigments for Integrally Colored Concrete.
   5. ASTM D4385 – Practice for Classifying Visual Defects in Thermosetting Reinforced Plastic Pultruded Products.
   6. ASTM F512 – Standard Specification for Smooth Wall Polyvinyl Chloride (PVC) Conduit and Fittings for Underground Installation.
   7. F2160 – Standard Specification for Soldi Wall High Density Polyethylene (HDPE) Conduit Based on Controlled Outside Diameter (OD).
C. Federal Specifications:
   1. W-C-1094A – Conduit and Conduit Fittings Plastic, Rigid.
D. National Electrical Manufacturer's Association (NEMA):
   1. NEMA TC 2 – Electrical Polyvinyl Chloride (PVC) Conduit.
   2. NEMA TC 3 – Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
   3. NEMA TC 6 – PVC and ABS Plastic Utilities Duct for Underground Installation.
   4. NEMA TC 8 – Extra Strength PVC Plastic Utilities Duct for Underground Installation.
   5. NEMA TC-14 – Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
   6. TCB 4 - Guidelines for the Selection and Installation of Smooth-Wall Coilable High-Density Polyethylene (HDPE) Conduit for Trench Installation.
E. Underwriters Laboratories, Inc. (UL):
   1. UL 651 – Schedules 40, 80, Type EB and A Rigid PVC Conduit and Fittings
   2. UL 1684 – Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.

1.05 SUBMITTALS:

A. Submit as specified in Division 01 and Section 26 05 10 – General Electrical Requirements for administrative and procedural requirements for submittals.

B. Product Data: Submit the following for each type of product specified and included as minimum:
   1. Data sheets for each product supplied.

C. Shop Drawings: Provide the following as minimum:
   1. Submit shop drawings for fabrication and installation of pre-cast concrete structures and cast-in-place concrete structures including the following:
      a. Steel reinforcement drawings.
      b. Elevation showing openings, pulling irons, cable supports, sump, steps, covers, frames and other details.

D. Closeout Submittals: Final documentation shall include the following as minimum:
   1. Certified "As-Built"/"As-Installed" drawings.
   2. Copies of all approved Product Data.

1.06 QUALITY ASSURANCE:

A. Manufacturer Qualifications:
   1. The manufacturer shall be by a company specializing in providing precast products and services normally associated with precast-concrete construction. Design of precast handholes shall be prepared by a professional engineer licensed in the state associated with the project to conform to the procedures set forth in ACI 318 and applicable standards of this specification and of the size, shape, and details indicated or specified.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Ducts:
   1. Carlon.
   2. Certain-Teed.
   3. Cantex.

B. Duct Spacers:
   1. Carlon.
   2. CertainTeed.
   3. Formex.
   4. Professional Plastics.

C. Concrete Inserts:
   1. Unistrut Corporation.
   2. B Line Systems, Inc.

D. Precast Handholes and Manholes:
   1. Barbour Concrete Co.
   2. Champion Precast Inc.
   3. Old Castle.
   4. Engineer approved equal.

2.02 DUCTS:

A. Conduit Types for Concrete Encasement:
   1. Schedule 40:
      a. Tested to Underwriters' Laboratories, Inc. (UL) Standard UL 651.

b. Schedule 40, Heavy Wall, Thickness conforming to NEMA TC-2 and TC-3.

B. Rated for use with 90°C conductors.
C. Provide with all necessary end bells, couplings, offset couplings, elbows, plugs, and other fittings.
D. Sizes as indicated.
E. Provide PVC coated rigid galvanized steel elbows for all duct termination risers and all non-sweeping 90 degree bends.
F. Provide PVC-Coated Rigid Steel conduit for all risers, through floor, and through wall penetrations.
G. Provide prefabricated duct spacers (trench cards) or interlocking type plastic duct spacers for duct spacing as indicated.

2.03 REINFORCING STEEL:

A. Provide as specified in Division 03.

2.04 CONCRETE:

A. Provide as specified in Division 03 and as indicated.

2.05 PRECAST HANDHOLES AND MANHOLES:

A. Precast concrete with precast concrete base and top slab shall conform to ASTM C857 and C858, and Concrete Division 03.
B. Units shall be constructed monolithically or of assembled sections with tongue-and-groove joints.
C. Concrete top cover shall be removable with recessed galvanized steel lifting inserts. Lifting inserts shall conform to ASTM C857.
D. Provide a flush mounted 30-inch manhole frame and cover shall be cast in the center of the cover.
E. Provide flush mounted plastic coated pulling irons in the walls located opposite of each set of duct openings.
F. Provide duct terminators to accommodate ducts entering as indicated.
G. Provide 8-inch sump hole through base slab.
H. Provide galvanized cable rack supports in each wall.
I. Provide submittal for precast reinforced concrete handholes prior to installation. The submittal shall be sealed by a professional engineer licensed in the state associated with the project.

2.06 CASTINGS:

A. Manhole Frames and Covers:
1. ASTM A48, Class 30B. Cover shall be marked with “Electric.”
2. Watertight bolt-down type with drop handles.
3. Machine-bearing surfaces to provide an even seating.
4. Coat with coal-tar pitch varnish or equivalent coating system.

2.07 WARNING TAPE:

A. Standard detectable warning tape, 4-mil 3 inch wide tape, red with black letters imprinted with "CAUTION BURIED ELECTRIC CABLE BELOW".

2.08 "PULLING IN" ROPE:

A. Nylon or nylon equivalent composite.
B. Minimum average breaking strength: 2000 pounds.

PART 3 - EXECUTION

3.01 EXCAVATION AND TRENCHING FOR DUCT BANKS AND HANDHOLES

A. Perform as specified in Division 31.
B. Work with extreme care near existing underground utilities to avoid damaging them.
C. Pitch the trench uniformly toward handholes or both ways from high points between handholes for required drainage.
D. Notify the Owner's representative for inspection prior to any duct bank installation and prior to concrete placement.

3.02 INSTALLATION:

A. Duct Banks:
   1. Ducts:
      a. Assemble as follows:
         (1) On spacers to maintain horizontal and vertical separation indicated.
         (2) With joints in adjacent ducts staggered.
         (3) All joints watertight by application of joint sealer compound furnished by duct manufacturer.
         (4) No reinforcing steel or other ferrous material between individual ducts.
      b. Securely tie overall at 5 foot or closer intervals as required.
      c. Secure to anchors after assembling to prevent flotation when placing concrete.
      d. Slope towards handholes with a minimum continuous slope of 1/2 percent.
      e. Align ducts for each 100 feet not greater than 4 inches horizontal.
      f. All risers shall be PVC coated rigid galvanized steel as specified.
      g. All elbows at duct termination risers and non-sweeping bends shall be PVC coated rigid galvanized steel as specified.
      h. Install end bells flush with face of concrete at each handhole and termination point unless indicated otherwise.
      i. Immediately after cleaning, install a "pulling in" rope in each duct, and plug each end of all ducts.
   2. Install detectable warning tape along the entire length of duct banks at a depth of 12 inches below grade or as indicated on drawings.
   3. Reinforcing:
      a. Duct banks shall be steel reinforced at the following locations:
         (1) Within 10-ft of and under all roadways and parking areas.
         (2) Within 10-ft of all locations where duct bank ties into or passes under a structure including buildings and manholes and handholes.
         (3) Other locations as indicated.
      b. Where duct banks terminate at vertical concrete structures (e.g. manholes and handholes), drill and epoxy longitudinal duct bank reinforcement into the structure.
   4. Concrete:
      a. Concrete shall be installed for all duct bank.
      b. Do not place prior to inspection and approval of duct and reinforcing installation by Engineer.
      c. Place as specified in Division 03.
      d. Mark concrete using red sprinkled (dry shake) pigmentation or by a red color admixture in concrete according to ASTM C979/C979M.
B. Precast Handholes and Manholes:

1. Install a minimum of 6 inches of compacted granular material on undisturbed soil below handhole.
2. Place at location and alignment as indicated.
3. Top slab and handhole and manhole shall be set flush with finished grade.
4. Install conduits as indicated.
5. Provide sufficient cable slack during installation to rack and secure cabling around the handhole walls.

C. Duct and Conduit Sealing:
1. Seal the ducts and conduits at building entrances and at outdoor equipment with a suitable non-hardening compound to prevent the entrance of moisture and gases. Refer to Section 26 05 33 for duct seal requirements.

3.03 BACKFILLING:

A. Provide backfill and compaction as specified in Division 31.

3.04 ADJUSTING AND CLEANING:

A. Rod and clean all ducts with suitable cleaners, swabs, and mandrels after completion of the duct bank.

END OF SECTION 26 05 43

SECTION 26 05 48 – VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes the following:
   1. Isolation pads.
   2. Spring isolators.
   3. Restrained spring isolators.
   4. Channel support systems.
   5. Restraint cables.
   6. Hanger rod stiffeners.
   7. Anchorage bushings and washers.

B. Related Sections include the following:
   1. Section 26 05 33 - Raceways, Boxes, Seals, and Fittings for Electrical Systems: For commonly used electrical supports and hardware materials and installation requirements.

1.03 REFERENCE STANDARDS:

A. American Society for Testing and Materials (ASTM)
   1. ASTM-A492, “Standard Specification for Stainless Steel Rope Wire”
   2. ASTM A603, “Standard Specification for Zinc-Coated Steel Structural Wire Rope”
   3. ASTM E488, “Standard Test Methods for Strength of Anchors in Concrete Elements”

B. American Welding Society
   1. AWS D1.1/D1.1M, “Structural Welding Code – Steel”.

C. International Building Code (IBC)

D. International Code Council (ICC)
   1. ICC-ES, “ICC Evaluation Services”

E. Metal Framing Manufacturers Association (MFMA)
   1. MFMA-3, “Metal Framing Standards Publication”

F. National Fire Protection Association (NFPA).
   1. NFPA 70, “National Electrical Code (NEC)”.

G. Nationally Recognized Testing Laboratory (NRTL)

H. Occupational Safety and Health Administration(OSHA)
   1. OSHA 29 CFR 1910.7, “Definition and requirements for a nationally recognized testing laboratory”.

I. Office of Statewide Health Planning and Development for the State of California (OSHPD)

1.04 DEFINITIONS:

A. The IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.05 PERFORMANCE REQUIREMENTS:

A. Seismic-Restraint Loading:
   1. Site Class as Defined in the IBC: D.
   2. Assigned Seismic Category : B.
      a. Importance Factor, Ie = 1.25.
      b. Mapped Special Acceleration Parameters:
         (1) $S_s = 0.091$
         (2) $S_1 = 0.067$
      c. Design Acceleration Parameters:
         (1) $S_{ds} = 0.097$
         (2) $S_{d1} = 0.106$

1.06 SUBMITTALS:

A. Submit as specified in Division 01 and Section 26 05 10 – General Electrical Requirements for administrative and procedural requirements for submittals.

B. Product Data: For the following:
   1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
   2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
      a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
      b. Annotate to indicate application of each product submitted and compliance with requirements.
   3. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.

C. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators and seismic restraints.
      a. Coordinate design calculations with wind-load calculations required for equipment mounted outdoors. Comply with requirements in other Division 26 Sections for equipment mounted outdoors.
   2. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.
   3. Field-fabricated supports.
   4. Seismic-Restraint Details:
      a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
      b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.

c. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

D. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.
E. Qualification Data: For professional engineer and testing agency.
F. Welding certificates.
G. Field quality-control test reports.

1.07 QUALITY ASSURANCE:

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M.
D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.
E. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 VIBRATION ISOLATORS:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Ace Mountings Co., Inc.
   2. Amber/Booth Company, Inc.
   3. California Dynamics Corporation.
   4. Isolation Technology, Inc.
   5. Kinetics Noise Control.
   6. Mason Industries.
   7. Vibration Eliminator Co., Inc.
   8. Vibration Isolation.
   9. Vibration Mountings & Controls, Inc.
B. Pads : Arrange in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
   1. Resilient Material: Oil- and water-resistant neoprene.
C. Spring Isolators : Freestanding, laterally stable, open-spring isolators.
   1. Outside Spring Diameter: Not less than 80% of the compressed height of the spring at rated load.

2. Minimum Additional Travel: 50% of the required deflection at rated load.
3. Lateral Stiffness: More than 80% of rated vertical stiffness.
4. Overload Capacity: Support 200% of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- (6-mm-) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa).
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

D. Restrained Spring Isolators : Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.
1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Seismic or limit-stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80% of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50% of the required deflection at rated load.
5. Lateral Stiffness: More than 80% of rated vertical stiffness.
6. Overload Capacity: Support 200% of rated load, fully compressed, without deformation or failure.

2.02 SEISMIC-RESTRAINT DEVICES:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. Cooper B-Line, Inc.; a division of Cooper Industries.
4. Hilti Inc.
5. Loos & Co.; Seismic Earthquake Division.
6. Mason Industries.
7. TOLCO Incorporated; a brand of NIBCO INC.
8. Unistrut; Tyco International, Ltd.

B. General Requirements for Restraint Components: Rated strengths, features, and application requirements shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

D. Restraint Cables: ASTM A492 stainless-steel cables with end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
E. Hanger Rod Stiffener: Stainless steel tube or stainless steel slotted-support-system sleeve with internally bolted connections to hanger rod. Do not weld stiffeners to rods.
F. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchors and studs.
G. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices.
H. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
I. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E488. Minimum length of eight times diameter.
J. Adhesive Anchor: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E488.

2.03 FACTORY FINISHES:
A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

PART 3 - EXECUTION

3.01 EXAMINATION:
A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.
B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLICATIONS:
A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
B. Hanger Rod Stiffeners: Install hanger rod stiffeners where required to prevent buckling of hanger rods due to seismic forces.
C. Strength of Support and Seismic-Restraint Assemblies: Select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.03 SEISMIC-RESTRAINT DEVICE INSTALLATION:
A. Equipment and Hanger Restraints:
1. Install restrained isolators on electrical equipment.

2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

D. Drilled-in Anchors:
1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.04 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION:

A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.05 FIELD QUALITY CONTROL:

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Perform tests and inspections.

C. Tests and Inspections:
1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Structural Engineer, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.
3. Obtain Structural Engineer's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Structural Engineer.

5. Test to 90% of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.
9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

D. Remove and replace malfunctioning units and retest as specified above.
E. Prepare test and inspection reports.

3.06 ADJUSTING:

A. Adjust isolators after isolated equipment is at operating weight.
B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
C. Adjust active height of spring isolators.
D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 26 05 48

SECTION 26 05 53 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section specifies electrical identification work including the following:
   1. Buried cable and duct bank warnings.
   2. Electrical power, control, and communication conductors (and raceways).
   3. Operational instructions and warnings.
   4. Danger, caution and warning signs.
   5. Equipment/system identification nameplates.
   6. Source of supply and circuit identification labels.

1.03 RELATED REQUIREMENTS:

A. Section 26 05 73 – Power System Studies.

1.04 REFERENCE STANDARDS:

A. Applicable Standards: Comply with the applicable requirements of the following standards.
   1. American Society of Mechanical Engineers (ASME):
      a. A13.1 - Scheme for the Identification of Piping Systems.
   2. Federal Specifications (FS):
      a. FS L-P-387 - Polyethylene Low and Medium Density – Molding Material (for designation plates).
   3. National Electrical Manufacturers Association (NEMA):
      a. Z535.1 - Safety Colors.
      b. Z535.4 - Product Safety Signs and Labels.
   4. National Fire Protection Association (NFPA):
      a. 70 - National Electrical Code (NEC), as applicable to installation of identifying labels and markers for wiring and equipment.
      b. 70E - Electrical Safety in the Workplace.
      c. 72 - National Electric Safety Code (NESC) – IEEE C2.
   5. Occupational Safety and Health Administration (OSHA):
      a. 29 CFR 1910.144 - Safety Color Code for Marking Physical Hazards.
      b. 29 CFR 1910.145 - Specifications for Accident Prevention Signs and Tags.
   6. Underwriters Laboratories (UL), pertaining to electrical identification systems:
      a. 969 - Standards for Marking and Labeling Systems.

1.05 SUBMITTALS:

A. Refer to Division 01 and Section 26 05 10 - General Electrical Requirements for administrative and procedural requirements for submittals.
B. Includes, but not limited to, the following:
   1. Product Data: Submit manufacturer's data on electrical identification materials and products.

2. Samples: Submit samples of each color, lettering style, and other graphic representation required for each identification material or system.

1.06 QUALITY ASSURANCE:

A. Comply with ASME A13.1 and IEEE C2.
B. Comply with NFPA 70.
C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
D. Comply with NEMA Z535.4 for safety signs and labels.
E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.07 COORDINATION:

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
C. Coordinate installation of identifying devices with location of access panels and doors.
D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Subject to compliance with requirements, provide electrical identification products of one of the following (for each type marker):
1. Brady Worldwide, Inc.
2. Panduit Corp.
3. Seton Identification Products.
4. Thomas & Betts Corp.

2.02 ELECTRICAL IDENTIFICATION MATERIALS:

A. General: Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, selection is Installer's option; but provide single selection for each application.
B. Orange "Emergency" and "( )-VOLT" Conduit, Equipment, Box, and Cable Tray Markers:
1. General: Self-adhesive vinyl tape marker not less than 3 mils thick. Provide 1-1/8 inch wide by 4-1/2 inch long marker for 2 inch and smaller conduit. Provide 2-1/4 inch wide by 9 inch long marker for 2-1/2 inch and larger conduit and all cable tray. Except as otherwise indicated, provide black lettering which indicates highest voltage of cables(s) in conduit or cable tray. Provide black lettering that indicates "Emergency" power circuit is in conduit or cable tray.
2. Colors: Unless otherwise indicated or required by governing regulations, provide orange background tape marker.
C. Underground Type Plastic Line Marker:
1. General: Permanent, bright-colored, continuous-printed plastic tape marker, intended for direct-burial service; not less than 6 inches wide by 4 mils thick. Provide tape marker

with printing which most accurately indicates type of service of buried cable or duct bank. (Provide embedded continuous metallic strip or core when used with non-metallic conduit and fiber optic cable to enable locating.)

D. Wire/Cable Identification Bands:
   1. General: Vinyl self-adhesive cable/conductor markers of wrap-around type, print-on type with clear plastic self-adhesive cover flap; numbered to show circuit identification number indicated on Drawings or Shop Drawings.

E. Plasticized Tags:
   1. General: Preprinted or partially preprinted accident-prevention and operational tags, on plasticized card stock with matt finish suitable for writing, approximately 3-1/4 inches by 5-5/8 inches, with brass grommets and wire fasteners, and with appropriate preprinted wording, including large-size primary wording, e.g., "DANGER, DO NOT OPERATE." Tags shall comply with OSHA requirements.

F. Self-Adhesive Plastic or Vinyl Signs:
   1. General: Self-adhesive or pressure-sensitive, preprinted, flexible vinyl signs for operational instructions and warnings; of sizes suitable for application areas and adequate for visibility, with proper wording for each application.
      a. Colors: Unless otherwise indicated or required by governing regulations, provide white signs with black lettering.

G. Baked Enamel "Danger" Signs:
   1. "DANGER" signs of baked enamel finish on 20-gauge minimum aluminum; of standard safety red, safety black, and safety white as defined by NEMA Z535.1; 14 inches by 10 inches size, except where 10 inches by 7 inches is the largest size which can be applied where needed, and except where larger size is needed for adequate vision; with recognized standard explanation wording, e.g., "_____VOLTS, KEEP AWAY." Sign shall conform to OSHA and NEMA Z535.4.

H. Baked Enamel "Caution" Signs:
   1. "CAUTION" signs of baked enamel finish on 20-gauge minimum aluminum; of standard safety yellow with safety black letters; 14 inches by 10 inches size, except where 10 inches by 7 inches is the largest size which can be applied where needed, and except where larger size is needed for adequate vision; with recognized standard explanation wording, e.g., "Caution for Ear Protection Required in this Area."

I. Based Enamel "WARNING" Signs:
   1. "WARNING" signs of baked enamel finish on 20-gauge minimum aluminum; of standard safety orange with safety black letters; 14 inches by 10 inches size, except where 10 inches by 7 inches is largest size that can be applied where needed and except where larger size is needed for adequate vision; with recognized standard explanation wording. Sign shall conform to OSHA and NEMA Z535.4.

J. Engraved Plastic-Laminate Nameplates:
   1. General: Engraving stock melamine plastic laminate nameplates, in sizes (minimum height of characters shall be 1/8 inch) and thicknesses specified or indicated, engraved with engraver's standard letter style of sizes and wording indicated, white face and black core plies (letter color) except as otherwise indicated, specified or required. Colors shall comply with OSHA and NEMA Z535.1. Nameplate shall be punched for mechanical fastening except where adhesive mounting is necessary because of the surface type it is mounted to, or where mechanical fastening will compromise the enclosure protection ratings.
      a. Thickness: 1/16-inch, for units up to 20 square inches or 8 inch length; 1/8-inch for larger units.

b. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate surface it is mounted to.

2. Lettering and Graphics:
   a. Coordinate names, abbreviations, and other designations used in electric identification work with corresponding designations shown, specified, or scheduled. Provide numbers, lettering, and wording as indicated or, if not otherwise indicated, as recommended by manufacturer or as required for proper identification and operation/maintenance of electrical systems and equipment. Comply with ASME A13.1 pertaining to minimum sizes for letters and numbers. Comply with OSHA requirements. Comply with design requirements of NEMA Z535.4.

PART 3 - EXECUTION

3.01 APPLICATION AND INSTALLATION:

A. General Installation Requirements:
   1. Install electrical identification products as indicated, in accordance with manufacturer's written instructions and requirements of NEC.
   2. Coordination: Where identification is to be applied to surfaces which require finish painting, install identification after completion of painting.
   3. Regulations: Comply with governing regulations and requests of governing authorities for identification of electrical work.

B. Conduit and Cable Tray Identification Markers:
   1. General: Where electrical conduit is exposed, apply identification markers on electrical conduit at 20 foot intervals (visible from the floor) and within 3 feet of all panelboards, switchboards, switchgear, automatic transfer switches, emergency generators, substations, switches, devices, and circuit breakers (readily visible when standing in front of equipment). Identification on cable tray shall be on outside of both sidewalls at 20 foot intervals.

C. Underground Cable, Conduit, and Duct Bank Identification Marker:
   1. General: During back-filling/top-soiling of each exterior underground direct buried electrical, signal or communication cable, conduit and duct bank, install continuous underground-type plastic line marker, located directly over the direct buried cable, conduit or duct bank at 12 inches below finished grade. Where multiple small direct buried cables are buried in a common trench and do not exceed an overall width of 16 inches, install a single line marker.
   2. Install line marker for every cable below grade, regardless of whether direct-buried, protected in conduit, or conduit in duct bank.

D. Wire/Cable Identification Bands:
   1. General: Apply cable/conductor identification bands, including circuit number, on each wire/cable in each box/enclosure/cabinet where wires of more than one circuit or communication/signal system are present. Match identification with marking system used in panelboards, shop drawings, contract documents, and similar previously established identification for project's electrical work.

E. Operational Identification and Warning Plasticized Tags and Metal Signs and Plastic Signs:
   1. General: Wherever reasonably required to ensure safe and efficient operation and maintenance of electrical systems, and electrically connected mechanical systems and general systems and equipment, including prevention of misuse of electrical facilities by unauthorized personnel, install signs with instruction or warnings.

2. When signs are installed on switches, outlets, controls, devices and covers of electrical enclosures they may be self-adhesive vinyl or plastic.
3. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for intended purposes.
4. Where switchboards, switchgear, motor control centers, and panelboard are supplied by a feeder, provide an informational sign indicating each device or piece of equipment from where the power originates.
5. Receptacle outlets and switches shall include a source of supply circuit label that includes the panelboard tag and circuit number. E.g “ADM-PNL-040-01”.

F. Danger Signs:
1. General: In addition to installation of danger signs specified, indicated, and required by governing regulations and authorities, install appropriate danger signs at locations indicated and at locations subsequently identified by Installer of electrical work as constituting similar dangers for persons in or about Project.
2. XXXX Volts: Install danger signs (with actual circuit voltage) on all building doors, substations, switchgear, switchboards, panelboards switches, circuit breakers, etc., wherever it is possible (under any circumstances) for persons to come into contact with electrical voltages to ground greater than 277V.
3. Critical Switches/Controls: Install danger signs on switches and similar controls, regardless of whether concealed or locked up, where untimely or inadvertent operation (by anyone) could result in significant danger to persons or damage to or loss of property.
4. Provide the following danger sign on the equipment indicated:
   a. "Danger This Machine Starts Automatically" on all fire pumps, air compressors and emergency generators.
5. Provide the following danger signs on the doors leading to the equipment indicated:
   a. "Danger Hearing Protection Required" on all emergency generator room doors.
   b. "Danger: No Smoking, Matches or Open Flames" on all emergency generator room doors (, personnel doors opening into aircraft hangar,) and battery room doors.

G. Warning Signs:
1. Provide an orange background sign with black letters reading "WARNING: LOAD SIDE OF SWITCH MAY BE ENERGIZED BY BACKFEED" on all tie switches and tie circuit breakers.
2. Provide cable tray warning signs with 1-1/2-inch high black letters on an orange background that reads: "Warning! Not to be used as a walkway, ladder or support for ladders for personnel." Provide on each side of cable tray at 10-foot intervals, visible from the floor below.
3. Provide Arc Flash Warning signs on electrical equipment such as switchboards, switchgear, panelboards, industrial control panels, motor control centers and meter socket enclosures that are likely to require examination, adjustment, servicing, or maintenance while energized. Marking shall be permanently affixed and of a durable nature to withstand the environment within which it is installed.
4. Provide Available Fault Current Warning signs on electrical equipment as specified in Section 26 05 73. Label shall include possible incident energy exposure within arc flash boundary in front of equipment as well as meet NFPA 70E for additional content.

H. Caution Signs:
1. Provide yellow background caution signs with black letters on the doors leading to the equipment indicated:
   a. "Caution Ear Protection Required in this Area" on all emergency generator room doors.

2. Provide the following yellow background caution sign with black letters on all automatic transfer switches, switches, circuit breakers, equipment, and emergency panelboards that are energized by the emergency power system:
   a. "Caution Automatically Energized by the Emergency Power System."

I. Equipment/System Identification Nameplates:

1. General: Install engraved plastic-laminated nameplates on each major unit of electrical equipment in the building; including central or master unit of each electrical system including communication/control/signal/alarm systems, unless unit is specified with its own self-explanatory identification or signal system. Except as otherwise indicated, provide single line of text, 1/2-inch high lettering on 1-1/2-inch high sign (2 inches high were two lines are required), black lettering on white field. Provide text matching terminology and numbering of the contract documents and shop drawings. Nameplate shall include unit designation, normal source circuit number ("Fed from..."), circuit voltage, and other data specifically indicated. Nameplate shall indicate normal source circuit number ("Fed from..."), and emergency source circuit number ("Fed from..."), when the equipment is a transfer switch or fed directly from a transfer switch. Provide nameplates for each unit of the following categories of electrical work:
   a. Switchboards, panelboards, electrical cabinets, and enclosures. (Include main bus ampacity on the nameplate.)
   b. Access panel/doors to electrical facilities.
   c. Major electrical switchgear (Include main bus ampacity on the nameplate.)
   d. Electrical substations (Include main bus ampacity on the nameplate.)
   e. Motor control centers, (Include main bus ampacity on the nameplate.) and individual motor starters.
   f. Disconnect switches.
   g. Push buttons, selector switches, indicating lights. (Circuit number and voltage not required on nameplate).
   h. Power transfer equipment: Contactors and transfer switches.
   i. Lighting control equipment and contactors.
   j. Remote controlled switches, dimmer modules, and control devices.
   k. Transformers (Include primary voltage, secondary voltage, number of phases, feeder, and panelboards or equipment supplied by the secondary.)
   l. Inverters. (Include input voltage, output voltage, number of input phases.)
   m. Rectifiers. (Include input voltage, output voltage, and number of phases.)
   n. Frequency converters. (Include input and output frequency.)
   o. Battery racks.
   p. Power generating units.
   q. Telephone cabinets and switching equipment. (Circuit number and voltage not required on nameplate.)
   r. Clock/program master equipment.
   s. TV/audio monitoring master station.
   t. Fire alarm and mass notification systems master station.
   u. Security monitoring master station.
   v. Public address system.
   w. Uninterruptible power supplies (UPS).
   x. Wireway used as auxiliary gutter tap locations with circuit number of circuit being tapped. Provide on outside of wireway.
   y. Provide conduit markers on all conduit and pull boxes that contain medium voltage conductors and indicate voltage.

z. Provide "EMERGENCY" conduit markers on all conduit and pull boxes that contain emergency power conductors.
aa. Switchboard main switches and circuit breakers.

2. Install markers, tags, nameplates, and signs at locations indicated or, where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of equipment. Secure the identification with fasteners, except use adhesive where fasteners should not or cannot penetrate surface.

END OF SECTION 26 05 53

SECTION 26 05 73 – POWER SYSTEM STUDIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes computer-based fault-current, arc flash hazard analysis, and overcurrent protective device coordination studies.

B. The study shall be provided for the electrical distribution system and include all power sources (normal and emergency) down to the branch circuit overcurrent protective device and equipment.

1.03 RELATED REQUIREMENTS:

A. Section 26 05 53 – Identification for Electrical Systems.

1.04 REFERENCE STANDARDS:

A. The study shall be completed in accordance with the latest edition of the following standards:
   1. IEEE Standard 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems (IEEE Buff Book).
   2. IEEE 399 – Recommended Practice for Industrial and Commercial Power Systems Analysis (Brown Book).

B. The arc flash hazard analysis shall be completed in accordance with latest editions of the following standards:
   1. IEEE Standard 1584 – Guide for Performing Arc-Flash Hazard Calculations.
   2. NFPA70E – Standard for Electrical Safety Requirements for Employee Workplaces.

1.05 PERFORMANCE/DESIGN CRITERIA:

A. The study shall calculate the available short-circuit current at each point in the electrical distribution system. The overcurrent protective devices shall have an interrupting rating equal to or greater than the available short-circuit current at the point of application.

B. The study shall examine proper protection of electrical system components and utilization equipment such that the equipment has a sufficient short-circuit current rating.

C. The overcurrent protective devices shall be analyzed for selective coordination. This analysis shall identify any potential selective coordination problems up to the available short-circuit current. Any areas where the overcurrent protective devices are not selectively coordinated shall be explicitly noted and recommendations shall be made to achieve selective coordination.

D. The study shall include an arc flash hazard analysis for electrical distribution equipment. The analysis shall determine the flash protection boundary, incident energy, and required level of personal protective equipment (PPE) for workers at the electrical distribution equipment. The electrical distribution equipment shall be labeled with this information in accordance with codes and standards.

1.06 SUBMITTALS:

A. Submit as specified in Division 01 and Section 26 05 10 – General Electrical Requirements for administrative and procedural requirements for submittals.

B. Product Data: Submit computer analysis software to be used for the specified studies.

C. The results of the studies shall be summarized in report format with explanation of how to interpret the data.
D. As a minimum the report shall include the following:
   1. Short Circuit Study:
      a. A printout of input data, calculated results and an explanation of how to interpret the data.
      b. A one-line diagram identifying all bus locations and the maximum available three-phase and line-to-ground short-circuit currents at each bus.
      c. A bus-to-bus listing of the maximum available short-circuit current expressed in RMS symmetrical amperes and the X over R ratio of that fault current.
      d. A table of specified equipment short-circuit ratings versus calculated short-circuit current values with notations of locations where are specified equipment short-circuit ratings are less or greater than required at the point of application.
      e. An analysis of the results in which any overrating or inadequacies shall be called to the attention of the Engineer and recommendations made for improvements.
   2. Protective Device Coordination Study:
      a. Time-current characteristic curve drawings on log-log printouts which illustrate:
         (1) The recommended settings for all adjustable relays, overcurrent protective devices and ground fault protective devices provided for the project.
         (2) The key or limiting overcurrent device characteristics, load characteristics, and protection requirements affecting the settings or ratings of the overcurrent protective devices supplied.
         (3) The degree of selective coordination achieved with the overcurrent protective devices supplied.
      b. A tabulation of the recommended settings for all adjustable relays, overcurrent protective devices and ground fault protective devices and type selections for fuse protective devices supplied.
      c. An analysis of the results in which any inadequacies related to selective coordination shall be called to the attention of the Engineer with recommendations for improved coordination.
   3. Arc Flash Hazard Analysis Study:
      a. The following for each piece of switchgear, switchboard, motor control center, distribution panel, panelboard, automatic transfer switch, enclosed circuit breaker, disconnect switch, and equipment control panel installed on the project:
         (1) Minimum Arc Fault Current, Arc Flash Boundary and Arc Fault Incident Energy Level (cal/cm2).
         (2) Risk of personnel injury as a result of exposure to incident energy released during an arc flash event.
         (3) Appropriate ratings of personal protective equipment (PPE).
         (4) The Flash Protection Boundary (approach limit distance).
         (5) Information for equipment specific arc-flash hazard warning labels.
      b. Recommendations and methods to mitigate the hazard risk, where applicable, in order to reduce PPE requirements.
   4. Cut sheets and submittal information on the Arc Flash warning labels being provided. Coordinate with Section 26 05 53 – Identification for Electrical Systems.

1.07 QUALITY ASSURANCE:

A. The company and individual(s) performing the study shall have experience in power system analysis and completed projects of similar size and scope. The individual(s) performing the

study shall be a registered Professional Engineer in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of Engineer.

B. The company performing the study shall have the capability and experience to provide assistance during system start up.
C. Comply with IEEE 242 for short-circuit currents and coordination time intervals.
D. Comply with IEEE 399 for general study procedures.
E. Comply with IEEE 1584 or NFPA 70E for arc flash hazard analysis.

1.08 SEQUENCING AND SCHEDULING:

A. The selection of the company and the individual performing the study shall be submitted and approved by the design Engineer prior to the start of the study.
B. The study shall be completed and submitted and approved prior to the facility startup.

PART 2 - PRODUCTS

2.01 GENERAL:

A. The short circuit, protective device coordination, and flash hazard analysis study shall be completed with the computer software program SKM Power Tools. Other computer software programs shall not be allowed.
B. The Contractor shall provide all lengths of cable for use in the studies.
C. All equipment ratings, make, and model information shall be obtained by the Contractor from the equipment manufacturers and/or suppliers and provided for use in the studies.
D. Information on the electrical service including available fault current, transformer impedance, primary fuse ratings, primary cable size, and any other required information shall be obtained from the local utility for inclusion in the studies.
E. The study shall be inclusive of the entire electrical distribution system from all power sources (normal and emergency) down to the branch circuit overcurrent protective device and equipment.
F. Separate calculations shall be performed for both the normal and emergency sources. Device settings shall be based upon the normal source study.
G. The Arc Flash Study shall be based on the study that results in the highest incident energy.

2.02 SHORT CIRCUIT COORDINATION STUDY:

A. The short circuit study shall as minimum include the following:
    1. A schematic one-line drawing of the entire electrical system included in the study, from the power company system including the point of delivery, to each primary transformer, and including all main secondary buses of each transformer included in the study. Secondary buses shall include multiple secondary transformations within the scope of the study. Each device shall be identified using project assigned identification labels. Each motor 10 hp and larger shall be shown and identified. Each bus shall be assigned an identification number.
    2. Source voltage and impedance data shall be given in the analysis, including reactance and resistance in OHMS to the source, and available symmetrical and asymmetrical short circuit amperes at the point of delivery of electrical power. Short circuit amperes shall be based on an assumed bolted three-phase and line-to-ground short circuits.
    3. At each bus, including buses of all primary protective and switching devices, primary and secondary of all transformers, all secondary main and feeder breakers, and all secondary devices and panelboards within the scope of the study, the following shall be calculated:

a. Symmetrical RMS short circuit amperes, calculated using total source and motor contribution reactance and resistance values.
b. Asymmetrical average 3 phase RMS amperes at 1/2 cycle, calculated using actual total source and motor contribution X/R ratio.
c. Reactance ("X") and Resistance ("R") in OHMS at the voltage of the device being examined, including both The Power Company source and all motor contributions.

4. Calculation sheets for cable sections shall indicate voltage, wire size, cable length, reactance and resistance of the section in OHMS and total "X" and "R" to the source.
5. Calculation sheets for transformer sections shall indicate transformer kVA, secondary voltage, percent impedance, percent reactance, percent resistance, and total "X" and "R" value in OHMS at the secondary voltage to source, including The Power Company source impedance plus any primary motor contribution.
6. Calculation sheets for busway and miscellaneous devices shall provide all pertinent parameters including operating voltage, section "X" and "R" values in OHMS, and total "X" and "R" values in OHMS to the source, based on source impedance plus any motor contribution.
7. Bus summary sheets shall be provided giving consecutive bus numbers, description, voltage, "X" and "R" values in OHMS including The Power Company plus all motor contributions, symmetrical and asymmetrical short circuit amperes, X/R ration, and asymmetrical factor.
8. Motor summary sheets shall provide motor description and all pertinent motor data including subtransient reactance for each motor 10 hp and larger. Symmetrical short circuit amperes shall be given for each motor at the motor terminals.

2.03 PROTECTIVE DEVICE COORDINATION STUDY:

A. The protective device coordination study shall as a minimum include the following:
1. Time-current coordination plots shall be made on log-log software generated plots and shall graphically indicate the coordination proposed for all of the key systems. The plots shall include complete titles, one-line diagram and legend.
2. The Power Company's relay, fuse, or protective device shall be plotted with all load protective devices at the same voltage.
3. Transformer primary protective device, transformer magnetic inrush, transformer ANSI withstand points, secondary voltage fuse or circuit breaker and largest feeder fuse or circuit breaker shall be plotted at the secondary voltage. Circuit breaker curves shall include complete operating bands, terminating with the appropriate available short circuit current. Fuse curves shall be identified as either total clearing time or damage time as applicable.
4. Low voltage circuit breakers shall have instantaneous, short delay, long-time pick-up and ground fault trip settings and ground fault ampere and time delay settings identified as plotted. Sensor or monitor rating shall be stated for each circuit breaker. All regions of the circuit breaker curve shall be identified.
5. The coordination plots shall include significant motor starting characteristics and large motor protective devices.
6. Feeder circuit breakers shall have the time-damage curve of the feeder conductors plotted to indicate protection of the conductor insulation at the total clearing time of the circuit breaker or fuse. The time-damage point shall be calculated for the specific parameters of conductor insulation used, with average 3 phase RMS asymmetrical amperes as 1/2 cycle calculated using actual resistance and reactance values of the source plus all motor contributions which exist at the load end of the feeder conductors.

7. A determination of settings or ratings for the overcurrent and ground fault protective devices supplied. Where necessary, an appropriate compromise shall be made between selective coordination and service continuity with selective coordination considered more important than system service continuity. The time-current coordination analysis shall be performed with the aid appropriate software.
8. A summary tabulation shall be provided listing manufacturer and type for all overcurrent protective devices and all recommended settings of each adjustable band included in each device.
9. Settings of protective devices shall minimize the arc flash hazard while maintaining selective coordination.

2.04 ARC FLASH HAZARD ANALYSIS STUDY:

A. The arc flash hazard analysis study shall as minimum include the following:
   1. Calculate incident energy levels and flash protection boundaries at all relevant equipment busses based on available short-circuit current, protective device clearing time and other applicable one-line diagram information.
   2. As a minimum, the following shall be calculated for each piece of switchgear, switchboard, motor control center, distribution panel, panelboard, automatic transfer switch, enclosed circuit breaker, disconnect switch, and equipment control panel to be installed on the project:
      a. Minimum Arc Fault Current, Arc Flash Boundary and Arc Fault Rating (cal/cm2).
      b. Risk of personnel injury as a result of exposure to incident energy released during an arc flash event.
      c. The appropriate ratings of personal protective equipment (PPE).
      d. The Flash Protection Boundary (approach limit distance) as required by NFPA 70E.
   3. Provide equipment specific arc-flash hazard warning label requirements per NEC Section 110.16, including all information specified to be provided on individual equipment warning labels.
   4. Provide recommendations and incorporate with the protective coordination study methods to mitigate the hazard risk, where applicable, in order to reduce PPE requirements.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are as indicated on Drawings.
B. Proceed with short circuit and coordination study only after relevant equipment submittals have been approved and assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.02 PROTECTIVE DEVICE SELECTION AND SETTINGS:

A. Prior to project Substantial Completion, the Contractor shall set all relays, overcurrent devices and ground fault protection devices and confirm selection of fuse overcurrent devices as follows:
   1. Relays: Reset all adjustable relay settings from the factory default settings to the settings recommended in the studies specified in this Section.

2. Circuit Breakers and Motor Circuit Protectors: Reset all adjustable trip settings from the factory default settings to the settings recommended in the studies specified in this Section.
3. Ground Fault Protection Devices: Reset all adjustable device settings from the factory default settings to the settings recommended in the studies specified in this Section.
4. Fuses: Confirm that fuse types installed on the project are as recommended in the studies specified in this Section.

B. Certification: Prior to project Substantial Completion, the Contractor shall submit a document certifying that the Contractor has completed the settings and selection scope specified to the Engineer.

3.03 INSTALLATION:

A. Install arc flash and available fault current labels on equipment as specified in Section 26 05 53 – Identification for Electrical Systems.

END OF SECTION 26 05 73

SECTION 26 09 23 - LIGHTING CONTROL EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. Types of lighting control equipment specified in this Section include the following:
   1. Time controlled switches.
   2. Photo sensor controls.
   3. Standalone daylight-harvesting switching controls.
   4. Indoor occupancy sensors.
   5. Emergency shunt relays.

1.03 RELATED REQUIREMENTS:

A. Division 26 Sections for wires/cables, electrical boxes, fittings, and wiring devices which are required in conjunction with lighting control equipment work.
B. Section 26 05 10 – General Electrical Requirements.
C. Section 26 27 26 – Wiring Devices.

1.04 REFERENCE STANDARDS:

A. Applicable Standards: Comply with applicable requirements of the following standards.
   1. Electronic Industries Association (EIA):
      a. RS-232 - Interface between data terminal and equipment data communication equipment employing serial binary data interchange.
      b. RS-453 - Dimensional, Mechanical, and Electrical Characteristics Defining Phone Plugs and Jacks.
   2. National Electrical Manufacturers' Association (NEMA):
      a. Pub. No. 250 - Enclosures for Electrical Equipment (1,000V Maximum).
   3. National Fire Protection Association (NFPA):
      a. 70 - National Electrical Code (NEC): Comply with applicable local electrical code requirements of the authority having jurisdiction and NEC as applicable to construction and installation of lighting control and communications equipment.
   4. Underwriters Laboratories (UL): Provide lighting control equipment and components which are UL-listed and labeled.
      a. 486A - Wire Connectors and Soldering Lugs for Use with Copper Conductors.

1.05 SUBMITTALS:

A. Refer to Division 01 and Section 26 05 10 – General Electrical Requirements for administrative and procedural requirements for submittals.
B. Includes, but not limited to, the following:
   1. Product Data: Submit manufacturer's data on lighting control equipment and components.
   2. Device plates and plate color and material.
   3. Ballasts and lamp combinations compatible with dimmers.
   4. Wiring Diagrams: Power, signal, and control wiring.

5. Shop Drawings: Submit dimensioned drawings of lighting control equipment and components including, but not necessarily limited to, programmable controllers, transceivers, printers, relays, sensors, contactors, and switches. Provide floor plans that clearly identify each controlled zone, including the address code of each zone.
6. Wiring Diagrams: Submit wiring diagrams for lighting control equipment and components showing control wiring and interconnection wiring, including connections to equipment components and electrical power. Differentiate between portions of wiring that are manufacturer factory installed and portions that are field installed.
7. Agreement to Maintain: Prior to time of final acceptance, the Contractor shall submit four copies of an agreement for continued service and maintenance of lighting control equipment for Owner's possible acceptance. Offer terms and conditions for furnishing parts and providing continued testing and servicing, including replacement of materials and equipment, for a one year period with an option for renewal of the Agreement by the Owner.
8. Operation and Maintenance Manuals: Furnish maintenance manuals which contain equipment cuts, operating instructions, shop drawings, wiring diagrams, troubleshooting procedures, and spare parts list for equipment. Ensure that the manual includes operating instructions in addition to instructions for revising the system's software package.

C. Samples for Initial Selection: For master and remote-control stations, and faceplates with factory-applied color finishes and technical features.
D. Samples for Verification: For master and remote-control stations, and faceplates with factory-applied color finishes and technical features.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. Deliver lighting control equipment and components in factory-fabricated type containers or wrappings that properly protect equipment from damage.
B. Store lighting control equipment in original packaging and protect from weather and construction traffic. Store at secured and insured warehouse location. Wherever possible, store indoors; where necessary to store outdoors, store above grade and enclose with watertight wrapping.
C. Handle lighting control equipment carefully to prevent physical damage to equipment and components. Do not install damaged equipment; remove from site and replace damaged equipment with new.

1.07 QUALITY ASSURANCE:

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Subject to compliance with requirements, provide lighting control equipment of one of the following (for each type of equipment):
1. Crestron.
2. Cooper Industries, Inc.
3. Cutler-Hammer.
4. Eaton Corporation.

5. General Electric Co.
6. Hubbell Building Automation, Inc.
7. Intermatic, Inc.
8. Leviton Manufacturing Company, Inc.
9. Lighting Control and Design; Acuity Lighting Group, Inc.
10. Lightolier Controls.
11. Lithonia Lighting; Acuity Lighting Group, Inc.
12. Lutron Electronics, Inc.
13. RAB Lighting.
14. Sensor Switch, Inc.Square D Co.; a brand of Schneider Electric.
15. NSi Industries LLC; TORK Products.
16. Watt Stopper.

2.02 TIME SWITCHES:

A. Electronic Time Switches: Solid state, programmable, with alphanumeric display; complying with UL 917.
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Contact Configuration: DPST.
   3. Contact Rating: 20-A LED load, 120/240Vac.
   4. Programs: Eight on-off set points on a 24-hour schedule and an annual holiday schedule that overrides the weekly operation on holidays.
   5. Programs: Two on-off set points on a 24-hour schedule, allowing different set points for each day of the week and an annual holiday schedule that overrides the weekly operation on holidays.
   6. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels.
   7. Astronomic Time: All channels.
   8. IAutomatic daylight savings time changeover.
   9. Battery Backup: Not less than seven days reserve, to maintain schedules and time clock.

2.03 OUTDOOR PHOTOELECTRIC SWITCHES:

A. Description: Solid state, with SPST dry contacts rated for 1,800VA tungsten LED load, to operate connected relay, load, contactor coils, or microprocessor input; complying with UL 773A.
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lux), with an adjustment for turn-on and turn-off levels within that range[, and a directional lens in front of the photocell to prevent fixed light sources from causing turn-off].
   3. Time Delay: Fifteen second minimum, to prevent false operation.
   4. Surge Protection: Metal-oxide varistor.
   5. Mounting: Twist lock complies with NEMA C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

2.04 DAYLIGHT-HARVESTING DIMMING CONTROLS:

A. System Description: Sensing daylight and electrical lighting levels, the system adjusts the indoor electrical lighting levels. As daylight increases, the lights are dimmed.

1. Lighting control set point is based on two lighting conditions:
   a. When no daylight is present (target level).
   b. When significant daylight is present.
2. System programming is done with two hand-held, remote-control tools.
   a. Initial setup tool.
   b. Tool for occupants to adjust the target levels by increasing the set point up to 25%, or by minimizing the electric lighting level.

B. Ceiling-Mounted Dimming Controls: Solid-state, light-level sensor unit, with separate controller unit, to detect changes in lighting levels that are perceived by the eye.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Sensor Output: 0 to 10Vdc to operate electronic dimming ballasts. Sensor is powered by controller unit.
3. Power Pack: Sensor has 24Vdc, Class 2 power source, as defined by NFPA 70.
4. Light-Level Sensor Set-Point Adjustment Range: 20 to 60 fc (120 to 640 lux).

2.05 INDOOR OCCUPANCY SENSORS AND VACANCY SENSORS:

A. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
3. Vacancy Sensor: Unless otherwise indicated, lights are manually turned on and sensor turns lights off when the room is unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
4. Combination Sensor: Unless otherwise indicated, sensor shall be programmed to turn lights on when coverage area is occupied and turn them off when unoccupied, or to turn off lights that have been manually turned on; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
5. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
6. Power Pack: Dry contacts rated for 20-A ballast load at 120 and 277Vac. Sensor has 24Vdc, 150-mA, Class 2 power source, as defined by NFPA 70.
7. Mounting:
   a. Sensor: Suitable for mounting in any position on a standard outlet box.
   b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
   c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
8. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
9. Bypass Switch: Override the "on" function in case of sensor failure.
10. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux); turn lights off when selected lighting level is present.

B. Ultrasonic Type: Wall or Ceiling mounted; detect occupants in coverage area through pattern changes of reflected ultrasonic energy .

1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. (56 sq. m) when mounted on a 96 inch- (2440 mm-) high ceiling.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1,000 sq. ft. (93 sq. m) when mounted on a 96 inch- (2440 mm-) high ceiling.
4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2,000 sq. ft. (186 sq. m) when mounted on a 96 inch- (2440 mm-) high ceiling.
5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet (27.4 m) when mounted on a 10 foot- (3 m-) high ceiling in a corridor not wider than 14 feet (4.3 m).

C. Dual-Technology Type: Wall or Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.
1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6 inch- (150 mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. inches (232 sq. cm), and detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1,000 sq. ft. (93 sq. m) when mounted on a 96 inch- (2440 mm-) high ceiling.

2.06 SWITCHBOX-MOUNTED OCCUPANCY SENSORS:

A. General Requirements for Sensors: Automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in a single gang switchbox.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operating Ambient Conditions: Dry interior conditions, 32 to 120ºF (0 to 49ºC).
3. Switch Rating: Not less than 800VA LED load at 120V and 1200VA LED load at 277V.

B. Wall-Switch Sensor:
1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 2,100 sq. ft (196 sq. m).
2. Sensing Technology: Dual technology - PIR and ultrasonic.
3. Switch Type: SP, field selectable automatic "on," or manual "on" automatic "off."
4. Voltage: 120V or 277V per drawings.
5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc (108 to 1600 lux). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
7. Concealed "off" time-delay selector at 30 seconds, and 5, 10, and 20 minutes.
8. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.
9. Color: Coordinate with Architect

2.07 LIGHTING CONTACTORS:

A. Description: Electrically operated and electrically held, combination-type lighting contactors with nonfused disconnect, complying with NEMA ICS 2 and UL 508.

1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15% or less total harmonic distortion of normal load current).
2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
3. Enclosure: Comply with NEMA 250.

2.08 EMERGENCY SHUNT RELAY:

A. Description: Normally closed, electrically held relay, arranged for wiring in parallel with manual or automatic switching contacts; complying with UL 924.
   1. Coil Rating: 120 or 277V per drawings.

2.09 CONDUCTORS AND CABLES:

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in 26 05 19 – Low voltage Power Conductors and Cables.
B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 26 05 19 - Low voltage Power Conductors and Cables.
C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Section 26 05 19 - Low voltage Power Conductors and Cables.

2.10 GENERAL DIMMING DEVICE REQUIREMENTS:

A. Compatibility: Dimming control components shall be compatible with other elements of lighting fixtures, ballasts, transformers, and lighting controls.
B. Dimmers and Dimmer Modules: Comply with UL 508.
   1. Audible Noise and Radio-Frequency Interference Suppression: Solid-state dimmers shall operate smoothly over their operating ranges without audible lamp or dimmer noise or radio-frequency interference. Modules shall include integral or external filters to suppress audible noise and radio-frequency interference.
   2. Dimmer or Dimmer-Module Rating: Not less than 125% of connected load unless otherwise indicated.

PART 3 - EXECUTION

3.01 SENSOR INSTALLATION:

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
B. Install and aim sensors in locations to achieve not less than 90% coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.02 CONTACTOR INSTALLATION:

A. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.03 WIRING INSTALLATION:

A. Wiring Method: Comply with Section 26 05 19 - Low Voltage Power Conductors and Cables.

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.04 GROUNDING:
A. Provide equipment ground connections for lighting control equipment. Tighten connectors to comply with tightening torques specified in UL 486A to assure permanent and effective grounding.

3.05 IDENTIFICATION:
A. Provide equipment grounding connections for lighting control equipment. Tighten connectors to comply with tightening torques specified in UL 486A to assure permanent and effective grounding.
B. Identify components and power and control wiring according to Section 26 05 53 – Identification for Electrical Systems.
1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
C. Label time switches and contactors with a unique designation.

3.06 FIELD QUALITY CONTROL:
A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
1. Continuity tests of circuits.
2. Operational Test: Set and operate controls to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.
3. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
C. Lighting control devices will be considered defective if they do not pass tests and inspections.
D. Remove and replace malfunctioning modular dimming control components and retest as specified above.
E. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.

3.07 ADJUSTING:
A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.

3.08 PERSONNEL TRAINING:

A. Building Operational Personnel on-site Training: Train Owner's building operating personnel on-site in procedures for starting-up, testing, operating, trouble shooting, servicing and preventive maintenance of the lighting control system equipment for a minimum period of eight hours.

END OF SECTION 26 09 23

SECTION 26 22 13 – LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section specifies transformer work as indicated by Drawings and Schedules.
B. Types of transformers specified in this Section include the following:
   1. Dry-type transformers.

1.03 RELATED REQUIREMENTS:

A. Section 26 05 19 – Low-Voltage Power Conductors and Cable.
B. Section 26 05 26 – Grounding and Bonding for Electrical Systems.
C. Section 26 05 53 – Identification for Electrical Systems.

1.04 REFERENCE STANDARDS:

A. ASTM International (ASTM):
   1. ASTM D877/D877M - Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids using Disk Electrodes.
   2. ASTM D923 - Standard Practice for Sampling Electrical Insulating Liquids.
B. Code of Federal Regulations (CFR):
   1. 10 CRF Part 429 - Certification, Compliance, and Enforcement for Consumer Products and Commercial and Industrial Equipment.
      a. 429.47 - Distribution Transformers.
   2. 10 CFR Part 431 - Energy Efficiency Program For Certain Commercial and Industrial Equipment, Subpart K – Distribution Transformers.
      a. 431.193 - Test procedures for measuring energy consumption of distribution transformers.
      b. 431.196 - Energy Conservation Standards.
C. Institute of Electrical and Electronics Engineers (IEEE):
   1. IEEE C2 - National Electric Safety Code.
   2. IEEE C57.12.00 - General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.
   3. IEEE C57.12.01 - General Requirements for Dry-Type Distribution and Power Transformers.
   4. IEEE C57.12.25 - Transformers Pad-Mounted, Compartmental-Type, Self-Cooled, Single-Phase Distribution Transformers with Separable Insulated High-Voltage Connectors; High Voltage, 34,500 GrdY/19,920 Volts and Below; Low Voltage, 240/120 Volts; 167 kVA and Smaller Requirements.
   5. IEEE C57.12.50 - Requirements for Ventilated Dry-Type Distribution Transformers 1 to 500 kVA, Single-Phase, and 15 to 500 kVA, Three-Phase with High-Voltage 601 to 34,500V, Low Voltage 120-600V.
   6. IEEE C57.12.90 - Test Code for Liquid-Immersed, Distribution, Power, and Regulating Transformers.
   7. IEEE C57.12.91 - Test Code for Dry-Type Distribution and Power Transformers.
D. National Electrical Manufacturers Association (NEMA):

1. NEMA ST 20 - Dry-type Transformers for General Applications.
2. NEMA TR 1 - Transformers, Regulators, and Reactors. (Supplements IEEE C57 - Series Standards.)
3. NEMA 250 - Enclosures for Electrical Equipment.

E. National Fire Protection Association (NFPA):
1. NFPA 70 - National Electrical Code (NEC). Comply with NEC as applicable to installation and construction of electrical power/distribution transformers.

F. Underwriters Laboratories (UL):
1. Comply with applicable requirements of UL 506 Safety Standard for Specialty Transformers. Provide transformers and components which are UL-listed and labeled.
2. UL 1561 - Dry-Type General Purpose Transformers.

1.05 SUBMITTALS:

A. Refer to Division 01 and Section 26 05 10 – General Electrical Requirements - for administrative and procedural requirements for submittals.

B. Product Data: Submit for each type of product specified and included, with the following as a minimum:
1. Technical product data: Includes, but not limited to, rated kVA, frequency, primary and secondary voltages, wiring diagram, percent taps, polarity, impedance and certification of transformer performance efficiency at 100% load, percentage voltage regulation at 100% load at 75ºC, full-load losses in watts, percent impedance at 75ºC, hot-spot and average temperature rise above 40ºC ambient temperature, sound level in decibels, and standard published data.

C. Shop Drawings: Submit the following as a minimum:
1. Manufacturer's drawings indicating dimensions and weight loadings for transformers and wall brackets.
2. Transformer nameplate data. Include center of gravity information in seismic zones.
3. Wiring Diagrams: Submit wiring and control diagrams for transformers. Clearly differentiate between portions of wiring that are manufacturer factory installed and portions to be field-installed.

D. Submit all field test data.

E. Closeout Submittals: Final documentation shall include:
1. Operation and Maintenance manuals.
2. Certified “As-Built” drawings.
3. Copies of all approved Product Data.
4. Copies of all approved Test Reports.
5. Warranty information.

F. Seismic Qualifications Certificates: Submit certifications that switchboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Section 26 05 48 – Vibration and Seismic Controls for Electrical Systems.

1.06 QUALITY ASSURANCE:

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7.

B. Source Limitations: Obtain each transformer type through one source from a single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
D. Comply with IEEE C2, National Electric Safety Code.
E. Comply with IEEE C57.12.90, Test Code for Liquid-Immersed, Distribution, Power, and Regulating Transformers. or IEEE C57.12.91, Test Code for Dry-Type Distribution and Power Transformers.
F. Testing procedures shall comply with 10 CFR 429.47 - Distribution Transformers and 10 CFR 431.193 - Test procedures for measuring energy consumption of distribution transformers.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. Transformers shall be stored according to the manufacturer's instructions and in a conditioned space to avoid condensation, dust, and other environmental contaminants. Store at secured and insured warehouse location.
B. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.
C. Handle and prepare transformers for installation according to NEMA ST 20 and manufacturer's instructions.

1.08 PROJECT SITE CONDITIONS:

A. Environmental Limitations:
   1. Do not deliver or install transformers until spaces are enclosed and weather tight, any wet work is complete and dry, work above transformers is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
   2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
B. Service Conditions: NEMA ST 20, usual service conditions, as follows:
   1. Ambient temperatures within limits specified.
   2. Altitude not exceeding 3,300 feet.

1.09 WARRANTY:

A. All equipment furnished under this Section shall be warranted by the Contractor and the equipment manufacturer(s) for a minimum period of one year after substantial completion.
B. Warranty shall include all parts, labor, and expenses to perform necessary work.

1.10 COORDINATION:

A. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
B. Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Subject to compliance with requirements, provide products of one of the following (for each type of transformer):
   1. ABB.
   2. Eaton.
   3. General Electric Company.

2.02 TRANSFORMERS:

A. General:
   1. Except as otherwise specified or indicated, provide manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by manufacturer, and as required for complete installation.
   2. Comply with DOE energy efficiency standards as defined by 10 CFR Part 431.196 – Energy Conservation Standards for all transformers 15 kVA and larger.
   3. Core material shall be grain-oriented, non-aging silicon steel. Coils shall be continuous windings without splices except for taps. Internal coil connections shall be brazed or pressure type. Provide transformers that are constructed to withstand seismic forces specified in Section 26 05 48 – Vibration and Seismic Controls for Electrical Systems. Provide permanent fungicidal treatment for coil and core.
   4. Enclosure ratings shall comply with NEMA 250 – Enclosures for Electrical Equipment.
      a. General Purpose - Ventilated Enclosures.
         (1) Provide NEMA 12 for interior electrical rooms.
         (2) Provide NEMA 4X for exterior locations.
      b. Non-Ventilated Enclosures.
         (1) Provide NEMA 12 enclosures.

B. Dry-Type Transformers (45 kVA or less):
   1. Factory-assembled and tested, general-purpose, air-cooled, dry-type transformers; of sizes, characteristics, and rated capacities indicated.
   2. Single-phase transformer: 480V primary and 240/120V secondary with grounded neutral, 60-hertz, 10 kV BIL.
   3. Three-phase transformer: 480V delta connected primary and 208/120V wye-connected secondary with grounded neutral, 60-hertz, 10 kV BIL.
   4. Aluminum primary and secondary windings. Manufacturer’s standard impedance.
   5. Provide primary winding with 4 full-capacity taps; two 2-1/2% increments below and above full-rated voltage for de-energized tap-changing operation.
   6. Insulate with 220ºC, UL-component-recognized insulation system with a maximum of 150ºC rise above 40ºC ambient temperature.
   7. Rate transformer for continuous operation at rated kVA.
   8. Limit transformer surface temperature rise to maximum of 65ºC.
   9. Provide terminal enclosure, with cover, to accommodate primary and secondary winding connections and raceway connectors.
   10. Equip terminal leads with connectors installed. Limit terminal compartment temperature to 75ºC when transformer is operating continuously at rated load with ambient temperature of 40ºC. Provide wiring connectors suitable for copper wiring.
   11. Cushion-mount transformers with external vibration isolation supports.
   12. Sound-level ratings shall not exceed IEEE/NEMA standards. Conform to NEMA ST 20.

13. Electrically ground core and coils to transformer enclosure by means of flexible metal grounding strap.
14. Provide transformers with ventilated or fully enclosed sheet steel enclosures. Apply manufacturer's standard light gray indoor enamel over cleaned and phosphatized steel enclosure.
15. All transformers shall be suitable for floor mounting unless noted otherwise.
16. Provide wall mounting brackets for wall- or column-mounted transformers.
17. Must comply with IEEE C57.12.01 and/or IEEE C57.12.50.
18. Must comply with UL 1561.

C. Dry-Type Transformers (above 45 kVA):
1. Factory-assembled and tested, general-purpose, ventilated, dry-type transformers; of sizes, characteristics, and rated capacities indicated.
2. Three phase, 480V delta-connected, 10-kV BIL primary; and 208Y/120V 4-wire, 60-hertz, wye-connected secondary with grounded neutral.
3. Provide primary windings with a minimum of 4 full-capacity taps; two 2-1/2% increments above full-rated voltage and two 2-1/2% increments below full-rated voltage for de-energized tap-changing operation.
4. Aluminum primary and secondary windings. Manufacturer's standard impedance.
5. Insulate with 220ºC, UL-component-recognized insulation system with a maximum of 150ºC rise above 40ºC ambient temperature.
6. Rate transformer for continuous operation at rated kVA.
7. Provide terminal enclosure, with hinged cover, to accommodate primary and secondary winding connections and raceway connectors.
8. Provide terminal board with clamp type connectors. Limit terminal compartment temperature to 75ºC when transformer is operating continuously at rated load with ambient temperature of 40ºC. Provide wiring connections suitable for copper wiring.
9. Integrally mount vibration isolation supports between core and coil assembly and transformer enclosure.
10. Electrically ground core and coils to transformer enclosure by means of flexible metal grounding strap.
11. Do not exceed maximum sound-level rating in accordance with IEEE/NEMA standards. Conform to NEMA ST 20.
12. Provide transformers with ventilated steel enclosures and lifting lugs. Apply manufacturer's standard light gray outdoor enamel over cleaned and phosphatized steel enclosure.
13. Provide transformers suitable for floor mounting.
14. Must comply with IEEE C57.12.01 and/or IEEE C57.12.50.
15. Must comply with UL 1561.

D. Equipment/System Identification: Provide equipment/system identification nameplates complying with Section 26 05 53 – "Identification for Electrical Systems."

E. Finishes: Coat interior and exterior surfaces of transformer, including bolted joints, with manufacturer's standard gray baked-on enamel.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
D. Verify that ground connections are in place and requirements in Section 26 05 26 – Grounding and Bonding for Electrical Systems have been met. Maximum ground resistance shall be 5 ohms at location of transformer.
E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. Install transformers as indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NESC, NEMA, and IEEE standards in accordance with recognized industry practices to ensure that products fulfill requirements. Arrange equipment to provide adequate space for access and for cooling air circulation.
B. Tighten electrical connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torqueing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A.
C. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer. Wall brackets shall meet the environmental requirements of the transformer installation for each location.
    1. Brace wall-mounting transformers as specified in Section 26 05 48 – Vibration and Seismic Controls for Electrical Systems.
D. Construct concrete bases and anchor floor-mounted transformers according to manufacturer's written instructions and seismic codes applicable to Project.

3.03 CONNECTIONS:

A. Provide equipment grounding connections for transformers as specified, indicated, and as required. Tighten connections to comply with tightening torques specified in UL 486A to assure permanent and effective grounding. Provide grounding in accordance with Section 26 05 26 – "Grounding and Bonding for Electrical Systems."

3.04 IDENTIFICATION:

A. Provide identification of transformers as specified in Section 26 05 53 - Identification for Electrical Systems.
B. Nameplates: Label each transformer with a nameplate complying with requirements for identification specified in Section 26 05 53 – Identification for Electrical Systems.

3.05 FIELD QUALITY CONTROL:

A. Tests and Inspections:
    1. Prior to energization of transformers, check all accessible connections for compliance with manufacturer's torque tightening specifications. Clean out any dust and dirt.
    2. Prior to energization, check circuitry for electrical continuity and for short circuits.
    3. Perform insulation resistance test: Megger between high-voltage winding to low-voltage winding, low-voltage winding to ground, and high-voltage winding to ground. Record and submit test results. If readings are below 50 megohms (at 77°F), notify Engineer before energizing transformer.
    4. Perform transformer turns ratio test (TTR) on the full winding and all taps. Record and submit test results.

5. Check cooling fans and controls, where provided, for proper operation.
6. Upon completion of installation of transformers and testing, energize primary circuitry at rated voltage and frequency from normal power source, and test transformers, including, but not limited to, audible sound levels, to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at the Site then retest to demonstrate compliance; otherwise, remove and replace with new units or components and proceed with retesting.
7. Adjust transformer primary taps for nominal system voltage at initial installation and again when the transformer reaches its designed "full" load condition after occupancy by the Owner. Schedule all required electrical outages with the Owner.

3.06 FINISHES:

A. Equipment coatings shall be free from scratches, rust, or other defects.
B. All damaged or defective coatings shall be repaired prior to final acceptance.
C. Field Painting:
   1. Touch Up:
      a. Contractor shall prepare surfaces and touch up manufacturer applied coatings as required for any damage during shipment and installation.
      b. Field painting shall be performed based on manufacturer’s recommended procedures.
      c. Transformer manufacturer shall furnish Contractor with an adequate quantity of touch-up paint to match the factory applied finish.

3.07 ADJUSTING AND CLEANING:

A. Upon completion of installation, clean interior and exterior of transformers. Remove paint splatters, spots, dirt and debris.

3.08 PROTECTION:

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until unit is placed into service.

END OF SECTION 26 22 13

SECTION 26 24 13 – SWITCHBOARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section specifies switchboard work that is indicated by drawings and schedules.
B. Types of switchboards specified in this Section include the following:
   1. Dead-Front Distribution:
      a. Circuit-breaker switchboards.

1.03 RELATED REQUIREMENTS:

A. Refer to applicable Division 26 Sections for wires/cables, grounding, identification, electrical raceways, fittings, and other items required in connection with switchboards.
B. Section 26 05 26 – Grounding and Bonding for Electrical Systems.
C. Section 26 05 53 – Identification for Electrical Systems.
D. Section 26 05 73 – Power System Studies.
E. Section 26 43 13 – Surge Protection Devices.
F. Section 40 61 96 – Process Control Software Programming and Reports.

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
B. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE):
   1. ANSI/IEEE C37.13 – Low-Voltage AC Power Circuit Breakers Used in Enclosures.
   2. ANSI/IEEE C36.16 – Related Requirements and Application Recommendations for Low-Voltage Power Circuit Breakers and AC Power Protectors, Preferred Ratings.
C. Institute of Electrical and Electronic Engineers (IEEE):
   1. IEEE 241 – Recommended Practice for Electric Power Systems in Commercial Buildings, Pertaining to Switchboards.
D. National Electrical Manufacturers' Association (NEMA):
   1. NEMA PB2 – Dead-Front Distribution Switchboards.
   2. NEMA PB 2.1 – General Instruction for Proper Handling, Installation, Operation, and Maintenance of Dead-Front Distribution Switchboards Rated 600V or Less.
   3. NEMA SG 3 – Low-Voltage Power Circuit Breakers.
E. National Fire Protection Association (NFPA): Comply with applicable local code requirements of the authority having jurisdiction and that portion of the NEC which pertains to installation and construction of switchboards.
   1. NFPA 70 – National Electrical Code (NEC).
   2. NFPA 70E – Standard for Electrical Safety in the Workplaces.
F. Underwriters Laboratories (UL) Compliance: Provide switchboards and components which are UL-listed and labeled.
   1. UL 98 – Enclosed and Dead Front Switches.
   2. UL 486A – Wire Connections and Soldering Lugs for Use in Copper Conductors.
   3. UL 489 – Molded Case Circuit Breakers and Circuit Breaker Enclosures.
   4. UL 891 – Dead Front Electrical Switchboards.

5. UL 977 – Fused Power Circuit Devices.
6. UL 1054 – Ground-Fault Sensing and Relaying Equipment.
7. UL 1449 – Surge Protective Devices.

G. Structural Engineering Institute/American Society of Civil Engineers (SEI/ASCE):
1. SEI/ASCE 7-2002 – Minimum Design Loads for Buildings and other Structures.

1.05 SUBMITTALS:

A. Refer to Division 01 and Section 26 05 10 - General Electrical Requirements for administrative and procedural requirements for submittals.

B. Submittals shall be custom prepared by the switchboard manufacturer for this specific application.

C. Product Data: Submit for each type of product specified and included, with the following as minimum:
1. Data sheets for all components furnished as part of the equipment package. Indicate voltages, number of phases, frequency, short-circuit, and continuous current ratings.
2. Provide application data and time-current trip curves for main and branch circuit-breakers.
3. Instrument transformer performance curves and data.

D. Shop Drawings: Provide the following as minimum:
1. Submit dimensioned drawings of switchboards showing accurately dimensioned equipment sections, including auxiliary compartments, section components, and combination sections.
2. Indicate shipping splits and weight of each section. Complete loading diagrams covering static and dynamic loadings for all conditions of operation and structural steel details. Provide center of gravity information for all seismic rated switchboards. Indicate all required access points for all terminations.
3. Wiring Diagrams: Submit a wiring diagram for the complete switchboard unit showing connections to electrical power feeders, distribution branches, and associated auxiliaries. All external power and control connections shall be clearly identified.
a. Differentiate between portions of wiring that are manufacturer factory-installed and portions that are field-installed.
4. Nameplate schedule.
5. Surge Protective Device data and testing laboratory reports.
6. Coordination Study: Submit a coordination study of the complete electrical distribution system. Provide composite time-current curves. Clearly indicate all device settings and available fault currents. Refer to Section 26 05 73 – Power System Studies.
7. Provide documentation on communication system interface along with a complete list of all available parameters and associated addresses.
8. Provide paper documentation of the programmable logic controller program.

E. Seismic Qualification Certificates: Submit certification that switchboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems. Include the following:
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assemble components or on calculation.
2. Dimensioned Outline Drawing of Equipment Unit: Identify center of gravity and locate describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

F. Submit paint manufacturer's certification of VOC compliance and MSDS sheets. Submit certification of paint VOC level compliance as required by local or regional governing authorities.
G. Special Procedure Submittals:
   1. Start-up and commissioning instructions.
   2. Syllabus for Owner training.
H. Test and Evaluation Reports:
   1. Qualification Data: For qualified Installer and Testing Agency.
   2. Factory test reports.
   3. Commissioning and Field test reports.
I. Closeout Submittals: Final documentation shall include the following as minimum:
   1. Operation and Maintenance Manuals including the following:
      a. Operation and maintenance manuals for all components furnished.
      b. Certified "As-Built" drawings of all equipment with information listed above.
      c. Copies of all approved Product Data.
      d. Copies of all approved Test Reports.
      e. Spare parts and supply list with supplier names and part numbers.
      f. Warranty Information.
      g. Manufacturer's service and repair support during and after warranty including contact information.
      h. Training Materials. Includes final edited training videos.
J. Maintenance Material Submittals:
   1. Spare Parts:
      a. Three spare LED indicating lamps for each type and color used.
      b. Three spare indicating light assemblies.
      c. Three spare power and control fuses of each voltage and current rating used.
      d. One 12oz aerosol cans of manufacturer's touch-up paint for each color used. Color shall match the original factory applied color.
      e. All parts supplied with the equipment shall be properly labeled for ease of identification and to permit the shortest possible time to repair.

1.06 QUALITY ASSURANCE:

A. Materials and Equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall be the manufacturer's latest standard design that has been in satisfactory use.
B. Factory Tests:
   1. The switchboard assembly shall be completely and functionally tested in the manufacturer's facility prior to shipment. For systems shipped in multiple sections, the switchboard shall be quality tested utilizing the plug-together wiring system which shall be unplugged prior to shipment and plugged together again when the equipment is installed in order to maintain the integrity of the manufacturer's quality assurance testing.
   2. Conduct tests on all system components and subassemblies to assure that all devices and systems are in proper working order before delivery to jobsite.
   3. Automatic Throw-Over System: Simulate actual system operation. Includes simulations of power failure, transfer to emergency source, and re-transfer to normal source.
   4. Submit test reports as specified in Division 01.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. Deliver switchboards and components properly packaged and mounted on pallets or skids to facilitate handling of heavy items. Utilize factory-fabricated type containers or wrappings for switchboard and components which protect equipment from damage. Install impact measuring meters in containers which will indicate whether the container has been bumped or dropped. Return impact meters to the manufacturer for reuse upon delivery of switchboards. Inspect equipment to ensure that no damage has occurred during shipment.

B. All necessary hardware for reconnecting shipping splits shall be provided.

C. Store switchboard equipment in original packaging and protect from weather and construction traffic and according to the manufacturer's instructions. Store in a conditioned space to avoid condensation, dust, and other environmental contaminants. Store at secured and insured warehouse location.

D. Handle switchboard equipment carefully to prevent physical damage to equipment and components. Remove packaging, including the opening of crates and containers, avoiding the use of excessive hammering and jarring which would damage the electrical equipment contained therein. Do not install damaged equipment; remove damaged equipment from the site and replace with new.

1.08 SEQUENCING AND SCHEDULING:

A. Schedule delivery of switchboard equipment which permits ready building ingress for large equipment components to their designated installation spaces. Coordinate delivery of equipment with the installation of other building components.

B. Coordinate the size and location of concrete equipment pads. Cast anchor bolt inserts into concrete pad. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.09 PROJECT SITE CONDITIONS:

A. Do not install the switchboard equipment specified herein until designated installation spaces are suitable for intended service.

B. Final or temporary HVAC systems shall be in place and operational to maintain the ambient temperatures and humidity conditions at occupancy levels prior to energizing the switchboard and shall be maintained for the remainder of the construction period.

1.10 WARRANTY:

A. All equipment furnished under this section shall be warranted by the Contractor and the equipment manufacturer(s) for a minimum period of five years after completion of startup.

B. Warranty shall include all parts, labor, and expenses to perform necessary work.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Subject to compliance with requirements, provide switchboard units of one of the following for each type, and rating of switchboard:

1. Eaton Corporation.
2. General Electric, ABB Inc.
3. Siemens Corporation.
4. Schneider Electric.

2.02 EQUIPMENT SECTIONS AND COMPONENTS:

A. General: Except as otherwise indicated, provide switchboards and ancillary components of types, sizes, characteristics, and ratings indicated which comply with manufacturer's standard design, materials, components, and construction, in accordance with published product information, and as required for complete installation. Provide terminals UL rated for 75ºC (minimum) conductors.

B. Seismic Performance: Switchboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

C. AC Dead-Front Distribution Switchboards:
   1. Factory-assembled, dead-front, metal-enclosed, self-supporting secondary power switchboards, of types, sizes, electrical ratings, and characteristics indicated.
   2. Assemblies consisting of vertical panel units and containing circuit-breakers assemblies of quantities, ratings, and types indicated.
   3. Provide tin-plated copper main bus with connections to switching devices and circuit-breaker branches of sufficient capacity to limit rated continuous current operating temperature rise to no greater than 65ºC above average ambient temperature of 40ºC.
      a. Copper bus current density shall not exceed 1,000 amperes per square inch.
   4. Main bus and tap connections shall be plated and bolted tightly according to manufacturer's torquing requirements for maximum conductivity.
   5. Brace bus for short-circuit stresses greater than or equal to the minimum interrupting capacity indicated.
   6. Provide accessibility of line and load terminations from front of switchboard.
   7. Provide equipment with built-in lifting eyes and yokes.
   8. Provide vertical individual panel units, suitable for bolting together at project site.
   9. Construct switchboard enclosures suitable for the following environment:
      a. Installation: Indoors, NEMA Type 1.

D. Enclosures: Construct dead-front switchboards suitable for floor mounting, with front cabling/wiring accessibility and conduit accessibility as required. Provide welded steel channel framework; hinge front wireway covers to permit ready access to branch circuit-breaker load side terminals. Enclosure shall be suitable for being rolled or pushed into final location. Coat enclosures with manufacturer's standard corrosive-resistant finish.

E. Finish:
   1. Paint system with manufacturer's standard coating system suitable for intended service.
   2. Coating systems shall not contain any lead (0.00%), zinc or strontium chromates, mercury or mercury compounds, or asbestos. Coatings shall also be VOC compliant to meet the VOC level as required by the local or regional governing authorities. Equipment Manufacturers shall submit certification by coating manufacturers, including MSDS sheets, verifying these requirements.
   3. Exterior paint color shall be light gray.
   4. Provide factory-painted white mimic bus on front of each switchboard.

F. Nameplates:
   1. Wording and equipment tags as indicated.
   2. Engraved phenolic nameplates for each circuit breaker unit and other equipment units included in the assembly.
   3. Engraved phenolic "master" nameplate for each switchboard.
   4. Refer to Section 26 05 53 – Identification for Electrical Systems for additional labeling requirements.

G. Circuit Breakers: Except as otherwise indicated, provide circuit breakers and ancillary components, of types, sizes, ratings and electrical characteristics indicated, which comply with

manufacturer's standard design, materials, components, and construction in accordance with published product information and as required for a complete installation.

1. Insulated Case Circuit Breakers (Main) :
    a. Factory-assembled, electronically operated, insulated case circuit breakers
    b. Frame size and trip rating as indicated. 600Vac, 60 Hz, 3-phase, 3-pole, back connected, 100% continuous current rated, continuous current rating indicated, RMS symmetrical amperes interrupting capacity rating indicated.
    c. Provide fixed breaker elements with NEMA Type 1 general purpose enclosures.
    d. Construct with ground-fault protection sensors.
    e. Equip circuit breakers with solid-state controls and programming units possessing the following operating features:
        (1) Adjustable current, long time pickup and delay.
        (2) Adjustable current, short time pickup and delay.
        (3) Adjustable current, instantaneous pickup and delay.
        (4) Adjustable ground-fault time pickup and delay.
        (5) I^2t settings for instantaneous and ground fault.
        (6) Overload, short-circuit, and ground-fault target indicators.
        (7) Circuit Breaker Accessories: Provide the following insulated case circuit circuit-breaker accessories.
            (a) Shunt trip.
            (b) Undervoltage release.
            (c) Bell alarm with lockout.
            (d) Auxiliary contacts for Open/Close.
            (e) Communication Capability: ETHERNET/IP.
2. Molded-Case Circuit Breakers (Feeders):
    a. Factory-assembled, molded-case, manually-operated.
    b. Frame sizes and ampere rating as indicated, 600V, 60 Hz, 3 poles with RMS symmetrical interrupting ratings indicated.
    c. Provide breakers with permanent thermal and instantaneous magnetic trips in each pole and ampere ratings as indicated.
    d. Construct with overcenter, trip-free, toggle-type operating mechanisms with quick-make, quick-break action and positive handle trip indication.
    e. External handle clearly indicates when breaker is "ON," "OFF," or "TRIPPED," and lockable in the "OFF" position.
    f. Provide push-to-trip button on enclosure cover for mechanical tripping circuit breakers.
    g. Construct breakers for mounting in any physical position and operating in an ambient temperature of 40ºC.
    h. Provide breakers with mechanical screw type removable connector lugs, AL/CU rated.
    i. Breaker Accessories: Provide the following molded-case breaker accessories:
        (1) Shunt trip.
        (2) Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
        (3) Auxiliary contacts.
        (4) Alarm switch.
        (5) Undervoltage trip.

(6) Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system.

H. Provide an arc energy-reducing maintenance switch with a local status indicator for circuit breakers that meets requirements of the NEC where indicated on plans.

I. Switchboard Bus: Provide switchboard busing with sufficient cross-sectional area to fulfill UL 891 pertaining to temperature rise. Bus shall be continuous rated amperes as required. Construct through-bus of tin-plated copper (with silver-plated connections), with ampacity rating indicated, and with short-circuit current rating indicated. Provide fully rated main bus (tapered bus is not acceptable). Provide full capacity neutral bus. Provide ground bus full length of switchboard, firmly connected to each vertical section of the switchboard.

J. Metering:

1. Provide metering compartments, CTs, PTs, kWh meter, and instrument phase selector switches. Mount meters semi-recessed in front doors and install meter wiring and lacing with sufficient flexibility at hinged edge of meter front mounting plates to prevent damage. Provide the following metering devices where indicated.
   a. Instrument Transformers: IEEE C57.13, NEMA EI 21.1, and the following:
   b. Potential Transformers: IEEE C57.13; 120 V, 60 Hz, secondary; disconnecting type with integral fuse mountings. Burden and accuracy shall be consistent with connected metering and relay devices.
      (1) Current Transformers: IEEE C57.13; 5 A, 60 Hz, secondary; wound and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.
      (2) Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kVA.
      (3) Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondary wiring to ground overcurrent relays, via shorting terminals, to provide selective tripping of main circuit breaker.
   c. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:
2. Push-Button-selectable digital display of the following values with maximum accuracy tolerances as indicated:
   a). Phase Currents, Each Phase: ±1%.
   b). Phase-to-Phase Voltages, Three Phase: ±1%.
   c). Phase-to-Neutral Voltages, Three Phase: ±1%.
   d). Megawatts: ±2%.
   e). Megavars: ±2%.
   f). Power Factor: ±2%.
   g). Frequency: ±0.5%.
   h). Accumulated Energy, kWh: ±2%; accumulated values unaffected by power outages up to 72 hours.

K. Ground-Fault Protectors: Solid-state, ground-fault protection units of types and ratings indicated: equip with static relays, sensors, pilot lights, and push-buttons for fault indication, test, and reset; include fuse blocks, fuses, and control power transformers. Provide system which operates at 120Vac.

L. System Coordination: Provide settings for all adjustable trips such that the electrical system and switchboard devices are all selectively coordinated. Coordinate with Section 26 05 73 – Power System Studies.

M. Space Heaters:

1. Provide factory-installed differential thermostat controlled space heaters in each vertical section.
2. Space heaters shall be sized to prevent condensation within the enclosure.
3. Power space heaters internally to switchboard.
4. Provide required control power transformer and overcurrent protection for space heaters.

2.03 SURGE PROTECTIVE DEVICES (SPD):

A. Switchboard shall be provided with an integral Surge Protective Device (SPD) as indicated. Refer to Section 26 43 13 – Surge Protection Devices for requirements.

2.04 AUTOMATIC TRANSFER CONTROLS:

A. A service entrance rated automatic throw-over system shall be provided in the switchboard assembly and serve as the main switching device for the switchboard line-up.

B. The automatic throw-over system shall be rated as follows:
   1. Designed for 480V, 3-phase, 4 wire, amp rating as indicated.
   2. Shall be 100% equipment rated for continuous duty.
   3. Shall be listed as service entrance equipment.

C. Construction:
   1. The throw-over system shall consist of completely enclosed circuit breaker assemblies and a separate logic controller mounted in the switchboard assembly.
   2. Switchboard shall be provided with a redundant, 24Vdc power system to power network equipment, communications, control boards, and logic controllers.
      a. A minimum of two full capacity 120Vac to 24Vdc power supplies shall be provided for each switchboard. Each power supply shall be provided with a dedicated input circuit breaker and shall each be powered from a separately derived 120Vac source outside of the switchboard. Field terminal blocks shall be provided for this external power source.
      b. Each power supply shall be sized to accommodate all connected components plus a minimum of 20% spare capacity.
      c. A failure contact shall be provided from each power supply and wired to the switchgear PLC. Contact shall be rated a minimum of 3 Amps at 120Vac. Provide interposing relay if required.
   3. The transfer switch shall be capable of open transition operation. Operator selection shall be made available for this function.
   4. In the event of automatic transfer controller failure, electrical interlocking outside the PLC shall utilize breaker auxiliary contacts to logically prevent all three breakers (2 mains and 1 generator) from being closed at the same time.
      a. When the Auto/Manual switch is in Manual position, breaker control buttons shall be operable and protective interlocks including non-paralleling, non-reclosure onto a fault, and voltage protection shall remain intact. Breakers shall not close automatically. Utility breakers shall not close unless voltage is available on the line side.
   5. The transfer switch shall be capable of being operated manually under full rated load conditions. Manual operation shall be accomplished by a permanently attached manual operator, or by integrally mounted pushbuttons. Removable manual operating handles, and handles that may move in the event of an electrical operation during the manual operation, are not acceptable. Manual operators requiring source or load disconnection prior to manual operation are not acceptable.

6. An external key-operated selector switch shall be provided to provide disconnect and lock-out functionality of the Utility and Generator main breakers. Indicators shall be provided to show the availability of each source as well as breakers in a tripped or disconnected position.
7. Provide neutral disconnect link for three-pole solid neutral-to-ground main bonding jumper for all switches to meet UL service entrance requirements. Ground fault protection shall be provided in accordance with NFPA 70 Article 230-95.
8. The scheme of operation shall be controlled by a microprocessor-based programmable logic controller. The controller shall be hardened against potential problems from transients and surges. Operation and monitoring of both sources, input and output functions, and communications to the plant control system shall be managed by the controller.

D. Programmable Logic Controller (PLC):
1. The PLC shall be mounted in the switchboard instrument section and shall provide the operator with an overview of the transfer stats, parameters, and diagnostic data.
2. The PLC based control system shall include an HMI touchscreen mounted on the face of the switchboard instrument section for operator interface. The touchscreen shall be color, 12” inch (minimum diagonal) TFT LCD industrial display capable of displaying both text and graphics. The display shall support a minimum resolution of 800x600 pixels, 16 million colors. The HMI shall display the following as minimum:
   a. Main Menu Screen with a complete listing of major screens.
   b. System Overview Screen with a dynamic graphic display of the electrical one-line.
   c. System Control and Metering Screens with graphical presentations of all functions specified and minimum metered points as follows.
      (1) Line-to-line and line-to-neutral voltages for each source and the load.
      (2) Line frequency for each source and the load.
      (3) Load indication in kW and kVA.
      (4) Power factor.
      (5) Load current (per phase).
   d. Utility Screen that contains all of the adjustments and delays specified.
   e. Annunciation Screen that contains all of the status and alarm points for the system.
   f. Alarm Summary Screen that contains a time/date stamped system alarm summary.
   g. Password Entry Screen that contains a soft keyboard/keypad for password entry.
   h. Timer countdown for each time delay while functioning.
   i. Real-time clock.
3. The transfer switch interfaces shall include individual LED indicators and touchscreen indication of the following:
   a. Source 1 available.
   b. Source 1 connected.
   c. Source 2 available.
   d. Source 2 connected.
   e. System status.
   f. Source 3 available.
   g. Source 3 connected.

E. The automatic throw-over system shall be open transition only and contain the following features:
1. Password programming protection.
2. Set points shall be stored in Non-Volatile memory, and use of an external battery source to maintain operation during "dead" periods shall not be required.

3. Provision shall be made for manual transfer capabilities in the event of a PLC/HMI display failure.
4. The voltage of each phase of the normal source and the alternate source shall be monitored, with undervoltage dropout adjustable from 50% to 97% of nominal and pickup adjustable from dropout setting ±2% to 99% of nominal.
5. The voltage of each phase of the normal source and the alternate source shall be monitored, with overvoltage dropout adjustable from 105% to 120% of nominal and pickup adjustable from dropout setting +2% to 103% of nominal.
6. The frequency of the normal source and the alternate source shall be monitored, with underfrequency dropout adjustable from 90% to 97% of nominal and pickup adjustable from dropout setting +1 Hz to 99% of nominal.
7. The frequency of the normal source and the alternate source shall be monitored, with overfrequency dropout adjustable from 103% to 110% of nominal and pickup adjustable from dropout setting +1 Hz to 101% of nominal.
8. A time delay shall be provided to override a momentary power outage or voltage fluctuation, adjustable from 0 to 120 seconds.
9. A time delay shall be provided on transfer to source 2, adjustable from 1 to 1800 seconds.
10. A time delay shall be provided on retransfer from source 1 to source 2, adjustable from 0 to 1800 seconds. This time delay shall be bypassed if emergency source fails and normal source is available.
11. All delays shall be field adjustable from the operator touchscreen interface without the use of special software or tools.
12. Retransfer mode, selectable - manual or automatic from source 1 to source 2.

F. The automatic transfer controller shall contain the following input/outputs:
1. Minimum of six (6) SPDT contact outputs for control functions, rated 5A, 250Vac.
2. The logic controller input/output contacts shall function as specified and described as follows:
    a. Output contact for transfer switch fail alarm.
    b. Output contact for Breaker in Utility position.
    c. Output contact for Utility source available.
    d. Output contact for control power failure (Energized open, fail closed).
3. Provide one SPDT contact output for common alarm as minimum, rated 5A, 250Vac.

G. Annunciation
1. The system shall be provided with HMI annunciation in accordance with NFPA 110 requirements.
2. The annunciation system shall be equipped with a fast pulse horn (rated 80-95 dbA at three feet), a horn silence push-button, and acknowledge push-button. Any system alarm conditions shall cause the horn to sound until the horn silence button is depressed. Any subsequent alarms shall re-sound the alarm horn. The display shall operate such that any alarm point shall “flash” until acknowledged.
3. As minimum the following annunciation points shall be provided.
    a. Utility control not in Auto.
    b. Utility Circuit Breaker Failed to Close/Open.
    c. Utility Circuit Breaker Tripped.
    d. Controller Fault.

H. Description of Operation:
1. Automatic Transfer System (ATS):

a. The ATS shall be capable of being controlled in MANUAL at its HMI located on the switchboard or automatically by the controller when the MANUAL/AUTO function is in AUTO.

b. Manual Control:
   (1) When the ATS is in MANUAL control, opening and closing of the utility and generator source breakers shall be controlled at the switchboard HMI or by pushbuttons and switches located on the face of the switchboard.
      (a) Screen OPEN/CLOSE pushbuttons shall be provided on the switchboard HMI for opening and closing the primary and secondary source, main breakers.
      (b) Pushbuttons and switches shall be provided on the switchboard face to disengage the controller and to allow the main breakers to be controlled manually if the HMI or controller fails. There shall be an interlock between the utility and generator main breakers to prevent both source breakers from being closed at the same time.
      (c) Additional manual operations shall be provided as recommended by the manufacturer and as specified.

c. Automatic Control:
   (1) When in AUTO control, opening and closing of the primary and secondary main breakers shall be controlled by the ATS controller.
   (2) Sequence of Operation:
      (a) Normal Conditions:
         1). The utility main breaker one is closed.
         2). The generator breaker is open.
         3). The utility main breaker two is open.
         4). The MANUAL/AUTO switch is in the “AUTO” position.
      (b) Source 1 Power Failure:
         1). If an undervoltage, phase imbalance, or phase reversal is detected by the ATS equipment the primary main breaker one will open after an operator adjustable time delay, initially set at 1 second.
         2). Utility main breaker two will close.
         3). Source 1 and 2 failure, utility beaker one and two open. Operator place system in manual mode and manually close the generator circuit breaker.
      (c) Utility Source One Returns:
         1). When normal utility 1 is detected by the ATS equipment and the source stabilization delay (adjustable) has expired, a utility annunciation shall be provided.
         2). After verifying a utility source has become available, the operator will manually open the generator breaker and put the system into AUTO mode. Utility main breaker one shall close.
      (d) Loss of Power Simulation (Transfer Test) utility Source 1 to 2:
         1). Test switches shall be provided to simulate a main power failure.
         2). The operator will initiate a test by actuating the appropriate test switch to TEST mode.
         3). The test mode shall create an undervoltage condition and be detected by the associated undervoltage relay.
         4). The sequence of the test should follow the conditions of a Utility Power Failure as described in Part (b) above.

5). To end the transfer test the operator will return the test switch to the NORMAL position.
6). The sequence of the retransfer to primary power should follow the conditions of a Primary Power Returns as described in Part (c).

d. The ATS equipment status points and alarms shall be displayed on the operator workstation and Switchboard HMI. Refer to the I/O list in controls specification for I/O status and alarm points to be transmitted to the plant control system.

I. System Upsets and Procedures for Recovery:
1. In the event the ATS controller fails or senses a failure of the system the associated alarms shall be displayed on the switchboard HMI and alarm conditions shall be communicated to the plant control system via the EtherNet/IP network.

2.05 PLANT CONTROL SYSTEM (PCS) INTERFACE:

A. The switchboard system shall provide a network interface for the plant control system (PCS).
B. The interface shall be designed such that the PCS or external user interface can in no way compromise the integrity or interfere with the critical operations of the switchboard and the Automatic Throw-over System.
C. The communications protocol to the PCS shall be via EtherNet/IP.
1. A single Category 6 cable connection shall be used for this interface.
D. Refer to Section 40 61 96 – Process Control Software Programming and Reports for a control description of the PCS interfaces. Refer to the I/O list at the end of Section 40 61 96 for a complete list of required I/O points communicated with the PCS.
E. The system manufacturer shall prepare all points for consumption by the plant control system PLC and provide the necessary documentation and technical support for the Systems Integrator to fully integrate the system.

2.06 INFRARED (IR) WINDOWS

A. Flir Infrared (IR) Windows: Provide two factory-installed infrared (IR) Flir or engineer approved Equal windows per switchboard section. Factory located IR windows for maximum viewing of bus, conductor, breaker, and other termination points.

2.07 VOLTAGE INDICATING DEVICES AND VOLTAGE TEST PORTALS

A. Provide combination LED voltage indicating device and absence of voltage test portal for volt meter probes at each switchboard section, MCC section and panelboard section. Manufacturer shall be Grace Technologies PSED Combination Unit or engineer approved equal. Devices shall be factory installed into switchboard, MCC and panelboard sections.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine areas and conditions under which switchboards and components are to be installed. Do not proceed with the work until unsatisfactory conditions have been corrected.
B. Final or temporary HVAC systems shall be in place and operational to maintain the ambient temperatures and humidity conditions at occupancy levels prior to energizing the switchboard and shall be maintained for the remainder of the construction period.

3.02 INSTALLATION OF SWITCHBOARDS:

A. Install switchboards as indicated, in accordance with manufacturer's written instructions, and with recognized industry practices.

B. Comply with applicable requirements of NEC, NEMA PB 2.1, and NECA's "Standard of Installation." Provide seismic support and bracing to resist the forces of a Seismic event without damage.
C. Provide all openings in floors, walls, roofs, and other structures necessary for complete equipment installation, unless such openings are specifically indicated as being provided by others. Include openings through floors for future cables to connect to spare breakers and to spaces provided in equipment for future expansion.
D. Install a 4-inch high concrete equipment pad 4 inches wider and 4 inches deeper than the switchboard.
E. Level, shim, and anchor to floor or wall with bolts or concrete anchors.
F. Install all necessary wiring or interconnections as required.
G. Make all internal and external connections as indicated and as required by manufacturer's wiring diagrams.
H. Check all internal and external connections, especially current transformer secondary short circuiting jumpers, and tighten as required.
I. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A and the National Electrical Code.
J. Grounding:
    1. Provide equipment grounding connections for switchboards as indicated. Tighten connections to comply with tightening torques specified in UL 486A to assure permanent and effective grounds.
    2. Test for ground continuity. Test neutral continuity to grounded point of derived system.
K. Identification:
    1. Provide switchboard identification as specified in Section 26 05 53 - Identification for Electrical Systems.
    2. Provide switchboard with nameplate indicating designation, incoming line circuit number, voltage, and number of phases. Provide typed circuit directory indicating circuit number and load served. Provide each overcurrent device with a corresponding adhesive label with associated number and load served as indicated.
    3. Place arc flash label on equipment.
L. Place Dow Corning 3-6548 Silicone RTV or General Electric RTF762 sealant in the following locations:
    1. All holes in concrete walls, floors and roof slabs after installation of conduit.
    2. All unused holes and sleeves as approved by Resident Project Representative.

3.03 FIELD QUALITY CONTROL:

A. Manufacturer’s Field Services:
    1. Manufacturer's field service shall be provided as specified in this Section and in Division 01.
    2. Switchboard manufacturer shall provide the field services of a factory technician for a minimum of 3 day(s) on 3 separate occasions to supervise/inspect installation, test and start-up all equipment provided. All travel and living expenses shall be included. All equipment required for testing, start-up and performance verification shall be provided by the start-up technician.
    3. Additional days and trips shall be provided as required to fully complete field testing, startup, and training as specified.

4. The switchboard manufacturer shall provide a factory technician specializing in Ethernet/IP communication as part of the start-up field services. All equipment required for setup and configuration shall be provided by the technician. The technician shall be available to assist the Systems Integrator in setup and configuration of the plant control system network connections to the switchboard and associated network connected devices.

B. Field Testing:
1. Perform "start-up" tests as recommended by manufacturer.
2. Prior to energization of circuitry, check all accessible connections to manufacturer's torque tightening specifications.
3. Prior to energization, check for electrical continuity of circuits and for short-circuits.
4. Prior to energization check with an insulation resistance tester: phase-to-phase and phase-to-ground insulation resistance levels to ensure requirements are fulfilled. Record and submit field test data.
5. Configure networked equipment for proper communication on the Ethernet/IP PCS network.
6. Test network communication to all network connected electronic meters, trip units, and logic controllers and verify the overload device is responding to commands and reporting statuses properly to the plant control system.
7. The manufacturer's representative shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. The settings shall be in accordance with the approved short-circuit study, protective device evaluation study, and protective device coordination study.
8. Automatic Throw-Over System Tests: Simulate actual system operation. Includes, but is not limited to, simulations of power failure, transfer to emergency source, and re-transfer to normal source.

C. Additional Field Testing:
1. Provide additional field testing as required by switchboard manufacturer.

D. Submit field testing and commissioning reports as specified in Division 01.

3.04 FINISHES:

A. Equipment coatings shall be free from scratches, rust, or other defects.
B. All damaged or defective coatings shall be repaired prior to final acceptance.
C. Field Painting:
1. Touch Up:
a. Contractor shall prepare surfaces and touch up manufacturer applied coatings as required for any damage during shipment and installation.
b. Field painting shall be performed based on manufacturer's recommended procedures.
c. Switchboard manufacturer shall furnish Contractor with an adequate quantity of touch-up paint to match the factory applied finish.

3.05 ADJUSTING AND CLEANING:

A. Adjust operating mechanisms for free mechanical movement.
B. After field installation and final wiring terminations are completed the field connected power and control wiring and cables shall be adjusted and neatly secured with tie wraps, hook-and-loop straps, or the like.
C. Prior to final acceptance the switchboard interior and exterior shall be wiped clean and free from dust and debris.

3.06 DEMONSTRATIONS:

A. Subsequent to installation of switchboard and all main, feeder, and branch circuit wire and cable hook-ups, energize switchboards and demonstrate functioning in accordance with requirements.
B. Demonstrate the automatic throw-over system in both automatic and manual mode.
C. Where necessary, correct malfunctioning units and then retest to demonstrate compliance.

3.07 TRAINING:

A. The switchboard manufacturer shall provide a qualified representative for a minimum of one day of training at the customer's facility for operations, maintenance and service personnel.
    1. The training session shall include classroom discussion on the theory of operation of the equipment, as well as maintenance and service methods for the purchased equipment.
    2. Topics covered shall include safety, hardware layout and functions, power and control wiring, diagnostic indicators, keypad/display interface, programming, setup, configuration, operational indicators, faults, diagnostic tools, troubleshooting, and preventive maintenance.
    3. Hands-on training shall be provided on the equipment.
    4. Documentation shall be provided which shall include actual manuals for the equipment and drawings and schematics of equipment supplied for this project.
B. The Owner at their option shall be allowed to video record all training sessions for future reference.
C. Contractor shall record the training sessions and provide a final edited version to the Owner on a DVD-ROM and electronic video file format.

END OF SECTION 26 24 13

SECTION 26 24 14 – DOCKING STATION FOR PORTABLE GENERATOR

PART 1 - GENERAL

1.01 SUBMITTALS

A. Submit as specified in Division 01 and Section 26 05 10 – General Electrical Requirements for administrative and procedural requirements for submittals.

1.02 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. ETL/UL LISTED to 1008 Standards
C. UL 50 LISTED

1.03 COORDINATION

A. Coordinate layout and installation of Generator Docking Station, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels

1.04 GUARANTEE/WARRANTY

A. Manufacturer Warranty shall be provided for a minimum of 1 Year.
B. The equipment installed under this contract shall be left in proper working order
C. New materials and equipment shall be guaranteed against defects in composition, design or workmanship. Guarantee certificates shall be furnished.

PART 2 - PRODUCTS

2.01 DOCKING STATION

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
    1. TRYSTAR: Docking Station.
    2. Eaton.
    3. Square D.
    4. ABB.

2.02 GENERAL REQUIREMENTS

A. Enclosure
    1. NEMA 4X Rain-Tight Stainless Steel Enclosure
        a. Pad-lockable front door shall include a hinged access plate at the bottom for entry of temporary cabling that prevents unauthorized tampering while in use.
        b. NEMA 4X Integrity shall be maintained while temporary cabling is connected during use
        c. Front and Side shall be accessible for maintenance
        d. Top, Side, and Bottom shall be accessible for permanent cabling
B. Phase, Neutral, and Ground Busbar
    1. Material: Tin-plated Copper
    2. Equipment Ground Bus: bonded to box.
    3. Isolated Ground Bus: insulated from box.
    4. Ground Bus: 100% of phase size.
    5. Neutral Bus: Neutral bus rated 100 percent of phase bus.

C. Temporary generator connectors shall be Camlok style mounted on gland plate.
   1. Camlok shall be 16 Series model and color coded according to system voltage requirements.
   2. Camlok connections shall be Bus Bar Style, Cabling or Double Set Screw is not acceptable
   3. Camlok connection shall be protected against accidental contact while not in use
D. Permanent Connection shall be factory installed broad range set-screw mechanical type, located behind a physical barrier
E. Short Circuit & Withstand Rating
   1. Shall be minimum 65 KAIC unless otherwise indicated on drawings
F. Voltage & Amperage
   1. 480/277V, 3Ø, 4W, amperage as indicated on plans.
G. Factory Installed Phase Rotation Monitor Device:
   1. Phase monitoring relay to be Siemens 3U4512-1AR20 or equal and factory installed
H. Additional accessories shall be included in submittal drawing as follows:
   1. Battery Charger Receptacle 20A GFCI 125V.
   2. Block Heater Receptacle 30A L5-30 125V.
   3. 50A Twist-Lock 125V/250V.
   4. Kirk Key Door Interlock.
   5. Listed Monitoring Device.
   6. Strip Heater & Thermostat.
   7. Utility Light/Alarm.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine elements and surfaces to receive Generator Docking Station for compliance with installation tolerances and other conditions affecting performance of the Work.
B. Proceed with installation only after unsatisfactory conditions have been corrected

3.02 INSTALLATION

A. Surface, Flush or Base Mounted: Determined by Application
   1. Install anchor bolts to elevations required for proper attachment to Generator Docking Station.

3.03 IDENTIFICATION

A. Comply with requirements in Section 26 05 53 Identification for Electrical Systems.
B. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
C. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.04 FACTORY COMMISSIONING

A. Upon completion of the installation, the docking station shall be commissioned by the Manufacturer's factory authorized technician.
B. Scope of work shall include:
   1. Review and verify the installation of all Trystar components and verify the correct electrical flow as depicted on the one-line drawings.
   2. Factory training for on-site personnel to educate them on how to connect the GDS to a portable generator

3. The Manufacturer's factory authorized technician shall, upon completion of the commissioning provide a written report to the electrical contractor and electrical engineer indicating the completion of the work.
4. Any issue that is found during the start-up that is determined at that time to be a warranty issue will be covered by Manufacturer. Any issues that are specific to the scope for the electrical installing contractor are the sole responsibility of the installing contractor.
5. Upon successful completion of the commissioning, provide a complimentary 12-month warranty extension, above and beyond the 12-month manufacturer warranty.

3.05 FIELD QUALITY CONTROL

A. Third Party Tests and Inspections to include the following:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

B. Prepare test and inspection reports, including a certified report that identifies Generator Docking Station and that describes scanning results.

END OF SECTION 26 24 14

SECTION 26 24 16 – PANELBOARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section specifies panelboards including cabinets and boxes, as indicated by Drawings and Schedules, and as specified herein.

B. Types of panelboards and enclosures required for the Project include the following:

1. Service entrance panelboards.
2. Distribution panelboards.
3. Lighting and appliance branch-circuit panelboards.
4. Mini-power centers.

1.03 RELATED REQUIREMENTS:

A. Other Division 26 Sections for wires/cables, electrical boxes, fittings, and raceways required in conjunction with the installation of panelboards and enclosures.

B. Section 26 05 26 – Grounding and Bonding for Electrical Systems.

C. Section 26 05 53 – Identification for Electrical Systems.

D. Section 26 43 13 – Surge Protection Devices.

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with the latest standards revision in effect as of the date of the Contract Documents unless otherwise indicated.

B. Institute of Electrical and Electronic Engineers (IEEE):

1. IEEE C62.41.1 – Surge Environment in Low-Voltage (1000V and less) AC Power Circuits.
2. IEEE C62.41.2 – Characterization of Surges in Low-Voltage (1000V and less) AC Power Circuits.
3. IEEE C62.45 – Surge Testing on Equipment Connected to Low Voltage (1000V and less) AC Power Circuits.
4. IEEE C62.62 – Test Specification for Surge Protective Devices for Low Voltage AC Power Circuitry.

C. National Electrical Manufacturers Association (NEMA):

1. NEMA 250 – Enclosures for Electrical Equipment (1,000V Maximum).
2. NEMA PB 1 – Panelboards.
3. NEMA PB 1.1 – General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600V or Less.
4. NEMA PB 2.2 – Application Guide for Ground-Fault Protective Devices for Equipment.
5. NEMA ST 20 – Dry Type Transformers for General Applications.

D. InterNational Electrical Testing Association:

1. NETA ATS – Acceptance Testing Specifications for Electrical Power Equipment and Systems.

E. National Fire Protection Association (NFPA):
   1. NFPA 70 - National Electrical Code (NEC): Comply with applicable local code requirements of the authority having jurisdiction and NEC as applicable to installation and construction of electrical panelboards and enclosures.

F. Underwriters Laboratories (UL): Provide panelboard units which are UL listed and labeled.
   1. UL 50 - Electrical Cabinets and Boxes.
   2. UL 67 - Electrical Panelboards.
   3. UL 486A - Wire Connectors and Soldering Lugs for Use with Copper Conductors.
   4. UL 489 - Molded-Case Circuit Breakers and Circuit Breaker Enclosures.
   5. UL 869A - Electrical Service Equipment.
   6. UL 1053 - Ground-Fault Sensing and Relaying Equipment.
   7. 1283 – Electromagnetic Interference Filters.
   8. 1449 – Safety for Surge Protective Devices.
   9. Special Use Markings: Provide panelboards constructed for special use with appropriate UL markings which indicate that they are "Suitable for Use as Service Equipment" where applicable.

1.05 PERFORMANCE REQUIREMENTS:

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
   1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces or short circuit currents specified and the unit will be fully operational after the seismic event."

1.06 SUBMITTALS:

A. Submit as specified in Division 01 and Section 26 05 10 – General Electrical Requirements for administrative and procedural requirements for submittals.

B. Submittals shall be custom prepared by the panelboard manufacturer for this specific application.

C. Product Data: Submit for each type of product specified and included, with the following as a minimum:
   1. Data sheets for all components furnished as part of the system package.

D. Shop Drawings: Provide the following as a minimum:
   1. Panelboard dimensions and weight. Provide center-of-gravity information for each seismic rated panelboard.
   2. Complete data on circuit breakers. Submit time - current characteristic curves of all devices.
   3. Panelboard short-circuit interrupting capacity, and information on buses: Phase, neutral, and ground.
   4. Information on whether panelboard is fed from top or bottom.
   5. Data on maximum and minimum incoming and outgoing feeder and branch circuit wire size.
   6. Data on door, locks, and mounting: Surface or flush.
   7. Data on total number of poles and number of unused poles that is available for future use.

E. Closeout Submittals: Final documentation shall include the following as minimum:
   1. Operation and Maintenance Manuals including the following:
      a. Operation and maintenance manuals for all components furnished.
      b. Certified “As-Built” drawings of all equipment with information listed above.
      c. Copies of all approved Product Data.

d. Copies of all approved Test Reports.
e. Warranty Information.

F. Maintenance Material Submittals:
1. Furnish extra materials and spare parts that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
a. Keys: Two spares for each type of panelboard cabinet lock.

1.07 QUALITY ASSURANCE:

A. Testing Agency Qualifications: Member company of NETA or a NRTL.
1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Materials and Equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least one year prior to Bid opening.

C. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Panelboards shall comply with NEMA PB 1.

G. Comply with NFPA 70.

H. Mini-power centers shall conform to the applicable requirements of 10 CFR 429.47 – Distribution Transformers and 10 CFR 431.193 – Test procedures for measuring energy consumption of distribution transformers.

1.08 DELIVERY, STORAGE, AND HANDLING:

A. Panelboards shall be stored according to the manufacturer's instructions and in a conditioned space to avoid condensation, dust, and other environmental contaminants. Store at secured and insured warehouse location.

B. Handle and prepare panelboards for installation according to NEMA PB 1 and manufacturer's instructions.

1.09 PROJECT SITE CONDITIONS:

A. Environmental Limitations:
1. Do not deliver or install panelboards until spaces are enclosed, weathertight, dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Service Conditions: Rate equipment for continuous operation under the following conditions unless otherwise indicated.
a. Ambient Temperature Limits: -5ºC through 40ºC.
b. Altitude not exceeding 6,600 feet.

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Engineer, Construction Manager, Owner no fewer than 14 days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Engineer's, Construction Manager's, Owner's written permission.

1.10 COORDINATION:

A. Coordinate the layout and installation of panelboards and components with other types of equipment including raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.11 WARRANTY:

A. All equipment furnished under this Section shall be warranted by the Contractor and the equipment manufacturer(s) for a minimum period of one year after substantial completion.

B. Warranty shall include all parts, labor, and expenses to perform necessary work.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Subject to compliance with requirements, provide panelboard and mini-power center products of one of the following (for each type and rating of panelboard and enclosure):
1. ABB.
2. Eaton.
3. Siemens.
4. Square D, Schneider Electric.

2.02 GENERAL REQUIREMENTS FOR PANELBOARDS:

A. Except as otherwise indicated, provide panelboards, enclosures, and ancillary components of types, size, and ratings indicated, which comply with manufacturer's standard materials and with the design and construction in accordance with published product information.

B. Where types, sizes, or ratings are not indicated, comply with NEC, UL, and established industry standards for those applications indicated.

C. Equip with proper number of panelboard switching and protective devices as required for complete installation.

D. Provide ground fault circuit interrupter type circuit breakers where indicated.

E. Enclosures: Flush- and surface-mounted cabinets as indicated.
1. Provide enclosures fabricated by same manufacturer as panelboards which mate and match properly with panelboards.
2. Rated for environmental conditions at installed location. Provide NEMA type as described below and as defined by NEMA 250, unless indicated or specified otherwise.
   a. Indoor Dry and Clean Locations: NEMA Type 1 Type 12.
   b. Outdoor Locations: NEMA, Type 4X stainless steel.
   c. Wash-Down Areas: NEMA, Type 4X, stainless steel.
   d. Other Wet or Damp Indoor Locations: NEMA, Type 4X stainless steel.
3. Materials: Galvanized sheet steel cabinet type enclosures, in sizes required. Provide code gage (minimum 16-gage) thickness steel.

4. Must be UL 50 listed.
5. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Front doors shall have flush locks with three keys per panelboard, all panelboard enclosures keyed alike.
6. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
7. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections. Provide multiple knockouts and wiring gutters. Provide hinged doors over vertical wiring gutter.
8. Finishes:
   a. Color: Baked gray enamel finish over a rust inhibitor coating.
   b. Panels and Trim: Galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
   c. Back Boxes: Galvanized steel. Stainless Steel for NEMA 4X panelboards.
9. Directory Card: Inside panelboard door, equip with interior circuit directory frame and removable card with clear plastic covering.

F. Phase, Neutral, and Ground Buses:
1. Bus shall be braced to withstand available short-circuit currents as indicated.
2. Provide suitable lugs on neutral bus for incoming and outgoing feeders requiring neutral connections.
3. Equipment Ground Bus: Bare, uninsulated, adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
4. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box. Provide as indicated.
5. Material: Tin-plated, Hard-drawn copper, 98% conductivity.

G. Conductor Connectors: Suitable for use with conductor material and sizes indicated and specified.
1. Material: Tin-plated Hard-drawn copper, 98% conductivity.
2. Main and Neutral Lugs: Mechanical type.
3. Ground Lugs and Bus-Configured Terminators.
4. Feed-Through Lugs: As indicated, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Gutter-Tap Lugs: As indicated, suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
6. All lugs shall be mechanical type.
7. Provide terminals UL rated for 75ºC (minimum) conductors.

H. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.

I. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

J. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals as indicated.

K. Surge Protection Devices: Provide an integral surge protection device for each panelboard as specified. Refer to Section 26 43 13 – Surge Protection Devices for device requirements.

L. Provide panelboard nameplate as indicated.

2.03 SERVICE ENTRANCE AND POWER DISTRIBUTION PANELBOARDS:

A. Panelboards: NEMA PB 1, dead front, safety type, power and feeder distribution type, 480Y/277V and 208Y/120V, 3 phase, 4 wire, 60 hertz, with full-sized neutral bus as indicated.
B. Panelboard switching and protective devices in quantities, ratings, types, and with arrangements shown.
C. Anti-turn, solderless, pressure-type main lug connectors approved for use with copper conductors.
D. Provide panelboards with UL markings which indicate "suitable for use as service entrance equipment". Shall meet UL 869A.
E. Incoming Mains Location: Top or bottom as indicated.
F. Mains: Circuit breaker or lugs only as indicated.
G. Branch Overcurrent Protective Devices:
    1. Bolt-on, molded-case circuit breakers.
    2. Molded-case circuit breakers shall have toggle handles that indicate when tripped.
    3. Where multiple pole breakers are indicated, provide with common trip so overload on one pole will trip all poles simultaneously.
    4. Circuit breakers shall be replaceable without disturbing adjacent units.
H. Provide an integral surge protection device to protect the panelboard as specified this Section. Refer to Section 26 43 13 – Surge Protection Devices for device requirements.
I. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
    1. For doors more than 36 inches high, provide two latches, keyed alike.

2.04 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS:

A. Panelboards: NEMA PB 1, dead front, safety type, 480Y/277V and 208Y/120V (voltage rating as required), 3 phase, 4 wire, , 60 hertz with full-sized neutral bus.
B. Lighting and appliance branch-circuit type as indicated with switching and protective devices in quantities, ratings, types, and arrangements shown.
C. Incoming Mains Location: Top or bottom as required.
D. Mains: Circuit breaker or lugs only as indicated.
E. Branch Overcurrent Protective Devices:
    1. Bolt-on, molded-case circuit breakers.
    2. Molded-case circuit breakers shall have toggle handles that indicate when tripped.
    3. Where multiple pole breakers are indicated, provide with common trip so overload on one pole will trip all poles simultaneously.
    4. Circuit breakers shall be replaceable without disturbing adjacent units.
F. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
G. Provide an integral surge protection device to protect the panelboard as specified this Section. Refer to Section 26 43 13 – Surge Protection Devices for device requirements.

2.05 PANELBOARD INTEGRAL SURGE PROTECTION DEVICE:

A. Provide surge protection device (SPD) designed for installation within the panelboard. The SPD shall connect directly to the bus bar and have an integral disconnect. SPD shall be approved by panelboard manufacturer for installation within the panelboard. Indicating lights shall be mounted in the face of the panelboard. The unit shall provide the following modes of protection: line-to-line (L-L), line-to-ground (L-G), line-to-neutral (L-N), and neutral to ground (N-G).
B. Refer to Section 26 43 13 – Surge Protection Devices for SPD requirements.
C. Accessories:
    1. Green LED status indicator per phase.

2. Red LED service indicator.
3. Test function for LEDs and audible alarm.
4. Internal audible alarm with mute switch.
5. Surge event counter.

2.06 VOLTAGE INDICATING DEVICE VOLTAGE TEST PORTALS

A. Provide combination LED voltage indicating device and absence of voltage test portal for volt meter probes at each switchboard section, MCC section and panelboard section. Manufacturer shall be Grace Technologies PESD Combination Unit or engineer approved equal. Devices shall be factor installed into switchboard, MCC and panelboard sections.

2.07 MINI-POWER CENTERS:

A. General: Provide a combination transformer and panelboard as specified and indicated.
   1. Transformer: The transformer shall be totally enclosed, non-ventilated, NEMA 3R, dry-type, general purpose, 480V single-phase primary, 240/120V single-phase secondary, 60-Hz, 2-5% full capacity primary taps above and below normal, copper primary and secondary windings, maximum temperature rise of 115ºC at rated kVA, sound level rating shall not exceed NEMA ST 20 standards. Provide kVA rating as indicated. Comply with DOE energy efficiency standards as defined by 10 CFR Part 431.196 - Energy Conservation Standards for all transformers 15 kVA and larger.

B. Panelboards: NEMA PB 1, dead front, safety type with full-sized neutral bus, with switching and protective devices in quantities, ratings, types, and arrangements shown.

C. Incoming Mains Location: Bottom as required.

D. Mains: Circuit breaker as indicated.

E. Branch Overcurrent Protective Devices:
   1. Bolt-on, molded-case circuit breakers with minimum interrupting rating of 10,000 amperes at 240Vac.
   2. Molded-case circuit breakers shall have toggle handles that indicate when tripped.
   3. Where multiple pole breakers are indicated, provide with common trip so overload on one pole will trip all poles simultaneously.
   4. Circuit breakers shall be replaceable without disturbing adjacent units.

F. Conductor Connectors: Mechanical type for main, neutral, and ground lugs and buses.

G. Additional Requirements:
   1. The complete mini-power center shall be UL listed, rated for a minimum of 14,000 AIC rms, symmetrical at 480Vac, complete with lifting eyes and mounting brackets.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Verify Site conditions are suitable for installation of equipment.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF PANELBOARDS:

A. Install panelboards, mini-power centers, and enclosures as indicated, providing NEC required working space, in accordance with manufacturer's written instructions, applicable requirements of NEC and in compliance with recognized industry practices to ensure that products fulfill requirements. Provide seismic support and bracing that shall resist the forces of a Seismic Zone B event without damage.

B. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torqueing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A.

C. Fasten enclosures firmly to walls and structural surfaces, ensuring that they are permanently and mechanically anchored.

D. Provide properly wired electrical connections for panelboards within enclosures.

E. Install numbers on all circuit breakers and type the panelboard's circuit directory card upon completion of installation work. Clearly identify the load on each circuit and the circuit number according to the Contract Drawings.

F. Provide filler plates in all unused spaces.

G. Provision for future circuits at all flush mounted panelboards (unless indicated otherwise): Extend four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Extend four 1-inch conduits into raised floor space or below floor slab (not required for slabs on grade or basement floor slabs).

3.03 GROUNDING:

A. Provide equipment grounding connections for panelboard enclosures as indicated and as required by NEC. Tighten connections to comply with tightening torques specified in UL 486A to assure permanent and effective grounds. Provide grounding as specified in Section 26 05 26 – Grounding and Bonding for Electrical Systems.

3.04 IDENTIFICATION:

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 26 05 53 – Identification for Electrical Systems.

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate equipment served and room designations as indicated on the Drawings. Use a computer or typewriter to create directory; handwritten directories are not acceptable. Panelboard directory shall be subject to approval by the Engineer.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 05 53 – Identification for Electrical Systems.

D. Device Nameplates: Label each branch circuit device in power distribution panelboards with a nameplate complying with requirements for identification specified Section 26 05 53 – Identification for Electrical Systems.

3.05 FIELD QUALITY CONTROL:

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections as specified and as recommended by the equipment manufacturer.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:
   1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

E. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
   3. Prior to energization of electrical circuitry, check all accessible connections to manufacturer's tightening torque specifications.
   4. Prior to energization, check panelboard circuits for short circuits, electrical continuity of circuits, enclosure grounding and neutral grounding at service entrance and at incoming derived source transformer.
   5. Prior to energization of panelboards, check with insulation resistance tester the phase-to-phase and phase-to-ground insulation resistance levels of each phase bus to ensure requirements are fulfilled. Record and submit test results.
   6. Panelboards will be considered defective if they do not pass tests and inspections.
   7. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.06 FINISHES:

A. Equipment coatings shall be free from scratches, rust, or other defects.
B. All damaged or defective coatings shall be repaired prior to final acceptance.
C. Field Painting:
   1. Touch Up:
      a. Contractor shall prepare surfaces and touch up manufacturer applied coatings as required for any damage during shipment and installation.
      b. Field painting shall be performed based on manufacturer’s recommended procedures.
      c. Panelboard manufacturer shall furnish Contractor with an adequate quantity of touch-up paint to match the factory applied finish.

3.07 ADJUSTING AND CLEANING:

A. Adjust moving parts and operable components to ensure normal function as recommended by manufacturer.
B. Upon completion of installation, clean interior and exterior of panelboards. Remove paint splatters, spots, dirt and debris.
C. Touch-up scratched or marred surfaces to match original finishes.
D. Adjust transformer taps of mini-power centers as required.

3.08 PROTECTION:

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

3.09 DEMONSTRATION:

A. Subsequent to final wire and cable hook-ups, energize panelboards and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

END OF SECTION 26 24 16

SECTION 26 24 19 – MOTOR CONTROL CENTERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes the following:
   1. Motor control center and all necessary parts for complete assembly.
   2. Network components mounted within the motor control center.
   3. Coordination of motor horsepower and starter size, including overload protection, as required by the final designed horsepower submitted.

1.03 RELATED REQUIREMENTS:

A. Section 26 05 73 – Power System Studies.
B. Section 26 43 13 – Surge Protection Devices.
C. Section 40 66 00 – Process Control Networks.
D. Section 40 61 96 – Process Control Software Programming and Reports.

1.04 REFERENCE STANDARDS:

A. American National Standards Institute/National Electrical Manufacturers Association (ANSI/NEMA):
   1. ANSI/NEMA C37.50 – Low Voltage AC Power Circuit Breakers Used in Enclosures - Test Procedures.
   2. ANSI/NEMA C37.51 – Metal-Enclosed Low Voltage AC Power Circuit Breaker Switchgear Assemblies - Conformance Test Procedures.

B. American Society for Testing and Materials (ASTM):
   1. ASTM A123 – Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   2. ASTM A153 – Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   3. ASTM B5 – High Conductivity Tough Pitch Copper Refinery Shapes.
   4. ASTM B187 – Copper Bus Bar, Rod and Shapes and General Purpose Rod, Bar and Shapes.
   5. ASTM B188 – Seamless Copper Bus Pipe and Tube.
   6. ASTM B211 – Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod and Wire.
   7. ASTM B236 – Aluminum Bars for Electrical Purposes (Bus Bars).
   8. ASTM B317 – Aluminum-Alloy Extruded Bar, Rod, Pipe, Structural Profiles, and Profiles for Electrical Purposes (Bus Conductor).

C. Institute of Electrical and Electronic Engineers (IEEE):
   1. IEEE C37.13 – Low-Voltage AC Power Circuit-Breakers Used in Enclosures.
   2. IEEE C37.16 – Preferred Ratings, Related Requirements, and Application Recommendations for Low-Voltage AC (635 V and below) and DC (3200 V and below) Power Circuit Breakers.
   3. IEEE C37.20 – Metal-Enclosed Low-Voltage (1000 Vac and below, 3200 Vdc and below) Power Circuit Breaker Switchgear.
   4. IEEE C57.13 – Standard Requirements for Instrument Transformers.

D. National Electrical Manufacturers Association (NEMA):
   1. NEMA ICS Complete Set – Industrial Controls and Systems.
   2. NEMA PB 1 – Panelboards.

3. NEMA PB 2 – Deadfront Distribution Switchboards.
4. NEMA ST 20 – Dry-Type Transformers for General Application.

E. National Fire Protection Association (NFPA):
1. NFPA 70 - National Electrical Code (NEC): Comply with requirements of NEC as applicable to motor control center equipment and components.

F. Underwriters' Laboratories, Inc. (UL):
1. UL 50 – Enclosures for Electrical Equipment, Non-Environmental Considerations.
2. UL 489 – Molded Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
3. UL 508 – Industrial Control Equipment.
4. UL 845 – Motor Control Centers.
5. UL 857 – Busways.
6. UL 1449 – Surge Protective Devices.

1.05 SUBMITTALS:

A. Submit as specified in Division 01 and Section 26 05 10 – General Electrical Requirements for administrative and procedural requirements for submittals.

B. Submittals shall be custom prepared by the MCC manufacturer for this specific application.

C. Product Data: Submit for each type of product specified and included, with the following as minimum:
1. Data sheets for all components furnished as part of the system package.

D. Shop Drawings: Provide the following as minimum.
1. Fabrication and erection drawings.
2. Equipment dimensions, including stub-up locations, shipping splits and shipping weights.
3. Equipment ratings.
4. General outline drawing.
5. Detailed equipment installation drawings.
6. Schematic diagrams.
7. Bill of materials.
8. Nameplate schedule.
9. Surge Protective Device data and testing laboratory reports.
10. Sizing calculations for active harmonic filters.
11. Complete loading diagrams covering static and dynamic loadings for all conditions of operation and structural steel details.
12. Complete unit and internal wiring diagrams.
13. External connection diagrams.
14. Instrument transformer performance curves and data.
15. Time-current characteristic curves for overcurrent protective devices.
16. Configuration sheet for each intelligent overload relay that indicates all available settings for the relay along with recommended settings for each parameter. Any settings which require field adjustment or Engineer input shall be clearly indicated.
17. Complete list of available parameters from intelligent components including overload relays, variable frequency drives, and power meters. List shall include I/O addresses.

E. Seismic Qualification Certificates: Submit certification that switchboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems. Include the following:
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assemble components or on calculation.

2. Dimensioned Outline Drawing of Equipment Unit: Identify center of gravity and locate describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

F. Special Procedure Submittals:
1. Start-up and commissioning instructions.
2. Syllabus for Owner training.

G. Test and Evaluation Reports:
1. Factory acceptance test reports.
2. Commissioning test reports.

H. Closeout Submittals: Final documentation shall include the following as minimum:
1. Operation and Maintenance Manuals including the following:
a. Operation and maintenance manuals for all components furnished.
b. Certified "As-Built" drawings of all equipment with information listed above.
c. Copies of all approved Product Data.
d. Copies of all approved Test Reports.
e. Spare parts and supply list with supplier names and part numbers.
f. Warranty Information.
g. Manufacturer's service and repair support during and after warranty including contact information.
h. Configuration sheet for each intelligent overload relay indicating as installed settings for each relay.
i. Training Materials. Includes final edited training videos.

I. Maintenance Material Submittals:
1. Spare Parts:
a. Three spare LED indicating lamps for each type and color used.
b. Three spare indicating light assemblies.
c. Ten spare power and control fuses of each voltage and current rating used.
d. One 12oz aerosol cans of manufacturer's touch-up paint for each color used. Color shall match the original factory applied color.
e. One spare intelligent overload relay (NEMA Size 1).
f. One spare Ethernet network switch.
g. One spare 24Vdc power supply.
h. All parts supplied with the equipment shall be properly labeled for ease of identification and to permit the shortest possible time to repair.
2. Software:
a. Soft copy of computer software for programming solid-state overload relays and controllers supplied as part of the MCC equipment package.
b. Organize and submit software on a USB flash drive or DVD-ROM(s).

1.06 QUALITY ASSURANCE:

A. Materials and Equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least one year prior to Bid opening.

B. Factory Tests:
1. The manufacturer shall conduct tests according to industry standard requirements.
2. Perform factory tests on all system components and subassemblies to assure that all devices and systems are in proper working order before delivery to jobsite.
3. Test all power, control and communication systems for proper operation.

4. Simulate actual system operation.
5. System Level Tests:
    a. The system shall be given preliminary checks including verification of electrical connections including ground connections, power and control wiring shall be resistance checked point-to-point.
    b. Firmware of electronic components shall be checked for correct revision level.
    c. The equipment shall be fully checked against the approved drawings for compliance and correct physical dimensions.
6. Submit test reports as specified in Division 01.

C. Equipment shall be manufactured, assembled, tested and provided with appropriate UL labels.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. The MCC shall be delivered to the site pre-assembled and wired with all specified interconnecting wiring and cable. Cabling for connection across shipping splits shall be neatly coiled and identified. Exposed sections of equipment shall be fully protected from damage during shipment. All necessary hardware for reconnecting shipping splits shall be provided.
    1. The MCC manufacturer shall be responsible for all system interconnections across shipping splits at the project site.

B. Complete instructions for handling and storage shall be provided by the manufacturer prior to delivery of the equipment. All equipment shall have adequate provisions for handling by overhead crane or fork lift truck.

C. MCCs shall be stored according to the manufacturer's instructions and in a conditioned space to avoid condensation, dust, and other environmental contaminants. Store at secured and insured warehouse location.

1.08 COORDINATION:

A. Coordinate the size and location of concrete equipment pads. Cast anchor bolt inserts into the equipment pad as required. Concrete, reinforcement, and formwork are specified in Division 03.

1.09 PROJECT SITE CONDITIONS:

A. Do not store or install the MCC equipment specified herein until designated installation spaces are suitable for intended service.

B. Final or temporary HVAC systems shall be in place and operational to maintain the ambient temperatures and humidity conditions at occupancy levels prior to energizing the MCC and shall be maintained for the remainder of the construction period.

1.10 WARRANTY:

A. All equipment furnished under this section shall be warranted by the Contractor and the equipment manufacturer(s) for a minimum period of 5 years after completion of startup and as defined in Division 01.

B. Warranty shall include all parts, labor, and expenses to perform necessary work.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. ABB, Inc.
B. Eaton.
C. Schneider Electric.

D. Siemens.

2.02 MOTOR CONTROL CENTER ASSEMBLY:

A. Conform to ANSI/IEEE C37.20 and applicable ASTM, IEEE, NEMA and UL standards specified in PART 1, REFERENCES.
B. Rated 480Y/277-volt, 3-phase, 4-wire and 60 Hz.
C. The motor control center assembly including bus bracing and overcurrent devices shall have a minimum symmetrical interrupting rating as required.
D. Main horizontal bus of tin-plated copper with minimum rating as indicated continuous.
E. Vertical bus shall be tin-plated copper and shall be rated a minimum of 300 Amps.
F. Provisions shall be provided for splicing additional sections to either end of the motor control center.
G. Neutral bus continuous ampere rating 100% of main bus capacity.
H. Provide bonding jumper between the neutral and ground buses when indicated.
I. All copper bus bars shall be composed of 98% IACS copper with a current density of 1000-A per square inch and be plated as specified.
J. The dimensions (width, length and height) of the motor control center shall not be larger than the floor space allocated for the motor control center as indicated on the drawings.

2.03 ENCLOSURE:

A. Assemblies of vertical metal-enclosed sections, each nominally 20 inches wide, 20 inches deep, and 90 inches high, joined together to form totally enclosed freestanding units, designed to permit easy addition and removal of sections in the field.
B. NEMA Class I, Type B wiring construction, including intelligent MCC Ethernet.
C. NEMA Type 1, enclosure construction.
D. Ground bus provided for full length of the motor control center with lug for grounding the unit, located toward the bottom front of the MCC.
E. Section Arrangement:
    1. Minimum individual motor starter height: 12 inches.
    2. Minimum individual feeder device height: 6 inches.
    3. Front-mounted or arranged for back-to-back mounting as indicated.
    4. Arrange units to obtain best fill of each vertical section for minimum overall length, including spare spaces.
    5. Mount larger starters and transformers at bottom of each section.
    6. Locate metering components and other operator interface devices at a convenient operating height.
F. Construction:
    1. Horizontal wiring tray at top and bottom of unit.
    2. Vertical wireway with hinged door. Wireway shall have provisions for cable supports.
    3. Complete accessibility from front to all buses, starters, control devices, and all other components for wiring and maintenance.
    4. Front-mounted starter units, circuit breaker units, and other equipment in separate compartments isolated by steel barriers.
    5. Guide rails, separator bars, cover plates, and other provisions necessary for installation of a future starter unit in all future spaces and blank spaces remaining in the units after all required components are installed.
    6. Permanent base channel sills having closure strip at each end of units.
    7. Each unit compartment shall be provided with an individual hinged front door.

8. An operating mechanism shall be mounted on the primary disconnect of each starter unit. It shall be mechanically interlocked with the unit door to prevent access, unless the disconnect is in the OFF position. A mechanical means shall be provided to bypass this interlock. Padlocking capability shall be provided to positively lock the disconnect in the OFF position.

G. Finish:
1. Paint system with manufacturer's standard coating system suitable for intended service.
2. Exterior paint color shall be light gray.
3. Interior surfaces shall be painted white.

H. Nameplates:
1. Wording and equipment tags as indicated.
2. Engraved phenolic nameplates for each starter unit, fused disconnect unit, circuit breaker unit, and other equipment items that are unit mounted.
3. Engraved phenolic "master" nameplate for each motor control center.

2.04 INTELLIGENT SYSTEMS:

A. General:
1. Each motor control center shall be provided with a factory installed Ethernet network that utilizes Ethernet/IP communication protocol.
2. Ethernet/IP shall be the native communication language of the device and the use of protocol converter modules to allow devices to communicate on the specified network is not allowed.

B. Control Power:
1. Each combination motor starter, variable frequency drive, reduced voltage solid-state starter and contactor shall be provided with a unit mounted control power transformer to power control relays, indicating lights, motor space heaters, cooling fans and other equipment as indicated and specified.
2. Each MCC shall be provided with a redundant, 24Vdc power system to power network equipment, VFD communication and control boards, and intelligent overloads.
   a. A minimum of two full capacity 120Vac to 24Vdc power supplies shall be provided for each MCC. Each power supply shall be provided with a dedicated input circuit breaker and shall each be powered from a separately derived 120Vac source outside of the motor control center. Field terminal blocks shall be provided for this external power source.
   b. Each power supply shall be sized to accommodate all connected components plus a minimum of 20% spare capacity.
   c. A failure contact shall be provided from each power supply. Contact shall be rated a minimum of 3 Amps at 120Vac. Provide interposing relay if required. Contacts shall be factory wired to field terminal blocks.

C. Communication Network:
1. The motor control center shall have Category 5e Ethernet cabling installed from each intelligent unit back to the associated unit mounted Ethernet switch as indicated.
2. Refer to Section 40 66 00 – Network and Communication Equipment for Ethernet switch requirements. Provide a minimum of 20% spare ports for each motor control center.
3. For redundancy purposes the number of components connected to a single Ethernet switch shall be limited. A minimum of two network switches per MCC shall be provided. Switch connections shall be distributed to maximize the redundancy of the connected loads in the event of a single switch failure.

4. Ethernet cabling shall be routed through the MCC line-up, behind barriers that isolate the cabling from the unit space and wireways to prevent damage during installation.
5. Spare cables shall be routed to sections containing spare space. A minimum of one cable per 12-inches of spare space shall be provided.
6. The addition or removal of a unit from the network shall not interrupt the operation of other units within the system.
7. The manufacturer shall factory program the IP address, Subnet, and Default Gateway for all intelligent components. Coordinate with the Systems Integrator for IP Address assignments.

2.05 INCOMING LINE SECTION:

A. Incoming Power Feeder:
1. Necessary lugs, clamps, supports, space and all items to terminate cables and busway as required.
2. Main lug only or main circuit breaker as indicated.

2.06 MAIN CIRCUIT DEVICES:

A. Molded Case Circuit Breakers:
1. Provide for circuit breakers rated less than 225 Amps.
2. Molded-case, manually-operated, 3 pole.
3. Trip-free from handle.
4. Inverse time thermal element overload protection.
5. Instantaneous magnetic short-circuit protection on all poles.
6. External handle which clearly indicates when breaker is "ON," "OFF," or "TRIPPED," and lockable in the "OFF" position.

B. Molded-Case Circuit Breakers With Solid State Trip Unit:
1. Provide for circuit breakers rated 225 Amps and above.
2. Molded-case, manually-operated, 3 pole circuit breaker with solid state trip unit.
3. Trip-free from handle.
4. Solid state trip unit shall have the following features:
   a. Adjustable long time pickup.
   b. Adjustable long time delay.
   c. Adjustable short time pickup.
   d. Adjustable short time delay.
   e. Adjustable instantaneous time pickup.
   f. Adjustable instantaneous time delay.
   g. Adjustable ground fault time pickup.
   h. Adjustable ground fault time delay.
   i. I^2t settings for instantaneous and ground fault.
5. External handle which clearly indicates when breaker is "ON," "OFF," or "TRIPPED," and lockable in the "OFF" position.
6. Accessories:
   a. Auxiliary contacts as indicated.
   b. Shunt trip.

2.07 FEEDER DEVICES:

A. Provide Molded Case Circuit Breakers rated less than 200A:
1. Molded-case, manually-operated, 3 pole.
2. Trip-free from handle.

3. Inverse time thermal element overload protection.
4. Instantaneous magnetic short-circuit protection on all poles.
5. External handle which clearly indicates when breaker is "ON," "OFF," or "TRIPPED," and lockable in the "OFF" position.

B. Provide Molded-Case Circuit Breakers With Solid State Trip Unit rated 200A or greater:
1. Molded-case, manually-operated, 3 pole circuit breaker with solid state trip unit.
2. Trip-free from handle.
3. Solid state trip unit shall have the following features:
   a. Adjustable long time pickup.
   b. Adjustable long time delay.
   c. Adjustable short time pickup.
   d. Adjustable short time delay.
   e. Adjustable instantaneous time pickup.
   f. Adjustable instantaneous time delay.
   g. Adjustable ground fault time pickup.
   h. Adjustable ground fault time delay.
   i. I^2t settings for instantaneous and ground fault.
4. External handle which clearly indicates when breaker is "ON," "OFF," or "TRIPPED," and lockable in the "OFF" position.
5. Accessories:
   a. Auxiliary contacts as indicated.
   b. Shunt trip.

2.08 COMBINATION STARTERS:

A. General:
1. Factory-mounted interchangeable-type 12 inches or larger vertical modular units, with hinged doors.
2. Each combination starter shall be provided with a motor circuit protector (MCP) type disconnect.
   a. Shall be provided with an external handle that clearly indicates when the MCP is "ON," "OFF," or "TRIPPED" and be lockable in the "OFF" position.
   b. Molded-case, manually-operated, 3-pole.
   c. Adjustable, instantaneous-trip, magnetic-only-type circuit breaker.
   d. Coordinated unit rating for circuit protector and starter.
3. Suitable sized, fused, individual control transformers for supplying 120Vac control power to each motor starter coil, and its associated equipment as indicated.
4. Starters and starter spare spaces as indicated.
5. Each starter sized according to horsepower rating of motor furnished. One-line diagrams show approximate motor horsepower ratings and sizes of spare starters and spare starter spaces.
6. Auxiliary contacts as required by Contract Drawings.
7. Spare auxiliary contacts: One normally open and one normally closed, unless indicated otherwise.
8. Momentary or maintained start-stop push buttons, selector switches, control switches, time delay relays, and indicating lights for motor starters as indicated.

B. Full-Voltage Starters:
1. Provide full voltage NEMA type non-reversing starters.
2. Minimum starter size NEMA Size 1.
3. Provide voltage snubbers in parallel with contactor coil.

4. Provide with solid-state, self-powered overload relay sized for and adjustable to full load current of the motor being protected. Overload relay shall be manually reset and provide phase loss protection. Overload trip class shall be selectable between 5, 10, 20 and 30.
5. External manual reset of overload relay from outside of the unit enclosure.

C. Solid-State Reduced-Voltage Starter:
1. Provide solid-state reduced voltage starters with shorting contactors as indicated.
2. Microprocessor based solid-state controller.
3. Provide a smooth, stepless acceleration of a three phase induction motor.
4. Be capable of linear voltage ramp or current limit starting.
5. Have current limit capability adjustable between 150% and 450% of motor full load current.
6. Have an adjustable ramp time between 0.5 and 60 seconds.
7. Provide a soft stop capability to decelerate a motor over an adjustable time between 0 and 60 seconds.
8. Shall be rated for a minimum of four starts per hour at 450% current limit and a 30 second ramp time.
9. Power section shall consist of six Silicon Controlled Rectifiers (SCRs).
10. SCR's shall have a minimum repetitive peak inverse voltage rating of 1400 volts at 480 volts.
11. Have solid-state overload protection with an external manual reset and selectable overload trip class between 5, 10, 20 and 30.
12. Have phase loss detection which shall inhibit starting or shutdown the controller if a loss of any of the phases is detected.
13. Have shorted SCR detection which shall inhibit starting or shutdown the controller if one or more shorted SCRs are detected.
14. The following diagnostics shall be provided on the front of the controller:
    a. Control Power Available.
    b. Controller On.
    c. Overload Trip.
    d. Phase Loss.
    e. Shorted SCR.
15. Controller shall be convection cooled or fan cooled as required.
16. Have an ambient operating air temperature range of -20°C to +50°C without derating.
17. Shall be capable of operating in relative humidity of 5-95%, noncondensing.

D. Solid-State Intelligent Overload Relays:
1. Provide intelligent overload relays as indicated.
2. Provide with Ethernet/IP Ethernet communication capability.
3. Shall be provided with integral web page that allows for viewing and setting parameters utilizing standard web browser software.
4. Fully programmable electronic overload relays. Overloads shall provide a 4.5:1 adjustment range matched to NEMA contactor sizes 00-6. Overload relays shall monitor all 3 phases for current.
5. Parameter setting of the overload via network communications shall be supported.
6. Automatic, network, electronic and manual reset functions shall be supported.
7. As a minimum, the following protective functions shall be provided based on user configurable parameters:
    a. Thermal Overload.
    b. Current Phase Imbalance.
    c. Current Phase Loss.

d. Undercurrent.
e. Overcurrent.
f. Ground Fault.
g. Automatic Restart.

8. As a minimum, the overload shall provide the following user configurable parameters:
   a. Selectable Trip Class between 5, 10, 15, 20 and 30.
   b. Overload Restart Delay.
   c. Trip Delays for protective functions.
9. As a minimum, the overload shall provide the following diagnostic and operational information:
   a. Error and Trip Indicators.
   b. Ground Fault, L1, L2, L3 and 3 Phase Average Currents.
   c. Current Unbalance.
   d. Thermal Capacity Remaining.
   e. Fault History (Last 5 faults).
   f. Product Identifier.
   g. Run time accumulator.
10. Shall provide the following programmable I/O:
    a. Four (4) discrete inputs.
       (1) When more than Four (4) discrete inputs are indicated provide an expansion module to accommodate the additional I/O.
    b. Two (2) relay outputs.
11. Powered from 24Vdc.

2.09 ACTIVE HARMONIC FILTERS:

A. General Requirements:
1. Active harmonic filters shall be provided where required to meet 5% total demand distortion-current and 5% total harmonic voltage distortion and provide power factor correction to 0.95 lagging at the input lugs or circuit breaker for each MCC provided.
2. Units shall be selected and sized by the MCC manufacturer for all of the nonlinear loads connected to the MCC. Multiple units shall be provided if required. Units shall be sized to provide correction when only one of the nonlinear loads is operating or when all of the nonlinear loads are operating.
3. Shall provide harmonic cancellation to the 50th harmonic.
4. Maximum response time to step changes shall be 8 milliseconds.
5. Capable of paralleling up to 10 units.
6. All setup and programming of the filter shall be performed at the factory and tested at the factory.
7. CT and PT required for proper operation of the unit shall be provided and installed at the factory.

B. Over Current Protection:
1. Shall be provided with an input circuit breaker.
2. Provided with an external handle that clearly indicates when the circuit breaker is “ON”, “OFF”, or “TRIPPED” and be lockable in the “OFF” position.
3. Molded-case, manually-operated, 3-pole.
4. Provide instantaneous and thermal magnetic short circuit protection.

C. Physical Requirements:
1. Shall be capable of continuous operation in an average ambient temperature between 0°C and 40°C at an elevation up to 3300 feet (1000 meters) above MSL without derating.

Shall also be simultaneously suitable for continuous operation in a maximum humidity between 0 and 95% noncondensing.

2. Shall be air-cooled.

D. Keypad and Display:

1. A door mounted keypad with integral digital LCD display shall be furnished, capable of controlling the filter and setting parameters. The display shall present all diagnostic message and parameter values in standard engineering units when accessed, without the use of codes. The keypad shall allow the operator to enter exact numerical settings in standard engineering units. A plain English user menu (rather than codes) shall be provided in software as a guide to parameter setting.
2. As a minimum, the following parameters shall be available for display:
   a. AC line voltage.
   b. DC bus voltage.
   c. Load power factor.
   d. Unit output power factor.
   e. Load harmonic current.
   f. Load reactive current.
   g. Output harmonic current.
   h. Corrected load current.
   i. Unit status.
   j. Fault alarms.
3. Filter parameters shall be factory set in non-volatile memory and re-settable in the field through the keypad. Password security shall be available to protect parameters from unauthorized personnel.

E. Hard-Wired I/O:

1. Provide dry contact outputs rated a minimum of 2 Amps at 120 Vac to indicate the following:
   a. Filter operating.
   b. Common Fault alarm. If multiple units are provide in a single MCC line up fault contacts shall be wired in parallel to provide a single fault contact.

2.10 SURGE PROTECTIVE DEVICE (SPD):

A. Each MCC shall be provided with an integral Surge Protective Device (SPD). Refer to Section 26 43 13 – Surge Protection Devices.

2.11 PROTECTIVE RELAYS:

A. Motor Protection Relays:

1. Provide a microprocessor based motor protection relay for each pump motor as indicated on drawings.
2. The relays shall be front panel mounted and factory wired to field terminal blocks in the motor control center compartments.
3. The relay shall support the following ANSI protection functions:
   a. 37 - undercurrent/underpower.
   b. 38 - bearing temperature.
   c. 46 - current unbalance.
   d. 49 - stator temperature.
   e. 50/51 - instantaneous/overcurrent.
   f. 50G/51G - ground instantaneous/ground overcurrent.
   g. 66 - starts/hour and time between starts.

h. 86 - lockout.

4. The relay shall support the following field wiring:
   a. Three (3) 0 to 5 A phase current inputs.
   b. A minimum of 11 RTD inputs, field programmable, 100 ohm platinum.
   c. A minimum of four (4) discrete inputs, field programmable, optically isolated.
   d. A minimum of four (4) output relays, Form C, 120Vac minimum. One of the output relays shall be factory configured for trip function.
   e. Shall be powered from the motor control circuit.
   f. One (1) RS232 port and one (1) RS485 port for communication up to 19,200 bps.
   g. Tamper switch to prevent unauthorized tampering of setpoints.
5. Environmental rating: -40°C to +60°C.
6. Trip and alarm temperature range: 0 to 200°C.
7. The relay shall be capable of storing up to 250 sequential events records.
8. The relay shall be capable of retaining programmed setpoints and historical data in nonvolatile memory when the control power is removed.
9. The relay shall feature a minimum of fifteen (15) standard thermal overload curves which are user-selectable and a minimum of one (1) custom thermal overload curve which is user programmable. The thermal overload curves shall allow for the motors to operate continuously at 1.15 service factor without tripping on overload or overcurrent.
10. The relay shall be provided with a display and keypad. The display shall enable the users to view actual metered values, causes of alarms and trips and programming setpoints. The keypad shall enable the users to select the display of actual metered values, causes of alarms and trips, fault diagnosis and to program setpoints.
11. Provide LED indicators for displaying operating and trip statuses.
12. The relay shall be provided with a draw-out or fixed case. For a fixed case mounting, provide shorting terminal blocks for current transformer leads accessible from front of the compartments. The terminal blocks shall be General Electric PK-2 blocks or equal.
13. Provide setup and monitoring software with each relay. The software shall be Windows-based and shall be capable of creating, storing and downloading setpoint files to the relay. The software shall also be capable of viewing real-time values and retrieving, recording and trending of historical values.
14. Acceptable manufacturers: General Electric Company/Multilin, Basler Electric Company, Schneider Electric, Eaton or approved equal.

B. Current Transformers:
   1. Dry-type, torodial bushing or wound-type.
   2. Ratio as indicated or required by application.
   3. Accuracy conforming to ANSI/IEEE C57.13 Classification 2.5H or 2.5L for relaying and 0.3 for metering.
   4. Thermal and mechanical ratings corresponding to equipment with which applied.
   5. Secondary terminals connected to short-circuiting-type terminal blocks.

2.12 CONTACTORS:

A. Rated 600 volts.
B. 3 pole.
C. Coil designed to operate at 120Vac, 60 Hz.
D. Correct NEMA size with contacts rated for the specific load.

2.13 MISCELLANEOUS:

A. Push Buttons and Selector Switches:

1. Heavy duty, 30 mm units with contacts rated 10A continuous at 120Vac.
2. NEMA 4/12 rated.
3. Provide the number of contacts and contact development as required.
4. Start push buttons shall have green operators.
5. Stop push buttons shall have red operators.
6. Emergency Stop push buttons shall have red mushroom head operators.

B. Pilot Lights:
1. Heavy duty, 30 mm units.
2. NEMA 4/12 rated.
3. 120Vac cluster LED type.
4. Red lights shall indicate motor ON .
5. Green lights shall indicate motor OFF .
6. Amber lights shall indicate equipment failure.
7. White lights shall indicate power to MCC bucket ON.
8. Push-to-test type.

C. Control Relays:
1. Industrial type rated 600-volt, 60-Hz, with convertible contacts.
2. Minimum 10 Amp contact rating.
3. Coil voltage: 120-volt, 60-Hz.
4. Number of normally open and normally closed contacts as required.
5. Provide a minimum of two spare normally open and normally closed contacts.

D. Space Heaters:
1. Provide differential thermostat controlled space heaters in each section.
2. Space heaters shall be sized to prevent condensation within the enclosure.
3. Power space heaters from MCC.
4. Provide required control power transformer and overcurrent protection for space heaters.

E. Control Wiring:
1. Small wiring, necessary fuse blocks and terminal blocks within the motor control center shall be furnished as required.
2. Numbered terminal blocks shall be provided for field wiring and shall be suitable for copper cable rated for 75°C of the size as indicated on the drawings.
3. Terminal blocks shall be rated for 600 Vac.
4. Provide a minimum of 20% spare terminal blocks in each unit.
5. All internal control wire shall be type MTW, bundled and secured with nylon ties.
6. All current transformer secondary leads shall first be connected to conveniently accessible shorting terminal blocks before connecting to any other device.
7. Wire markers shall be installed at each end of all control wiring.

F. Control components mounted within the assembly, such as fuse blocks, relays, push buttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.

2.14 SOFTWARE:

A. When special software is required for interfacing or programming supplied equipment, provide one licensed copy of all required software to program, configure, control (for testing purposes) and monitor the intelligent overload relays, solid-state soft starters, variable frequency drives and power monitors. Software shall allow configuration files to be saved.

2.15 INFRARED (IR) WINDOWS

A. FLIR Infrared (IR) Windows: Provide two factory-installed infrared (IR) Flir or engineer approved equal windows per motor control center section. Factory locate IR windows for maximum viewing of bus, conductor, breaker, and other termination points.

2.16 VOLTAGE INDICATING DEVICES AND TEST PORTALS

A. Provide combination LED voltage indicating device and absence of voltage test portal for volt meter probes at each switchboard section, MCC section and panelboard section. Manufacturer shall be Grace Technologies PESD Combination Unit or engineer approved equal. Devices shall be factory installed into switchboard, MCC and panelboard sections.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Verify site conditions are suitable for installation of equipment.
B. Final or temporary HVAC systems shall be in place and operational to maintain the ambient temperatures and humidity conditions at occupancy levels prior to energizing MCCs and shall be maintained for the remainder of the construction period.

3.02 INSTALLATION:

A. Install shall conform to manufacturer's instructions.
B. Completely install as specified, indicated, or required for operation and continuous service at the locations indicated.
C. Provide all openings in floors, walls, roofs, and other structures necessary for complete equipment installation, unless such openings are specifically indicated as being provided by others. Include openings through floors for future cables to connect to spare breakers, starters, and the like and to spaces provided in equipment for future expansion.
D. Place Dow Corning 3-6548 Silicone RTV or General Electric RTF762 sealant in the following locations:
    1. All holes in concrete walls, floors and roof slabs after installation of conduit.
    2. All unused holes and sleeves as approved by Resident Project Representative.
E. For freestanding enclosures install a 4-inch high concrete equipment (housekeeping) pad 4-inches wider and 4-inches deeper than the MCC.
F. Level, shim, and anchor to floor or wall with bolts or concrete anchors, and grout all floor-mounted equipment.
G. Install all necessary wiring or interconnections as required.
H. Make all internal and external connections as indicated and as required by manufacturer's wiring diagrams.
I. Check all internal and external connections, especially current transformer secondary short circuiting jumpers, and tighten as required.
J. Place arc flash label on equipment.

3.03 FIELD QUALITY CONTROL:

A. Manufacturer’s Field Services:
    1. Manufacturer's field service shall be provided as specified in this Section and in Division 01.
    2. MCC manufacturer shall provide the field services of a factory technician for a minimum of 3 day(s) on 3 separate occasions to supervise/inspect installation, test and start-up all equipment provided. All travel and living expenses shall be included. All equipment

required for testing, start-up and performance verification shall be provided by the start-up technician.

3. Additional days and trips shall be provided as required to fully complete field testing, startup, and training as specified.
4. The MCC manufacturer shall provide a factory technician specializing in Ethernet/IP communication as part of the start-up field services. All equipment required for setup and configuration shall be provided by the technician. The technician shall be available to assist the Systems Integrator in setup and configuration of the plant control system network connections to the MCC and associated network connected devices.

B. Field Testing:
1. Perform “start-up” tests as recommended by manufacturer.
2. Prior to energization of circuitry, check all accessible connections to manufacturer's torque tightening specifications.
3. Prior to energization, check for electrical continuity of circuits and for short-circuits.
4. Prior to energization check with an insulation resistance tester: phase-to-phase and phase-to-ground insulation resistance levels to ensure requirements are fulfilled. Record and submit field test data.
5. Configure intelligent devices for proper communication on the Ethernet/IP network.
6. Configure intelligent device to maintain current state if network communication is lost unless specified or indicated otherwise. All devices shall be controllable locally at the motor starter or variable frequency drive if the communication system fails. Configure as required.
7. Set all parameters associated with intelligent overload devices for proper motor protection and system performance. Settings shall be recorded and included with final documentation as specified.
8. Test network communication to all network connected solid-state overload devices and verify the overload device is responding to commands and reporting statuses properly to the plant control system.

C. Additional Field Testing:
1. Provide additional field testing as required by motor control center manufacturer.

D. Submit field testing and commissioning reports as specified in Division 01.

3.04 FINISHES:

A. Equipment coatings shall be free from scratches, rust, or other defects.
B. All damaged or defective coatings shall be repaired prior to final acceptance.
C. Field Painting:
1. Touch Up:
a. Contractor shall prepare surfaces and touch up manufacturer applied coatings as required for any damage during shipment and installation.
b. Field painting shall be performed based on manufacturer’s recommended procedures.
c. MCC manufacturer shall furnish Contractor with an adequate quantity of touch-up paint to match the factory applied finish.

3.05 ADJUSTING AND CLEANING:

A. After field installation and final wiring terminations are completed the field connected power and control wiring and cables shall be adjusted and neatly secured with tie wraps, hook-and-loop straps, or the like.

B. Prior to final acceptance the MCC interior and exterior shall be wiped clean and free from dust and debris.

3.06 TRAINING:

A. The MCC supplier shall provide a minimum of one days of training at the customer's facility for operations, maintenance and service personnel.
   1. The training session shall include classroom discussion on the theory of operation of the equipment, as well as maintenance and service methods for the purchased equipment.
   2. Topics covered shall include safety, hardware layout and functions, power and control wiring, diagnostic indicators, keypad/display interface, software mapping, programming, setup, configuration, control loop tuning, operational indicators, faults, diagnostic tools, troubleshooting, and preventive maintenance.
   3. Hands-on training shall be provided on equipment.
   4. Documentation shall be provided which shall include actual manuals for the equipment and drawings and schematics of equipment supplied for this project.

B. Contractor shall record the training sessions and provide a final edited version to the Owner on a DVD-ROM and electronic video file format.

END OF SECTION 26 24 19

SECTION 26 27 26 –WIRING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section covers wiring devices for lighting and utilization equipment including but not limited to the following:
   1. Receptacles.
   2. Switches.
   3. Wall Plates.
   4. Plugs.
   5. Switch Rated Plugs and Receptacles.

1.03 RELATED REQUIREMENTS:

A. Section 26 05 26 – Grounding and Bonding for Electrical Systems.
B. Section 26 05 33 – Raceways, Boxes, Seals and Fittings for Electrical Systems.
C. Section 26 05 53 – Identification for Electrical Systems.
D. Section 26 50 00 – Lighting.

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
B. National Electrical Manufacturers Association (NEMA):
   1. NEMA WD 1 – General Color Requirements for Wiring Devices.
   2. NEMA WD 6 – Wiring Devices - Dimensional Specifications.
   3. NEMA 410 – Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts.
C. National Fire Protection Association (NFPA):
   1. NFPA 70 – National Electrical Code (NEC).
D. Underwriters Laboratories (UL):
   1. UL 20 – General-Use Snap Switches.
   2. UL 486A-486B – Wire Connectors.
   3. UL 498 – Attachment Plugs and Receptacles.
   4. UL 514D – Cover Plates for Flush-Mounted Wiring Devices.
   5. UL 943 – Ground-Fault Circuit-Interrupters.
   6. UL 1203 – Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations.
   7. UL 1310 – Class 2 Power Units.
   8. UL 1472 – Solid State Dimming Controls.
   9. UL 1682 – UL Standard for Safety Plugs, Receptacles, and Cable Connectors of the Pin and Sleeve Type.
   10. UL 1686 – UL Standard for Safety Pin and Sleeve Configurations.
   11. UL 2682 – Switch Rated Plugs and Receptacles.

1.05 SUBMITTALS:

A. Refer to Division 01 and Section 26 05 10 – General Electrical Requirements for administrative and procedural requirements for submittals.
B. Product Data for each product specified.

1.06 QUALITY ASSURANCE:

A. Conform to the requirements of NFPA 70.
B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. Wiring devices shall be packaged and shipped to the project site to avoid damage.
B. Store in a clean, dry space in original manufacturer's packing to avoid condensation, dust, and other environmental contaminants until ready for installation.

1.08 SEQUENCE AND SCHEDULING:

A. Schedule installation of wiring devices and associated wall plates after the surface upon which they are installed has received the final finish.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Appleton, Emerson Electric Co.
B. Cooper, Crouse-Hinds, Division of Eaton.
C. Hubbell, Inc.
D. Leviton Manufacturing Co., Inc.
E. Pass & Seymour, Legrand North America, Inc.
F. Russellstoll, Thomas & Betts.
G. Woodhead, Molex.
H. Source Limitation: Wiring device and associated wall plate shall be supplied from a single manufacturer for each type of device for consistency throughout project.

2.02 RECEPTACLES:

A. General:
   1. All receptacles shall be heavy-duty type and shall bear a UL 498 label and comply with NEMA WD 1 and WD 6 as applicable.
   2. Provide all necessary wiring and accessories as required for complete installation.
B. Flush-Mounted and Surface-Mounted Receptacles:
   1. Rated 20A at 125Vac.
   2. Duplex, arc-resistant, back and side-wired, 3-wire grounding type. NEMA reference 5-20R.
   3. Receptacle and wall plates shall be as follows:
      a. Flush mounted white receptacle “Heavy Duty” grade white 302 stainless steel wall plate with matching screws in finished areas.
      b. Flush-mounted receptacles in all other areas shall be gray with 302 stainless steel wall plates.
      c. Surface-mounted receptacles shall be gray and have castcopper-free aluminum FS or FD single or multiple gang boxes with matching cast aluminum cover plate.
   4. "Heavy Duty" grade type 5362, Fed. Spec. W-C-596 compliant, NEMA reference 5-20R.

5. Locations as indicated.
6. When indicated provide GFCI type as specified in this Section.

C. Flush-Mounted and Surface-Mounted UPS Receptacles:
1. Rated 20A at 125Vac.
2. Duplex, arc-resistant, back and side-wired, 3-wire grounding type.
3. Receptacle and wall plates shall be as follows:
   a. Flush-mounted receptacles in all other areas shall be red with 302 stainless steel wall plates.
   b. Surface-mounted receptacles shall be red and mounted in cast copper-free aluminum FS or FD single or multiple gang boxes with matching cast aluminum wall plate.
4. "Heavy Duty" grade type 5362, Fed. Spec. W-C-596 compliant. NEMA reference 520R.
5. Locations as indicated.

D. Ground Fault Circuit Interrupter (GFCI) Receptacles:
1. Flush or surface mounted as indicated.
2. Rated 20A at 125Vac, Fed. Spec. W-C-596.
3. Back and side wired terminals with feed-through design.
   a. Terminal installation unless indicated otherwise.
4. UL Standard 943 Class A, Group 1.
5. Leakage current sensitivity: 5 mA ±1 mA.
   a. Opens circuit within 25 milliseconds of reaching 5 mA.
6. Duplex, arc resistant and pre wired.
7. Cover plate materials and colors shall match standard receptacles as specified this Section.
8. FD box.
9. Locations as indicated.

E. Weatherproof Receptacles:
1. Flush or surface mounted as indicated.
2. Rated 20A at 125Vac, Fed. Spec. W-C-596. NEMA reference 520R.
3. GFCI receptacle as specified in this Receptacles Section when indicated.
4. Provide a gray receptacle with a cast aluminum weather-proof cover.
   a. Provide while in use cover for outdoor locations.
   b. Provide hinged self-closing, gasketed type covers for indoor damp locations.
5. FS or FD boxes.
6. Locations as indicated.

F. Twist Locking Receptacles:
1. Flush or surface mounted as indicated.
2. Rated 20A or 30A as required at 125Vac, NEMA reference L5-20 L5-30.
3. Cover plate materials and colors shall match standard receptacles as specified this Section.
4. Provide matching plug assembly when required for application indicated. Coordinate with Plugs this Section.

G. Surface-Mounted Explosion Proof Receptacle:
1. Rated 20A, 125V, 3-wire grounding type (NEMA 5-20R configuration).
2. Provide Feed-through design.
3. Cast copper-free aluminum housing
4. Top cover shall be hinged and spring loaded.
5. Receptacle shall incorporate a plug interlocking mechanism to prevent accidental disengagement while in use.

a. Receptacle interlocking mechanism shall not engage until the plug is fully inserted.

6. Provide a matching quick wiring plug for each receptacle provided.
   a. Plug shall be compatible with standard NEMA style receptacles.
7. Rated for service in Class I, Divisions 1 and 2, Groups C and D areas.
8. Must bear a label. Comply with UL 1203, UL 1682, and UL 1686 as applicable.

H. Special Receptacles:
1. Provide with ratings as indicated.
2. For flush mounted applications provide a gray receptacle with 302 stainless steel wall plate for flush mounted applications.
3. Provide with cast copper-free aluminum FS or FD single or multiple gang boxes with matching aluminum cover plate for surface mounted applications.
4. Provide with a NEMA 4X stainless steel mounting enclosure sized for the receptacle and necessary cable terminations.
5. Mounting hardware and cover screws shall be stainless steel.

I. Floor Receptacles:
1. Modular, above-floor service outlets and fittings of types and ratings indicated. Construct of cast aluminum. Use design compatible with floor outlet wiring methods indicated. Provide 20-ampere, 125V, 2-pole, 3-wire, grounding, gray duplex receptacles, NEMA configuration 5-20R. Provide with 3/4-inch or 1-inch NPT, 1-inch long, locking nipple for conduit installation.

J. Poke-Through Assembly Devices:
1. Factory-fabricated poke-through assembly devices with modular, flush (not 4-hour fire rated) or above-floor service outlets (as required), multi-channeled thru-floor raceway/fire stop assembly and below-floor junction box assembly. Construct above floor service fitting (or flush carpet flange) of die cast, satin finished aluminum with 20-ampere, 125V, 2-pole, 3-wire, grounding gray duplex NEMA 5-20R receptacle and modular communication/data service outlet with separation barrier between power and low-voltage section. Provide integral assembly UL listed as a total unit, with fire rating of 1, 1.5, 2, or 4 hours as required to be consistent with that of floor penetrated.

K. USB Charging Receptacles:
1. Rated 20A at 125Vac, NEMA 5-20R receptacle with two integral USB charging ports. “Heavy Duty” grade, arc-resistant, back and side-wired, 3-wire grounding type.
2. Shall comply with UL 94 for 5V flammability rating.
3. Shall comply with battery charging specification USB BC.1.2 and UL 1310.
4. Shall be compatible with USB 1.1/2.0/3.0 devices.
5. USB ports shall be rated 5Vdc, 2.1A each.
6. Cover plate materials and colors shall match standard receptacles as specified this Section.
7. Install where indicated.

2.03 SWITCHES:

A. General:
1. All switches and associated materials shall bear a UL 20 label and comply with NEMA WD 1.
2. Provide all necessary wiring and accessories as required for complete installation.

B. All single-pole, double-pole, three-way, and four-way switches as indicated.

C. Flush-Mounted, Tumbler, Self-Grounding, Heavy-Duty Switches:
1. Rated 20A at 120 or 277Vac.
2. Quiet type.

3. "Heavy Duty" grade.
4. White toggle and Industrial grade white 302 stainless steel wall plate with matching screws in finished areas.
5. Gray toggle in all other areas with 302 stainless steel wall plates.
6. Back and side wired design.
   a. Screw terminal installation unless indicated otherwise.
7. With grounding lug.

D. Surface-Mounted, Tumbler, Self-Grounding, Heavy-Duty Switches:
1. Rated 20A at 120V or 277Vac.
2. "Heavy Duty" grade switch with gray toggle.
3. FS and FD single or multiple gang cast boxes.
4. Cast aluminum cover plates and matching countersunk screws.
5. Locations indicated.

E. Weatherproof, Self-Grounding, Heavy-Duty Switches:
1. Rated 20A at 120V or 277Vac.
2. Gray toggle.
3. Flush or surface mounted as indicated.
4. FS or FD boxes with PVC gasketing.
5. "Heavy Duty" grade.
6. Lever-type, cast aluminum, gasketed cover plate.
   a. Cooper, Crouse-Hinds No. DS185 or engineer approved equal.
7. Locations indicated.

F. Explosion Proof Switches:
1. Enclosure rated for service in Class 1, Division 1 and 2, Groups C and D areas.
2. Heavy-Duty switches rated 20A at 120V or 277Vac.
3. Locations and mounting as indicated.
4. Crouse-Hinds EFS/EFD, Hubbell-Killark FXS, or Engineer-approved equal.
5. Must bear a UL 1203 label.

2.04 PLUGS:

A. Rated 20A at 125Vac.
B. Industrial grade.
C. Provide with cord clamp to accept a cord range as required.
D. Integral cable grip with offset cable gripping jaws secured with two screws.
E. Grounding type.
F. NEMA WD 6 ratings to match associated source receptacle.
G. Provide for locations indicated.

2.05 SWITCH RATED PLUGS AND RECEPTACLES:

A. Meltric Type DSN and DS Switch-Rated Type Plugs & Receptacles.
1. Plugs and receptacles shall be listed to UL 2682 'Switch Rated Plugs and Receptacles'.
2. Plugs and receptacles shall have constant pressure butt-contacts with solid silver-nickel tips. Pin and sleeve contacts are not permitted.
3. Receptacles shall have dead front construction: live parts shall be inaccessible to thin tool or wire.
4. Plugs and receptacles rated 100A and below shall be able to close at least once into a conditional short-circuit current of up to 65,000A when protected by an RK1 fuse sized no greater than 400% of the highest full load motor current associated with the device. Plugs and receptacles rated higher than 100A shall be able to close into a short-circuit

with available fault current of 10,000A when protected by an RK1 fuse sized no greater than 400% of the highest full load motor current associated with the device.

5. Plugs and receptacles shall incorporate an integral switching mechanism to ensure the load is broken before the plug is removed from the receptacle.
6. Plug and receptacle wire terminals shall be spring-assisted to prevent loosening due to conductor yielding, shocks, vibrations or thermal cycling.
7. The minimum environmental rating of plugs and receptacles shall be Type 3R (DS Series), Type 4X and IP66/IP67/IP69k (DSN Series).
8. Ingress protection shall be achieved automatically when the plug is fully inserted into the receptacles, without additional manual operation.
9. Plugs and receptacles shall have a system of different keying positions in order to discriminate between circuits or incompatible operating voltages or frequencies.
10. Plugs and receptacles installed outdoors shall be able to withstand UV radiation.
11. Plugs and receptacles shall be MELTRIC Switch-Rated Series or engineer approved equal.

B. Meltric Type DXN Hazardous Location Type Plugs and Receptacles.

1. Plugs and receptacles shall be UL or CSA rated for Class I Division 2 Group A, B, C, D and Class II Division 2 Group E, F, G environments.
2. Plugs and receptacles shall be rated to ATEX II 2 G/D DUST T85 EEx ed IIC T6.
3. The minimum environmental rating of plugs and receptacles shall be IP66/IP67. Ingress Protection shall be achieved automatically when the plug is fully inserted into the receptacles, without any additional manual operation.
4. Receptacles shall have a dead front, live parts shall be inaccessible to a thin tool or wire.
5. Plugs and receptacles shall have constant pressure butt-contacts with solid silver-nickel contact tips. Pin and sleeve contacts are not permitted.
6. Plugs and receptacles shall be able to safely connect and disconnect equipment under full load in potentially explosive environments.
7. Hazardous duty rated plugs and receptacles shall be MELTRIC DXN Series or engineer approved equal.

C. Meltric Type DR Series Type Plugs & Receptacles.

1. Plugs and receptacles shall have constant pressure butt-contacts with solid silver-nickel tips. Pin and sleeve contacts are not permitted.
2. Receptacles shall have dead front construction: live parts shall be inaccessible to thin tool or wire.
3. Plugs and receptacles shall incorporate an integral load break mechanism to ensure the load is broken before the plug is removed from the receptacle.
4. Plug and receptacle wire terminals shall be spring-assisted to prevent loosening due to conductor yielding, shocks, vibrations or thermal cycling.
5. The minimum environmental rating of plugs and receptacles shall be Type 3R. Ingress protection shall be achieved automatically when the plug is fully inserted into the receptacles, without additional manual operation.
6. Plugs and receptacles shall have a system of different keying positions in order to discriminate between circuits or incompatible operating voltages or frequencies.
7. Plugs and receptacles installed outdoor shall be able to withstand UV radiation.
8. Plugs and receptacles shall be MELTRIC DR Series or engineer approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. General:
   1. Install wiring devices and accessories in accordance with manufacturer's written instructions, and in accordance with recognized industry practices.
   2. Coordinate with other work, including painting, electrical boxes, and wiring installation.
   3. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for wiring devices. Where manufacturer's torqueing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A-486B.
   4. Install wiring devices only in electrical boxes which are clean - free from building materials, dirt, and debris.
   5. Painting work shall be completed prior to device wall plate installation.

B. Receptacles:
   1. Mount receptacles outlets 1'-6" (450 mm) above floor, walkways, or finished grade unless indicated otherwise.

C. Switches:
   1. Mount 4 feet (1.2 meters) above floor, walkways, or finished grade unless indicated otherwise.
   2. Install close to trim on lock side when located near doors.

D. Wiring Circuits:
   1. Home Run Groupings:
      a. Group in home runs with not more than one conductor of each phase and 100% sized neutral and ground wire in one conduit.
      b. Circuits which are protected by ground fault circuit interrupter (GFCI) devices shall use their own separate and isolated neutral between the GFCI device and load.
   2. Use circuit numbers as indicated.
   3. Use type SVN3 wire for lighting and receptacle circuits unless indicated otherwise.
   4. Do not install wire smaller than No. 12 AWG.
   5. Install larger size wire as indicated or required to conform to requirement of NFPA 70 (NEC).
   6. Install in concealed and exposed conduit systems as indicated.

3.02 IDENTIFICATION:

A. Comply with Section 26 05 53 – Identification for Electrical Systems.

B. Identify each receptacle with panelboard identification and circuit number. Use hot stamped or engraved machine printing with black-filled lettering on face of plate and durable wire markers or tags inside outlet boxes.

C. Controlled receptacles shall be identified with controlled receptacle marking symbol complying with requirements in NFPA 70.

3.03 PROTECTION:

A. Protect installed devices from damage.

B. Devices and wall plates that are damaged, stained, or painted shall be replaced prior to final acceptance.

3.04 FIELD QUALITY CONTROL:

A. Testing:

1. Prior to energizing circuits, test wiring for electrical continuity and for short-circuits. Ensure proper polarity of connections is maintained.
2. After circuits are energized, test wiring devices and demonstrate compliance with requirements.
    a. Test each receptacle with a receptacle tester to ensure proper polarity.
    b. Test ground fault circuit interrupters with the local test button and with a receptacle tester to simulate a remote ground fault.
    c. Verify the phase rotation is identical on all multi-phase receptacles.

END OF SECTION 26 27 26

SECTION 26 28 13 - FUSES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Cartridge fuses rated 600 V ac and less for use in the following:
    a. Control circuits.
    b. Motor-control centers.
    c. Panelboards.
    d. Switchboards.
    e. Enclosed controllers.
    f. Enclosed switches.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.03 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Eaton (Bussmann).
B. Littelfuse.
C. Mersen (Gould/Ferraz).

2.02 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.
    1. Type RK-1: 250 or 600-V as required, zero- to 600-A rating, 200 kAIC, time delay.
    2. Type RK-5: 250 or 600-V as required, zero- to 600-A rating, 200 kAIC, time delay.
    3. Type CC: 600-V, zero- to 30-A rating, 200 kAIC, time delay.
    4. Type CD: 600-V, 31- to 60-A rating, 200 kAIC, time delay.
    5. Type J: 600-V, zero- to 600-A rating, 200 kAIC, time delay.
    6. Type L: 600-V, 601- to 6000-A rating, 200 kAIC, time delay.
    7. Type T: 250-V, zero- to 1200-A or 600-V, zero- to 800-A rating as required, 200 kAIC, time delay.
B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
C. Comply with NEMA FU 1 for cartridge fuses.
D. Comply with NFPA 70.
E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install spare-fuse cabinet(s) in location shown on the Drawings.

3.02 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 26 28 13

SECTION 26 29 13 –ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section specifies starters, contactors, push buttons, switches, indicating lights, relays, and motor controller work as indicated and specified.

1.03 RELATED REQUIREMENTS:

A. Refer to applicable Division 26 Sections for wires/cables, grounding, identification, electrical raceways, and boxes and fittings required in connection with enclosed controllers.
B. Section 26 05 26 – Grounding and Bonding for Electrical Systems.
C. Section 26 05 33 – Raceways, Boxes, Seals, and Fittings for Electrical Systems.
D. Section 26 05 53 – Identification for Electrical Systems.

1.04 REFERENCE STANDARDS:

A. National Electrical Manufacturers Association (NEMA):
   1. NEMA 250 – Enclosures for Electrical Equipment (1,000V Maximum).
   2. NEMA AB 1 – Molded-Case Circuit Breakers.
   3. NEMA ICS 1 – General Standards for Industrial Control Systems.
   4. NEMA ICS 2 – Industrial Control Devices, Controllers, and Assemblies.
   5. NEMA ICS 3 – Industrial Systems.
   6. NEMA ICS 6 – Enclosures for Industrial Controls and Systems.
   7. NEMA KS 1 – Enclosed Switches.
   8. NEMA MG1 – Motors and Generators.
B. National Electrical Contractor's Association (NECA):
   1. NECA NEIS 1 - Standard for Good Workmanship in Electrical Construction.
C. National Fire Protection Association (NFPA):
   1. NFPA 70 – National Electrical Code (NEC): Comply with applicable local electrical code requirements of the authority having jurisdiction and NEC Articles 200, 250, 430 and 702 as applicable to installation and construction of enclosed controllers.
D. Underwriters Laboratories (UL): Provide controllers and components which are UL-listed and labeled.
   1. UL 50 – Enclosures for Electrical Equipment.
   2. UL 98 – Enclosed and Dead-Front Switches.
   3. UL 486A – Wire Connectors and Soldering Lugs for Use with Copper Conductors.
   4. UL 489 – Molded Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
   5. UL 508 – Electric Industrial Control Equipment.

1.05 DEFINITIONS:

A. CPT: Control power transformer.
B. MCCB: Molded-case circuit breaker.
C. MCP: Motor circuit protector.
D. N.C.: Normally closed.
E. N.O.: Normally open.

F. OCPD: Overcurrent protective device.
G. SCR: Silicon-controlled rectifier.

1.06 SUBMITTALS:

A. Refer to Division 01 and Section 26 05 10 – General Electrical Requirements for administrative and procedural requirements for Submittals.
B. Includes, but not limited to, the following:
   1. Product Data: Submit manufacturer's data and installation instructions on motor controllers, contactors, push buttons, selector switches, indicating lights and relays.
   2. Shop Drawings: Submit Shop Drawings of motor controllers showing dimensions and weights. Submit dimensional data on push buttons, selector switches, indicating lights and relays.
      a. Show tabulations of the following:
         (1) Each installed unit's type and details.
         (2) Factory-installed devices.
         (3) Nameplate legends.
         (4) Short-circuit current rating of integrated unit.
         (5) Features, characteristics, ratings, and factory settings of individual OCPDs in combination controllers.
   3. Wiring Diagrams: Submit power and control schematic and wiring diagrams for motor controllers and contactors. Differentiate between portions of wiring which are manufacturer factory installed and portions which are field-installed.
   4. Field quality-control reports.
   5. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed and arrange to demonstrate that switch settings for motor running overload protection suit actual motors to be protected.
C. Closeout Submittals:
   1. Information listed above.
   2. Operation and Maintenance Data: Include the following as minimum:
      a. “As-Built” drawings.
      b. Field quality-control reports.
      c. Warranty information.
      d. Routine maintenance requirements for enclosed controllers and installed components.
      e. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
      f. Manufacturer's written instructions for setting field-adjustable overload relays. Include installed and operating load current with list of settings.
      g. Manufacturer's written instructions for testing, adjusting, and reprogramming reduced-voltage solid-state controllers.
D. Maintenance Material Submittals:
   1. Spare Parts:
      a. One spare LED indicating lamps for each type and color used.
      b. One spare indicating light assembly.
      c. Ten spare power and control fuses of each voltage and current rating used.
   2. All parts supplied with the equipment shall be properly labeled for ease of identification and to permit the shortest possible time to repair.

1.07 PRODUCT DELIVERY, STORAGE, AND HANDLING:

A. Deliver Equipment and components properly packaged in factory-fabricated type containers.
B. Store Equipment and components in original packaging and in a clean dry space; protect from weather and construction traffic.
C. Handle Equipment and components carefully to avoid breakage, impact, denting, and scoring of finishes. Do not install damaged Equipment; replace and return damaged units to Equipment manufacturer.

1.08 COORDINATION, SEQUENCING AND SCHEDULING:

A. Sequence equipment installation work with other work to minimize possibility of damage and soiling during remainder of construction period.
B. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.09 QUALITY ASSURANCE:

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Subject to compliance with requirements, provide motor controllers, contactors, push buttons, switches, indicating lights, and relays of one of the following:
   1. Eaton.
   2. ABB.
   3. Schneider Electric.
   4. Siemens.

2.02 COMBINATION MAGNETIC MOTOR STARTERS:

A. Full-voltage, non-reversing, reversing or two speed, NEMA style, with motor circuit protector (MCP) type disconnect.
B. Minimum NEMA Size 1.
C. Motor Circuit Protector:
   1. Shall be provided with an external handle that clearly indicates when the MCP is "ON," "OFF," or "TRIPPED" and be lockable in the "OFF" position.
   2. Molded-case, manually-operated, 3-pole.
   3. Adjustable, instantaneous-trip, magnetic-only-type circuit breaker.
   4. Coordinated unit rating for circuit protector and starter.
D. Interrupting rating RMS Symmetrical as required.
E. Provide with solid-state, self-powered overload relay sized for and adjusted to full load current of motor being protected. Overload relay shall be manually reset and provide phase loss protection.
F. External manual reset of overload relay from outside of the enclosure.
G. Built-in 480/120V control transformer on 480V units of adequate capacity for all control devices as indicated on Contract Drawings.
H. Auxiliary contacts as required by Contract Drawings.

I. Momentary or maintained start-stop push buttons, selector switches, control switches, control relays, and indicating lights to implement control sequence indicated.
   1. Heavy duty, 30 mm units.
   2. Start push buttons shall have a green operator.
   3. Stop push buttons shall have a red operator.
   4. 120Vac cluster LED, push to test type indicating lights.
   5. Red lights shall indicate “Equipment On”.
   6. Green lights shall indicate “Equipment Off”.
   7. Amber lights shall indicate “Equipment Failure”.

2.03 REDUCED-VOLTAGE SOLID-STATE CONTROLLERS:

A. General Requirements for Reduced-Voltage Solid-State Controllers: Comply with UL 508.

B. Factory-assembled combination of reduced-voltage solid-state controller, OCPD, and disconnecting means for use with 3-phase squirrel cage induction motors.

C. MCP Disconnecting Means:
   1. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
   2. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
   3. Auxiliary contacts "a" and "b" arranged to activate with MCP handle.

D. Reduced-Voltage Solid-State Controllers: An integrated unit with power SCRs, heat sink, microprocessor logic board, door-mounted digital display and keypad, shorting contactor, and solid-state overload relay; suitable for use with NEMA MG 1, Design B, polyphase, medium induction motors.
   1. Configuration: Standard duty; nonreversible.
   2. Starting Mode: Provide a smooth, stepless acceleration of a three-phase induction motor.
   3. Be capable of linear voltage ramp or current limit start.
   4. Have current limit capability adjustable between 150% and 450% of motor full load current.
   5. Have an adjustable ramp time between 0.5 and 60 seconds.
   6. Provide an adjustable soft stop capability to decelerate a motor over an adjustable time between 0 and 60 seconds.
   7. Shorting Contactor: Operates automatically when full voltage is applied to motor, and bypasses the SCRs. Solid-state controller protective features shall remain active when the shorting contactor is in the bypass mode.
   8. Shorting Contactor Coils: Pressure-encapsulated type; manufacturer's standard operating voltage, matching control power or line voltage, depending on contactor size and line-voltage rating. Provide coil transient suppressors.
   9. Have shorted SCR detection which shall inhibit starting or shut down the controller if one or more shorted SCRs are detected.
   10. Have an ambient operating air temperature range of -5ºC to +50ºC without derating.
   11. Be operable in relative humidity of 5-95%, non-condensing.
   12. Logic Board: Identical for all ampere ratings and voltage classes, with environmental protective coating.
   13. Control Circuits: 120Vac; obtained from integral CPT, with primary and secondary fuses of sufficient capacity to operate integral devices. CPT shall be sized to include the load of the motor heater.
      a. CPT Spare Capacity: 100 VA.

14. Keypad, front accessible; for programming the controller parameters, functions, and features; shall be manufacturer's standard and include not less than the following functions:
    a. Adjusting motor full-load amperes, as a percentage of the controller's rating.
    b. Adjusting current limitation on starting, as a percentage of the motor full-load current rating.
    c. Adjusting linear acceleration and deceleration ramps, in seconds.
    d. Initial torque, as a percentage of the nominal motor torque.
    e. Adjusting torque limit, as a percentage of the nominal motor torque.
    f. Adjusting maximum start time, in seconds.
    g. Adjusting voltage boost, as a percentage of the nominal supply voltage.
    h. Selecting stopping mode, and adjusting parameters.
    i. Selecting motor thermal overload protection class between 5 and 30.
    j. Activating and de-activating protection modes.
    k. Selecting or activating communication modes.
15. Digital display, front accessible; for showing motor, controller, and fault status; shall be manufacturer's standard and include not less than the following:
    a. Controller Condition: Ready, starting, running, stopping, auto mode, manual mode.
    b. Motor Condition: Amperes, voltage, power factor, power, and thermal state.
    c. Fault Conditions: Controller thermal fault, motor overload alarm and trip, motor under-load, overcurrent, shorted SCRs, line or phase loss, phase reversal, and line frequency over or under normal.
16. Push Buttons and Selector Switches:
    a. Heavy-duty 30 mm units with contacts rated 10A continuous at 120Vac.
    b. NEMA 4X rated.
    c. Provide the number of contacts and contact development as indicated.
    d. Start push buttons shall have red operators.
    e. Stop push buttons shall have green operators.
17. Pilot Lights:
    a. Heavy-duty, 30 mm units.
    b. NEMA 4X rated.
    c. 120Vac cluster LED type.
    d. Amber lights shall indicate equipment failure.
    e. Push-to-test type.
    f. Include general indication for:
        (1) Motor Faults
18. Controller Diagnostics and Protection:
    a. Microprocessor-based thermal protection system for monitoring SCR and motor thermal characteristics, and providing controller over-temperature and motor-overload alarm and trip; settings selectable via the keypad.
    b. Protection from line-side reverse phasing; line-side and motor-side phase loss; motor jam, stall, and under-load conditions; and line frequency over or under normal.
    c. Shunt trip that opens the disconnecting means when the controller diagnostics detect a faulted solid-state component.
19. Remote I/O Features:
    a. The following inputs/outputs prewired to terminal blocks.
        (1) Form C status contacts that change state when controller is running.

(2) Form C alarm contacts that change state when a starter fault condition occurs.
(3) Form C status of remote/local switch.
(4) Remote start/stop control.

20. Solid-State Overload Relay:
    a. Self-powered.
    b. Switch or dial selectable for motor running overload protection.
    c. Sensors in each phase.
    d. Tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
21. External overload reset push button.

2.04 CONTACTORS:

A. Mechanically held contactor.
B. Rated 600Vac.
C. Number of poles: As indicated or required.
D. 30Amp rated contacts unless indicated otherwise.
E. Auxiliary control devices, push buttons, and indicating lights as indicated.
F. Push Buttons and Selector Switches:
    1. Heavy-duty 30 mm units with contacts rated 10A continuous at 120Vac.
    2. NEMA 4X rated.
    3. Provide the number of contacts and contact development as indicated.
G. Pilot Lights:
    1. Heavy-duty, 30 mm units.
    2. NEMA 4X rated.
    3. 120Vac cluster LED push-to-test type, with color as indicated.

2.05 CIRCUIT BREAKERS:

A. Rated 480V, 3-phase, 60-hertz, with interrupting ratingRMS Symmetrical as required.
B. External handle which clearly indicates when breaker is "ON," "OFF," or "TRIPPED" and is lockable in the "OFF" position.
C. Molded-case, manually-operated, 3-pole.
D. Trip-free from handle.
E. Inverse time thermal element overload protection.
F. Instantaneous magnetic short-circuit protection on all poles.
G. Provide neutral and grounding lug kit.
H. Shall comply with NEMA AB1 and UL 489.

2.06 SAFETY SWITCHES:

A. Provide as required by NEC, specified or indicated.
B. Positive quick-make, quick-break mechanism, visible blades, and line terminal shield.
C. Single throw or double throw type when specified for source or load transfer.
D. Provide number of poles as indicated.
E. Provide auxiliary contacts for interlocking with motor starter or VFD when indicates. Contact quantity as required.
F. Furnish heavy duty type.
G. Shall comply with NEMA KS 1 and UL 98.
H. Short circuit rating as required.

2.07 ENCLOSURES:

A. Enclosed Controllers: NEMA ICS 6, to comply with environmental conditions at installed location.

B. Unless otherwise indicated, provide enclosed controllers with the following NEMA enclosure ratings:

1. NEMA 4X, stainless steel enclosures for outdoor areas.
2. NEMA 4X, stainless steel enclosures for process areas.
3. NEMA 12 enclosures for interior finished areas and electrical rooms.
4. NEMA 7 for classified locations.

2.08 CONTROL STATIONS:

A. Heavy duty, 30 mm push buttons and selector switches with number of contacts as required. Contacts shall be rated a minimum of 10 Amps at 120Vac.

B. Start push buttons shall have a green operator.

C. Stop push buttons shall have a red operator.

D. Emergency Stop push buttons shall have red mushroom head operators.

E. Unless otherwise indicated, provide control stations with the following NEMA enclosure ratings:

1. NEMA 4X, 304-stainless steel enclosures for outdoor and process areas.
2. NEMA 7, cast aluminum, explosion proof enclosure for classified locations.
3. NEMA 12 enclosures for interior finished areas and electrical rooms.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine areas and surfaces to receive enclosed controllers, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION:

A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall.

B. For controllers not at walls, provide freestanding racks complying with Section 26 05 33 – Raceways, Boxes, Seals, and Fittings for Electrical Systems.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Comply with NECA 1.

E. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 468A and the National Electrical Code.

3.03 IDENTIFICATION:

A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Section 26 05 53 – Identification for Electrical Systems.
   1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
   2. Label each enclosure with engraved nameplate.
   3. Label each enclosure-mounted control and pilot device.

3.04 GROUNDING:

A. Provide equipment grounding connections for motor controller and control equipment as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounding.
B. Grounding shall conform to Section 26 05 26 – Grounding and Bonding for Electrical Systems.

3.05 FIELD QUALITY CONTROL:

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
B. Acceptance Testing Preparation:
   1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.
C. Tests and Inspections:
   1. Inspect controllers, wiring, components, connections, and equipment installation.
   2. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.
   3. Test continuity of each circuit.
   4. Check all equipment grounds for continuity.
   5. Remove all blocking used for shipments.
   6. Verify that voltages at controller locations are within ±10% of motor nameplate rated voltages. If outside this range for any motor, notify Engineer before starting the motor(s).
   7. Test each motor for proper phase rotation.
   8. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
   9. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
D. Enclosed controllers will be considered defective if they do not pass tests and inspections.
E. Prepare test and inspection reports including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.06 ADJUSTING AND CLEANING:

A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.
B. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust to six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts.

If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Engineer before increasing settings.

C. Set field-adjustable switches and program microprocessors for required start and stop sequences in reduced-voltage solid-state controllers.

D. Coordinate with Section 26 05 73 – Power System Studies.

3.07 DEMONSTRATION:

A. Upon completion of installation of motor controller and control equipment and electrical circuitry, energize circuitry and demonstrate functioning of equipment in accordance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and retest to demonstrate compliance.

B. Engage a factory-authorized service representative to train Owner's maintenance personnel to use and reprogram microprocessor-based, reduced-voltage solid-state controllers.

C. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.

END OF SECTION 26 29 13

SECTION 26 29 23 – VARIABLE FREQUENCY MOTOR CONTROLLERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes variable frequency drives (VFD) and associated equipment.
B. Every variable frequency drive system shall consist of all system components required to meet the performance, protection, safety, testing, and certification criteria of this specification.
C. The VFD system must:
   1. Represent a fully integrated package. Any components not manufactured by the VFD manufacturer shall be purchased by the VFD manufacturer and supplied with the VFD.
   2. Include all material and labor necessary to interconnect any VFD system elements, even if shipped separately including input harmonic filters.
D. Any modifications to a standard product provided to meet this specification shall be performed by the VFD manufacturer only.
E. The VFD system shall be completely factory pre-wired, assembled and then tested as a complete package by the VFD manufacturer, to assure a properly coordinated, fully integrated drive system.
F. Any third party certification, safety or protection requirements shall be applied to the VFD system as a whole. Certification or protection of system elements or individual components by themselves is not acceptable.

1.03 RELATED REQUIREMENTS:

A. Section 26 05 26 – Grounding and Bonding for Electrical Systems
B. Section 26 05 53 – Identification for Electrical Systems

1.04 REFERENCE STANDARDS:

A. Provide equipment in full accordance with the latest applicable rules, regulations, and standards of:
   1. National Electric Code (NEC).
   2. Underwriters' Laboratories (UL).
   3. American National Standards Institute (ANSI).
   4. National Electrical Manufacturers Association (NEMA).
   5. Institute of Electrical and Electronics Engineers (IEEE).
      a. IEEE 519: Recommended Practice and Requirements for Harmonic Control in Electric Power Systems.
   6. Federal Communications Commission (FCC).

1.05 SUBMITTALS:

A. Submit as specified in Division 01 and Section 26 05 10 – General Electrical Requirements for administrative and procedural requirements for submittals.
B. Submittals shall be custom prepared by the VFD system manufacturer for this specific application.
C. Product Data: Submit for each type of product specified and included, with the following as minimum:
   1. Data sheets for all components furnished as part of the system package.
D. Shop Drawings: Provide the following as minimum:

1. Equipment dimensions, including stub-up locations, shipping splits and shipping weights.
2. Block diagram showing the basic control and protection systems specifying the protection, control, trip and alarm functions at the different locations, the reference signals and commands and the auxiliary supplies.
3. Electrical one-line diagram showing main and auxiliary circuitry, including main power input, VFD system grounding and auxiliary supplies.
4. Wiring diagrams, including external connection terminals.
5. Certifications.
6. Provide documentation on communication system interface along with a complete list of all available parameters and associated addresses.
7. Provide paper documentation of the programmable logic controller program.

E. Seismic Qualification Certificates: Submit certification that switchboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems. Include the following:
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assemble components or on calculation.
   2. Dimensioned Outline Drawing of Equipment Unit: Identify center of gravity and locate describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

F. Special Procedure Submittals:
   1. Start-up and commissioning instructions.
   2. Syllabus for Owner training.

G. Test and Evaluation Reports:
   1. Factory test reports.
   2. Efficiency and power factor values.
   3. Field test reports.

H. Closeout Submittals: Final documentation shall include the following as minimum:
   1. Operation and Maintenance Manuals including the following:
      a. Operation and maintenance manuals for all components furnished.
      b. Certified “As-Built” drawings of all equipment with information listed above.
      c. Copies of all approved Product Data.
      d. Copies of all approved Test Reports.
      e. Spare parts and supply list with supplier names and part numbers.
      f. Warranty Information.
      g. Manufacturer’s service and repair support during and after warranty including contact information.
      h. Training Materials. Includes final edited training videos.

I. Maintenance Material Submittals:
   1. Spare Parts:
      a. Three spare LED indicating lamps for each type and color used.
      b. Three spare indicating light assemblies.
      c. Three spare power and control fuses of each voltage and current rating used.
   2. Software:
      a. Soft copy of PLC programs including all programming comments.
      b. Organize and submit software on a USB flash drive.

1.06 QUALITY ASSURANCE:

A. Materials and Equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least one year prior to Bid opening.

B. Qualifications:
   1. The VFD manufacturer shall be able to demonstrate experience in manufacturing VFDs to demonstrate their capability to provide parts and service support.
   2. It is the intention of this specification to purchase dependable and reliable equipment offering the best performance available from currently proven technology. All equipment furnished under this contract must, therefore, have documentation showing proof of actual operation in similar service.

C. Factory Tests:
   1. The manufacturer shall conduct tests according to industry standard requirements.
   2. Perform factory tests on all VFD assemblies to assure that all devices and systems are in proper working order before delivery to jobsite.
   3. Test all power, control and communication systems for proper operation.
   4. Simulate actual system operation.
   5. System Level Tests:
      a. The system shall be given preliminary checks including verification of electrical connections including ground connections, power and control wiring shall be resistance checked point-to-point.
      b. Firmware shall be checked for correct revision level.
      c. Visual check shall be performed to verify: degree of protection for cabinets, input isolation is lockable in the off-position, marking of terminals and wiring, space availability for cable termination, accessibility of components and ease of maintenance and repair.
      d. The VFD system shall be fully checked against the approved drawings for compliance and correct physical dimensions.
      e. All control voltage levels are to be checked and verified.
      f. A no load test is to be performed on the system.
      g. Drive is to be connected to an unloaded motor and feedback signals shall be verified.
      h. Output voltage shall be calibrated.
      i. All logic and interlocks including customer logic and instrumentation shall be tested.
   6. Submit test reports as specified in Division 01.

D. VFDs shall be manufactured, assembled, tested and provided with a UL label.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. The VFD system shall be delivered to the site pre-assembled and wired with all specified interconnecting wiring and cable. Cabling for connection across shipping splits shall be neatly coiled and identified. Exposed sections of equipment shall be fully protected from damage during shipment. All necessary hardware for reconnecting shipping splits shall be provided.

B. The VFD system manufacturer shall be responsible for all system interconnections across shipping splits at the site.

C. Complete instructions for handling and storage shall be provided prior to delivery of the equipment. All equipment shall have adequate provisions for handling by overhead crane or fork lift truck.

D. VFDs shall be stored according to the manufacturer's instructions and in a conditioned space to avoid condensation, dust, and other environmental contaminants. Store at secured and insured warehouse location.

1.08 PROJECT SITE CONDITIONS:

A. Do not store or install the VFD equipment specified herein until designated installation spaces are suitable for intended service.

B. Final or temporary HVAC systems shall be in place and operational to maintain the ambient temperatures and humidity conditions at occupancy levels prior to energizing the VFDs and shall be maintained for the remainder of the construction period.

1.09 WARRANTY:

A. All equipment furnished under this section shall be warranted by the contractor and the equipment manufacturer(s) for a minimum period of five years after completion of startup.

B. Warranty shall include all parts, labor, and expenses to perform necessary work.

1.10 MAINTENANCE:

1. All maintenance materials supplied with the equipment shall be properly labeled for ease of identification and to permit the shortest possible time to repair.
2. Any parts that come from a sub-supplier shall be labeled with that manufacturer's name and part number.
3. Manufacturer shall state closest point where spare parts are stocked and where service can be obtained.
4. Manufacturer shall warrant that all parts shall be available for a minimum of ten years.
5. Maximum response time for trouble calls shall be two hours.
6. A qualified service technician shall be onsite within twenty-four hours of a qualified request.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Variable Frequency Drives 0.50 - 50 Horsepower:
   a). ABB.
   b). Allen-Bradley, Rockwell Automation, Inc.
   c). Eaton.
   d). General Electric.
   e). Robicon, Siemens Industry, Inc.
   f). Schneider Electric.

B. Variable Frequency Drives 60 – 500 Horsepower:
   a). ABB.
   b). Allen-Bradley, Rockwell Automation, Inc.
   c). General Electric.
   d). Robicon, Siemens Industry, Inc.
   e). Schneider Electric.

2.02 CONSTRUCTION:

A. General Requirements:
   1. VFD shall be microprocessor based and utilize Pulse Width Modulation (PWM) for speed control of an induction motor.

2. The VFD shall utilize Insulated Gate Bipolar Transistors (IGBT's).
    a. The VFD shall be sized to operate the indicated motor. Loads driven by VFD are variable torque unless indicated otherwise. Constant torque loads are indicated on the Contract Drawings.
3. The VFD shall be capable of producing a variable AC voltage/frequency output to provide continuous operation of a standard induction motor over a 5-100% speed range.
4. As a commissioning and troubleshooting feature, the VFD power circuit shall be capable of operating without a motor connected to the VFD output.
5. VFD rated for variable torque loads shall be capable of a momentary overload of 110% for one minute.

B. Input Harmonics:
1. The VFD shall be equipped with an integral 3% or 5% line reactor, as indicated by the Control Diagrams.
2. All VFDs greater than 50 horsepower shall incorporate one of the following topologies:
    a. Eighteen pulse or greater converter and drive isolation transformer.
    b. Designed with active components in the front end converter.
    c. Matrix conversion technology using bidirectional switching over the drive's full power and voltage range for a direct AC to AC conversion.
    d. The total harmonic voltage distortion at the point of common coupling shall be less than 5% and the total demand (current) distortion TDD shall be less than defined by the latest version of IEEE 519 with the following exception. The TDD shall not exceed 12% even when higher limits are allowed. The point of common coupling shall be defined as the bus servicing the feeder breaker to VFD.
    e. The drive isolation transformer, if required, shall meet the following:
        (1) Provide the phase shifting required for the multi-pulse converter.
        (2) Shall be a rectifier grade isolation type with a K-factor of 20 or higher and rated for the drive overload capability.
        (3) Shall have a maximum 115°C rise for 40°C ambient and minimum 220°C insulation.
3. Compliance with harmonic distortion limits shall be verified with field measurements as required in PART 3. Test report shall be submitted as specified in Division 01.
4. The VFD shall be equipped with an EMI/RFI filter.
5. The VFD shall meet local requirements for telephone interference restrictions.

C. Motor Compatibility:
1. Motor life expectancy shall not be compromised in any way by operation with the VFD system. The VFD shall provide motor overload protection in any operating condition.
2. The VFD output waveform shall be suitable for operating a squirrel cage induction motor without derating or requiring additional service factor.
3. The system design shall not have any inherent output harmonic resonance in the operating speed range.
4. The VFD output shall produce no electrically-induced, pulsating torque to the output shaft of the mechanical system eliminating the possibility of exciting a resonance caused by VFD induced torque pulsations.
5. The VFD shall protect the motor from high-voltage dv/dt stress which would cause insulation breakdown of an "inverter ready" motor. If the VFD requires an output filter to meet this requirement, it shall be an integral part of the VFD system and be included within the VFD enclosure.
6. As a minimum, an output filter shall be provided:

a. The output filter shall be designed to eliminate reflective waves and convert the PWM wave form to a near sinusoidal wave form.
b. Shall eliminate torque ripple and voltage wave reflection.
c. Designed for use with a wide range of carrier frequencies from 2kHz to 12kHz.
d. Short Term Overload Rating for 200% of rated current for a minimum of 3 minutes.
e. Insulation System shall be Class R (220°C) as minimum.
f. Temperature Rise of 115°C.
g. Ambient temperature rating of 40°C enclosed panel or 50°C open panel.
h. Voltage Distortion < 5% (typical).
i. UL listed.

D. VFD System Efficiency:
1. Guaranteed minimum total VFD system efficiency (η_{sys}) shall be a minimum 96% at 100% speed. Efficiency evaluation shall include all applicable devices such as the input harmonic filter, isolation transformer, VFD converter, and output filter, as indicated below. Auxiliary controls, such as internal VFD control boards, cooling fans, shall be included in all loss calculations.
2. The VFD system efficiency is as follows: $\eta_{sys} = \eta_{VFD} \times \eta_{tans} \times \eta_{harm} \times \eta_{filter}$

Converter/Inverter (VFD)	η_{VFD}
Isolation Transformer	η_{trans}
Input Harmonic Filter	η_{harm}
Output Filter	η_{filt}

E. System Input Power Factor: VFD system shall maintain a 95% minimum power factor from 30% to 100% of rated speed.
F. Speed Regulation: VFD speed regulation shall be ±0.5% without encoder or tachometer feedback.
G. Sound Level: Maximum allowable audible noise from the VFD system will be 80 dBA at a distance of one meter (3.3 ft) at any speed or load condition. VFD systems with audible noise in excess of this limit shall be provided with sufficient noise abatement treatment to reduce the sound pressure level below 80 dBA.
H. Integral VFD Bypass:
1. A complete factory-wired and tested bypass system consisting of an output contactor and bypass contactor. Overload protection shall be provided in both drive and bypass modes.
2. Door interlocked, padlockable circuit breaker that will disconnect all input power from the drive and all internally mounted options.
3. The drive/bypass shall provide single-phase motor protection in both the VFD and bypass modes.
4. The following operators shall be provided:
a. Bypass Hand-Off-Auto.
b. Drive/Bypass Mode Selector Switch.
c. Bypass fault reset.
5. The following indicating lights (pilot type) shall be provided. A test mode or push-to-test feature shall be provided.
a. Power-On (Ready).
b. Run enable open.
c. Bypass mode selected.
d. Drive running.
e. Bypass running.

f. Drive fault.
g. Bypass fault.

6. The following relay (Form C) outputs from the bypass shall be provided:
   a. System started.
   b. System running.
   c. Drive fault.
7. The digital inputs for the system shall accept 24V or 120Vac (selectable). The bypass shall incorporate an internally sourced power supply and not require an external control power source.
8. Customer Terminal Strip: All drive terminals shall be wired to a separate terminal strip.
9. The remote start/stop contact shall operate in VFD and bypass modes.
10. Class 20 or 30 (selectable) electronic motor overload protection shall be included.
11. Provide a VFD bypass system for the following VFDs
    a. IPS 200HP Motor #1 VFD.
    b. IPS 200HP Motor #2 VFD.
    c. IPS 200HP Motor #3 VFD.
    d. IPS 125HP Motor #4 VFD
    e. IPS 125HP Motor #5 VFD

2.03 AVAILABILITY AND RELIABILITY:

A. Firing Signals: All internal firing signals, and other communications (which link operational controls with power components such as status and diagnostic signals) shall meet noise immunity and safety requirements as defined by applicable IEEE Standards.
B. Power Sag Ride-Through: The VFD system shall be capable of continuous operation with a 20% voltage sag on the input power line.
C. "Catch-A-Spinning-Load" Capability: The VFD system shall be able to catch and take control of a spinning load if started while rotating equipment is already spinning. Appropriate safeguards shall be included in this operation to prevent damaging torque(s), voltages or currents from impacting any of the equipment. The user shall have the option of employing this feature or disabling it.
D. Auto-Restart Capability: The VFD system shall be capable of automatically restarting in the event of a power failure or drive trip. The VFD system shall provide the user with the choice of automatically restarting or not. The user shall be able to selectively apply this feature to some, but not necessarily all, conditions as determined by the user to be appropriate for the specific application.
E. Ground Fault Withstand: In the event of a ground fault, the VFD shall annunciate the ground fault condition and trip offline to clear the fault. The cause of the shutdown shall be logged to the fault history and be available at the keypad.

2.04 SERVICEABILITY/MAINTAINABILITY:

A. Front Access: The VFD system shall be designed for front access only.
B. Power Component Accessibility: All power components in the converter sections shall be designed for easy removal and accessibility to minimize repair downtime.
C. Marking/Labeling: Sleeve-type wire marker tags or other acceptable means of permanent identification shall be applied to power and control wiring. Individual nameplates shall be provided for all major components of the VFD system.

2.05 PHYSICAL REQUIREMENTS:

A. Environmental Requirements: The VFD system shall be capable of continuous operation in an average ambient temperature between 0°C and 40°C at an elevation up to 3300 feet (1000 meters) above MSL without derating. The VFD system shall also be simultaneously suitable for continuous operation in a maximum humidity between 0 and 95% noncondensing.

B. Heat Dissipation/Cooling System:
   1. The VFD system shall be air-cooled.

C. Enclosure:
   1. All VFD system components including, but not limited to, circuit breaker, line reactor, isolation transformer, and output filters shall be mounted and wired by the VFD system manufacturer in a grounded enclosure meeting the following requirements:
   2. VFD and auxiliary components shall be housed in a NEMA 1 gasketed or NEMA 12 enclosure.
      a. Cabinets and doors shall be fabricated using heavy gauge steel for sturdy construction and dimensional integrity to assure long-term fit and function. All doors shall be gasketed to provide environmental protection and secure fits.
      b. Units shall be provided with air filters covering all air inlets. Inlet air filters shall be 100% washable, with a progressively structured, corrosion-free media. Filters shall be front replaceable (for cleaning) while the VFD is in operation without exposing maintenance personnel to any of the power components.
      c. Paint procedures and materials shall be manufacturer's system designed and proven for resistance to chemical attack in industrial power-house environments.
   3. The enclosure shall be sized and designed for proper heat dissipation or equipped with an external corrosion resistant heat sink.
   4. Access to the VFD keypad and other control devices shall be available without opening the enclosure.
   5. Enclosures shall be designed to avoid harmonic and inductive heating effects. The enclosure shall be designed to shield any outside equipment from interference, enclosing and shielding the complete system to eliminate any radio frequency interference in compliance with FCC Part 18 requirements.

D. Installation/Cabling: All VFD system wiring (power, control and protection) shall be located internally within the VFD system enclosure. If special requirements of the project require that one or more VFD system components must utilize external cabling or connections to complete the VFD system excluding separately mounted input harmonic filter, this cabling and connecting shall be entirely supplied and/or contracted by the VFD system supplier, and approved by the Engineer. All external power conductors (bus or cable) shall be insulated. Power wiring shall be isolated by voltage class. Control and instrument wiring shall be isolated from power wiring.

2.06 PROTECTIVE DEVICES/DIAGNOSTICS:

A. Protective Features and Circuits:
   1. The controller shall include the following alarms and protective features:
      a. Static instantaneous over-current and over-voltage trip.
      b. Under-voltage and power loss protection.
      c. Over-temperature protection.
      d. Electronic motor inverse time overload protection.
      e. When power is restored after a complete power outage, the VFD shall be capable of catching the motor while it is still spinning and restoring it to proper operating speed without the use of an encoder.

2. The VFD system shall be protected from damage due to the following, without requiring an output contactor:
   a. Single-phase fault or three-phase short circuit on VFD system output terminals.
   b. Loss of input power due to opening of VFD input disconnect device or utility power failure during VFD operation.
   c. Loss of one (1) phase of input power.
   d. Motor regeneration due to backspin or loss of VFD input power.
3. The VFD shall be able to withstand the following fault conditions without damage to the power circuit components:
   a. Failure to connect a motor to the VFD output.
   b. VFD output open circuit that may occur during operation.
4. The VFD shall include a customer selectable automatic restart feature. When enabled, the VFD shall automatically attempt to restart after a trip condition resulting from over-current, over-voltage, under-voltage, or over-temperature.
5. The VFD system shall have the user selectable option of programming up to three speed avoidance bands. This gives the user the ability to block out and prevent operation at any undesirable speed, such as one that may be coincident with a mechanical resonance condition.

B. Diagnostics and Fault Recording:
1. The control logic section shall be fully digital and not require analog adjustment pots or fixed selector resistors.
2. Fault log data shall be stored in nonvolatile memory.
3. The VFD shall include a comprehensive microprocessor based digital diagnostic system which monitors its own control functions and displays faults and operating conditions.
4. A "FAULT LOG" shall record, store, and display upon demand, a minimum of the last four fault events.

2.07 INTERFACES:

A. Switches and Lights:
1. Selector switches, pushbuttons and pilot lights shall be provided on the front panel of the unit as indicated and specified.
2. Selector switches, pushbuttons and pilot lights shall be heavy duty 30 mm units with NEMA rating suitable for the specified enclosure. Pilot lights shall be LED push-to-test type.
3. As a minimum the following devices shall be provided:
   a. Local/Off/Remote selector switch.
   b. Start pushbutton.
   c. Stop pushbutton.
   d. Emergency Stop pushbutton.
   e. Running and Off indicating lights.
      (1) Red indicators for Equipment On.
      (2) Green indicators for Equipment Off.
   f. Fault indicating light.
   g. Speed Potentiometer.

B. Keypad and Display:
1. A front panel mounted keypad with integral digital LCD display shall be furnished, capable of controlling the VFD and setting drive parameters. The display shall present all diagnostic message and parameter values in standard engineering units when accessed, without the use of codes. The keypad shall allow the operator to enter exact numerical

settings in standard engineering units. A plain English user menu (rather than codes) shall be provided in software as a guide to parameter setting.

2. As a minimum, the following parameters shall be available for display:
   a. Speed demand in percent.
   b. Output current in amperes.
   c. Output Frequency in hertz.
   d. Output voltage.
   e. Total 3-phase kW output.
   f. Kilowatt hour meter.
   g. Elapsed time running meter.
   h. Run status.
   i. Fault status.
3. Drive parameters shall be factory set in non-volatile memory and re-settable in the field through the keypad. Password security shall be available to protect drive parameters from unauthorized personnel.
4. The keypad module shall contain a "self-test" software program that can be activated to verify proper keypad operations.

C. Hard-Wired I/O and Control Devices:
1. The VFD shall include programmable I/O for application specific configuration. The drive shall be configurable to operate in a local and remote mode. The drive shall provide for the following programmable input/output points to be associated with the control functions:
   a. Digital Inputs:
      (1) Provide a minimum of 6 fully programmable inputs configured, as indicated.
   b. Digital Outputs, Form C Relay (Dry Contract rated a minimum of 2 Amps at 120 Vac);
      (1) Provide a minimum of 2 fully programmable outputs configured, as indicated.
   c. Analog Input:
      (1) One 4-20 mA isolated input to control drive output (motor speed) when indicated.
   d. Analog Output:
      (1) One 4-20 mA isolated output signal representing drive speed and scaled 0-100%.
2. All programming shall initially be performed at the factory and tested at the factory. Specific requirements for the starting and stopping sequences shall be as indicated.
3. The VFD shall have provisions to power auxiliary devices as indicated.
4. Provide terminal blocks, pushbuttons, indicating lights and control relays as indicated, to provide control, indication and isolation of field-mounted devices.
5. The VFD shall be capable of implementing a speed control PID loop to maintain a level pressure setpoint as indicated.

D. Programmable Logic Controller:
1. The VFD shall be provided with a programmable logic controller installed within the VFD enclosure.
2. The programmable logic controller can be integral to the VFD control system or provided as a standalone controller installed within the VFD enclosure and wired to control the VFD.
3. The programmable logic controller shall include a comprehensive instruction set including: relay contact inputs, relay coil outputs, timers, counters, arithmetic functions, logical expressions, and PID loops.

4. The programmable logic controller shall be equipped with the required inputs and outputs to implement the control scheme indicated on the contract drawings.
5. The programmable logic controller shall be programmed to implement the control scheme described on the contract drawings.
6. All digital inputs and outputs shall be rated for 120 Vac and all analog inputs and outputs shall be 4-20mA, unless indicated otherwise.
7. The programmable logic controller shall be equipped with communication port capable of communicating the same protocol as specified for the VFD. The establishment and connection of the network shall be made and tested at the factory. A single communication port shall be available for connection of the programmable logic controller and VFD communication port to the plant communication network.
8. The programmable logic controller shall be programmed using ladder logic software.
9. Provide one licensed copy of the programming software.

E. Communication and Protocols:
1. The VFD shall be capable of direct communication to a standard x86 computer for serial link setup of parameters, fault diagnostics, trending and diagnostic log downloading.
2. The VFD shall be provided with an Ethernet communication card capable of communicating on a Ethernet/IP network.
   a. All control functions including start/stop and speed control shall be available via the network.
   b. All status and monitored input points shall be available via the network.
3. Provide a complete list of available control and indication points including required documentation for network configuration.

2.08 COMPONENT REQUIREMENTS:

A. Printed Circuit Boards: All printed circuit boards shall be new. They shall be conformably coated for moisture and chemical resistance, in addition to any dielectric coating properties. All boards shall be tested as specified.

B. Wiring:
1. All control wiring shall be physically separated from the power wiring. The VFD system shall be pre-wired within the enclosure. Spade-type connectors are not acceptable. No soldering shall be used in connection with any wiring. Wiring shall be adequately supported to avoid tension on conductors and terminations. All wiring shall be run in surface mounted conduit or wire-ways. Any section of wiring outside of conduit or wire-way shall be securely tied with cable ties or hook-and-loop (Velcro type) straps at intervals not exceeding 6 inches. No cables shall be tied off to or in any way supported from power busses. Wherever wiring passes metal edges or through holes, suitable guards or grommets shall be provided to prevent cutting or chafing of the insulation.
2. All terminal blocks shall have at least 20% spares. No more than two wires shall be terminated on one terminal.
3. All wiring shall be tagged with permanent labels at each termination, junction box, and device. Labels shall correspond to the schematic and wiring diagrams.

C. Ground Connection: Corrosion resistant grounding pads or terminals shall be provided in each power cubicle. A copper ground bus shall be provided for grounding of control circuits.

D. Input Power Terminations: Input and output power connections shall be made to isolated, supported and plated bus strap connections or terminal blocks. Sufficient space shall be provided for termination connections from the top or the bottom of the VFD cubicle.

E. Control Power:

1. A suitable sized 480 volt to 120 volt single phase control power transformer shall be provided to power all cooling fans and auxiliary devices. Additional capacity shall be provided for control devices powered from the VFD as indicated.
2. Control power for 24Vdc digital inputs shall be provided.
3. Shall be provided with ability to power VFD logic and communication boards from an external 120Vac Uninterruptible Power Supply (UPS) power source. The external power source shall allow the VFD to be programmed and configured without 480Vac power being supplied to the VFD, and allow communication and logic to maintain operation in the event of 480Vac power loss as long as the external power source is maintained. Provide the necessary field terminal blocks and 24Vdc power supply as required for this purpose.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Verify site conditions are suitable for installation of equipment.
B. Final or temporary HVAC systems shall be in place and operational to maintain the ambient temperatures and humidity conditions at occupancy levels prior to energizing VFDs and shall be maintained for the remainder of the construction period.

3.02 INSTALLATION:

A. Install to conform to manufacturer's instruction
B. Completely install as specified, indicated, or required for operation and continuous service at the locations indicated.
C. Wall mounted units shall be mounted approximately 4 feet to the centerline above the floor unless indicated otherwise.
D. Provide all openings in floors, walls, roofs, and other structures necessary for complete equipment installation, unless such openings are specifically indicated as being provided by others.
E. Place Dow Corning 3-6548 Silicone RTV or General Electric RTF762 sealant in the following locations:
   1. All holes in concrete walls, floors and roof slabs after installation of conduit.
   2. All unused holes and sleeves as approved by Resident Project Representative.
F. Level, shim, and anchor to floor or wall with bolts or concrete anchors, and grout all floor-mounted equipment.
G. Install all necessary wiring or interconnections as required.
H. Make all internal and external connections as indicated and as required by manufacturer's wiring diagrams.
I. Check all internal and external connections and tighten as required.
J. For freestanding enclosures install a 4-inch high concrete equipment (housekeeping) pad 4-inches wider and 4-inches deeper than the VFD.

3.03 FIELD QUALITY CONTROL:

A. Manufacturer’s Field Services:
   1. Manufacturer's field service shall be provided as specified in this Section and in Division 01.
   2. VFD system manufacturer shall provide the field services of a factory technician for a minimum of 3 day(s) on 3 separate occasions to supervise/inspect installation, test and start-up all equipment provided. All travel and living expenses shall be included. All

equipment required for testing, start-up and performance verification shall be provided by the start-up technician.

3. Assist the installing Contractor in the setup and configuration of the communications network.

B. Field Testing:

1. Perform "start-up" tests as recommended by manufacturer.
2. Establish proper direction of rotation for the motor controlled by the VFD.
3. Verify that the VFD operates properly in the "manual" control mode and in the "automatic" or "remote" control mode.
4. Verify that the VFD's speed adjusts properly with local speed controls and "automatic" or "remote" speed signals.
5. Set the maximum "locked rotor" current draw as recommended by the manufacturer and approved by the Engineer.
6. Set the minimum and maximum speed set points and the acceleration and deceleration ramp times as indicated or recommended by the Engineer.
7. Operate the VFD at 100% speed for at least 10 minutes and monitor output current. The output current should remain below the full load current listed on the motor nameplate. Check for excessive heating of the VFD and motor. Report any discrepancies to Engineer.
8. Verification of VFD input harmonic voltage and current distortion limits specified shall be verified at rated speed and rated power as part of final startup and acceptance of each VFD installation. A recording type Fluke, Multilin PQM, BMI or equivalent harmonic analyzer displaying individual and total harmonic currents and voltages shall be utilized.
9. Compliance with harmonic distortion limits shall be verified with field measurements at the point of common coupling (PCC) for each VFD. Measurements shall be made with all VFDs (or all VFDs that can be operated simultaneously) which are connected to the PCC in operation, and the measurements repeated without the VFDs in operation. Any distortions present when the VFDs are not in operation shall be subtracted from the readings when the VFDs are in operation. Test report shall be prepared and submitted as indicated below.
    a. Harmonic-Analysis Studies:
        (1) Scope of Study: Determine the impact of nonlinear loads and their associated harmonic contributions on the voltage and currents throughout the electrical system. Provide an analysis of all possible operating scenarios which will be or have been influences by the proposed or completed additions or changes to the subject system.
        (2) Procedure: The harmonic-analysis study shall be performed in accordance with the recommended practices and procedures set forth in IEEE 399.
        (3) Study Report: Results of the harmonic-analysis study shall be summarized in a final report containing the following items:
            (a) Basis, description, purpose, and scope of the study.
            (b) Tabulations of the data used to model the system components and corresponding one-line diagram.
            (c) Descriptions of the scenarios evaluated and the basis for each.
            (d) Tabulations of rms voltages, rms currents, and total capacitor bank loading versus associated equipment ratings. Equipment with insufficient ratings shall be clearly identified for each of the scenarios evaluated.

(e) Tabulations of calculated voltage-distortion factors, current-distortion factors, and individual harmonics versus the limits specified by IEEE 519. Calculated values exceeding the limits specified in the standard shall be clearly noted.
(f) Plots of impedance versus frequency showing resonant frequencies to be avoided.
(g) Tabulations of the system transformer capabilities based on the calculated nonsinusoidal load current and the procedures set forth in IEEE C57.110. Overloaded transformers shall be clearly noted.
(h) Conclusions and recommendations.

10. Test network communication and verify that VFD is responding to commands and reporting statuses properly to the PLC control system.
11. Test the operation of the programmable logic controller and verify that operation conforms to the description on the contract drawings.

3.04 FINISHES:

A. Equipment coatings shall be free from scratches, rust, or other defects.
B. All damaged or defective coatings shall be repaired prior to final acceptance.
C. Field Painting:
1. Touch Up:
a. Contractor shall prepare surfaces and touch up manufacturer applied coatings as required for any damage during shipment and installation.
b. Field painting shall be performed based on manufacturer's recommended procedures.
c. VFD manufacturer shall furnish Contractor with an adequate quantity of touch-up paint to match the factory applied finish.

3.05 ADJUSTING AND CLEANING:

A. After field installation and final wiring terminations are completed the field connected power and control wiring and cables shall be adjusted and neatly secured with tie wraps, hook-and-loop straps, or the like.
B. Prior to final acceptance VFD interior and exterior shall be wiped clean and free from dust and debris.

3.06 TRAINING:

A. The VFD system supplier shall provide a minimum of one day of training at the customer's facility for operations, maintenance and service personnel.
1. The training session shall include classroom discussion on the theory of operation of the equipment, as well as maintenance and service methods for the purchased equipment.
2. Topics covered shall include safety, hardware layout and functions, power and control wiring, diagnostic indicators, keypad/display interface, software mapping, programming, setup, configuration, control loop tuning, operational indicators, faults, diagnostic tools, troubleshooting, and preventive maintenance.
3. Hands-on training shall be provided on equipment.
4. Documentation shall be provided which shall include actual manuals for the equipment and drawings and schematics of equipment supplied for this project.
B. Contractor shall record the training sessions and provide a final edited version to the Owner on a video DVD-ROM and electronic video file format (MPEG-4 AVC/H.264 or equivalent).

END OF SECTION 26 29 23

SECTION 26 33 53 – STATIC UNINTERRUPTIBLE POWER SUPPLY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section specifies Uninterruptible Power Supply (UPS) systems and associated accessories.

B. Provide UPS units and accessories as specified and indicated.

1.03 RELATED REQUIREMENTS:

A. Section 40 62 00 – Computer System Hardware and Ancillaries.

B. Section 40 66 00 – Process Control Networks.

C. Section 40 67 00 – Process Control Panels and Hardware.

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

B. The seller shall furnish Equipment which conforms in all respects to applicable industry standards and sound engineering practice.

C. Design, fabricate, assemble, install and test Equipment to conform to the applicable standards specified herein.

D. National Fire Protection Association (NFPA):

1. NFPA 70 – National Electrical Code.

E. Institute of Electrical and Electronics Engineers (IEEE):

1. IEEE C62.41 – Surge Voltages in Low-Voltage AC Power Circuits.
2. IEEE C62.41.1 – Surge Environment in Low-Voltage (1000 Volts and less) AC Power Circuits.
3. IEEE C62.41.2 – Characterization of Surges in Low-Voltage (1000 Volts and less) AC Power Circuits.
4. IEEE 519 – Harmonic Control in Electric Power Systems.
5. IEEE 944 – Recommended Practice for the Application and Testing of Uninterruptible Power Supplies for Power Generating Stations.

F. Code of Federal Regulations (CFR), Federal Communications Commission (FCC):

1. 47 CFR - FCC Part 15, Subpart J, Class A.

G. Underwriters Laboratories (UL).

1. UL 1449 – Surge Protective Devices.
2. UL 1778 – Uninterruptible Power Supply Equipment.

1.05 SUBMITTALS:

A. Submit as specified in Division 01 and Section 26 05 10 – General Electrical Requirements for administrative and procedural requirements for submittals.

B. Product Data: Submit for each type of product specified and include the following as minimum:

1. Device list and bills of material.
2. Data sheets for all hardware and software.

C. Shop Drawings: Provide the following as minimum:

1. Wiring Diagrams.

2. Battery runtime calculations.

D. Closeout Submittals: Final documentation shall include the following as minimum:
   1. Information listed above.
   2. Commissioning test reports.
   3. Operation and maintenance manuals.

E. Maintenance Material Submittals:
   1. Software:
      a. Original CD/DVD-ROM disks and/or flash drives containing all software provided with supplied equipment. Associated licenses and license documentation shall be included.
      b. Organize and submit in a 3-ring binder.

F. Seismic Qualification Certificates: Submit certification that switchboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Section 26 05 48 – Vibration and Seismic Controls for Electrical Systems.

1.06 QUALITY ASSURANCE:

A. All Equipment and Material furnished shall have an acceptable history of satisfactory reliable service in similar use for a period of at least two years.

B. Equivalent newly developed Equipment with less than two years actual service will be considered from established manufacturers if it has been adequately tested, meets the requirements of this Contract, and is approved by Engineer. Such Equipment shall be noted in the proposal for review.

C. Factory Tests:
   1. Perform factory tests on complete system to verify proper operation before delivery to jobsite.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. UPS equipment and accessories shall be packaged and shipped to the project site to avoid damage.

B. All equipment shall be stored according to the manufacturer's instructions and in a conditioned space to avoid condensation, dust, and other environmental contaminants. Store at secured and insured warehouse location.

1.08 PROJECT SITE CONDITIONS:

A. Do not store or install UPS equipment specified herein until designated installation spaces are enclosed, weather tight, and free of contaminants.

B. Final or temporary HVAC systems shall be in place and operational to maintain the ambient temperatures and humidity conditions at occupancy levels prior to installation and shall be maintained for the remainder of the construction period.

1.09 WARRANTY:

A. UPS units shall be provided with a minimum 5-year manufacturer's warranty.

B. All other peripherals shall be provided with a minimum 5-year warranty period.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Uninterruptible Power System (UPS):
   1. Liebert, Emerson Electric Company.

2. Mitsubishi.
3. Powerware.

2.02 SCALABLE, DOUBLE CONVERSION UPS:

A. Scalable, network grade, on-line double conversion, uninterruptible power system rated 12 kVA with continuous line conditioning, inverter, batteries and control system.
B. N+1 redundancy with one more power module than is required to support rated load.
C. Field replaceable, hot swappable power and battery modules.
D. Redundant and hot swappable control modules.
E. Internal bypass.
F. Tower unit with minimum chassis capacity to support full unit rating and provide minimum runtime specified.
G. Electrical Capacity: Provide scalable unit with installed capacity and full unit rating as indicated. Scalable increments shall be a maximum of 4kVA.
H. Provide a unit that will produce its full rated output continuously.
I. The unit shall utilize double conversion technology to continuously clean the power in either normal or emergency mode to protect against spikes, sags, surges, noise, lightning, and brownouts.
J. Input Voltage: 120/208-volt, 60 hertz, single phase (3-wire with ground).
K. Output Voltage: 120/208-volt, 60 hertz, single phase (3-wire with ground).
L. The unit shall automatically switch to battery inverter backup upon loss of power and retransfer on return of normal power. These transfers shall have no effect on the output waveform and shall be transparent to the connected load.
M. The output waveform will be 60 hertz ±0.5-hertz sine wave with less than 5% total harmonic distortion (THD).
N. Shall conform to IEEE 519.
O. Surge withstand shall exceed C62.41.1 and C62.41.2.
P. Noise rejection - common mode better than 120 dB; transverse mode greater than 60 dB.
Q. Output shall have an isolated neutral.
R. Electromagnetic interference shall be minimized to ensure that computer systems shall neither effect nor be affected by the UPS. RFI filtering shall be provided on the input and output to minimize high frequency noise interference.
S. The batteries shall be sealed maintenance-free type NiCAD batteries.
T. The battery charger shall be fully automatic capable of recharging the batteries within 3 hours.
U. The unit shall automatically disconnect from the batteries and shutdown, preventing damage to the batteries due to a deep discharge.
V. The battery capacity shall be such to be able to sustain a power outage of 60 minutes at 100% rated wattage output, and to maintain 50% of rated wattage output for a period of 120 minutes.
W. Ambient Environment: 0°C to 40°C.
X. Provide with an LCD operator interface. Status indicators and audible alarm shall indicate normal, transfer to inverter, battery charging and overload, or failure alarm.
Y. Provide with UPS management card supporting Ethernet network interface to allow communication with the plant control system via SNMP (simple network management protocol). The network interface card shall also provide a web interface for monitoring and management of the UPS utilizing standard web browser software.
Z. Connections:
   1. Input: Hardwired.
   2. Output: Hardwired.
AA. Maintenance Bypass Switch:

1. Provide a rack mounted, make-before-break maintenance bypass switch rated for the full frame capacity output of the supplied UPS. Minimum size as indicated.

PART 3 - -EXECUTION

3.01 EXAMINATION:

A. Verify site conditions are suitable for installation of equipment. The area for installation shall be fully enclosed, weather tight, and free of contaminants.

B. Final or temporary HVAC systems shall be in place and operational to maintain the ambient temperatures and humidity conditions at occupancy levels prior to installation and shall be maintained for the remainder of the construction period.

3.02 INSTALLATION:

A. Install the UPS system and associated accessories as indicated.

B. Provide the required access for maintenance of the equipment.

C. The UPS system shall be put in operation per the manufacturer's recommendations.

3.03 FIELD QUALITY CONTROL:

A. Manufacturer’s Field Services:

1. Manufacturer's field service shall be provided as specified in this Section and in Division 01.
2. The manufacturer shall provide the field services of a factory technician for a minimum of 3 days to supervise/inspect installation, test and start-up all equipment provided. All travel and living expenses shall be included. All equipment required for testing, start-up and performance verification shall be provided by the start-up technician.
3. Replacement parts shall be available 24 hours a day, 7 days a week, so the parts may be delivered to the customer site within 24 hours.
4. Assist the installing Contractor in the setup and configuration of the network card and associated communications.

B. Field Testing:

1. Prior to energization check all accessible connections to manufacturer's torque tightening specifications.
2. Prior to energization, check for short-circuits.
3. Perform “start-up” tests as recommended by manufacturer.
4. Verify proper operation of alarm and status signals.

3.04 ADJUSTING AND CLEANING:

A. Prior to final acceptance all UPS units and associated equipment shall be wiped clean and free from dust.

B. If equipment interiors have been exposed to dust and other contaminates the Contractor shall provide the necessary interior cleaning of equipment. Use precaution and proper cleaning methods to avoid damage of equipment.

3.05 TRAINING:

A. The training session shall be of sufficient content and duration to provide a basic understanding of the hardware/software in general and specific instruction on the Site-specific implementation.

B. The UPS system supplier shall provide a minimum of 8 hours of training at the customer's facility for operations, maintenance and service personnel.

1. The training session shall include classroom discussion on the theory of operation of the equipment, as well as maintenance and service methods for the equipment.
2. Topics covered shall include safety, hardware layout and functions, power and control wiring, diagnostic indicators, keypad/display interface, faults, diagnostic tools, troubleshooting, and preventive maintenance.
3. Hands-on training shall be provided on equipment.
4. Documentation shall be provided which shall include actual manuals for the equipment and drawings and schematics of equipment supplied for this project.
5. The training session shall be coordinated with Owner and Engineer.

C. Contractor shall record the training sessions and provide a final edited version to the Owner on a DVD-ROM and electronic video file format.

END OF SECTION 26 33 53

SECTION 26 43 13 – SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes parallel and series-wired, surge protective devices (SPDs) for service entrance and AC distribution equipment not exceeding 1000V, including disconnects, switchboards, motor control centers, panelboards, and point-of-service equipment (power for control panels).

1.03 RELATED REQUIREMENTS:

A. Section 26 05 26 – Grounding and Bonding for Electrical Systems.
B. Section 26 24 13 – Switchboards.
C. Section 26 24 16 – Panelboards.
D. Section 26 24 19 – Motor Control Centers.
E. Section 40 66 00 – Process Control Networks: For antenna surge protective devices.
F. Section 40 67 00 – Process Control Panels and Hardware: For control panel Type 2 and Type 4 surge protective devices that protect data and signal lines, CATV/CCTV, and other hard-wired communication devices within a control panel.

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
B. National Fire Protection Association (NFPA):
    1. NFPA 70 – National Electrical Code (NEC)
        a. Article 285 – Surge-Protective Devices (SPDs) 1 kV or Less.
    2. NFPA 780 – Standards for the Installation of Lightning Protection Systems.
C. National Electrical Manufacturers Association (NEMA). Comply with applicable requirements of the following standards:
    1. NEMA 250 – Enclosures for Electrical Equipment (1,000V maximum).
D. Underwriters Laboratories (UL). Comply with applicable requirements of the following standards:
    1. UL 1283 – Electromagnetic Interference Filters.
    2. UL 1449 – Surge Protective Devices.
E. Institute of Electrical and Electronic Engineers (IEEE) comply with applicable requirements of the following standard.
    1. IEEE C62.33 – Test Specifications for Metal-Oxide Varistor Surge Protective Components.
    2. IEEE C62.41.1 – Surge Environment in Low-Voltage (1000V and less) AC Power Circuits.
    3. IEEE C62.41.2 – Characterization of Surges in Low-Voltage (1000V and less) AC Power Circuits.
    4. IEEE C62.45 – Surge Testing for Equipment Connected to Low Voltage (1000V and less) AC Power Circuits.

5. IEEE C62.62 – Test Specifications for Surge-Protective Devices (SPDs) for Use on the Load Side of the Service Equipment in Low Voltage (1000 V and less) AC Power Circuits.
6. IEEE 1100 (Emerald Book) – Recommended Practice for Powering and Grounding Electronic Equipment.

1.05 DEFINITIONS AND ABBREVIATIONS:

A. I-n: I-nominal rating.
B. MCOV: Maximum Continuous Operating Voltage rating.
C. MOV: Metal Oxide Varistors.
D. SAD: Silicon Avalanche Diodes.
E. SCCR: Short Circuit Current Rating.
F. SPD: Surge Protection Device.
G. VPR: Voltage Protection Rating.
H. Type 1 SPDs – Permanently connected SPDs intended for installation between the secondary of the service transformer and the line side of the service equipment overcurrent device, as well as the load side, including watt-hour meter socket enclosures and intended to be installed without an external overcurrent protective device.
I. Type 2 SPDs – Permanently connected SPDs intended for installation on the load side of the service equipment overcurrent device; including SPDs located at the branch panel.
J. Type 3 SPDs – Point of utilization SPDs, installed at a minimum conductor length of 10 meters (30 feet) from the electrical service panel to the point of utilization, for example cord connected, direct plug-in, receptacle type and SPDs installed at the utilization equipment being protected.

1.06 SUBMITTALS:

A. Submit as specified in Division 01 and Section 26 05 10 – General Electrical Requirements for administrative and procedural requirements for submittals.
B. Product Data – Submit for each type of product specified, including the following as a minimum:
    1. Data sheets:
        a. Physical details and dimensions.
        b. Power input voltage and frequency.
        c. Type category.
        d. UL 1449 Listing documentation verifying the following:
            (1) Short Circuit Current Rating (SCCR).
            (2) Voltage Protection Ratings (VPRs) for all modes.
            (3) Maximum Continuous Operating Voltage rate (MCOV) for Type 1 and Type 2 SPDs.
            (4) I-nominal rating (I-n) for Type 1 and Type 2 SPDs.
            (5) Device type designation.
        e. Peak surge current rating per phase.
C. Shop Drawings: For externally-mounted units, provide shop drawings including manufacturer's installation requirements, field connections and manufacturer's recommended wire and breaker sizes.
D. Closeout Submittals – Final documentation shall include the following as a minimum:
    1. Operation and Maintenance Manuals including the following:
        a. Operation and maintenance manuals for each type of SPD.
        b. Copies of all approved Product Data.

c. Copies of all approved Shop Drawings.
d. Warranty information.

1.07 QUALITY ASSURANCE:
A. Installer Qualifications:
B. Testing Agency Qualifications:

1.08 SOURCE QUALITY CONTROL:
A. Tests, inspections: At the shop, factory, plant, or place of manufacture.
B. Verification of performance: Compliance with specified criteria.

1.09 DELIVERY, STORAGE, AND HANDLING:
A. Integral SPDs shall be delivered, pre-installed, and stored according to the requirements of the distribution equipment or control panel in which they are installed. Store at secured and insured warehouse location.

1.10 PROJECT SITE CONDITIONS:
A. Do not deliver or install SPDs or equipment in which they are installed until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above installation area is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.11 WARRANTY:
A. SPD manufacturer shall provide free replacement of the entire model with a minimum warranty period of 10 years from date of shipment. This warranty shall be limited only by failure to comply with manufacturer's installation instructions and applicable national or local code and may not exclude lightning or temporary overvoltage.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:
A. A manufacturer's presence on this list does not guarantee that all of its models are acceptable. The Contractor is responsible for insuring that each SPD model meets all requirements of this specification.
1. Eaton.
2. General Electric.
3. Libert.

2.02 GENERAL REQUIREMENTS FOR SURGE PROTECTIVE DEVICES:
A. UL 1449 4th Edition listed and labeled.
B. Shall be UL labeled as a Type 1 or Type 2 device, shall be intended to be installed on the load side of the service entrance equipment and shall not require external or supplemental overcurrent safety controls to meet UL 1449 4th Edition.
C. The surge protective device (SPD) shall be of a modular design using fast-acting transient energy protection that will divert and dissipate the surge energy.
D. Shall provide independent, directly-connected suppression components on each mode in the electrical distribution system, at least seven modes in Wye systems (L-N, L-G, N-G) and six modes (L-L, L-G) in Delta and impedance grounded Wye systems.

E. Shall be an internally-mounted device as specified or indicated.
F. Shall use metal oxide varistor or MOV-hybrid technology as necessary. Spark gaps, selenium cells and SCRs shall not be acceptable.
G. Shall include internal fuses and thermally protection over every suppression component of every mode, including N-G unless protecting the service entrance.
H. Shall have integral, panel front status monitors or remote status panel ability as a minimum to indicate a continuous positive status of all protected modes, including N-G mode where applicable. Diagnostics shall be electrically isolated to prevent damage by surges.
I. Shall be UL labeled with a short circuit current rating of 200kA.
J. The maximum continuous operating voltage at 60 Hz shall be capable of sustaining at least 115% of the peak voltages continuously without degrading.
K. The maximum UL 1449 Third Edition Voltage Protection Ratings (VPR) for the device must not exceed the following:

Service	L-N	L-G	N-G	L-L	MCOV
120V 2-wire + Gnd	600V	1000V	600V	NA	150
120/240Vac 3-Wire + Gnd	700V	700V	700V	1200V	150
208/120Vac 3-phase, 3 or 4-wire	700V	700V	700V	1200V	150/276
480 Vac 3-phase, 3 Wire Delta	NA	1800V	NA	1800V	550
480/277 Vac 3-phase, 3-wire or 4-wire	1200V	1200V	1200V	2000V	550/320

L. Type 1 and Type 2 SPDs shall be UL labeled with 20kA I-n for compliance to UL 96A Lightning Protection Master Label and NFPA 780.

2.03 SERVICE ENTRANCE SURGE PROTECTIVE DEVICE:

A. The SPD shall be suitable for 480/277V, 3-phase, 4-wire 60 Hz, service-entrance equipment and be integrally mounted.
B. Service entrance units shall be tested and demonstrated suitable for application within ANSI/IEEE C62.41 Category C environments.
C. Shall have a peak surge current of 240 kA per phase.

2.04 SURGE PROTECTIVE DEVICE FOR MOTOR CONTROL CENTERS, DISTRIBUTION PANELBOARDS AND POINT OF SERVICE EQUIPMENT:

A. The SPD shall be suitable for 480/277V, 120/240V, 208/120V, 120V, 1-phase,3-phase, 3-wire, 4-wire 60Hz and be integrally mounted.
B. Downstream SPD units shall be tested and demonstrated suitable for application with ANSI/IEEE C62.41 Category B environments.
C. Shall have a peak surge current of 160 kA per phase.
D. Internally-mounted units shall have an enclosure designed for mounting within a motor control center, control panel, or panelboard.
E. Shall include EMI/RFI filtering for ring wave suppression.
F. Shall have a minimum EMI/RFI filtering of -30dB at 100 kHz.
G. UL 1283 Listed (Latest Edition).

2.05 ADDITIONAL REQUIREMENTS FOR SPDS INTEGRAL TO THE POWER DISTRIBUTION EQUIPMENT:

A. The SPD shall be mounted to the equipment by a direct bus bar connection.
B. The SPD shall not limit the use of through-feed lugs, sub-feed lugs, or sub-feed breaker options.
C. The power distribution equipment shall be capable of re-energizing upon removal of the SPD.

2.06 ACCESSORIES:

A. Monitoring Diagnostics/Accessories:
   1. Protection Status Indicators - Each unit shall have a green/red solid-state indicator light that reports the status of the protection element on each phase.
      a. Wye configured units, shall have indication in the L-N and L-G and N-G modes.
      b. Delta configured units, shall have status indication in the L-G and L-L modes.
      c. The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.
   2. Remote Status Monitor: The SPD must include Form C dry contacts (one NO and one NC) for remote annunciation of its status. Both the NO and NC contacts shall change state under any fault condition.
   3. Audible Alarm and Silence Button: The SPD shall contain an audible alarm that will be activated under any fault condition. There shall also be an audible alarm silence button used to silence the audible alarm after it has been activated.
   4. Surge Event Counter: The SPD shall be equipped with an LCD display that indicates to the user how many surges have occurred at the location.
      a. The surge counter shall trigger each time a surge event with a peak current magnitude of a minimum of 50 ± 20A occurs. A reset pushbutton shall also be standard, allowing the surge counter to be zeroed. The reset button shall contain a mechanism to prevent accidental resetting of the counter via a single, short-duration button press. To prevent accidental resetting, the surge counter reset button shall be depressed for a minimum of 2 seconds in order to clear the surge count total.
      b. The ongoing surge count shall be stored in non-volatile memory. If power to the SPD is completely interrupted, the ongoing count indicated on the surge counter's display prior to the interruption shall be stored in non-volatile memory and displayed after power is restored. The surge counter's memory shall not require a backup battery to achieve this functionality.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine area and location of equipment to receive SPDs for compliance with manufacturer's environmental conditions and other conditions affecting performance of the Work.
B. Examine field installed SPDs before installation. Reject SPDs that have been wet, moisture damaged, or physically damaged.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 GENERAL INSTALLATION REQUIREMENTS:

A. The installation of the surge suppression system shall be installed in strict accordance with the manufacturer's recommended practices and in compliance with the NEC.
B. The Contractor shall verify the proper application of the SPD (i.e. voltage, phases, etc.)
C. The Contractor shall verify that all neutral conductors are bonded to the system ground at the service entrance or at the serving transformer prior to installation of the SPD.
D. The phase, neutral and grounding conductors serving the SPD shall be gently twisted to reduce the SPD system inductance and shall be kept at the minimum length. Avoid any sharp bends and coils in the conductors.
E. Do not perform insulation resistance tests on a piece of electrical equipment with an SPD installed. SPDs are not designed to withstand the relatively high voltages applied for the duration of a megger test measured in seconds. Disconnect the SPD during insulation testing and reconnect immediately after testing is over.

3.03 INSTALLATION OF INTERNALLY-MOUNTED SPDS:

A. When installed within a switchboard, motor control center, or panelboard, the SPD shall be installed in a dedicated bucket or space.
B. When installed within a control panel, the SPD shall be provided and installed by the control panel fabricator. Refer to Section 40 67 00 – Process Control Panels and Hardware.
C. Provide a disconnecting means or overcurrent protection and wiring as recommended by the manufacturer. When no recommendation is provided install the SPD through a 30-Amp circuit breaker using 10-gauge wire.

3.04 FIELD QUALITY CONTROL:

A. Perform tests and inspections: Inspect SPDs, modules, connections, and installation. Test and Inspect SPDs for proper function per manufacturers recommendations.

3.05 CLEANING:

A. Prior to final acceptance enclosure interior and exterior shall be wiped clean and free from dust and debris.

3.06 DEMONSTRATION:

A. Upon completion of installation of SPDs and associated electrical circuitry, energize circuitry and demonstrate functioning of equipment in accordance with manufacturer’s requirements. Where possible, correct any malfunctioning units at the project site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and retest to demonstrate compliance.

3.07 TRAINING:

A. Provide a minimum of 1 hour of training for each type of SPD provided at the customer's facility for operations, maintenance and service personnel.
    1. The training session shall include classroom discussion on the theory of operation of the equipment, as well as maintenance and service methods for the purchased equipment.
    2. Topics covered shall include safety, hardware layout and functions, power and control wiring, diagnostic indicators, keypad/display interface, faults, diagnostic tools, troubleshooting, and preventive maintenance.
    3. Hands-on training shall be provided on equipment. Specific training shall demonstrate the replacement procedures for SPD modules.

4. Documentation shall be provided which shall include actual manuals for the equipment and drawings and schematics of equipment supplied for this project.

B. Contractor shall record the training sessions and provide a final edited version to the Owner on a video DVD-ROM and electronic video file format.

END OF SECTION 26 43 13

SECTION 26 50 00 – LIGHTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes the following:
   1. Interior Luminaires:
      a. Light-emitting Diode (LED) type.
   2. Exterior luminaires.
      a. Light-emitting diode (LED) type.
   3. Emergency lighting units.
   4. Exit signs.
   5. Ballasts and drivers.
   6. Emergency ballasts and drivers
   7. Lamps.
   8. Luminaire accessories.
   9. Poles and accessories.

1.03 RELATED REQUIREMENTS:

A. Section 03 30 00 – Cast-in-Place Concrete: Materials and installation requirements for concrete bases for poles.
B. Section 26 05 10 – General Electrical Requirements.
C. Section 26 05 26 – Grounding and Bonding for Electrical Systems.
D. Section 26 05 33 – Raceways, Boxes, Seals, and Fittings for Electrical Systems.
E. Section 26 05 53 – Identification for Electrical Requirements.
F. Section 26 27 26 – Wiring Devices.
G. Section 26 09 23 – Lighting Control Equipment

1.04 REFERENCE STANDARDS:

A. American Association of State Highway and Transportation Officials (AASHTO):
   1. AASHTO LTS – Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals; American Association of State Highway and Transportation Officials; 5th Edition, with 2011 Interim Revisions.
B. American National Standards Institute (ANSI)/Institute of Electrical and Electronic Engineers (IEEE):
   1. ANSI/IEEE C62.41.2 – Recommended Practice on Characterization of Surges in Low-Voltage (1000V and less) AC Power Circuits; 2002 (Cor 1, 2012).
   2. ANSI/IEEE C136.10 – American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing; 2010.
C. Illuminating Engineering Society of North America (IESNA):
   1. IESNA LM-63 – ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).
   2. IESNA LM-64 – Photometric Measurements of Parking Areas; 2001 (Reaffirmed 2007).
   3. IESNA LM-79 – Electrical and Photometric Measurements of Solid-State Lighting; Latest Edition.

4. IESNA RP-8 – American National Standard Practice for Roadway Lighting; Illuminating Engineering Society of North America; 2000 (R2005) (ANSI/IES RP8).
5. LM-80 – IES Approved Method: Measuring Lumen Maintenance of LED Light Sources.
6. TM-21 – Projecting Long Term Lumen Maintenance of LED Light Sources.

D. National Electrical Contractors Association (NECA):
1. NECA 1 – Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
2. NECA/IESNA 500 –Standard for Installing Indoor Commercial Lighting Systems; National Electrical Contractors Association; 2006.
3. NECA/IESNA 501 – Recommended Practice for Installing Exterior Lighting Systems; 2006.
4. NECA/IESNA 502 – Standard for Installing Industrial Lighting Systems; National Electrical Contractors Association; 2006.

E. National Electrical Manufacturers Association (NEMA):
1. NEMA 410 – Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; National Electrical Manufacturers Association; 2011.
2. NEMA LE 4 – Recessed Luminaires, Ceiling Compatibility; National Electrical Manufacturers Association; 2012.

F. National Fire Protection Associations (NFPA):
1. NFPA 70 – National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
2. NFPA 101 – Life Safety Code; National Fire Protection Association; 2012.

G. Underwriters Laboratories (UL):
1. UL 844 –Luminaires for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.
2. UL 924 – Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.
3. UL 1598 – Luminaires; Current Edition, Including All Revisions.
4. UL 8750 – Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS:

A. Coordination:
1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the Work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
4. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc., installed under other Sections or by others. Coordinate elevation to obtain specified foundation height.
5. Notify Engineer of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.06 SUBMITTALS:

A. Refer to Division 1 – Submittals and Section 26 05 10 – General Electrical Requirements, for administrative and procedural requirements for submittals.

B. Shop Drawings:
   1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
   2. Provide photometric calculations where luminaires are proposed for substitution upon request.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features. Arrange in order of luminaire designation.
   1. Lamps: Include rated life, color temperature, color rendering index (CRI), initial and mean lumen output, and energy efficiency data.
   2. Emergency Ballasts and Drivers: Include list of compatible lamp configurations associated lumen output, and battery and charger data.
   3. Emergency Lighting Units: Battery and charger data.
   4. Exit Signs: Battery and charger data.
   5. Poles: Include information on maximum supported effective projected area (EPA) and weight for the design wind speed, materials, dimensions, finishes, required anchor bolts, and manufactured pole foundations.
   6. Provide means of attaching luminaires to supports, and indication that attachment is suitable for components involved.

D. Certificates for Bi-level Ballasts, Dimming Ballasts and Dimming Drivers: Manufacturer's documentation of compatibility with dimming controls to be installed.

E. Certificates for Poles and Accessories: Manufacturer's documentation that products are suitable for the luminaires to be installed and comply with designated structural design criteria.

F. Wiring diagrams: Include diagrams for power, signal and control wiring. Differentiate between portions of wiring which are manufacturer factory-installed and portions which are field-installed.

G. Field Quality Control Reports.

H. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.
   1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled or on calculations.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

I. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

J. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
   1. Provide a list of all lamp types used on the Project; use ANSI and manufacturers' codes.

K. Maintenance Materials: Furnish the following for Owner's use in maintenance of Project.
   1. See Division 01 for additional Equipment and Materials provisions.

2. Extra Fuses: 5% of total quantity installed for each type, but not less than two of each type.
3. Extra LED drivers: 2% of total quantity installed for each type, but not less than one of each type.
4. Touch-Up Paint: one quart, to match color of pole finish.

1.07 QUALITY ASSURANCE:

A. Conform to requirements of NFPA 70.
B. Maintain at the Project Site a copy of each referenced document that prescribes execution requirements.
C. Provide luminaires from a single manufacturer for each luminaire type.
D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section.

1.08 DELIVERY, STORAGE, AND HANDLING:

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 501 (exterior lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions. Store at secured and insured warehouse location.
B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.09 FIELD CONDITIONS:

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.10 WARRANTY:

A. Interior Lighting:
   1. LED luminaires shall have a minimum 5-year manufacturer warranty.
   2. Provide five-year pro-rata warranty for batteries for emergency lighting units.
   3. Provide ten-year pro-rata warranty for batteries for self-powered exit signs.
   4. Provide three-year full warranty for emergency ballasts and drivers.
B. Exterior Lighting:
   1. Provide five-year manufacturer warranty for all exterior luminaires.
   2. Provide five-year manufacturer warranty for metal corrosion.
   3. Provide five-year manufacturer warranty for color retention.
C. Repair or replace all luminaires and lighting poles that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Luminaires:
   1. Acuity Brands, Inc.
      a. American Electric Lighting.
      b. Holophane.
      c. Lithonia.
      d. Mark Architectural Lighting.
      e. Peerless.

2. Benjamin Division; Thomas Industries Inc.
3. Cooper Lighting, a division of Eaton.
4. CPM Lighting, Inc. (Columbia-Prescolite-Moldcast).
5. Day-Bright Lighting, Division of Emerson Electric Co.
6. Hubbell Lighting, Inc.
7. KIM Lighting, Inc.
8. Lutron Electronics Company, Inc.
9. HE Williams.
10. Philips Lighting.
11. Approved Equal.

B. Emergency Lighting Units and Exit Signs:
1. Acuity Brands, Inc.
2. Cooper Lighting, a division of Eaton.
3. Hubbell Lighting, Inc.
4. HE Williams.
5. Philips Lighting.
6. Approved Equal.

C. Drivers:
1. General Electric Company/GE Lighting.
2. Iota Engineering.
3. Lutron Electronics Company, Inc.
4. Osram Sylvania.
5. Philips Lighting Electronics/Advance.
6. Approved Equal.
7. Manufacturer Limitations: Where possible, for each type of luminaire provide drivers produced by a single manufacturer.

D. Emergency Drivers:
1. Iota Engineering, LLC.
2. Lithonia Lighting.
3. Philips Emergency Lighting/Bodine.
4. Approved Equal.
5. Manufacturer Limitations: Where possible, for each type of luminaire provide emergency drivers produced by a single manufacturer.

E. Lamps:
1. General Electric Company/GE Lighting.
2. Osram Sylvania.
3. Philips Lighting Company.
4. Approved Equal.
5. Manufacturer Limitations: Where possible, provide lamps produced by a single manufacturer.

F. Light Sensitive Control Devices:
1. Cooper - Crouse-Hinds, a division of Eaton.
2. Intermatic, Inc.
3. Fisher-Pierce, Sunrise Technologies of the Electro Switch Corporation.
4. Approved Equal.

G. Poles:
1. Acuity Brands, Inc.
2. Cooper Lighting, a division of Eaton.
3. Hubbell Lighting, Inc.

4. Valmont Industries, Inc.
5. GE Current
6. Approved Equal.
7. Manufacturer Limitations: Where possible, provide all poles produced by a single manufacturer.

2.02 LUMINAIRE TYPES:

A. Furnish products as indicated in the luminaire schedule included on the Contract Drawings.

2.03 LUMINAIRES:

A. Provide products that comply with requirements of NFPA 70.
B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
C. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
D. Provide products complying with Federal Energy Management Program (FEMP) requirements.
E. Provide products with lamp base complying with ANSI C81.61.
F. Provide exterior lighting products complying with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
G. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
H. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, integral mounting provisions, etc., as necessary for a complete operating system.
I. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
J. Interior Luminaire Materials:
    1. Metal Parts:
        a. Free of burrs and sharp corners and edges.
        b. Sheet metal components shall be steel unless otherwise indicated.
        c. Form and support to prevent warping and sagging.
    2. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
    3. Diffusers and Globes:
        a. Acrylic Diffusers: 100% virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
        b. Glass: Annealed crystal glass unless otherwise indicated.
        c. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
    4. Housings:
        a. Extruded-aluminum housing and heat sink.
        b. 5VA(fl) fiberglass housing and heatsink as indicated on the contract drawings.
        c. Painted finish after fabrication, finish as indicated in luminaire schedule.
    5. Conduit: Minimum 3/4 inch (21 mm) in diameter, type as specified.
    6. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

a. Label shall include the following lamp characteristics:
(1) "USE ONLY" and include specific lamp type.
(2) Lamp diameter, shape, size, wattage, and coating.
(3) ANSI ballast type (M98, M57, etc.) for HID luminaires.
(4) CCT and CRI for all luminaires.

7. Metal Finishes:
a. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples, and if they can be and are assembled or installed to minimize contrast.

K. Exterior Luminaire Materials:
1. Metal Parts: Free of burrs and sharp corners and edges.
2. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.
3. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
4. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.
5. Exposed Hardware Material: Stainless steel.
6. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
7. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.
8. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
a. White Surfaces: 85%.
b. Specular Surfaces: 83%.
c. Diffusing Specular Surfaces: 75%.
9. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
10. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.
11. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and drivers as applicable. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
a. Label shall include the following lamp and ballast characteristics:
(1) "USES ONLY" and include specific lamp type.
(2) CCT and CRI for all luminaires.

L. Recessed Luminaires:
1. Ceiling Compatibility: Comply with NEMA LE 4.
2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.

M. Hazardous (Classified) Location Luminaires: Listed and labeled as complying with UL 844 for the classification of the installed location.

N. LED Luminaires:
1. General:

a. LED Luminaire Components: UL 8750 recognized or listed as applicable. Tested according to LM-79.
b. Luminaires shall be binned with a minimum of a three-step MacAdam Ellipse to ensure color consistency among luminaires.

2. LED Luminaires with Integral LEDs:
   a. Correlated Color Temperature (CCT):
      (1) Indoor: 3,500K (neutral) or 4000K as indicated on the drawings.
      (2) Outdoor: 4,000K unless otherwise indicated.
   b. Color Rendering Index (CRI): Not less than 80.
   c. Average Rated Life: Not less than 50,000 hours for an operating cycle of three hours per start.
   d. Lamps shall be dimmable from 100% to 5% of maximum light output where indicated.
   e. LED Assembly shall be mounted to die cast aluminum housing for thermal management.
   f. LED drivers shall have a power factor greater than 0.90 lagging and less than 20 percent total harmonic current distortion (THD).
   g. Operating temperature of LED assembly and fixture shall be rated for -30 to +40°C ambient.
   h. Fixture shall be UL listed for operation in damp locations when indicated.

2.04 EMERGENCY LIGHTING UNITS:

A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
B. Recessed Luminaires: Comply with NEMA LE 4.
C. Operation: Upon interruption of normal power source or brownout condition exceeding 20% voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
D. Battery:
   1. Size battery to supply all connected lamps, including emergency remote heads where indicated.
   2. Remote Mounted: Provide NEMA 250, Type 1 enclosure listed for installation inside, on top of, or remote from luminaire. Remote assembly shall be located no less than half the distance recommended by the manufacturer.
E. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
F. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
G. Provide low-voltage disconnect to prevent battery damage from deep discharge.
H. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.
I. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
   1. Ambient Temperature: Less than 0ºF (-18ºC) or exceeding 104ºF (40ºC), with an average value exceeding 95ºF (35ºC) over a 24-hour period.
   2. Ambient Storage Temperature: Not less than -4ºF (-20ºC) and not exceeding 140ºF (60ºC).
   3. Humidity: More than 95% (condensing).

4. Altitude: Exceeding 3,300 feet (1000 m).

J. Accessories:
1. Provide compatible accessory mounting brackets where indicated or required to complete installation.
2. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
3. Provide compatible accessory wire guards where indicated.
4. Where indicated, provide emergency remote heads that are compatible with the emergency lighting unit they are connected to and suitable for the installed location.
5. Provide compatible accessory remote combination test switch/indicator light where indicated.

2.05 EXIT SIGNS:

A. Description: Exit signs and similar signs for special purpose applications such as area of refuge/rescue assistance.

B. All Exit Signs: Internally illuminated with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
1. Number of Faces: Single or double as indicated or as required for the installed location.
2. Directional Arrows: As indicated or as required for the installed location.

C. Self-Powered Exit Signs:
1. Operation: Upon interruption of normal power source or brownout condition exceeding 20% voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
2. Battery: Sealed maintenance-free nickel cadmium unless otherwise indicated.
3. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
4. Provide low-voltage disconnect to prevent battery damage from deep discharge.
5. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

D. Accessories:
1. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
2. Provide compatible accessory wire guards where indicated.

2.06 DRIVERS:

A. LED Drivers:
1. Provide LED drivers that are UL recognized complying with UL 8750.
2. Inrush Current: Not exceeding peak currents specified in NEMA 410.
3. Input Voltage: Suitable for operation at voltage of connected source, with variation tolerance of ±10%.
4. Total Harmonic Distortion: Not greater than 20%.
5. Power Factor: Not less than 0.95.
6. Sound Rating: Class A, suitable for average ambient noise level of 20 to 24 decibels.
7. Compatibility: Specifically designed for use with the specified LEDs, with no visible flicker and for full light output unless dimmer or bi-level switching control is indicated.
8. Driver Operating Frequency: Greater than 40 kHz.
9. Current Crest Factor: Not greater than 1.5.

10. Surge Tolerance: Capable of withstanding characteristic surges according to IEEE C62.41.2, location category A.
11. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of CFR, Title 47, Part 18, for Class A, non-consumer applications.
12. Driver Marking: Include wiring diagrams with lamp connections.

2.07 EMERGENCY DRIVERS:

A. LED Emergency Drivers:
1. Description: Self-contained, battery powered, LED emergency driver units suitable for use with indicated luminaires, complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
2. Compatibility:
   a. Drivers: Compatible with AC drivers and LED loads rated for Class 2 output.
   b. Lamps: Compatible with LED lamp manufacturer supplied.
3. Operation: Upon interruption of normal power source, solid-state control automatically switches connected lamp(s) to the emergency driver for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
4. Emergency drivers shall include sufficient time delays to prevent overcurrent of the LED's in the event both emergency and standard drivers supply load simultaneously.
5. Battery:
   a. Sealed maintenance-free high-temperature nickel cadmium unless otherwise indicated. Minimum of 7 year life expectancy.
   b. Recharge time shall be 24 hours or less.
6. Diagnostics: Provide accessible and visible multi-chromatic combination test switch/indicator light to display charge, test, and diagnostic status and to manually activate emergency operation.
7. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status and field selectable audible alert.
8. Operating Temperature: From 32ºF (0ºC) to 122ºF (50ºC) unless otherwise indicated or required for the installed location.
9. Accessories:
   a. Provide compatible accessory remote combination test switch/indicator light where indicated.

2.08 LAMPS:

A. All Lamps:
1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
3. Lamp Bases: Comply with ANSI C81.61.
4. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
5. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Engineer to be inconsistent in perceived color temperature.

B. LED Lamps: Wattage and bulb type as indicated, with base type as required for luminaire.

1. Correlated Color Temperature (CCT):
   (1) Indoor: 3,500 K and 4000K unless otherwise indicated.
   (2) Outdoor: 4,000K unless otherwise indicated.
2. Color Rendering Index (CRI): Not less than 80.
3. Average Rated Life: Not less than 50,000 hours for an operating cycle of three hours per start.
4. Lamps shall be dimmable from 100% to 1% of maximum light output where indicated.

2.09 POLES:

A. General – All Poles:
1. Provide poles and associated support components from single manufacturer suitable for the luminaire(s) and associated supports and accessories to be installed. Refer to luminaire schedule for basis of design poles.
2. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.
3. Material: Aluminum, unless otherwise indicated.
4. Shape: Round tapered, unless otherwise indicated.
5. Finish: Match luminaire finish, unless otherwise indicated.
6. Mounting Height: 10 feet (maximum) above the top of the basins for the poles installed on the treatment basins and 33 feet above finished grade for site poles, unless otherwise indicated.
7. Mounting: Install on concrete foundation, height as indicated on the drawings, unless otherwise indicated.
8. Unless otherwise indicated, provide with the following features/accessories:
   a. Top cap.
   b. Handhole, minimum clear opening of 4 by 6 inches (102 by 153 mm) size, oval shaped, with cover secured by stainless-steel captive screws.
   c. Anchor bolts with leveling nuts or leveling shims.
   d. Anchor base cover.
   e. Brackets: as required.
   f. Hinged pole design for treatment basin poles.
      (1) Provide winch as required to operate hinged mechanisms.
   g. Pole-top tenon,4-inch.
   h. Drill patterns as required for supplied fixtures.
9. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
   a. Materials: Shall not cause galvanic action at contact points.
   b. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
   c. Anchor-Bolt Template: Plywood or steel.
10. Breakaway Supports: Frangible breakaway supports, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS-4-M.

B. Metal Poles: Provide ground lug, accessible from handhole or transformer base.
1. Aluminum Poles:
   a. Poles: Seamless, extruded structural tube complying with ASTM B429/B429M, Alloy 6063-T6 with access handhole in pole wall.
   b. Poles: ASTM B209 (ASTM B209M), 5052-H34 marine sheet alloy with access handhole in pole wall.

(1) Shape: Round, tapered.
(2) Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

c. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

d. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, listed for attaching grounding and bonding conductors of type and size indicated, and accessible through handhole.

e. Brackets for Luminaires: Detachable, with pole and adapter fittings of cast aluminum. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.
(1) Tapered oval cross section, with straight tubular end section to accommodate luminaire.
(2) Finish: Same as luminaire.

f. Factory Applied Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
(1) Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
(2) Natural Satin Finish: Provide fine, directional, medium satin polish (AAM32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
(3) Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
(4) Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
(a) Color: Coordinate with Architect and Owner.

2.10 GROUNDING AND BONDING LUGS:

A. Welded ½-inch (13-mm) threaded lug, complying with requirements in Section 26 05 26 - Grounding and Bonding for Electrical System, listed for attaching grounding and bonding conductors of types and size indicated, and accessible through handhole.

2.11 PHOTO ELECTRIC CONTROL DEVICES (PHOTOCELLS):

A. Rated for multiple control of lighting fixtures as indicated.
B. Turns lights "on" at 3 footcandles, "off" at 8 footcandles.
C. Flush-mounted, weatherproof cell rated 1000-watts at 120Vac or 277Vac, as indicated.
D. Operates from -40°C to 70°C (-40°F to 158°F).
E. Intermatic 4000 Series, Fisher-Pierce FT15, Cooper-Crouse Hinds D2S20, or Engineer approved equal.
F. FD box.
G. Locations as indicated.
H. Lighting Controllers: As specified on the contract drawings.

2.12 ACCESSORIES:

A. Interior Lighting:
   1. Stems for Suspended Luminaires: Steel tubing, minimum 1/2 inch size, factory finished to match luminaire or field-painted as directed.
   2. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4 inch size, field-painted as directed.
   3. Hook Hangers for Suspended Luminaires: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug. Hook hanger shall include safety latch.
   4. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

B. Exterior Lighting:
   1. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Verify that field measurements are as shown on the drawings.
B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
C. Verify that suitable support frames are installed where required.
D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION:

A. Provide extension rings to bring outlet boxes flush with finished surface.
B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION:

A. Coordinate locations of outlet boxes provided under Section 26 05 33 – Raceways, Boxes, Seals, and Fittings for Electrical Systems as required for installation of luminaires provided under this Section.
B. Install products according to manufacturer's instructions.
C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship), NECA 500 (commercial lighting), NECA 501 (exterior lighting), and NECA 502 (industrial lighting).
D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
E. Supports:
   1. Sized and rated for luminaire weight.
   2. Able to maintain luminaire position after cleaning and relamping.
   3. Provide support for luminaire without causing deflection of ceiling or wall.
   4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100% of luminaire weight and vertical force of 400% of luminaire weight.
F. Suspended Ceiling Mounted Luminaires:
   1. Do not use ceiling tiles to bear weight of luminaires.
   2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.

3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
4. Secure pendant-mounted luminaires to building structure.
5. Secure to any required outlet box.
6. Secure lay-in luminaires to ceiling support channels using UL listed safety clips at four corners.
7. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gage, connected from opposing corners of each recessed luminaire to building structure.
8. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
9. Install at least one independent support rod or wire from structure to a tab on luminaire. Wire or rod shall have breaking strength of the luminaire weight at a safety factor of 3.
10. See appropriate Division 09 Section where suspended grid ceiling is specified for additional requirements.

G. Recessed Luminaires:
1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around perimeter of luminaire.
3. Install trims tight to mounting surface with no visible light leakage.
4. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
5. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

H. Suspended Luminaires:
1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet in length, with no more than 4 feet (1.2 m) between supports.
4. Install canopies tight to mounting surface.
5. Where longer than 48 inches (1200 mm), brace to limit swinging.
6. Unless otherwise indicated, support pendants from swivel hangers.
7. Provide damping of luminaire oscillations where needed.
8. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of luminaire chassis, including one at each end.

I. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
1. Attach luminaire per manufacturer's recommendations.
2. Do not attach luminaires directly to gypsum board.

J. Pole-Mounted Luminaires:
1. Maintain the following minimum clearances:
   a. Comply with IEEE C2.
   b. Comply with utility company requirements.
2. Poles and Pole Foundations Set in Concrete Paved Areas: Install poles with minimum of 6-inch (150-mm) wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch (25 mm) below top of concrete slab.

3. Raise and set poles using web fabric slings (not chain or cable).
4. Foundation-Mounted Poles:
    a. Provide cast-in-place concrete foundations for poles as indicated, in accordance with Section 03 30 00.
        (1) Install anchor bolts plumb per template furnished by pole manufacturer.
        (2) Position conduits to enter pole shaft.
    b. Install foundations plumb.
    c. Install poles plumb, using leveling nuts or shims as required to adjust to plumb.
    d. Tighten anchor bolt nuts to manufacturer's recommended torque.
    e. Install non-shrink grout between pole anchor base and concrete foundation, leaving small channel for condensation drainage.
    f. Install anchor base covers or anchor bolt covers as indicated.
    g. Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.
    h. Use a short piece of 1/2-inch (13-mm) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
5. Grounding:
    a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.
6. Install separate service conductors, 12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.

K. Ground-Mounted Luminaires:
1. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 03 30 00 - Cast-in-Place Concrete.

L. Corrosion Protection:
1. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
2. Steel Conduits: Comply with Section 26 05 33 – Raceways, Boxes, Seals and Fittings for Electrical Systems.

M. Install accessories furnished with each luminaire.

N. Provide seismic bracing and support such that the light fixtures and/or lamps will not fail during a seismic event.

O. Bond products and metal accessories to branch circuit equipment grounding conductor.

P. Emergency Lighting Units:
1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
2. Install lock-on device on branch circuit breaker serving units.
3. Emergency lighting conductors shall be routed in conduit separate from the normal per circuits.

Q. Exit Signs:
1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
2. Install lock-on device on branch circuit breaker serving units.

R. Emergency Ballasts and Drivers:

1. For field-installed units, install inside luminaire unless otherwise indicated. Where installation inside luminaire is not possible, install on top of luminaire.
2. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal ballast(s) or driver(s) in luminaire. Bypass local switches, contactors, or other lighting controls.
3. Install lock-on device on branch circuit breaker serving units.

S. Remote Ballasts and Drivers: Install in accessible location as indicated or as required to complete installation, using conductors per manufacturer's recommendations not exceeding manufacturer's recommended maximum conductor length to luminaire.

T. Lamp Burn-In: Operate lamps at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

U. Light Sensitive Control Devices:
1. Direct toward the north sky where possible.
2. Set the adjustable control to operate at the specified foot-candle level.
3. Install as indicated.
4. Connect to control lighting fixtures indicated.

3.04 FIELD QUALITY CONTROL:

A. Inspect each product for damage and defects.

B. Operate each luminaire after installation and connection to verify proper operation.

C. Test self-powered exit signs, emergency lighting units, and emergency ballast and drivers to verify proper operation upon loss of normal power supply.

D. Verify operation of photoelectric controls.

E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Engineer.

3.05 ADJUSTING:

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Engineer. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Engineer or authority having jurisdiction.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Engineer or authority having jurisdiction.

D. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this Work may be required during hours of darkness.

3.06 CLEANING:

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 501 (exterior lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES:

A. See Section 01 - Closeout Submittals for closeout submittals.

B. Demonstration: Demonstrate proper operation of luminaires to Engineer, and correct deficiencies or make adjustments as directed.

C. Just prior to Substantial Completion, replace all lamps that have failed.

3.08 PROTECTION:

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION 26 50 00

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

SECTION 28 10 00 – ELECTRONIC ACCESS CONTROL AND INTRUSION DETECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section describes the requirements for access control and intrusion detection systems. The systems shall be user-configurable and scalable.

B. The provided system shall be designed in conformance to the Owner's existing standards for controllers, readers, and other ancillary devices for use and deployment to new project sites.

C. The system shall be provided and installed by the Owner's pre-approved security sub-contractors as follows:
   1. Securitas Technology. 2640 NE Hagan Rd., Lee's Summit, MO 64064.
   2. Engineer approved equal.

D. The new access control system shall coordinate with Section 28 15 23 – Video Intercom Entry System for gate entrance controls.

E. The completed access control system shall include, but not be limited to, the following major components:
   1. Security access control and monitoring software platform including the following as minimum.
      a. Access control system server(s) and associated operating system.
      b. Security workstation(s).
      c. Credential validation database.
      d. Credential card personalization and creation software.
      e. Credential card printer and encoder software.
   2. Access control panels with Ethernet network interfaces.
   3. Access controllers including the following:
      a. Door controllers.
      b. I/O interfaces and expansion modules.
      c. Power supplies, backup batteries, and battery chargers.
   4. Electrified door hardware, electric strikes, egress hardware, panic exit devices, power transfer hinges, and other auxiliary door hardware shall be as specified in Section 08 70 00.
   5. Access control hardware including the following:
      a. Proximity card readers.
      b. Door lock keypads.
      c. Combination card readers with keypad.
      d. Request to Exit (REX) motion sensors and push-buttons.
      e. Magnetic lock and panic hardware with special locking arrangement for fire-rated doors.
      f. Near field communication (NFC) access control devices.
      g. Door status and gate status contacts.
      h. Card readers.
      i. Entry pedestals for gates or doors.
      j. Power supplies as required.

6. Intrusion detection hardware including the following:
    a. Motion sensors.
    b. Break glass sensors.

F. The complete IP based intercom/video entry system shall include, but not limited to, the following major components:
1. Intercom/video door stations.
2. Master stations (IP Phone).
3. Gate pedestal(s).
4. Power supplies as required.

G. The Contractor shall be responsible for providing fully operational security access control/intrusion detection and intercom/video systems as indicated on drawings. All necessary hardware and software required for the complete system shall be the responsibility of the Contractor and shall be provided under this Contract with no additional costs to the Owner.

H. Coordinate with the door hardware vendor for door lock types and door hardware to ensure a fully integrated and functional system.

I. Conduit and cabling requirements shall be coordinated with the electrical sub-contractor as required for raceways and installation of cables.

J. All equipment shall be UL listed.

1.03 RELATED REQUIREMENTS:

A. Section 08 71 00 – Door Hardware.
B. Section 26 05 19 – Electrical Power Conductors and Cables.
C. Section 26 05 26 – Grounding and Bonding for Electrical Systems.
D. Section 26 05 33 – Raceways, Boxes, and Supports for Electrical Systems.
E. Section 28 15 23 – Video Intercom System
F. Section 28 20 00 – Video Surveillance System.
G. Section 32 31 13 – Chain-Link Fences and Gates.
H. Section 40 66 00 – Process Control Networks.

1.04 REFERENCE STANDARDS:

A. American Water Works Association (AWWA)
1. Guidelines for Physical Security

B. Electronic Components Industry Association (ECIA):
1. EIA/ECA-310-E – Cabinets, Racks, Panels, and Associated Equipment.

C. National Fire Protection Association (NFPA):
1. 70 – National Electrical Code (NEC).

D. National Electrical Manufacturers Association (NEMA):
1. 250 – Enclosures for Electrical Equipment (1,000V maximum).

E. Underwriters Laboratories (UL):
1. 50 – Enclosures for Electrical Equipment.

1.05 SUBMITTALS:

A. Submit as specified in Division 1.

B. Manufacturer with prime responsibility shall assume responsibility for all Compliance Submittals.

C. Product Data: Submit the following for each type of product specified and included as minimum:
1. Data sheets for all components furnished.

D. Qualification Statements: - Fabricator's qualifications.
E. Shop Drawings: Provide the following as minimum:
   1. Fabrication drawings, front elevation, wiring diagrams, and bills of material for access control panels.
   2. Electrical connection diagrams showing termination locations for all field wiring. External connection diagrams shall indicate cable number and wire color for field cables terminated at the panel.
   3. Engraving schedule and physical dimensions for nameplates.
F. Special Procedure Submittals:
   1. Test Plan:
      a. Provide a complete and detailed test plan for the supplied access control panels.
      b. Include procedures for certification, validation, and testing.
   2. Syllabus for Owner training.
G. Test and Evaluation Reports:
   1. Factory test reports.
   2. Field test reports.
H. Closeout Submittals: Final documentation shall include the following as minimum:
   1. Operation and Maintenance Manuals including the following:
      a. Operation and maintenance manuals for all components furnished.
      b. Certified "As-Built"/"As-Installed" drawings.
      c. Copies of all approved Product Data.
      d. Copies of all approved Test Reports.
      e. Spare parts and supply list.
      f. Warranty Information.
      g. Contractor Information.
I. Maintenance Material Submittals:
   1. Software:
      a. Original downloads and/or flash drives containing all software associated with the supplied equipment.
      b. Organize and submit all software copies on flash media.

1.06 QUALITY ASSURANCE:

A. Materials and Equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least 1 year prior to Bid opening.
B. The security access control and intrusion detection systems, specified herein, shall be designed and installed by trained and qualified personnel who have ~~minimum of five (5) years of~~ experience designing and installing similar systems per AWWA physical security guidelines for water treatment plants.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. Access control panels and associate equipment shall be packaged and shipped to the project site in such a manner as to avoid damage.
B. All equipment shall be stored according to the manufacturer's instructions and in a conditioned space to avoid condensation, dust, and other environmental contaminants.

1.08 PROJECT SITE CONDITIONS:

A. Do not store or install the control panel equipment specified herein until designated installation spaces are suitable for intended service.

B. For indoor control panels final or temporary HVAC systems shall be in place and operational to maintain the ambient temperatures and humidity conditions at occupancy levels prior to energizing panel and shall be maintained for the remainder of the construction period.

1.09 WARRANTY:

A. All equipment furnished under this Section shall be warranted by the Contractor and the equipment manufacturer(s) for a minimum period of two years after substantial completion.

B. Warranty shall include all parts, labor, and expenses to perform necessary work.

C. Warranties shall comply with the requirements of Section 01 78 36.

1.10 SPARE PARTS:

A. Provide the following spare parts:

1. Provide five (5) spare fuses of each type used including those used in power supplies.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Access Control System (Controllers, control panels, software and accessories):

1. HID Global.
2. LenelS2.
3. Mercury Security (HID Mercury), HID Global.

B. Door and Gate Contacts:

1. George Risk Industries, Inc.
2. G.E. Interlogix - Sentrol.
3. Honeywell.
4. Engineer approved equal.

C. Request-to-Exit (REX) Motion Detectors:

1. G.E. Security.
2. Honeywell.
3. Bosch Security Systems.
4. Engineer approved equal.

D. Card Readers:

1. HID Global.
2. Engineer approved equal.

2.02 ACCESS CONTROL SYSTEM:

A. The access control system shall include, but is not limited to, access controllers, communications adapters, access control panels, power supplies, and system software.

B. The access control system shall be based on the following or approved equal components:

1. LenelS2 access controllers and software.
2. LenelS2 LNL series interface modules and reader controllers.
3. Software integration into Lenel OnGuard security system platforms. The access controllers shall be fully compatible with peripheral devices associated with access control and intrusion detection devices.

a. Additional licenses or software packages shall be provided as required for a fully functional and integrated access control system.

C. Each access control cabinet shall have a single backplane capable of supporting the required modules. Module quantities shall be as required to support all doors, card readers, and associated monitoring devices to create a fully functional system.

D. The access control system shall be capable of monitoring any alarm devices with dry contact outputs, such as motion sensors, door contacts, etc. Provide relay modules, as required.

E. Each cabinet (or controller modules) shall have the following I/O capabilities as minimum:
   1. Two reader interfaces.
   2. Inputs: 8 programmable as N.O. or N.C.
      a. Door position and Request to Exit (REX).
      b. Tamper and Power Fail Monitors.
   3. Outputs: 4 Form C, SPDT, 5A@ 30VDC.
      a. Two Door Strikes.
      b. Two Auxiliary Alarms.
   4. Communications:
      a. The system shall include an Ethernet network gateway for communications across the security system Ethernet network.
      b. The system shall support serial communication (RS-485) for interconnection of multiple backplanes and downstream interface modules.

F. The system shall be expandable for control of up to 64 access points per site and be networked with unlimited sites.

G. The peripherals, specified in this Section, shall be fully compatible with the specified access control system. The Contractor shall be responsible for integrating the peripherals to the access control system.

H. The network cabling and all required wiring between peripherals and network components shall be provided as recommended by the equipment manufacturers. Color of all security network cables shall be yellow.

I. The access control system shall be fully operational with programmed information. The Contractor shall coordinate with the Owner for the programming input data.

J. The access control system components shall be housed in NEMA 1 lockable enclosures.
   1. The enclosures shall be ventilated and sized to accommodate all required components and dissipate the heat generated in the panel.
   2. The interconnecting cables and wires shall be neatly arranged and installed in wiring channels.
   3. The components shall be DIN rail or shelf mounted inside the enclosure and shall be secured.
   4. Provide DIN-railed mounted terminal strips, as required, inside the enclosure for all field wiring terminations, excluding communication cables. The terminal strips shall be rated for 300V applications and shall be sized to accommodate field wire sizes.

K. Provide all required power supplies for all components housed in the security panel and all peripheral devices connected to the security panel. Power supplies shall have minimum of 25% spare capacity. All power supplies shall be provided with overload and short circuit protection and shall be mounted in the security panel.

L. Each access control panel shall include a 7AH battery (min) with charging system to provide backup in the event of power failure. Battery and charger shall be as recommended by the manufacturer.

M. Software:
1. Provide all required software installed on the new security server and indicated workstations for complete system monitoring and management of the access control system.
2. The software shall store all system transactions in a common database stored on the existing network server. The database shall be accessible by the security system workstation.
3. The System Software Repository shall be configured on the security server using a virtual machine running Windows Server 2016 OS or as required by the provided software. Coordinate with the Owner for Windows Server Licensing.

2.03 DOOR CONTACTS:

A. Coordinate with Section 08 70 00 – Finish Hardware.
B. Recessed mounted door contacts shall meet the following requirements:
1. Designed for recessed mounting in the door frame.
2. 3/4-inch diameter.
3. Minimum 1/2-inch gap in steel doors.
4. Hermetically sealed reed switch with matching actuating magnet.
5. Minimum one foot lead length.
6. Normally closed when active (door is closed).
7. Compatible with specified access control modules.
C. Surface mounted door contacts shall meet the following requirements:
1. Hermetically sealed reed switch with matching actuating magnet.
2. Brushed anodized aluminum housing.
3. Three foot stainless steel armored cable.
4. Mounting bracket as required.
5. Normally closed when active (door is closed).
6. Compatible with specified access control modules.
7. All mounting hardware shall be included for the installation.
8. Compatible with the installation environmental conditions.

2.04 GATE AND OVERHEAD DOOR CONTACTS:

A. The gate and overhead door contacts shall meet the following requirements:
1. Hermetically sealed reed switch with matching actuating magnet.
2. Brushed anodized aluminum housing.
3. 3-inch wide operation gap distance.
4. Minimum three foot stainless steel armored cable.
5. Mounting bracket as required.
6. Normally open contact.
7. Compatible with specified access control modules.

2.05 MOTION REQUEST TO EXIT (REX) DETECTORS:

A. Provide motion REX detectors when indicated. The motion REX detector shall meet the following requirements:
1. Dual technology utilizing passive infrared and radar technology.
2. Voltage: 12 to 24 Vac/Vdc.
3. Alarm Output: DPDT Form C contact.
4. Alarm duration: Adjustable from 0.5 – 60 seconds.

5. Adjustable detection range 5-15 feet.
6. Activation LED.
7. Operating temperature: -29°C to 49°C., 0 to 95% non-condensing
8. All mounting hardware (wall mount) shall be included for the installation.

2.06 MANUAL REQUEST TO EXIT:

A. Refer to Division 08 for exit devices integral to door hardware.
B. Where exit device is not integral to door hardware, provide manual request to exit pushbutton as follows:
   1. Green with "PUSH TO EXIT" lettering.
   2. Stainless steel cover plate.
   3. Momentary SPDT contact rated minimum 1A at 24-Vdc.
   4. FS or FD box mounting.
   5. Mounting:
      a. Finished Spaces: Recessed.
      b. Unfinished Spaces: Surface-mount.

2.07 CARD READER:

A. The card reader shall meet the following requirements:
   1. Read range: Up to 3 inches with compatible card.
   2. Input voltage: 5–16Vdc at reader.
   3. Operating temperature: -30°C to 65°C.
   4. Enclosure: The reader shall be of potted, polycarbonate material, sealed to a NEMA rating of 4X.
   5. LED indicator with tri-color standard (red, green, amber or blue).
   6. Audio tone.
   7. Output format: Wiegand.
   8. Frequency: 125 kHz (excitation).
   9. Factory or field programmable.
   10. Rated for indoor and outdoor installation.
   11. Compatible with specified access control modules.
B. Reader shall be compatible with Owner's existing standard HID Proximity Access Cards.
   1. Provide HID 20NKS series card readers, or Engineered-approved equal, where mullion-mounted.
   2. Provide HID 40NKS series card readers, or Engineered-approved equal, for all other locations.

2.08 WIRING SYSTEM:

A. Provide basic wiring materials which comply with Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables and Section 26 05 33 – Raceways, Boxes, and Supports for Electrical Systems.
B. Wire and cabling types shall be in accordance with the requirements of the system manufacturer and as indicated on the drawings.
C. Provide raceways and wiring required for fully operational systems. Coordinate with Division 26 for raceways.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Verify site conditions are suitable for installation of equipment.

B. Final or temporary HVAC systems shall be in place and operational to maintain the ambient temperatures and humidity conditions at occupancy levels prior to energizing the access control panels and shall be maintained for the remainder of the construction period.

3.02 INSTALLATION:

A. All components shall be installed in accordance with the manufacturer's installation manuals and recognized industry practices.

B. Provide all labor, materials, startup, programming, etc. for a fully functioning system.

C. Mount equipment plumb, level, square, and secure.

D. Installation of basic wiring system materials:

1. Install wiring, raceways, and electrical boxes and fittings in accordance with Section 26 05 19 – Electrical Power Conductors and Cables and Section 26 05 33 – Raceways, Boxes, and Supports for Electrical Systems.
2. Install all wiring in raceways.
3. Where possible, install wires and cables without splices. Make connections and splices at terminal strips in terminal boxes, cabinets or at equipment terminals.

3.03 PROGRAMMING:

A. Access Control:

1. The access control system shall be programmed to allow access to the indicated areas. Coordinate with the Owner for a complete list of employees and access control rights.
2. Program the database tags, descriptions, and alarm reports in a clear and concise manner.
3. The security access control for the entrance/exit automatic gate operators shall meet the following sequence of operations. Coordinate with gate equipment to be supplied under Section 32 31 00.
    a. Normal Request for Entry:
        (1) The security access control system shall open the gate when the request for entry is made via the entry card reader.
    b. Intercom Assisted Entry:
        (1) The intercom system shall be utilized to request entry at the associated gate through video and voice interaction.
        (2) When the intercom call button is pressed a call notification is sent to each master station (IP Phone). The call may be answered by any master station. If it is determined by the master station user that the gate needs to be opened, the user will provide a card swipe action to initiate the gate operator.
        (3) The card swipe will log the user approving the gate open action through the security system log.
    c. Emergency Entry:
        (1) A knox box shall be provided for emergency services entry in the event operations staff is not available. An access card shall be programmed and stored in the knox box for use by emergency service personnel. Coordinate with the local emergency services.
    d. Normal Request to Exit:

(1) The gate shall be designed for a free exit using an inductive loop request to exit. If the inductive loop detects the presence of a vehicle the request-to-exit contact shall be activated to the gate access control module and the gate shall open.

e. Manual request to Exit:
(1) A card reader shall be provided on the secure side of each entrance gate at the security network enclosure. When a valid card swipe is detected, the request-to-exit contact shall be activated to the gate access control module and the gate shall open.

f. Gate close operation:
(1) Once the gate reaches its full open status, the gate shall be programmed to stay open for 30 seconds (adjustable) before the gate starts its closing cycle. The gate closing cycle shall be inhibited if the gate operator and associated protective devices detect any obstruction along the closing path of the gate.

4. The security access control for a typical man door shall meet the following sequence of operations:
a. Normal Request for Entry:
(1) The security access control system shall release the associated electric strike when the request for entry is made via the man door card reader. The electric strike shall be released and remain released for 6 seconds (adjustable) before the system secures the man door lock.

b. Normal Request to Exit:
(1) The man door shall be designed for a free exit using a request to exit push button, a motion sensing device, or integral request to exit contact in the associated door hardware set as indicated. The request to exit devices shall initiate a contact closure to the access control module exit circuit. The access control module shall release the door and give a permissive to the system for a free exit. The system shall incorporate a 10 second time delay (adjustable) after the request to exit is given to complete the exit cycle.

c. Forced Door:
(1) In the event the door contact status changes to open without a card swipe permissive or request to exit, the system shall initiate an alarm at the security workstation.

3.04 FIELD QUALITY CONTROL:

A. Manufacturer's Field Services:
1. The equipment supplier shall provide the field services of a trained technician for the amount of time required to commission, test and start-up all equipment provided.
2. All travel and living expenses shall be included for all trips to the site. All equipment required for testing, start-up and performance verification shall be provided by the start-up technician.

B. Check all internal and external connections and tighten as required.
C. Perform I/O checkout on all points and verify proper operation.
D. Verify proper connection of communication cabling and proper communication system configuration.
E. Field verify proper operation of all inputs and outputs.
F. Record results of I/O checkout and submit test reports as specified in Division 01.

3.05 ADJUSTING AND CLEANING:

A. After field installation and final wiring terminations are completed the access control panel wiring and cables shall be adjusted and neatly secured with tie wraps, hook-and-loop straps, or the like.
B. Wiring duct covers shall be replaced and secured as required.
C. Prior to final acceptance control panel interior and exterior shall be wiped clean and free from dust and debris.

3.06 TRAINING:

A. The Security System Supplier shall provide formal training for operators, maintenance and service personnel.
B. A training schedule and log shall be developed. The training schedule shall identify scheduled dates and times for all training sessions specified in this Division. The training log shall identify dates for training and record training session attendees.
C. Training sessions shall be scheduled with the Owner a minimum of two weeks prior to occurrence and a training schedule shall be maintained and communicated to the Owner on a routine basis.
D. Provide a minimum of 2 hours of training at the customer's facility for operations, maintenance and service personnel.
    1. The training session shall include classroom discussion on the theory of operation of the equipment, as well as maintenance and service methods for the purchased equipment.
    2. Topics covered shall include safety, hardware layout and functions, power and control wiring, diagnostic indicators, keypad/display interface, faults, diagnostic tools, troubleshooting, and preventive maintenance.
    3. Hands-on training shall be provided on equipment.
    4. Documentation shall be provided which shall include actual manuals for the equipment and drawings and schematics of equipment supplied for this project.
E. Contractor shall make digital video recordings of all on-Site training for training purposes. Any charges for this video recording shall be included.
F. Provide training as specified in each applicable Section, this Division.

END OF SECTION 28 10 00

SECTION 28 15 23 – VIDEO INTERCOM ENTRY SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section describes the requirements for gate access control and video intercom systems. The systems shall be user-configurable and scalable.

B. The complete IP based intercom/video system shall include, but not be limited to, the following major components:
   1. Security network control panels and power supplies.
   2. Raceways. Coordinate requirements with Division 26.
   3. Wire and Cabling.
   4. Intercom/video entry stations.
   5. Intercom/video master station IP Phone.
   6. Gate pedestal(s).
   7. Card Readers. Coordinate with Section 28 10 00.
   8. Gate operators, gate safety devices, and gate motor controller shall be as specified in Section 32 31 13 – Chain Link Fences and Gates.

C. The subcontractor shall be responsible for providing fully operational gate security access control and intercom/video systems as indicated on drawings. All necessary hardware and software required for the complete system shall be the responsibility of the subcontractor.

D. The system shall be provided and installed by the Owner's pre-approved security sub-contractor as follows:
   1. Video Surveillance Systems:
      a. Electronic Technology, Inc. (ETI), 5700 Merriam Drive, Merriam, Kansas 66203.

E. Coordinate scope of supply with Section 28 20 00 – Video Surveillance System and Section 28 10 00 – Electronic Access Control and Intrusion Detection as required.

F. Coordinate with the entrance gate hardware vendor for to ensure a fully integrated and functional system.

G. Conduit and cabling requirements shall be coordinated with the equipment supplied and as indicated for installation of cables.

H. All equipment shall be UL listed.

1.03 RELATED REQUIREMENTS:

A. Section 26 05 19 – Electrical Power Conductors and Cables.
B. Section 26 05 26 – Grounding and Bonding for Electrical Systems.
C. Section 26 05 33 – Raceways, Boxes, and Supports for Electrical Systems.
D. Section 28 10 00 – Electronic Access Control and Intrusion Detection.
E. Section 28 20 00 – Video Surveillance System.
F. Section 32 31 13 – Chain-Link Fences and Gates.
G. Section 40 66 00 – Process Control Networks.

1.04 REFERENCE STANDARDS:

A. American Water Works Association (AWWA)
   1. Guidelines for Physical Security

B. Electronic Components Industry Association (ECIA):
   1. EIA/ECA-310-E – Cabinets, Racks, Panels, and Associated Equipment.

C. National Fire Protection Association (NFPA):
   1. 70 – National Electrical Code (NEC).
D. National Electrical Manufacturers Association (NEMA):
   1. 250 – Enclosures for Electrical Equipment (1,000V maximum).
E. Underwriters Laboratories (UL):
   1. 50 – Enclosures for Electrical Equipment.

1.05 SUBMITTALS:

A. Submit as specified in Division 1.
B. Manufacturer with prime responsibility shall assume responsibility for all Compliance Submittals.
C. Product Data: Submit the following for each type of product specified and included as minimum:
   1. Data sheets for all components furnished.
D. Qualification Statements: Fabricator's qualifications.
E. Shop Drawings: Provide the following as minimum:
   1. Fabrication drawings, front elevation, wiring diagrams, and bills of material for access control panels.
   2. Electrical connection diagrams showing termination locations for all field wiring. External connection diagrams shall indicate cable number and wire color for field cables terminated at the panel.
   3. Engraving schedule and physical dimensions for nameplates.
F. Special Procedure Submittals:
   1. Test Plan:
      a. Provide a complete and detailed test plan for the supplied access control panels.
      b. Include procedures for certification, validation, and testing.
   2. Syllabus for Owner training.
G. Test and Evaluation Reports:
   1. Factory test reports.
   2. Field test reports.
H. Closeout Submittals: Final documentation shall include the following as minimum:
   1. Operation and Maintenance Manuals including the following:
      a. Operation and maintenance manuals for all components furnished.
      b. Certified "As-Built"/"As-Installed" drawings.
      c. Copies of all approved Product Data.
      d. Copies of all approved Test Reports.
      e. Spare parts and supply list.
      f. Warranty Information.
      g. Subcontractor Information.
I. Maintenance Material Submittals:
   1. Software:
      a. Original downloads and/or flash drives containing all software associated with the supplied equipment.
      b. Organize and submit all software copies on flash media.

1.06 QUALITY ASSURANCE:

A. Materials and Equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least 1 year prior to Bid opening.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. Security control panels and associate equipment shall be packaged and shipped to the project site in such a manner as to avoid damage.

B. All equipment shall be stored according to the manufacturer's instructions and in a conditioned space to avoid condensation, dust, and other environmental contaminants.

1.08 PROJECT SITE CONDITIONS:

A. Do not store or install the control panel equipment specified herein until designated installation spaces are suitable for intended service.

B. For indoor control panels final or temporary HVAC systems shall be in place and operational to maintain the ambient temperatures and humidity conditions at occupancy levels prior to energizing panel and shall be maintained for the remainder of the construction period.

1.09 WARRANTY:

A. All equipment furnished under this Section shall be warranted by the Subcontractor and the equipment manufacturer(s) for a minimum period of two years after substantial completion.

B. Warranty shall include all parts, labor, and expenses to perform necessary work.

C. Warranties shall comply with the requirements of Section 01 78 36.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Intercom/Video System:

1. Axis Communications.
   a. Intercom Station: Axis I8016-LVE.
2. Grandstream Networks, Inc.
   a. Master Station: IP Telephone GXV3370.
3. Engineer approved equal.

2.02 INTERCOM/CAMERA SYSTEM:

A. A complete IP based integrated hands-free intercom and video system shall be manufactured by Axis Communications.

B. The complete system shall include, but not limited to, the following:

1. Provide one master stations in the administration building control room.
2. Provide door stations at the following locations:
   a. Main entrance gate pedestal.
3. Master Station – shall be an IP based desktop video phone for used with SIP based systems. The unit shall feature a 7" touch screen TFT LCD, built-in Wi-Fi and Bluetooth, dual-switched auto-sensing 10/100/1000Mbps network port, and speaker phone. Built-in PoE/PoE+ to power the device. Programmable for communicating to the specified door station and provide for control of the door station output relay.
4. Door Station – NEMA 4X, Vandal resistant, flush mount, color video entry intercom device. The station shall include support for Session Initiation Protocol (SIP) for integration with VoIP systems and peer to peer sessions. The unit shall be provided with the necessary mounting box to facilitate installation. The faceplate shall be stainless steel, the call button shall be stainless and the camera shall be protected with a clear lens cover. The door station shall feature a color CMOS camera, speaker, and mic for communication, and illumination LED for low light conditions. The door station shall support ONVIF Profile G, M, S, and T.

a. The door stations shall be capable of providing a closed contact output for operating entrance gate equipment from the master stations.

2.03 PEDESTALS:

A. Provide a dual level 42-inch/80-inch gooseneck pedestal with offset for mounting of enclosures for access control card readers and intercom/camera. The stand shall be hollow to allow for the passage of cables and shall be designed for mounting on a concrete foundation.
B. Provide lockable NEMA 4 enclosures with rain shield over the face mounted components for mounting of indicated devices. Enclosure shall be sized to accommodate the indicated components.
C. Pedestal and enclosure shall be provided with a black powder-coated corrosion resistant finish.
D. Refer to Contract Drawings for pedestal configurations.
E. Coordinate with card readers and intercom stations supplied.

2.04 WIRING SYSTEM:

A. Provide basic wiring materials which comply with Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables and Section 26 05 33 – Raceways, Boxes, and Supports for Electrical Systems.
B. Wire and cabling types shall be in accordance with the requirements of the system manufacturer.
C. Provide the necessary raceways and wiring required for a fully operational systems.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Verify site conditions are suitable for installation of equipment.
B. Final or temporary HVAC systems shall be in place and operational to maintain the ambient temperatures and humidity conditions at occupancy levels prior to energizing the access control panels and shall be maintained for the remainder of the construction period.

3.02 INSTALLATION:

A. All components shall be installed in accordance with the manufacturer's installation manuals and recognized industry practices.
B. Provide all labor, materials, startup, programming, etc. for a fully functioning system.
C. Mount equipment plumb, level, square, and secure.
D. Installation of basic wiring system materials:
   1. Install wiring, raceways, and electrical boxes and fittings in accordance with Section 26 05 19 – Electrical Power Conductors and Cables and Section 26 05 33 – Raceways, Boxes, and Supports for Electrical Systems.
   2. Install all wiring in raceways.
   3. Where possible, install wires and cables without splices. Make connections and necessary splices at terminal strips in terminal boxes, cabinets or at equipment terminals.

3.03 PROGRAMMING:

A. Access Control:
   1. The security access control for the entrance/exit automatic gate operators shall meet the following sequence of operations. Coordinate with equipment to be supplied under Section 32 31 13.

a. Normal Request for Entry:
   (1) The gate entry control system shall open the gate when the request for entry is made via the entry card reader.
b. Intercom Assisted Entry:
   (1) The intercom system shall be utilized to request entry at the associated gate through video and voice interaction.
   (2) When the intercom call button is pressed a call notification is sent to each master station. The call may be answered by any master station. If it is determined by the master station user that the gate needs to be opened, the user will provide a card swipe action or push-button action through the master station interface to initiate the gate operator.
c. Emergency Entry:
   (1) A knox box shall be provided for emergency services entry in the event operations staff is not available. An access card shall be programmed and stored in the knox box for use by emergency service personnel.
   (2) Coordinate with the local emergency services and Owner for emergency procedures and protocols.
d. Normal Request to Exit:
   (1) The gate shall be designed for a free exit using an inductive loop request to exit. If the inductive loop detects the presence of a vehicle the request-to-exit, contact shall be activated to the gate access control module and the gate shall open.
e. Gate close operation:
   (1) Once the gate reaches its full open status, the gate shall be programmed to stay open for 30 seconds (adjustable) before the gate starts its closing cycle. The gate closing cycle shall be inhibited if the gate operator and associated protective devices detect any obstruction along the closing path of the gate.

B. Intercom/Video System:
   1. The intercom/video system shall be programmed to allow communication between the entrance gate and the master station within the administration building operations control room.
   2. The video streams shall be programmed to stream video to the security access control software package using the Ethernet network ONVIF compatible client. Provide the necessary programming and drivers required for this functionality.

3.04 FIELD QUALITY CONTROL:

A. Manufacturer's Field Services:
   1. The equipment supplier shall provide the field services of a trained technician for the amount of time required to commission, test and start-up all equipment provided.
   2. All travel and living expenses shall be included for all trips to the site. All equipment required for testing, start-up and performance verification shall be provided by the start-up technician.
B. Check all internal and external connections and tighten as required.
C. Perform I/O checkout on all points and verify proper operation.
D. Verify proper connection of communication cabling and proper communication system configuration.
E. Field verify proper operation of all inputs and outputs.
F. Record results of I/O checkout and submit test reports as specified in Division 1.

3.05 ADJUSTING AND CLEANING:

A. After field installation and final wiring terminations are completed the access control panel wiring and cables shall be adjusted and neatly secured with tie wraps, hook-and-loop straps, or the like.
B. Wiring duct covers shall be replaced and secured as required.
C. Prior to final acceptance control panel interior and exterior shall be wiped clean and free from dust and debris.

3.06 TRAINING:

A. The subcontractor or supplier shall provide training for operators, maintenance, and service personnel.
B. A training schedule and log shall be developed. The training schedule shall identify scheduled dates and times for all training sessions specified in this Division. The training log shall identify dates for training and record training session attendees.
C. Training sessions shall be scheduled with the Owner a minimum of two weeks prior to occurrence and a training schedule shall be maintained and communicated to the Owner on a routine basis.
D. Provide a minimum of 1 hours of training at the customer's facility for the gate entrance video/intercom system.
E. Provide training as specified in each applicable Section, this Division.
F. The Owner at their option shall be allowed to video record all training sessions for future reference.

END OF SECTION 28 15 23

SECTION 28 20 00 – VIDEO SURVEILLANCE SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section describes the requirements for Video Surveillance System as indicated on the Drawings and specified herein.

B. The completed system shall include, but not be limited to, the following major components:
   1. Surveillance Cameras.
   2. Security Server, Security Client Workstation, and Server management software for IP Cameras.
   3. Security network switches.
   4. Fiber and UTP cables.
   5. Fiber patch panels, media converters and other hardware interfaces.
   6. Field cabinets.
   7. Power supplies.
   8. Raceways.

C. The Subcontractor shall be responsible for providing Video Surveillance devices fully installed and operational for use by the Owner.

D. The system shall be provided and installed by the Owner's pre-approved security sub-contractor as follows:
   1. Video Surveillance Systems:
      a. Electronic Technology, Inc. (ETI), 5700 Merriam Drive, Merriam, Kansas 66203.

E. Coordinate scope of supply with Section 28 10 00 – Electronic Access Control, Intrusion Detection, Section 28 15 23 Video Intercom System, and Division 40 for shared network infrastructure, shared large display monitors, and additional security management software and server requirements.

1.03 RELATED REQUIREMENTS:

A. Section 26 05 19 – Electrical Power Conductors and Cables.
B. Section 26 05 26 – Grounding and Bonding for Electrical Systems.
C. Section 26 05 33 – Raceways, Boxes, and Supports for Electrical Systems.
D. Section 28 15 23 – Video Intercom Entry System.
E. Section 40 66 00 – Process Control Networks.

1.04 REFERENCE STANDARDS:

A. American Water Works Association (AWWA)
   1. Guidelines for Physical Security.

B. Electronic Components Industry Association (ECIA):
   1. EIA/ECA-310-E – Cabinets, Racks, Panels, and Associated Equipment.

C. National Fire Protection Association (NFPA):
   1. 70 – National Electrical Code (NEC).

D. National Electrical Manufacturers Association (NEMA):
   1. 250 – Enclosures for Electrical Equipment (1,000V maximum).

E. Underwriters Laboratories (UL):
   1. 50 – Enclosures for Electrical Equipment.

1.05 SUBMITTALS:

A. Submit as specified in Division 1.

B. Manufacturer with prime responsibility shall assume responsibility for all Compliance Submittals.

C. Product Data: Submit the following for each type of product specified and included as minimum:

1. Data sheets for all components furnished.

D. Installation Plan:

1. Provide recommended installation locations and mounting heights.

~~D.~~E. Qualification Statements:

1. Fabricator's qualifications.

~~E.~~F. Shop Drawings: Provide the following as minimum:

1. Wiring diagrams and bills of material for the complete video surveillance system.
2. Electrical connection diagrams showing termination locations for all field wiring. External connection diagrams shall indicate cable number and wire color for field cables terminated at the panel.
3. Engraving schedule and physical dimensions for nameplates.

~~F.~~G. Special Procedure Submittals:

1. Test Plan:
   a. Provide a complete and detailed test plan for the supplied equipment
   b. Include procedures for certification, validation, and testing.
2. Syllabus for Owner training.

~~G.~~H. Test and Evaluation Reports:

1. Factory test reports.
2. Field test reports.

~~H.~~I. Closeout Submittals: Final documentation shall include the following as minimum:

1. Operation and Maintenance Manuals including the following:
   a. Operation and maintenance manuals for all components furnished.
   b. Certified As-Built/As-Installed drawings.
   c. Copies of all approved Product Data.
   d. Copies of all approved Test Reports.
   e. Spare parts and supply list.
   f. Warranty Information.
   g. Subcontractor Information.

1.06 QUALITY ASSURANCE:

A. Materials and Equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least 1 year prior to Bid opening.

B. The Video Surveillance systems, specified herein, shall be designed and installed by trained and qualified personnel who have ~~minimum of five (5) years of~~ experience installing similar systems per AWWA physical security guidelines for water treatment plants.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. Surveillance Cameras and associate equipment shall be packaged and shipped to the project site in such a manner as to avoid damage.

B. All equipment shall be stored according to the manufacturer's instructions and in a conditioned space to avoid condensation, dust, and other environmental contaminants.

1.08 PROJECT SITE CONDITIONS:

A. Do not store or install the video surveillance equipment specified herein until designated installation spaces are suitable for intended service.

B. For indoor network equipment final or temporary HVAC systems shall be in place and operational to maintain the ambient temperatures and humidity conditions at occupancy levels prior to network switch commissioning and shall be maintained for the remainder of the construction period.

1.09 WARRANTY:

A. All equipment shall be provided with a minimum one-year warranty period.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Surveillance Cameras:
   1. Axis Communications.
      a. Axis P3719-PLE (15MP).
      b. Axis Q3538-LVE (8MP).

B. Security Switches:
   1. Rack mounted and panel mounted network switches shall comply with Section 40 66 00 – Process Control Networks.

C. Video Management Software:
   1. Genetec Inc.
      a. Genetec Security Center Software.

D. Security Server:
   1. Genetec StreamVault SV-2000E appliance.
   2. Engineer-approved equal.

2.02 VIDEO SURVEILLANCE SYSTEM:

A. The video surveillance system shall include, but not limited to, surveillance cameras, security server, client workstation, mounting hardware, CAT6 and fiber cabling, PoE injectors and extenders, surge suppression, and power supplies.

B. The video management software shall provide the necessary interface to view, control, and configure the network security cameras. The software shall be capable of addressing and viewing of ONVIF profile S and T device streams attached to the security network. The software system shall include video analytics to improve operator efficiency. The system shall include mobile viewing capabilities, streaming profiles, timeline visualization of recorded events as well as snapshots in live view and playback modes. The software shall include configurable recording capabilities for the connected devices.

C. A new rack mounted security server, security client workstation, security switches, cameras, and associated software configurations shall be provided as indicated and required for a complete system.
   1. Mounting locations for the specified equipment shall be as indicated on the Contract Drawings.

D. Video coverage shall include views of all locations indicated with motion detection activated on the cameras for large open areas of the plant.

E. Use 8MP dome camera with varifocus and zoom for entrance gate.

F. Use 15MP multidirectional cameras (360 degree coverage) for all large open area views.

G. The peripherals, specified in this Section, shall be fully compatible with the specified surveillance cameras.
H. The network cabling and all required wiring between peripherals and network components shall be provided as indicated and shall be as recommended by the equipment manufacturers.

2.03 MOUNTING HARDWARE AND ACCESSORIES:

A. Provide the necessary mounting hardware for each camera application.
B. Mounting accessories include but not limited to the following:
   1. Pole mounting hardware.
   2. Wall mount.
   3. Pendant kit.
   4. Corner mounting bracket.
C. PoE Extender:
   1. Provide PoE extenders as required and indicated for cameras exceeding the manufacturer's maximum recommended distance for a single PoE cable run.
   2. Provide AXIS T8129 PoE extender or Engineer-approved equal and associated mounting enclosures as indicated or required. Outdoor enclosures shall be rated NEMA 4X stainless steel

2.04 MEDIA CONVERTERS:

A. Media converters shall be provided to convert from fiber optic cabling to copper category 6 cabling for locations indicated or required.
B. The media converter shall convert between 10/100BaseTX and 100BaseFX.
C. Products shall operate in an environment with an ambient temperature range of –40˚ C to +70˚C and relative humidity between 0% to 95% (non-condensing).
D. The module shall be UL listed.
E. Data Specifications:
   1. Data Interface: Ethernet IEEE802.3.
   2. Data Rate: 10/100 Mbps.
   3. Operation Mode: Full or Half Duplex
F. Shall have the following status indicators as minimum: Power, Fault, and Link.
G. Operate from 12VDC or 24VDC. Provide the required AC to DC power supply for connection to standard 120Vac outlet or terminal connections.
H. Shall be installed within the security camera interface enclosure at each camera location as specified and indicated.

2.05 SECURITY CAMERA INTERFACE ENCLOSURE:

A. Provide a NEMA 4X enclosure for exterior locations and NEMA 12 enclosure for interior locations when required to house the associated media converter and PoE injectors as indicated or required.
B. The enclosure shall include a circuit breaker, surge protective device, and a 120Vac duplex outlet for supplying power to the specified equipment. Any other necessary components for the indicated locations shall be included within the enclosure.
C. Refer to Section 40 67 00 – Process Control Panels and Hardware for applicable component specifications.

2.06 WIRING SYSTEMS:

A. Provide basic wiring materials which comply with Section 26 05 19 – Electrical Power Conductors and Cables and Section 26 05 33 – Raceways, Boxes, and Supports for Electrical Systems.
B. Wire and cabling types shall be in accordance with the requirements of the system manufacturer.
C. Provide conduit and wiring, including power and fiber, for fully operational systems.
D. Provide fiber or Ethernet cable to each camera from the required network panels and racks as indicated.
E. Provide surge suppression as required to protect system headend equipment from transients.

2.07 SURGE PROTECTIVE DEVICES:

A. Ethernet Surge Protection:
    1. Provide an Ethernet surge protector for all Category 6 cable connections entering the network rack or outdoor network enclosures from an outdoor mounted camera.
    2. DIN rail mount.
    3. Protection from surges up to 10kV.
    4. Support IEEE 802.3bt up to 95W.
    5. Supports data rates of up to 1Gbps.
    6. Compatible with supplied cameras.
    7. AXIS TU8001 or engineer approved equal.
B. 120Vac Power Surge Protection:
    1. Provide a series rated surge protective device to prevent surges on all dedicated power circuit to the cameras from entering the panelboard supplying power to the cameras.
    2. Surge protective device shall be DIN rail mounted and installed in a NEMA 12 enclosure with hinged cover.
    3. Surge protective devices shall meet the following requirements:
        a. Finger safe screw type terminals.
        b. Three-stage surge protection.
        c. Minimum five year warranty.
        d. Minimum surge current capacity of 4 kA per mode (8/20µs).
        e. Minimum lightning surge current capacity of 2.5 kA per path (10/350µs).
        f. Maximum let thru voltage line to ground 380 Vac.
        g. Maximum let thru voltage line to line of 600 Vac.
        h. Minimum continuous current rating of 15A.
        i. Response time of less than 25 nanoseconds.
    4. Provide surge protective device from one of the following manufacturers:
        a. EDCO.
        b. MCG Surge Protection.
        c. MTL Incorporated.
        d. Phoenix Contact.
        e. Approved-equal.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Verify site conditions are suitable for installation of equipment.
B. Final or temporary HVAC systems shall be in place and operational to maintain the ambient temperatures and humidity conditions at occupancy levels prior to energizing the security

network switches and servers. Suitable conditions shall be maintained for the remainder of the construction period.

3.02 INSTALLATION:

A. All components shall be installed in accordance with the manufacturer's installation manuals and recognized industry practices.
B. Provide all labor, materials, startup, programming, etc. for a fully functioning system.
C. Mount equipment plumb, level, square, and secure.
D. Mount the security server in the network rack indicated. Mount the client workstation at the location indicated.
E. Power all security system equipment with UPS power circuits indicated.
F. Conduit for perimeter security shall be direct buried, a minimum of 30 inches below grade, and shall be PVC coated RGS or installed within a designated duct bank system as shown on the Contract Drawings. Refer to Section 26 05 33 – Raceways, Boxes, and Supports for Electrical Systems for raceways and Section 26 05 19 – Electrical Power Conductors and Cables for power and control wiring. For network cables, refer to Section 40 66 00 – Process Control Networks.
G. Install wires and cables without splices, where possible. Make connections and splices at terminal strips in terminal boxes, cabinets or at equipment terminals.

3.03 FIELD QUALITY CONTROL:

A. Manufacturer's Field Services:
   1. The equipment supplier shall provide the field services of a trained technician for the time required to commission, test and start-up all equipment provided.
   2. All travel and living expenses shall be included for all trips to the site. All equipment required for testing, start-up and performance verification shall be provided by the start-up technician.
B. Check all internal and external connections and tighten as required.
C. Perform I/O checkout on all points and verify proper operation.
D. Verify proper connection of communication cabling and proper communication system configuration.
E. Field verify proper operation of all inputs and outputs.
F. Record results of I/O checkout and submit test reports as specified in Division 1.
~~F.~~G. Final camera aiming angles and monitor views shall be approved by Owner prior to final acceptance.

3.04 ADJUSTING AND CLEANING:

A. After field installation and final wiring terminations are completed the video surveillance wiring and cables shall be adjusted and neatly secured with tie wraps, hook-and-loop straps, or the like.
B. Wiring duct covers shall be replaced and secured as required.
C. Prior to final acceptance control panel interior and exterior shall be wiped clean and free from dust and debris.

3.05 TRAINING:

A. Provide a minimum of 2 hours of training at the customer's facility for operations, maintenance, and service personnel.
   1. The training session shall include classroom discussion on the theory of operation of the equipment, as well as maintenance and service methods for the purchased equipment.

2. Topics covered shall include safety, hardware layout and functions, power and control wiring, diagnostic indicators, interface, faults, diagnostic tools, troubleshooting, and preventive maintenance.
3. Hands-on training shall be provided on equipment.
4. Documentation shall be provided which shall include actual manuals for the equipment and drawings and schematics of equipment supplied for this project.

B. Contractor shall make digital video recordings of all on-Site training for Owner's future training purposes. Any charges for this video recording shall be included.

END OF SECTION 28 20 00

SECTION 28 31 00 – ADDRESSABLE FIRE ALARM SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. Furnish all labor, materials, and equipment for a fully operational fire alarm system in full compliance with the applicable NFPA standards and all other codes, regulations, and laws applicable to the work, and in full compliance with the intent of the plans and specifications, including all work inferable from same.

B. Section includes:
   1. Fire alarm control unit (FACU).
   2. Initiating devices.
   3. Notification appliances.
   4. Input and output modules.
   5. System accessories.
   6. Wiring and connections.
   7. Raceway.
   8. Supervising station monitoring.
   9. Surge protective devices.
   10. System programming.
   11. System testing.

C. Pay for all necessary construction permits related to the fire alarm system.

D. Related Sections:
   1. SECTION 07 84 13 – PENETRATION FIRESTOPPING.
   2. SECTION 09 90 00 – PROTECTIVE COATINGS.
   3. SECTION 26 05 19 – LOW VOLTAGE POWER CONDUCTORS AND CABLES.
   4. SECTION 26 05 26 – GROUNDING.
   5. SECTION 26 05 33 – RACEWAYS BOXES, SEALS AND FITTINGS.
   6. SECTION 26 05 53 – ELECTRICAL IDENTIFICATION.

1.03 REFERENCES:

A. Applicable Codes and Standards (latest edition or as adopted by local jurisdiction):
   1. 2018 IBC (International Building Code) with State and local amendments.
   2. 2018 IFC (International Fire Code) with State and local amendments.
   3. Local Codes including local policies, interpretation, and standards.
   4. Americans with Disabilities Act (ADA).
   5. FM Global (FM):
      a. FM Approvals - Approval Guide.
      b. Property Loss Prevention Data Sheets.
   6. NFPA (National Fire Protection Association) - Latest edition or as adopted by local jurisdiction:
      a. NFPA 70 – National Electrical Code (NEC) (2017).
      b. NFPA 72 – National Fire Alarm and Signaling Code (2016, 2019 for submittal requirements only).
      c. NFPA 170 – Standard for Fire Safety and Emergency Symbols (2018)

d. NFPA 820 – Standard for Fire Protection in Wastewater Treatment and Collection Facilities (2020).

7. Underwriters Laboratories (UL): Comply with provisions of UL safety standards pertaining to fire alarm systems; provide products and components which are UL-listed and labeled.
   a. Fire Protection equipment directory.

1.04 DEFINITIONS:

A. References to the Fire Protection Engineer in this SECTION shall mean one of the following:
   1. A registered professional engineer (P.E.), experienced in the design of fire alarm systems and registered in the project State, who has passed the fire protection engineering written examination administered by the National Council of Examiners for Engineering and Surveys (NCEES) and has relevant fire protection experience.
   2. A registered P.E., registered in the project State, experienced in the design of fire alarm systems and all other facets of fire protection and life safety for at least three projects with the same type of facility and system(s) as utilized in the project, including responsibility for fire suppression, life safety (including building code analysis) and fire alarm systems.
   3. A registered P.E. in a related engineering discipline, experienced in the design of fire alarm systems and registered in the project State, with a minimum of 5 years of experience, dedicated to fire protection engineering that can be verified with documentation.

B. References to the Fire Alarm Technician in this SECTION shall mean:
   1. A qualified fire protection technician certified at Level III with the National Institute for Certification in Engineering Technologies (NICET) in Fire Alarm Systems.

C. References to the Fire Alarm Installer in this SECTION shall mean:
   1. A qualified fire protection technician certified at Level II with the National Institute for Certification in Engineering Technologies (NICET) in Fire Alarm Systems.

D. References to the Manufacturer's Authorized Representative in this SECTION shall mean:
   1. A qualified fire protection technician certified at Level III with the National Institute for Certification in Engineering Technologies (NICET) in Fire Alarm Systems, trained, experienced, and authorized by the fire alarm equipment manufacturer on the installation, programming, testing, and operation of their equipment.

E. References to the Fire Alarm Control Unit in this section shall mean:
   1. A control unit performing the ~~combined~~ functions of ~~both~~ a fire alarm control unit ~~and autonomous control unit~~.

1.05 PERFORMANCE REQUIREMENTS:

A. The system shall be a complete, supervised, noncoded, analog/addressable, protected-premises fire alarm system.

B. Provide fire alarm system suitable for type of occupancy as defined by the locally adopted building code and as approved by local authority having jurisdiction (AHJ).

C. Provide occupant notification using audible horns and visible strobes with occupant notification conforming to NFPA 72.

D. Fire alarm system design shall be approved by the Engineer and authorities having jurisdiction.

1.06 ACTION SUBMITTALS:

A. Refer to DIVISION 01 for administrative and procedural requirements for submittals.

B. Shop Drawings: Prepare working plans, product data sheets, and calculations for the complete fire alarm system in accordance with the documentation requirements of NFPA 72, 2019 Edition.
   1. Employ the services of a Fire Alarm Technician and Fire Protection Engineer. The Fire Alarm Technician shall prepare the fire alarm system shop drawings and calculations for submittal. The Fire Protection Engineer shall directly oversee the design and sign and seal the shop drawings and calculations for submittal.

C. Shop drawing submittals shall include, but not be limited to, the following:
   1. Name of protected premises, owner, and occupant (where applicable).
   2. Name of installer or contractor.
   3. Location of protected premises.
   4. Device legend in accordance with NFPA 170.
   5. Date of issue and any revisions.
   6. Scaled floor plan drawings (minimum scale of 1/8" = 1'-0") which include:
      a. Floor identification
      b. Point of compass
      c. Graphic scale
      d. All walls and doors
      e. All partitions extending to within 10 percent of the ceiling height
      f. Room and area descriptions
      g. Equipment, device, component, and appliance locations
      h. Settings of notification appliances (candela or wattage)
      i. Temperature rating of heat detectors
      j. Locations of monitor/control interfaces to other systems
      k. Unique address or identifier on each device and appliance
      l. Locations of fire alarm primary power disconnecting means
      m. System riser locations
      n. Type and number of fire alarm system components, devices, and appliances on each circuit, on each floor level
      o. Type and quantity of conductors and conduit (if used) for each circuit
         (1) Indicate wire and cable routing
         (2) Conduit and circuit routing
         (3) Number of wires or cables in each conduit or pathway
         (4) Conduit sizes
         (5) Unique identifier for each circuit.
      p. Identification of any ceiling over 10 ft in height where automatic detection will be installed
      q. Types of construction and details of ceiling geometries, including beams and solid joists, where automatic detection will be installed
      r. Location of all supply and return air diffusers (where automatic detection is used)
   7. System riser diagrams, coordinated with the floor plans, which include:
      a. General arrangement of the system in building cross-section
      b. Number of risers
      c. Type and number of circuits in each riser
      d. Type and number of system components, devices, and appliances on each circuit, on each floor or level shown in the order of connection
      e. Settings of notification appliances (candela or wattage)

f. Unique address or identifier on each device and appliance
g. Number of conductors for each circuit
h. Point-to-point field wiring diagrams (riser diagram) of the entire fire alarm system showing all equipment, devices, appliances, and circuits
i. Show devices and appliances in the correct order
j. Show location of all tee taps where permitted
k. Each circuit shall be provided with unique identifier

8. Control unit/equipment wiring diagrams for all equipment listed as a control unit, control unit accessory, power supply, or battery charger.
   a. All field wiring terminals with terminal identification
   b. Indicate and label all connected circuits
   c. Include unique identification of the control equipment
   d. Field connections to supervising station signaling equipment
   e. Field connections to fire safety control interfaces
9. Typical wiring details devices and appliances
10. Sequence of operations matrix
11. Interface of fire safety functions
12. Provide fire stopping details for penetration through fire and smoke walls, barriers, and partitions. Include UL System numbers for each detail.
13. Submit graphic display plan.

D. Calculations
   1. Battery calculations
   2. Voltage drop calculations

E. Product data sheets
   1. Provide product data sheets for all equipment, devices, appliances, etc. used.
      a. Outdated or poorly reproduced cut sheets will not be accepted.
   2. Product data sheets shall be annotated to indicate the exact model, configuration, finishes, and other options that will be provided.
      a. Cut sheets with multiple models, configurations and options that are not annotated will not be accepted.
   3. Submit power requirements for all equipment, devices, and appliances.
   4. Provide product data sheets for each cable and conductor type used.
   5. Information on termination types and raceway to be used.

F. The shop drawings, including resubmittals, shall be submitted as a complete submittal package including, but not limited to, shop drawings/working plans, annotated product data sheets, and calculations. Partial submittals and submittals not fully complying with the requirements and recommended practices of NFPA 72-2019 and this specification will be returned disapproved without review.

G. Shop drawings shall be wholly generated and coordinated by the Fire Alarm Contractor. Partial or complete reproductions of the Engineer's drawings will not be accepted.

H. Shop drawing resubmittals shall be accompanied by a response letter addressing each comment in the Engineer's review of the shop drawings. Changes to the working plans shall be clouded to indicate the revised area and annotated to indicate the revision number and revision date.

I. Submit shop drawings, cut sheets, and calculations to the AHJ for review.

J. Submit shop drawings, cut sheets, and calculations to the Owner's Insurance underwriter for review, if applicable.

K. Submit shop drawings, cut sheets, and calculations as specified in DIVISION 01 SUBMITTALS to the Engineer for review.
L. Submit a fire alarm system acceptance test procedure detailing the procedures to be followed for testing of the control equipment, remote monitoring, wiring systems, devices, accessories and notification appliances. Identify each piece of control equipment, device, appliance and circuit to be tested. Describe the test procedure for each item. Identify all equipment and personnel required for the testing.
    1. Test procedures are to be written to minimally disrupt facility operations (minimize activation of evacuation notification appliances, AHU shutdown, etc.) in support of testing requirements.
M. Obtain all approvals prior to purchasing equipment or beginning installation.
N. The Fire Alarm Contractor assumes sole responsibility for purchasing equipment or beginning installation before all approvals are obtained. No change orders will be awarded due to purchasing equipment or beginning installation prior to obtaining approvals.

1.07 INFORMATION SUBMITTALS:
A. Contractor qualifications: The Fire Alarm Contractor shall be a qualified fire alarm contractor, licensed and regularly engaged in the installation of fire alarm systems of similar size and complexity.
    1. Submit contractor qualifications and license information.
B. Designer qualifications:
    1. Submit qualifications of Fire Protection Engineer.
    2. Submit qualifications of Fire Alarm Technician.
    3. Submit qualifications of Fire Alarm Installer.
    4. Submit qualifications of Manufacturer's Authorized Representative.

1.08 CLOSEOUT SUBMITTALS:
A. Submit operations and maintenance manuals in accordance with DIVISION 01. In addition to items specified in DIVISION 01, provide documentation in accordance with the documentation requirements of NFPA 72. Include as-built drawings, product data sheets, calculations, and a copy of the site-specific software.
B. Submit all field test data per NFPA 72 and specifications.
    1. Submit NFPA 72 System Record of Completion and applicable Supplementary Records of Completion.
    2. Submit NFPA 72 System Record of Inspection and Testing and applicable Supplementary Records of Inspection and Testing.
C. Submit complete warranty information.

1.09 QUALITY ASSURANCE:
A. Design and install fire alarm systems in accordance with the applicable NFPA standards, locally adopted building code, fire code, and other local policies, interpretations and standards as listed in Part 1 References.
    1. If there is a conflict between the reference codes or standards and this SECTION, it is the Contractor's responsibility to notify the Engineer in writing. The most stringent requirement, as determined by the Engineer shall apply.
B. Compliance with referenced NFPA standards is mandatory. This includes advisory provisions listed in the appendices of such standards, as though the word "shall" had been substituted for the word "should" wherever it appears.

C. Installer Qualifications:
   1. The Contractor for the fire alarm installation shall be a qualified fire alarm contractor, regularly engaged in the installation of fire alarm systems ~~for a minimum of 5 years~~ with required state and local licenses.
   2. A licensed electrician shall be permitted to install conduit, cabling, backboxes and wire.
   3. The Contractor's responsibilities include designing, fabricating, installing and programming the fire alarm system, and providing professional design and engineering services needed to assume engineering responsibility.
      a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports shall be by a qualified Fire Alarm Technician.
      b. The Contractor shall maintain a qualified Fire Alarm Installer on-site during installation.
      c. The Contractor shall maintain a qualified Manufacturer's Authorized Representative on-site during preliminary and final testing.
      d. The Manufacturer's Authorized Representative shall supervise the installation, programming, preliminary testing, and final testing. The Manufacturer's Authorized Representative shall provide the required instruction to the Owner's personnel in the system operation, maintenance, and programming.

PART 2 - PRODUCTS

2.01 GENERAL:
A. All equipment shall be Listed by Underwriter's Laboratories and included in the latest edition of the U.L. Fire Protection Equipment directory or Approved by FM Global and listed in the FM Approvals - Approval Guide.
B. All components provided shall be listed for use with the selected system.
C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.02 MANUFACTURERS:
A. Fire alarm system control equipment, devices, appliances, components, and accessories may be provided by any manufacturer who can meet this specification.

2.03 FIRE ALARM AND DETECTION SYSTEMS:
A. General: Provide a complete analog/addressable fire alarm system and products of types, sizes, and capacities indicated, which comply with manufacturer's standard design, materials, components; constructed in accordance with published product information and as required for complete installation. Provide fire alarm and detection systems for applications indicated.
B. The fire alarm system shall provide operation of detection devices, alarm notification, local annunciation, and auxiliary control functions.
C. System Wiring and Supervision:
   1. Provide Class B initiating device circuits (IDC).
   2. Provide Class B notification appliance circuits (NAC).
   3. Provide Class B signaling line circuit (SLC).
   4. Provide circuits with a minimum Pathway Survivability Level 0.
D. Power Supplies: Provide system for operation on 120VAC power supply from the building electrical system. Fire alarm systems shall be power limited, operating on 24 VDC.

1. Provide battery back-up as secondary power supply. Provide back-up battery and battery charger each with 20% spare capacity for future use. Design battery back-up to take over supply to system instantaneously. Provide battery with adequate capacity to be capable of operation of system for:
   a. 24 hours under normal supervisory (nonalarm) conditions and then for 5 minutes under alarm conditions.
2. Battery capacity requirement shall be met regardless of whether an emergency power generator is provided as part of the project.
3. The battery charger shall completely recharge batteries within 48 hours.

E. Spare circuit capacity:
1. Do not load notification appliance circuits (horn/strobe) beyond 80 percent of capacity.
2. Provide a minimum of 25 spare device addresses.

F. Required System Features:
1. Refer to the functional matrix on the drawings.
1. Alarm initiation from heat detectors, linear heat detection, and manual pull stations.
2. Supervisory indication from duct smoke detectors.
3. Fan shut down relays.
4. Occupant notification with audible and visible occupant notification appliances.

G. Wiring System Materials: Provide basic wiring materials which comply with SECTION 26 05 33 – RACEWAYS, BOXES, SEALS, AND FITTINGS FOR ELECTRICAL SYSTEMS.
1. Provide wire and cable in accordance with requirements of NFPA 70 and the FACU manufacturer.
2. Provide conductors which are listed and approved for fire alarm usage.
3. Conductors shall be solid except those used in circuits requiring shielding.
4. Minimum SLC conductor size shall be 18 AWG.
5. Minimum IDC conductor size shall be 18 AWG.
6. Minimum NAC conductor size shall be 16 AWG.
7. Provide shielded conductors for SLC's where recommended by the manufacturer or otherwise required due to other building systems or construction. Communications issue resulting from interference will be considered a deficient installation to be corrected at no additional cost.
8. Provide shielded conductors for SLC's.
9. Conduit shall be electrical metallic tubing (EMT) or rigid metal conduit (RMC).
   a. Minimum conduit size shall be ¾ inch.
   b. All conduit shall be factory finished or field painted red.
10. Fittings and seals shall be metallic suitable for use with the conduit type.
11. Terminal Boxes, Junction Boxes, and Covers: Provide fire alarm terminal boxes, junction boxes, and covers prefinished red or painted with red enamel. Label boxes as required by the AHJ and specifications.

H. Fire Alarm Control Equipment (FACU panel):
1. Provide FACU enclosures for housing devices and circuits necessary to perform required functions. Control panels shall comply with UL 864.
2. Provide control panel for operation on 120VAC supply and for 24VDC (power limited) system operation with integral battery standby power source.

3. Provide a fire alarm communicator (FAC) to transmit signal to supervising station. The FAC shall have selectable reporting paths to include cellular only, IP only, or IP primary/cellular backup. Provide with 24-hour battery backup.
4. A fire alarm signal shall activate notification appliances throughout the building. Audible appliances shall produce a three-pulse temporal pattern in accordance with NFPA 72. Visible appliances shall operate in accordance with NFPA 72.
5. Panels must be capable of fiber networking.
6. FACU shall have an RS 232 port.
7. FACU shall include dry output contacts, rated 24VDC, for the following status points:
   a. Alarm.
   b. Trouble.
   c. Supervisory.
8. Enclosure: NEMA ICS 6, Type 1, enameled-steel, cabinet.
   a. Mounting: Surface.

I. Initiating Devices
1. All initiating devices shall be intelligent, addressable devices except where specifically noted otherwise.
2. Addressable Manual Fire Alarm Pull Stations: Provide manufacturer's standard construction, red enclosure, manual fire alarm pull station with the following features.
   a. Surface mounted in unfinished areas.
   b. Outdoor units and units located in wet indoor locations shall be weatherproof.
   c. Addressable.
   d. Non-break glass operation.
   e. Double action.
   f. Key operated to reset.
      (1) Reset key must be the same as the FACU key.
3. Addressable Automatic Heat Detectors shall comply with UL 521:
   a. Addressable Combination 15°F per minute rate of rise and 200°F fixed temperature spot type, 24VDC restorable.
4. Linear Heat Detection:
   a. Shall consist of an approved Digital Linear Heat Detector.
   b. The Linear Heat Detection System's spacing and/or proximity locations shall be determined by applicable NFPA, State Codes, Local Codes, International Codes and/or the manufacturer's recommendations.
   c. Performance Requirements:
      (1) Shall be rated for up to 5~~3~~0-foot spacing and/or proximity detection.
      (2) Shall be compatible with any listed or approved fire alarm panel.
      (3) Shall detect an overheat or fire at its rated temperature.
      (4) Shall report any equipment related fault through a fault output relay.
      (5) Shall be installed to comply with NFPA standards (and the authority having jurisdiction and/or the manufacturers recommendations).
   d. Basis of Design: Protectowire PHSC-XCR 200 degree wire with PIM-530E Interface Module. Listed alternate equal and approved products will be considered.
5. Automatic Smoke Detectors: Provide manufacturer's standard construction automatic smoke detectors of the following types.
   a. Addressable In-duct photoelectric type, 24VDC, with integral and remote test-reset-off keyed switch and remote LED alarm light. Provide sampling tubes of design

and dimension as recommended by the manufacturer for the specific duct size where it is applied. Detector shall comply with UL 268A. Provide integral fan shutdown relay. A trouble signal shall occur when the cover is removed.

J. Notification Appliances
   1. Unless otherwise noted, provide notification appliance with the following color and lettering:
      a. Red base and grill lettered "FIRE" in 1-inch high, white letters in unfinished areas.
   2. Horns: Provide manufacturer's standard construction, 24VDC, fire alarm horn with following features.
      a. Coded
      b. Surface mounted (with grille) in unfinished areas and outdoors. (Outdoor units shall be weatherproof).
      c. Electronic Tone. Electromechanical designs are not acceptable.
   3. Visible Alarm Strobes: Strobe shall comply with UL 1971 except as noted otherwise. Provide manufacturer's standard construction alarm lights with the following features.
      a. Clear lens.
      b. 24VDC Xenon or LED strobe.
      c. Flash intensity, rate and duration shall comply with NFPA 72.

K. System Accessories
   1. Addressable Input Modules (AIMs):
      a. Same manufacture as the FACU.
      b. Input modules shall include an LED that changes states to indicate an alarm or supervisory condition. Module LED's shall be visible without removal of covers.
      c. Monitor modules with multiple addresses and a single LED indicator are not acceptable. Multi-address modules with LED indicators for each input and address are acceptable when mounted in cabinet with all LED's visible without removing cover.
   2. Addressable Output Modules (AOMs):
      a. Same manufacture as the FACU.
      b. Output modules shall include an LED that changes states to indicate an activated condition. Module LED's shall be visible without removal of covers.
      c. Modules with multiple addresses and a single LED indicator are not acceptable. Multi-address modules with LED indicators for each output and address are acceptable when mounted in cabinet with all LED's visible without removing cover.
   3. Surge Protective Devices:
      a. Transient Voltage Surge Suppressors (TVSS) for use on AC power to FACU.
         (1) Series Connected
         (2) UL 1449 4th Edition, UL 1283

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Examine areas and conditions under which fire alarm systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 DELIVERY, STORAGE, AND HANDLING:

A. Handle fire alarm equipment carefully to prevent damage, breaking, and scoring. Do not install damaged equipment or components; replace with new.

B. Store fire alarm equipment in a clean, dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

3.03 GENERAL:

A. Provide a complete and fully operational fire alarm system as described herein and as shown on the drawings.

B. Equipment shall be installed and wired in accordance with this specification, project drawings and approved shop drawings.

C. Provide all new wiring, conduit, junction boxes and outlet boxes required for the system, including connections to initiating, indicating and control devices furnished by others.

D. The Fire Alarm Installer shall oversee the fire alarm installation and shall be on site during all fire alarm system work.

3.04 INSTALLATION OF BASIC WIRING SYSTEM MATERIALS:

A. Install wiring, raceways, and electrical boxes and fittings in accordance with SECTION 26 05 33 – RACEWAYS, BOXES, SEALS, AND FITTINGS FOR ELECTRICAL SYSTEMS and NFPA 70.

B. Install all wiring in conduit or raceways.

C. Support conduit in accordance with the NEC and Division 26.

1. Tension only hangers are not permitted (for example, batwings).
2. Flexible conduit is permitted only where connecting to devices and appliances located in removable ceiling tiles; and where specifically indicated on the drawings.

D. Conceal conduit in walls or above ceilings unless otherwise indicated. Conduit may be surface mounted in unfinished areas (example: mechanical and electrical equipment rooms).

E. Route conduit to devices and appliances not mounted directly on walls or ceilings as a single pendent drop to each device or appliance from the ceiling surface above. Do not trapeze conduit across an open space.

F. Do not use fire alarm equipment as a raceway for routing power or low voltage wiring. Only wiring terminating within the equipment enclosure may be run into the enclosure.

G. Where possible, install wires and cables without splices. Make connections and splices at terminal strips in terminal boxes, cabinets or at equipment terminals.

H. Ground one end of shielding on circuits with shielded conductors.

I. All fire alarm devices within 10 feet of open drain connections shall be in NEMA 4 boxes with waterproof raceway.

J. Firestop all penetrations through smoke and fire barriers.

3.05 INSTALLATION OF FIRE ALARM SYSTEMS:

A. Install fire alarm system as indicated, in accordance with equipment manufacturer's written instructions and complying with applicable portions of the NEC.

B. Manual Pull Stations:

1. Install fire alarm manual pull stations as indicated on the drawings.

C. Heat detectors:

1. Install heat detectors in accordance with NFPA 72 and as indicated on the drawings.
2. Space heat detectors in accordance with NFPA72 and as indicated on the drawings.

3. Spacing of heat detectors shall be adjusted in accordance with NFPA 72 requirements for ceiling height and construction type.
4. Install test switches for linear heat detection in an accessible location.

D. Addressable Modules
1. Install modules in backbox or manufacturer provided enclosure with LED visible without cover removal.

E. Duct Smoke Detectors:
1. Duct mounted smoke detectors shall be installed in the ductwork between six and ten duct equivalent diameters of straight, uninterrupted ductwork from a bend or opening. Coordinate installation with Division 23 Contractor.
2. Coordinate with Division 23 Contractor and make connection from duct detector or output module to air handling equipment shutdown contacts.

F. Alarm Notification Appliances:
1. Install notification appliances as indicated on the drawings, spaced in accordance with NFPA 72.
2. Install wall mounted audible alarms not less than 90 inches above finished floor nor less than 6 inches below ceiling.
3. Install wall mounted visible alarm strobes with the entire lens between 80 and 96 inches above finished floor.
4. Mount appliances at uniform heights.
5. Appliances may be surface mounted in unfinished areas. Surface installation shall be with a factory provided back box. The aesthetic appearance shall not have any mounting holes or screw heads visible when the installation is completed.
6. Outdoor notification appliances shall be NEMA 4X, IP56 rated and shall be installed with suitable weatherproof back box, seals and gaskets.

G. Wiring: Wiring of fire alarm system is work of this Section but is not specifically detailed on drawings.
1. Complete wiring in accordance with the NEC and the manufacturer's requirements.
2. Consistently color code wiring throughout the system and install per manufacturer's point-to-point wiring diagram.
3. Determine exact number of wires required for each device, appliance, and circuit. Connect each device or appliance with sufficient wiring to complete its intended operation.
4. Size all raceway per the NEC. Minimum sizes shall be as specified in this SECTION.
5. All fire alarm circuits shall be supervised. Provide end-of-line resistors where required to supervise conventional device circuits, power circuits, releasing circuits, etc. This includes the wiring between fire alarm devices and auxiliary devices such as air handling units.
6. Install devices and appliances using power supplies, circuits and wire sizes to alleviate voltage drops which would make devices operate below the voltage limits for which they are designed. Calculate voltage drops before wire and equipment is installed.
   a. Perform voltage drop calculations for notification appliance circuits using the following criteria
      (1) Starting voltage shall be 20.4 VDC.
      (2) The current shall be the maximum current draw listed in the manufacturer’s literature (UL Max current draw at 16 VDC) for the selected candela rating and sound output setting.

(3) The wire resistance shall be the resistance for single strand, uncoated, copper conductors in Table 8 of the NEC unless the product data sheet for the conductor included in the product data submittal indicates a different value. The wire resistance shall be adjusted to account for the maximum ambient temperature anticipated.

(4) The minimum voltage at each notification appliance shall be 16 VDC at all notification appliances.

7. Install surge suppressors on all 120 VAC power supplies to fire alarm equipment and on fire alarm circuits entering or leaving the building. Ground surge protection devices in accordance with the manufacturer's recommendations.
8. Identify all conductors with permanent markings at each device and panel.

H. Emergency Control Functions and Interfaces:
1. Provide all modules, wiring, and make final connections to equipment interfaced, controlled, or monitored by the fire alarm system. Provide modules and supervised power for interface with mechanical air handling units and dampers for automatic control of HVAC systems, and other systems as indicated on the drawings.
2. Connections to other systems shall be made by the suppliers of those systems.
3. Install modules a maximum of 3 feet from the controlled or monitored circuit or device. All relay contacts shall be Form C to permit interface with normally open and normally closed circuits. Install all relays in properly sized equipment enclosures.
4. Coordinate with Division 23 for location and quantity of air handling units requiring duct smoke detectors. Provide, install, and wire detector for shutdown of air handling equipment.

I. Programming: Final system software configuration shall be verified in the field by the system supplier coordinating with the Engineer and the Owner. The system shall include all programming required to provide a proper functioning system as described herein.
1. Program the system to function properly and according to the operational matrix indicated on the drawings.

3.06 INSTALLATION OF BASIC IDENTIFICATION:

A. Install electrical identification in accordance with SECTION 26 05 53 - ELECTRICAL IDENTIFICATION and this SECTION.

B. All junction, terminal, and pulling box covers shall be factory finished or painted red and shall be identified in a permanent and legible manner to indicate the zone and circuit that it contains.
1. Label the inside cover of the box.
2. Hand lettering is not acceptable.

C. Label all system controls and equipment including remote power supplies, amplifiers, and fire alarm communicators.
1. Labels shall be permanent red phenolic labels with engraved white letters.
2. Labels shall match fire alarm as-built drawings.

D. All detection and terminal devices shall be identified in a permanent and legible manner to indicate the device zone and address keyed to the posted operations and maintenance instructions.
1. Hand lettering is not acceptable.
2. Use labels such as:
a. HD## (heat detector)
b. DSD## (duct smoke detector)
c. MM## (monitor module)

d. CM## (control module)
e. RM## (relay module)

E. All notification appliances shall be identified in a permanent and legible manner to indicate the device number keyed to the posted operations and maintenance instructions.
1. Hand lettering is not acceptable.
2. Use labels such as:
a. HS## (horn/strobe)
b. H## (horn)
c. S# (strobe)

F. All wiring shall be labeled at each termination and in each junction or pulling box.
1. SLC wiring shall be labeled using the following format:
a. Input (from previous device on SLC): "SLC from SD##" or "SLC from FACU"
b. Output (to next device on SLC): "SLC to SD##" or "SLC to FACU"
2. NAC wiring shall be labeled using the following format:
a. Input (from previous device on NAC): "NAC from HS##", "NAC from RPS#"
b. Output (to next device on NAC): "NAC to HS##" or "NAC to RPS#"

G. Label each fire alarm control unit, power supply, and other equipment provided with 120VAC power with the panel location, number and circuit number powering the equipment.

H. Label batteries with the date of installation.

3.07 FIELD QUALITY CONTROL AND TESTING:

A. Connection and Supervision: Make connections to panel and perform all testing under the supervision of the Fire Alarm Technician.

B. Protect fire alarm devices during construction. Replace any unprotected smoke detectors.

C. All wiring shall test free from open conductors, shorts and/or crosses between conductors, and grounded conductors.

3.08 TESTING:

A. The Manufacturer's Authorized Representative shall perform all testing.

B. Participate in pre-testing between subcontractors for all building systems with interface with the building fire alarm system.

C. Provide all materials, equipment, and labor for testing.
1. This includes specialized equipment such as manometers.

D. System Test and Approval:
1. Prior to final acceptance of system, the Manufacturer's Authorized Representative shall test the system per NFPA 72 requirements. Test each manual, automatic, sensing, detecting, and alarm device.
a. Test each circuit for open circuits, shorts, grounds, and loop resistance. Record test results of each circuit test and include in close-out submittals.
b. All resettable smoke detection devices shall be tested with "canned smoke."
c. Duct smoke detector testing shall include verifying pressure differential with a manometer or as recommended by the manufacturer.
d. All resettable thermal sensors shall be tested with heat, and non-resettable thermal sensors shall be tested by short-circuiting each end-of-line device's contacts.
e. Test all HVAC, exhaust fan, interfaces for proper operation.
f. Correct any deficiencies prior to final acceptance testing. Submit written notification to the Engineer that the system has been pre-tested and all deficiencies have been corrected.

2. In presence of the Authority Having Jurisdiction, Owner's Representative, and Engineer's representative, the Manufacturer's Authorized Representative shall perform acceptance testing in accordance with NFPA 72. Test each manual, automatic, sensing, detecting, and alarm device, notification appliance, emergency function, and equipment interface in accordance with NFPA 72.
3. After being signed by the Authority Having Jurisdiction, submit a copy of test results to the Engineer, Owner, and Owner's insurance carrier, and the Authority Having Jurisdiction. Provide a copy of the inspection record at the fire alarm control panel.
4. The Manufacturer's Authorized Representative shall provide up to 4 hours of on-site training of the Owner's personnel on procedures related to start-up, shutdown, operation, troubleshooting, servicing, adjusting and preventative maintenance for the system. Provide Owner with 10 days advance notice of training. Coordinate training with Division 23 and Division 26.

3.09 MAINTENANCE:

A. The equipment supplier shall maintain a local service organization which is available to perform testing, inspection, repair, and maintenance service on the system.

3.10 SPARE PARTS:

A. Provide a list of manufacturer-recommended spare parts and accessories for maintenance of the system. Including recommended quantities and unit prices.
B. Provide spare parts for the fire alarm system.
   1. General: All spare parts shall be directly interchangeable with the corresponding components of the installed systems.
   2. All spare parts shall be suitably packaged and identified by nameplate, stamping, or tagging.
   3. The following spare parts and accessories shall be included:
      a. Provide 1 spare spot-type heat detector.
      ~~a.~~b. Provide linear heat detection parts and accessories as recommended by manufacturer.
      ~~b.~~c. Provide 1 spare audible/visual notification appliance.
   4. Furnish a list of all other spare parts and accessories which the manufacturer recommends to be stocked for maintenance of the system.
C. Keys and locks for all equipment shall be identical. Keys shall be identified by an appropriate number stamped on the key or on a metal tag attached thereto. If required, a key numbering chart shall be provided in each operations and maintenance manual furnished.
   1. Not less than 6 keys for each type required shall be provided.

END OF SECTION 28 31 00

SECTION 31 11 00 – CLEARING AND GRUBBING

PART 1 - GENERAL

1.01 SUMMARY

A. Clearing and grubbing, within the Site and as indicated in the Contract Documents, shall consist of the removal and disposal of all trees, stumps, roots, logs, shrubs, grass, weeds, fallen timber, trash (surface and buried), buildings, foundations, fences and all other material designated for removal and disposal.

1.02 SPECIFICATION MODIFICATIONS

A. It is understood that throughout this section these Specifications may be modified by appropriate items indicated in the Contract Documents.

1.03 RELATED SECTIONS

A. Section 02 41 00 – Demolition.
B. Section 31 20 50– Site Preparation and Earthwork.

1.04 DEFINITIONS

A. Clearing – The removal and disposal of all materials such as trees, brush, fallen timber and other materials found on or above the surface of the site. It shall include, but is not limited to, the removal of the following: buildings, fences, lumber, trash and other waste. Salvaging and disposing of the materials shall be as specified in this section and in the Contract Documents.
B. Stripping – The removal and disposal of material such as: sod, grass, weeds, agricultural crops, bushes, brush and all decayed vegetative matter from the surface of the ground without disturbing the earth more than is necessary.
C. Grubbing – The removal and disposal of all material such as stumps, roots, buried debris, foundations and trash encountered below the surface of the ground that has not been included in the description of clearing.
D. Trees – Woody growth having a diameter of 2 inches or greater as measured 4.5 feet above the ground.
E. Brush – Dense vegetation consisting of shrubs, bushes and small trees less than 2 inches in diameter as measured 4.5 feet above the ground.

1.05 SUBMITTALS

A. All permits required for the Work specified in this section.
B. Landfill Information: The Contractor shall submit for review and approval all proposed landfill sites to be used for the disposal of debris resulting from clearing and grubbing.

1.06 QUALITY ASSURANCE

A. The Contractor is responsible for the quality assurance and quality control of the Work.

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Salvaged materials shall be handled, stored and delivered as specified in the plan.

1.08 LIMITS OF WORK

A. The limits of clearing and grubbing area shall extend according to the Drawing unless otherwise follow APWA 2100 Specification, Section - 2101.4.
B. Large projects shall be cleared and grubbed as construction progresses. Mass clearing and grubbing shall be avoided.
C. An undisturbed strip of not less than 25 feet in width consisting of existing grass or other vegetation shall be kept in place around the perimeter of the construction site and protected from damage. The Contractor shall strip only those areas necessary for the construction of the
project.

PART 2 – PRODUCTS - Not Applicable

PART 3 – EXECUTION

3.01 PERIMETER EROSION AND SEDIMENT CONTROLS

A. Perimeter erosion and sediment controls as shown in the drawing shall be installed prior to the start of clearing and grubbing the Site.
B. When needed for the installation of perimeter controls, limited clearing and grubbing will be allowed to accommodate the Contractor's perimeter installation operation.

3.02 PRESERVATION OF TREES

A. No trees shall be removed outside the excavated area or outside filled areas, unless their removal is indicated on the Drawings or as authorized by the Owner.
B. Trees left standing shall be protected from permanent damage by construction.

3.03 CLEARING

A. Trees located within the permanent easement and temporary construction easement shall be removed as indicated on the Drawings.
B. Clearing shall consist of removing all materials such as trees, brush, downed timber, trash, waste and other objectionable materials found on or above the surface of the site. The Contractor shall tag or identify existing trees, shrubs and landscape materials to be removed; and obtain approval prior to removal.

3.04 STRIPPING

A. Stripping and stockpiling shall include the removal and disposal of material such as: sod, grass, weeds, agricultural crops, bushes, brush and all decayed vegetative matter from the 4-6 inch of topsoil of the ground without disturbing the earth more than is necessary and placing when completed.

3.05 GRUBBING

A. Grubbing shall consist of the removal and disposal of all material such as stumps, roots, buried debris, foundations and trash encountered below the surface of the ground that has not been included in the description of clearing.
B. The vegetative matter shall be removed to the following depths:
    1. A minimum depth of 12 inches below ground line or subgrade, whichever is lower.
    2. A minimum depth of 18 inches below ground line or subgrade, whichever is lower, at water containment areas (berms, dams, levees, lagoons, ponds, dikes etc.).
C. Remove and dispose of all stumps, roots and other vegetative matter larger than 2 inches in diameter.
D. When materials encountered below grade that are detrimental to the proposed improvement, the material shall be removed to a depth necessary to provide adequate space for installation and support for the proposed improvement.

3.06 EMBANKMENT AREAS

A. Unless otherwise noted on the plans, where undisturbed stumps and roots are encountered and the fill depth will exceed 3 feet, the stumps and roots may be left in place provided they do not extend above final grade.

3.07 BORROW AREAS

A. All stumps, roots and other objectionable matter shall be removed from the borrow material used for embankment or fill. The borrow area shall be left in a well-drained and smooth condition and restored.

3.08 BACKFILL

A. Backfill all holes, pits and depressions resulting from clearing and grubbing.
B. Backfill with suitable material and grade the area to drain. shall place and compacted in conformance with Section 31 20 50 – Site Preparation and Earthwork.

3.09 DISPOSAL OF MATERIAL

A. Dispose of all materials from the clearing and grubbing operations at a approved location, as arranged for by Contractor, at no additional cost to the Owner.
    1. Unless otherwise specified in Specific Project Requirement or portions of the Contract Documents, the Contractor may claim and salvage any material which the Contractor may consider of value but shall not delay any work associated with the Contract by the salvaging operations. Contractor may consider of value but shall not delay any work associated with the Contract by the salvaging operations.
B. Open burning of brush or debris on the Site is not allowed.

END OF SECTION 31 11 00

SECTION 31 20 50 – SITE PREPARATION AND EARTHWORK

PART 1 – GENERAL

1.01 SUMMARY

A. This section covers earthwork and grading associated with general excavation, backfill and compaction required for the Work.

B. This section also covers the handling, storage, transportation and disposal of all excavated material; sheeting and shoring, subgrade preparation, dewatering as necessary or required, protection of adjacent property, construction of fills and embankments, surfacing and grading; and other appurtenant work.

1.02 SPECIFICATION MODIFICATIONS

A. It is understood that throughout this section these Specifications may be modified by appropriate items indicated on the Contract Drawings.

1.03 RELATED SECTIONS

A. Section 31 11 00 - Clearing and Grubbing

B. Section 31 23 33 – Trenching and Backfilling for Open-Cut Construction

C. Section 02 41 00 - Demolition

1.04 CODES AND STANDARDS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

B. American Society for Testing and Materials (ASTM):

1. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soils Using Standard Effort (12,400 ftlb/ft3).
2. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.
3. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
4. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
5. ASTM D4546 - Standard Test Method for One-Dimensional Swell or Collapse of Soils.
6. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

C. City of Kansas City, Missouri Department of Public Works, Construction and Material Specifications (http://kcmo.gov/publicworks/design-construction-standards/) KCMO PW 2202, Subsection 2202, Untreated Compacted Aggregate.

D. Missouri Department of Transportation, Missouri Standard Specifications for Highway Construction, Division 1000, Materials Details.

1.05 DEFINITIONS

A. Paved Areas – Areas for which the final surfacing will be street pavement, shoulders, driveways, parking lots, curbs, gutters, sidewalks, or other surface features.
B. Unpaved Areas – Areas for which the final surfacing will be in a green space.
C. Gravel Area- Areas for which the final surface is gravel as show in the drawing.

1.06 SUBMITTALS

A. Submit as specified in contract document.
B. Shop Drawings:
    1. Sheeting and Shoring Plan – Prior to excavation, the Contractor shall submit a shoring design that is signed and sealed by a registered professional engineer in the State of Missouri for all excavations greater than twenty (20) feet in depth (in accordance with 29 CFR Past 1926 - OHSA Subpart P - Excavations and Trenches). Submittal will be for informational purposes only.
C. Testing Reports:
    1. Laboratory testing results for proposed Borrow Materials.
    2. Laboratory testing results and quarry control reports for Granular Material.
    3. Laboratory testing results for and quarry control reports Granular Bedding.
    4. Moisture-density (Proctor) test results.
D. Commercial Laboratory – submit name, contact information and certification of the commercial testing laboratory requirement.
E. Blasting (as applicable): Not Allowed

1.07 QUALITY ASSURANCE

A. The Contractor is responsible for the quality assurance and quality control of the Work.
B. Sampling and Testing:
    1. Tests to determine conformance with all requirements of this Specification for quality and properties of all Contractor-secured materials, including borrow materials proposed for use, shall be performed by an independent, state-certified, commercial laboratory retained and compensated by the Contractor and approved by the City or Engineer.
    2. All work associated with QUALITY ASSURANCE shall be included in the Bid Price and will be incidental to the Work. No separate measurement or payment will be made.
    3. Contractor required to retain a qualified surveyor to set control for the project.

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

A. The Owner will furnish the Site in accordance General Conditions specification.
B. General Project Requirements, paragraph EASEMENTS AND RIGHT-OF-WAY for use of private property for delivery, storage and handling.
C. Perform in a manner to prevent contamination or segregation of materials.

1.09 EXISTING UTILITES

A. The Contractor shall notify utilities prior to excavation in accordance with Section

00700 – General Conditions, Article 6 – Contractor's Responsibilities, paragraph NOTIFICATION OF ULTILITIES.

B. Contractor is responsible for reopening and repairing of any damage of existing utilities and pipes due to movement of construction machinery and equipment.
C. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand, start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured.
D. Support uncovered lines or other existing work affected by the excavation until approval for backfill is granted.
E. Report damage to utility lines or subsurface construction immediately.

PART 2 - PRODUCTS

2.01 MATERIALS ENCOUNTERED

A. Suitable Materials – Materials suitable for use in backfill, fill and embankment include job excavated or borrow material that is free of debris, roots, organic matter, frozen matter and shale particles/rock/stone or gravel with all dimensions less than 2 inches:
   1. Cohesionless materials include gravels, gravel-sand mixtures, sands and gravelly sands; generally exclusive of clayey and silty material with the following properties:
      (a) Free-draining.
      (b) Impact compaction will not produce a well-defined moisture-density relationship curve.
      (c) Maximum density by impact methods will generally be less than by vibratory methods.
      (d) Generally less than 15% by dry weight of soil particles pass a No. 200 sieve.
   2. Cohesive materials include materials made up predominately of silts and clays generally exclusive of sands and gravel with the following properties:
      (a) Impact compaction will produce a well-defined moisture-density relationship curve.
      (b) Are not free draining.

B. Unsuitable Materials – Materials unsuitable for use in backfill, fill and embankment include all material that contains debris, roots, organic matter, frozen matter, shale particles/rock/stone or gravel with any dimension greater than 2 inches. Additionally, as determined by the Owner/Design Professional, any other materials that are too wet or otherwise unsuitable for providing a stable subgrade or stable foundation for structures or trenches.
C. Material used for embankment or fill:
   For soils used below structural elements (such as: footings, slabs, pavements and mats), the portion of material passing the No. 40 sieve shall have a liquid limit not exceeding 40 and a plasticity index not exceeding 25 when tested in accordance with ASTM D4318.

2.02 TOPSOIL

A. On-Site Topsoil – Surface soil stripped and stockpiled on site and modified as necessary to meet the requirements specified herein. When available, topsoil must be existing surface soil stripped and stockpiled on the Site.
B. Off-Site Topsoil – Conform to requirements specified herein. Additional topsoil must be furnished by the Contractor.
C. Composition – Natural, friable soil representative of productive, well-drained soils in the area, free of subsoil, stumps, rocks larger than 2- inch diameter, brush, weeds, toxic substances and other material detrimental to plant growth. Amend topsoil pH range to obtain a pH of 5.5 to 7.
D. Topsoil shall be of a quality at least equal to the existing topsoil in adjacent areas, free from trash, stones, debris and well suited to support plant growth.

2.03 SOIL CONDITIONS

A. All Materials encountered, regardless of type, character composition and condition shall be considered "unclassified" for the purpose of payment. Determine quantity of various materials to be excavated prior to submitting Bid. Rock encountered shall be handled at no extra cost to Owner.

2.04 WASTE MATERIALS

A. Waste materials, as described for purposes of this Section, consist of unsuitable materials such as: rock, surplus excavated material, demolition debris and other materials considered unacceptable for use as fill or can be wasted on site, in designated areas shown in the plan.
B. Waste materials shall not include environmental pollutants, hazardous substances, contaminated products, by-products, samples or waste materials of any kind that are regulated under environmental laws.
C. Excess soil shall be stockpiled in areas indicated on plans or used as backfill on structures within the existing plant to be demolished and backfilled.

2.05 BORROW MATERIALS

A. Suitable fill materials, granular materials and topsoil obtained from locations arranged for by Contractor (off the Site) are required to the extent sufficient suitable materials cannot be obtained from excavation and trenching.
B. Borrow materials shall not exhibit characteristics of high shrink or swell potential as determined from Atterberg limit tests (ASTM D4318) and/or swell tests (ASTM D4546) unless otherwise specified herein.

2.06 GRANULAR FILL MATERIAL

A. Granular fill material shall consist of crushed stone, sand and gravel or reclaimed asphalt or concrete. The aggregate shall not contain more than 15 percent deleterious rock and shale. The fraction passing the No. 40 sieve shall have a plasticity index not to exceed six. Any sand, silt, clay and any deleterious rock and shale shall be uniformly distributed throughout the material.

B. Reclaimed asphalt or concrete materials meeting the requirements of aggregate must be approved for use by the City.
C. Granular fill material shall be in accordance with the following gradation requirements defined in Table 1 below:

Table 1. Gradation for Granular Fill Material

Sieve Size	Mass Percent Passing		
	MoDOT Type 5	AB3	KCMO PW 2202**
2 inch		0	
1 ½ inch		0-5	
1 ¼ inch			100
1 inch	100		72 to 100
¾ inch		5-30	60 to 90
½ inch	60 to 90		
3/8 inch			43 to 74
No. 4	35 to 60	35-60	28 to 60
No. 8		45-70	
No. 10			16 to 40
No. 30	10-35		
No. 40		60-84	3 to 22
No. 200	0-15	80-92	8 to 20*

1. For type AB-3, the fraction passing the No. 200 sieve shall not exceed ¾ of the fraction pasting the No. 40 sieve.
2. For KCMO PW 2200, the difference between Mass Percent Passing of successive sieve sizes shall not exceed 25%. That fraction of material; passing the No. 40 sieve shall have a plasticity index not to exceed 8.
3. MoDOT Type 5 material shall conform to Missouri Department of Transportation, Standard Specifications for Highway Construction, Section 1007, Type 5 Aggregate.

2.07 GEOTEXTILE
Not Used

2.08 CONTROLLED LOW STRENGTH MATERIAL (CLSM)
Not used

PART 3 - EXECUTION

3.01 DEMOLITION
Demolition shall be conducted in accordance with Section 02-41-00 – Demolition.

3.02 CLEARING AND GRUBBING

Perform clearing and grubbing, in accordance with Section 31 11 00 – Clearing and Grubbing, as indicated and as required to perform the Work.

3.03 STRIPPING

A. Stripping shall consist of scraping areas clean of all brush, grass, weeds, roots and other materials.
B. Remove topsoil from areas within limits of excavation, trenching, borrow and areas designated to receive fill.
C. Strip to a minimum depth of 6 inches, but to a sufficient depth to remove excessive roots in heavy vegetation, unsuitable material or brush areas and as required to remove all soil containing organic material or segregate topsoil.
D. Stockpile topsoil in areas designated or approved by the City/Design Professional where it will not interfere with construction operations or existing facilities. Stabilize and protect stockpiles from runoff per the SWPPP plan.

3.04 GENERAL REQUIREMENTS FOR OPEN EXCAVATIONS

A. Excavations shall be restored to the level of the adjacent surfaces as soon as practicable.
B. Protective Measures in Paved Areas:
    1. Excavations within paved areas shall be protected and secured in accordance with existing federal, state and local codes and standards. This includes, but not limited to, the most current edition of the Manual of Uniform Traffic Control Devices.

C Protective Measures Unpaved Areas:
    1. Supervision – As a temporary measure, the Contractor may provide personnel to supervise an open excavation that is not otherwise protected. Supervision shall ensure that the public is protected and shall serve the same function as a protective cover or fencing. A protective cover or fencing shall be installed for all excavations that are not supervised.
    2. Protective Cover – A protective cover shall be installed over the excavation so that it can sustain the weight of any persons and/or objects placed upon it. The cover shall be of sufficient weight or fixed to the ground so it cannot be moved. Protective covers shall have no opening(s) or protuberance(s) of sufficient size to cause a fall or injury. Advance warning devices shall be installed as required by the City/Design Professional.
    3. Fencing – Any excavation that is not covered shall be fenced in so that it surrounds the entire excavation area and prevents entry. The fencing shall be minimum of 42 inches in height. The fence shall be secured and upright at all times.
D. Inspection and Maintenance – Protective measures (coverings and fences) shall be inspected by the Contractor at least daily to assure integrity. Protective measures in heavy traffic areas shall be inspected more often as necessary.
E. Excavation permits shall be secured prior to starting the work.

3.05 EXCAVATION

A. Excavations shall provide adequate working space and clearances for the work to be performed therein and for installation and removal of concrete forms.
B. In no case shall excavation faces be undercut for extended footings.
C. Subgrade surfaces shall be clean and free of loose material of any kind when concrete is placed thereon.
D. Classification of Excavated Materials – No classification of excavated materials will be made. Excavation and trenching work shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the work, regardless of the type, character, composition or condition thereof.

3.06 DEWATERING

A. Dewatering equipment shall be provided to remove and dispose of all surface water and groundwater entering excavations, trenches or other parts of the Work.
B. To prevent damage from hydrostatic pressure, flotation or other cause, all excavations shall be protected and kept dry during subgrade preparation and continually thereafter until the structure is built or the pipe is installed and the area is backfilled.
C. All excavations for concrete structures or trenches which extend down to or below groundwater shall be dewatered by lowering and keeping the groundwater level beneath such excavations 12 inches or more below the bottom of the excavation.
D. Surface water shall be diverted or otherwise prevented from entering excavations or trenches to the greatest extent possible without causing damage to adjacent property.
E. If the material within the excavation becomes unsuitable or unstable as a result of the Contractor's inability to implement adequate surface diversion or dewatering measures, then the Contractor shall remove unsuitable materials and replace with approved compacted fill material as directed by City and at no additional cost to the City.
F. Surface water and groundwater that contains silt and soil shall not be disposed of without pre-treatment.
G. The Contractor is responsible for the condition of any pipe, conduit or drainage way which is utilized for drainage purposes. Any such pipe, conduit or drainage way utilized shall be left clean and free of sediment.

3.07 SHEETING AND SHORING

A. The Contractor shall provide all shoring, bracing, cribbing, trench boxes, underpinning and sheeting as necessary to support excavations.
B. The Contractor shall provide a Sheeting and Shoring Plan that includes provisions that will accomplish the following:
    1. Prevent undermining of pavements, foundations and slabs.
    2. Prevent slippage or movement in banks or slopes adjacent to the excavation.
    3. Allow for the abandonment of shoring and sheeting materials in place in critical areas as the Work is completed. In these areas, backfill the excavation to within 3 feet of the finished grade and remove the remaining exposed portion of the shoring before completing the backfill.
    4. Except where banks are cut back on a stable slope, excavations for structures shall be supported as necessary to prevent caving or sliding.

5. Excavations shall provide adequate working space and clearances for the Work to be performed.
6. Undercutting of excavation faces is prohibited.

3.08 BACKFILL AND COMPACTION

A. Fills and embankments shall be constructed to the lines and grades indicated on the Drawings, using suitable material.
B. Weather Limitations – Construction of fills and embankments during freezing weather shall not be done except by permission of the City/Design Professional. No fill or embankment materials shall be installed on frozen surfaces, nor shall froze material, snow or ice be placed in the fill or embankment.
C. After preparation of the fill or embankment site, the subgrade shall be leveled and rolled so that surface materials of the subgrade will be compacted and well bonded with the first layer of the fill or embankment and for subsequent layers.
D. All fill and embankment materials shall be placed in layers not to exceed 8 inches in un-compacted thickness.
E. Excess soil shall be stockpiled in areas indicated on plans or used as backfill on structures within the existing plant to be demolished and backfilled. No shale particles, rock, gravel or stone with any dimension greater than 2 inches shall be placed in the upper 18 inches of any fill or embankment. Rocks or stones within the allowable size limit may be incorporated in the remainder of fills and embankments, provided they are distributed so that they do not interfere with proper compaction.
F. The material in each layer shall be wetted or dried as required and thoroughly mixed to ensure uniform moisture content and adequate compaction. Each layer shall be thoroughly compacted as follows:
    1. Unpaved Areas:
        (a) 95% of maximum dry density at moisture content range from 3% below optimum to 2% above optimum as determined by ASTM D698.
        (b) If the material fails to meet the density specified, compaction methods shall be altered.
    2. Paved Areas:
        (a) All subgrades below paved area and within 1 foot of a paved areas shall be compacted to 95% of maximum dry density at moisture content range from 3% below optimum to 2% above optimum as determined by ASTM D698 for the subgrade 1 foot outside of paved areas.
        (b) If the material fails to meet the density specified, compaction methods shall be altered.
G. Trenches in Embankments – Wherever a trench is to pass through a fill or embankment, the fill or embankment material shall be placed and compacted to an elevation not less than 36 inches above the top of pipe elevation before the trench is re-excavated.
H. Unless otherwise specified in Section 01015 – Specific Project Requirements, trenches and pipes that pass through a water-containing embankment shall eliminate the granular embedment material and the trench bottom shall be graded to provide uniform and continuous support for the pipe. The pipe shall be embedded in embankment material

containing no rocks, stones or other pervious material. The embedment material shall be compacted as specified for the embankment.

3.09 GRANULAR FILLS

A. Granular fill material shall be provided where indicated on the drawings.
B. Granular fill material shall be placed on suitably prepared subgrades and compacted by vibration.
C. If the material fails to meet the density specified, compaction methods shall be altered.
D. Where granular fills are to be covered with concrete, the top surface shall be graded to the required subgrade.
E. Granular fill should be placed in loose lifts not in excess of 8 inch thick.

3.10 FIELD QUALITY CONTROL

A. Compaction Tests:
    1. Two initial gradation tests shall be made for each type of embedment, fill and backfill material used and one additional gradation test shall be made for each additional 500 tons of each material. At the sole expense of the Contractor, moisture-density (Proctor) tests, relative density tests on the materials and all in place field density tests shall be performed by the Contractor. All tests performed shall be done in accordance with ASTM D698.
    2. The method of in-place compaction testing including density and moisture content shall be as follows:
        (a) Density - Cohesive materials: ASTM D2167, ASTM D1556 or ASTM D6938.
        (b) Density - Cohesion-less materials: ASTM D6938.
        (c) Moisture Content: ASTM D6938.
    3. The minimum frequency of in-place compaction testing including density and moisture content will be as follows:
        (a) At least one test for every 2,000 cubic yards of material placed in a mass fill or for every 1000 sf
        (b) At least one test when the City suspects the quality of moisture control or effectiveness of compaction.
    4. Any material/fill failing to meet required densities shall be removed, replaced and compacted as necessary to achieve specified results.
    5. Removal of in-place material and replacement with approved new material will be required if scarifying and re-compaction do not produce the required densities.

3.11 EQUIPMENT

A. The Contractor shall utilize appropriate equipment to obtain the compaction requirements specified. Acceptable equipment includes, but is not limited to, the following:
    1. Tamping Rollers.
    2. Pneumatic Rollers.
    3. Vibratory Rollers.

4. Other methods that have been tested and have been shown to meet the specified compaction rates.

B. Power tampers or rammers shall be used for the compaction of material in areas where it is impractical or unsafe to use heavy equipment or as recommended by the City.
C. Vibratory plate compactors, manual or attached to excavation equipment, may be used for consolidation of embedment and compaction of granular fill in areas where it is impractical or unsafe to use heavy equipment or as recommended by the City.
D. All compaction equipment is subject to the approval of the City/Design Professional.

3.12 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
    1. Provide a smooth transition between adjacent existing grades and new grades.
    2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
    1. Lawn or Unpaved Areas: Plus or minus 1 inch.
    2. Sidewalks: Plus or minus 1 inch.
    3. Pavements: Plus or minus 1/2 inch.
C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.13 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.
C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.14 FINAL GRADING AND PLACEMENT OF TOPSOIL

A. After all trenching, backfilling, compaction and embankments to be constructed have been rough graded, all areas shall be final graded to the indicated elevations, slopes and contours.
B. All cuts, fills, embankments and other areas which have been disturbed or damaged by construction operations shall be surfaced with at least 6 inches of topsoil to meet final grade.

C. Use of graders or other power equipment will be permitted for final grading and dressing slopes, provided the result is uniform and equivalent to manual methods.
D. All surfaces shall be graded to provide effective drainage. Unless otherwise indicated, a slope of at least 1 percent shall be provided.
E. Final grade shall be smooth, even and free from clods, rocks, stones, weeds, brush and other debris.

3.15 DISPOSAL OF EXCESS EXCAVATED MATERIALS

A. Except as otherwise permitted, all excess excavated materials shall be stockpiled in the designated areas mention in the drawing.
B. Demolition Debris, see Section 02 41 00 – Demolition.
C. Rock – Excavated rock in excess of the amount permitted to be installed in trench backfill shall be disposed of off-site.
D. Other Debris – Waste material and other debris encountered in during excavation shall be disposed of off-site.
E. The disposal of waste and surplus excavated materials, including hauling, handling and grading is incidental to Earthwork. No separate measurement or payment shall be made.

3.16 RIGHT OF WAY CLEARING

A. Stump Treatment;
Du Pont "Krenite S" or approved equal. To facilitate application, supervision, and inventory of TM units, as defined in PART 3.02, the spray solution shall be colored by the addition of an oil soluble red dye suitable for use in the chemical mixture. The dye shall be equivalent to "Oil Red" or "Red O."
B. Clearing and Brush Removal:
    1. Trim, remove, or protect trees as indicated by Contract Drawings or as instructed by the Engineer or Owner.
    The right-of-way shall be "clear cut" as indicated. Cut stumps to within 3 inches of ground level. Treat the entire stump with the specified stump treatment in accordance with the manufacturer's recommendations. If treatment is sprayed, perform spraying in such manner, at such pressure, and under such wind conditions that drift of spray material to adjacent vegetation will be avoided. Treatment should be performed the same day that brush and tree cutting removal work is completed but in no event later than 72 hours from the time tree cutting is performed. If moisture or wind conditions prevent treatment in accordance with the above, perform treatment as soon thereafter as possible.
    2. For trees in yards, grub stumps to 6 inches below grade and restore the ground to match the surrounding yard.
    3. After trimming, trees shall have a balanced, symmetrical shape.
    4. Where rights-of-way cross major roads or rivers, access to the rights-of-way shall be such that a screen of natural vegetation is left the full width of the right-of-way on each side of the road or river crossing.

END OF SECTION 31 20 50

SECTION 31 23 33 – TRENCHING AND BACKFILLING FOR OPEN-CUT CONSTRUCTION

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes:
   1. Excavation, sheeting, bracing and all operations necessary for the preparation of trenches for bedding pipes and pipe appurtenances, conduit and buried cable.
   2. Pipe embedments and encasements.
   3. Filling (under, adjacent, and above pipes, conduits and buried cables) of trenches.

B. Related Work Specified Elsewhere:
   1. Site Preparation and Earthwork: SECTION 31 20 50.
   2. Concrete: DIVISION 3.

1.02 REFERENCES:

A. Applicable Standards:
   1. American Society for Testing and Materials (ASTM): (Equivalent AASHTO standards may be substituted as approved.)
      a. C88 - Test Methods for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
      b. D698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN∃m/m^3)).
      c. D1241 - Materials for Soil-Aggregate Subbase, Base, and Surface Courses.
      d. D1556 - Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
      e. D2167 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
      f. D4253 - Test Methods for Maximum Index Density and Unit Weight of Soils using a Vibratory Table.
      g. D4254 - Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
      h. D4318 - Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
      i. D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
      j. STP 479 - Special Procedures for Testing Soil and Rock for Engineering Purposes, 5th Edition, "Burmister Method."
   2. U.S. Department of Interior, Bureau of Reclamation (USBR):
      a. Earth Manual, 2nd Edition, Designation E-12, Relative Density of Cohesionless Soils, Alternate Method.

1.03 SUBMITTALS:

A. Submit as specified in DIVISION 1.

1.04 QUALITY ASSURANCE:

A. Sampling and Testing:
   1. Tests to determine conformance with all requirements of this Specification for quality and properties of all Contractor-secured materials, including borrow materials (both on or

off Site) proposed for use, shall be performed by an independent, commercial laboratory retained and compensated by Contractor, and accepted by Engineer.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Definitions and classifications of materials used in this Section are stated in PART 3 - EXECUTION this Section.

PART 3 - EXECUTION

3.01 TRENCHING:

A. General:
   1. Excavate all materials within the specified limits for excavation.
   2. Perform excavation by any recognized method of good practice to complete the Work in the most expeditious manner in conformance with specified requirements.
   3. Take precautions to ensure no damage to existing facilities or equipment, or other work.
   4. All materials encountered, regardless of type, character, composition, and condition thereof, shall be considered "unclassified" for the purpose of payment. . Rock encountered shall be handled at no extra cost to Owner.

B. Equipment and Methods:
   1. Types of equipment and methods may be at Contractor's option, where structures or other facilities are not endangered.
   2. Perform by hand methods when required to save or protect trees, culverts, utilities, or other structures above or below ground.

C. Blasting:
   1. Blasting will not be permitted.

D. Side Walls:
   1. Make vertical or slope within specified trench width limitations below a horizontal plane 12 inches above top of pipe.
   2. Make vertical or sloped as required for stability, above a horizontal plane 12 inches above top of pipe.
   3. Excavate without undercutting.
   4. Sheet and brace where necessary.
      a. Use where required by Specifications or Drawings and where resulting slopes from excavation or trenching might endanger (in-place or) proposed structures.
      b. Mandatory where sloped side walls would extend beyond construction right-of-way and as indicated on Drawings.
      c. Provide on Site prior to start of excavation in each section, and make such adjustments as are required to meet unexpected conditions.
      d. Space and arrange sheeting and bracing as required to exclude adjacent material and according to the stability of excavation slopes.
      e. Remove simultaneously with filling, except as otherwise approved, and fill voids left after withdrawal with granular fill or other approved material.
      f. Leave in place when required by conditions of supported material and cut off at approved elevation below the surface.
         (1) No higher than one foot below finished surface grade, and

(2) No lower than one foot above top of buried pipe or conduits.

E. Trench Depth:
1. Depth shall be sufficient to provide the minimum bedding requirements for the pipe being placed.
2. Do not exceed that indicated where conditions of bottom are satisfactory.
3. Increase depth as necessary to remove unsuitable supporting materials. Unsuitable materials shall be defined as mud, muck, frozen earth, and material that is not free of debris, roots, organic matter, refuse, ashes, and cinders.

F. Trench Bottom:
1. Protect and maintain when suitable natural materials are encountered.
2. Remove rock fragments and materials disturbed during excavation or raveled from trench walls.
3. Restoring overexcavation:
   a. Restore overexcavation of depth 6 inches or less with trench stabilization material.
   b. Correct at no extra cost to Owner when trench is overexcavated without authority or to stabilize bottom rendered unsuitable through negligence or improper operations.
   c. Trench Stabilization Material:
      (1) Materials shall be one of the following:
         (a) As specified for Granular Pipe Embedment.
         (b) Conform to ASTM D1241, Gradation A or B.
      (2) Compact in lifts not exceeding 6 inches loose thickness.
         (a) With pneumatic or vibratory equipment.
         (b) To density specified for granular pipe embedment.

G. Trench Width:
1. Excavate trench to a width which will permit satisfactory jointing of the pipe and thorough tamping of the bedding.
2. For single pipe installation maintain trench widths below a plane 12 inches above top of pipe as follows:

	Trench Width	
Nominal Pipe Size	Minimum	Maximum
Less than 24"	Pipe od + 1'	Pipe od + 2'
24" to 60"	Pipe od + 2'	Pipe od + 4'
Larger than 60"	Pipe od + 3'	Pipe od + 5'

3. For multiple pipe installations maintain trench widths below a plane 12 inches above the top of the largest pipe as follows:

	Trench Clearances	
Nominal Pipe Size of Outside Pipe	Minimum From Outside Pipe	Maximum From Outside Pipe
Less than 24"	6"	12"
24" to 60"	12"	24"
Larger than 60"	18"	30"

4. Above plane defined in 2. and 3., no maximum limit.
5. Maximum trench width limitations shall apply beginning 3 feet from manhole or structure walls.

6. Maximum width shall be as near the minimum specified as can be controlled by construction equipment and methods used.

H. Trenching in Fill Areas: Perform after compacted fill has reached an elevation of not less than one foot above the top of the pipe.

I. Test Pits:
1. Excavate test pits sufficiently in advance of trenching to enable adequate planning of construction procedure.
2. Locate as follows:
a. Where unstable material is suspected that may require special protective measures.
b. Where ground water may require special handling methods.
c. Where indicated or otherwise approved.
d. Where interference or conflict with other utilities and/or structures could affect alignment of pipe.
3. With lateral dimension not less than minimum trench width specified for location excavated.
4. To depth required to obtain information desired.

3.02 PIPE EMBEDMENTS AND ENCASEMENTS:

A. Granular Pipe Embedment:
1. Gradation: Conform to one of the following:
a. Gravel or crushed stone which shall not have a loss of more than 15% after 5 cycles when tested for soundness with sodium sulfate as described in ASTM C88, and shall be of the following gradation:

Percent Passing	Sieve Size
100	3/4-inch
40-60	3/8-inch
0-5	No. 8

2. Placement: Place granular embedment as follows:
a. Level bottom layer at proper grade to receive and uniformly support pipe barrel throughout its length.
b. Form shallow depression under each joint to facilitate grouting.
c. Add second layer simultaneously to both sides of the pipe with care to avoid displacement.
d. Complete promptly after completion of jointing operationsand approval to proceed.
e. Substitute for any part of earth fill to within 2 feet of final grade at Contractor's option.
3. Compaction: Compact granular bedding as follows:
a. In lifts not exceeding 12 inches in compacted depth.
b. Rod, spade, or use pneumatic or vibratory equipment:
(1) Throughout depth of embedment.

3.03 TRENCH FILL:

A. General:
1. Complete placement promptly after approval to proceed.
a. Upon completion of pipe embedment.

b. Only after concrete encasement has obtained 70% of design strength. Determination of design strength percentage obtained shall be as specified in DIVISION 3.

2. Use hand methods to a horizontal plane 12 inches above top of pipe conduit or duct banks.
3. Use approved mechanical methods where hand fill is not required.
4. Until compacted depth over conduit exceeds 3 feet, do not drop fill material over 5 feet. Then distance may be increased 2 feet for each additional foot of cover.

B. Earthen (Cohesive) Fill:
1. Suitable fill materials include material from excavations and borrow areas that is free of debris, roots, organic matter, refuse, ashes, cinders, frozen earth, and which is free of rock with any dimension greater than one-half the specified thickness.
2. Unsuitable materials include material that does not conform to the above or other materials that are determined by Engineer as too wet or otherwise unsuitable for providing a stable fill.
3. Moisture content shall be that required to obtain specified compaction of the soil or as indicated.
4. Perform moisture curing by wetting or dryinig of the material as required to attain compaction criteria.
5. Compact with approved equipment to a minimum of 95% of maximum dry density within the moisture content range from -3% below optimum to +3% above optimum. Optimum moisture and maximum density shall be determined by ASTM D698.

C. Compaction Testing:
1. The method of in-place compaction testing, including density and moisture content, shall be as follows:
a. Density - cohesive materials: ASTM D2167 and ASTM D1556.
b. Density - cohesionless materials: ASTM D6938.
c. Moisture Content: ASTM D6938.
2. The minimum frequency of in-place compaction testing including density and moisture content will be as follows:
a. At least one test every 100 feet of trench length under pavement and for every three vertical feet of backfill lifts placed. A minimum of two sets of test are required for each trench backfilled regardless of length
b. At lest one test every 300 feet of trench length in unpaved areas and for every three vertical feet of backfill lifts placed. A minimum of two sets of test are required for each trench backfilled regardless of length.
3. Fill failing to meet required densities shall be removed or scarified and recompacted as necessary to achieve specified results, at no additional cost to OWNER.
4. Removal of in-place material and replacement with approved new material will be required if scarifying and recompaction do not produce the required densities.

D. Equipment:
1. Compaction equipment shall conform to the following requirements and be subject to the approval of Engineer.
a. Tamping Rollers:
(1) May be towed or self-propelled.
(2) Have staggered uniformly spaced knobs or feet. When fully loaded, they shall exert at least 250 psi on combined area of tamping feet in contact with ground.

(3) Be equipped with cleaning fingers maintained at full length to prevent accumulation of material between feet.
(4) Maintain all equipment in good repair.

b. Pneumatic rollers:
(1) Have two axles, not less than 9 wheels with pneumatic tires of equal size, diameter, and ply rating, a rigid steel frame, and a body suitable for ballast loading. Tracking wheels shall overlap by a minimum of 1/4-inch.
(2) Tires shall be uniformly inflated at all times.
(3) May be self-propelled or towed.

c. Power tampers shall be used for compaction of material in areas where it is impractical or unsafe to use heavy equipment, and as recommended by Engineer.

d. Vibratory rollers:
(1) Have either one or two smooth-surfaced steel drums with a minimum diameter of 42 inches.
(2) Have a minimum vibrating force of 300 pounds per cycle per inch of drum width.
(3) Have a minimum vibrating frequency of 1,200 cycles per minute with a means of adjusting the resonance of the dynamic force.
(4) May be self-propelled or towed.

e. Vibratory plate compactor may be used for compaction of sand and/or gravel material in areas where it is impractical or unsafe to use heavy equipment, and as recommended by Engineer.

END OF SECTION 31 23 33

SECTION 31 66 12 – CAST-IN-PLACE GROUND IMPROVEMENT ELEMENTS

PART 1 - GENERAL

1.01 SUMMARY:

A. Work under this Section shall consist of designing, furnishing, and installing cast-in-place ground improvement elements (CGEs) as indicated on the Drawings and specified in this Section.

B. The Contractor shall secure the services of a Professional Engineer licensed in Missouri to design CGEs and the load transfer platform (LTP) to provide bearing capacity and mitigate the effects of settlement on the proposed foundations for protection of structures and utilities at the Project Site.

C. At a minimum, this Work shall include the following:

1. Detailed planning and design of the CGEs and LTP to satisfy the requirements of this Section.
2. Supply of all equipment, material, labor, and supervision to install the CGE and LTP system.
3. Obtaining the applicable State and municipal permits (if required), and for conforming to all State and local regulations.
4. Adherence to all methods and standards described in this Specification.
5. Layout of CGEs, spoil removal, dewatering, subgrade preparation following CGE installation and all associated work shall be included as part of the Work.

D. Contractor shall visit the Site prior to bidding to observe and review specific Site conditions and requirements for equipment, methods, and costs for the CGEs.

E. Contractor shall verify the location of all underground conduits, piping, duct banks and utilities prior to installation.

1.02 REFERENCE STANDARDS:

A. General:

1. Standards listed by reference, including revisions by issuing authority, form a part of this Section to extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.
2. Where specifications and reference documents conflict, the Owner shall make the final determination of applicable document.
3. Unless otherwise noted, the latest revision of the following reference standards shall apply to this Section. B. Applicable Standards:

1. American Society of Civil Engineers (ASCE):
   a. ASCE/SEI 7-10 - Minimum Design Loads for Buildings and Other Structures.
2. ASTM International (ASTM):
   a. C31 – Making and Curing Concrete Test Specimens in the Field
   b. C33/C33M - Concrete Aggregates.
   c. C109/C109M - Compressive Strength of Hydraulic Cement Mortars (Using 2-inch or 50-mm Cube Specimens).
   d. C125 - Concrete and Concrete Aggregates.

e. C150/C150M - Portland Cement.
f. C494/C494M - Chemical Admixtures for Concrete.
g. C618 - Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
h. C937 - Grout Fluidifier for Preplaced-Aggregate Concrete.
i. C938 - Proportioning Grout Mixtures for Preplaced-Aggregate Concrete.
j. C939 - Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method).
k. C940A - Expansion and Bleeding of Freshly Mixed Grouts for PreplacedAggregate Concrete in the Laboratory.
l. C941 - Water Retentivity of Grout Mixtures for Preplaced-Aggregate Concrete in the Laboratory.
m. C942 - Compressive Strength of Grouts for Preplaced-Aggregate Concrete in the Laboratory.
n. C953 - Time of Setting of Grouts for Preplaced-Aggregate Concrete in the Laboratory.
o. C1107/C1107M- Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
p. D 1194 – Bearing Capacity of Soil for Static Load and Spread Footings.

3. International Code Council:
   a. 2018 International Building Code (IBC, 2018).

1.03 EXPERIENCE QUALIFICATIONS:

A. The CGEs shall be installed by a specialty contractor with documented experience with CGEs.
B. The Contractor shall provide experienced management, supervisory, engineering, and other related key personnel as required to implement the CGE program, as follows:
   1. The project manager shall have experience with CGEs while in the full-time employ of the Contractor.
   2. The superintendent shall have experience with CGEs while in the full-time employ of the Contractor.
   3. The Contractor's Professional Engineer shall have experience with design of the CGEs and LTPs and be licensed in Missouri.
C. As detailed in this Section, the Contractor shall provide evidence of previous CGE project experience, and evidence of management, supervisory, engineering, and other related key personnel experience.
D. The experience statement of past work and description of equipment and techniques proposed for use shall be submitted at time of Bid and will be considered in the evaluation of bids. Work may be suspended if Contractor substitutes unqualified personnel for approved personnel during construction. If work is suspended due to the substitution of unqualified personnel, Contractor shall be liable for additional costs resulting from the suspension of work and no adjustment in contract time resulting from the suspension of work will be allowed.
E. The Contractor shall not sublet the whole or any part of the contract without the express permission in writing.

1.04 DEFINITIONS:

A. Cast-in-place ground improvement elements (CGEs) – A ground improvement method that consists of the construction of vertical grout columns. The drill stem is typically advanced using either full or partial displacement techniques, and the resulting void is then filled with fluid cement grout as the drill stem is removed from the drill hole.

B. CGE system – All cast-in-place ground improvement elements, the Load Transfer Platform, and any other elements required for adequate performance of the ground improvement.
C. Load Transfer Platform (LTP) – Also known as a bridging layer, an engineered layer of select fill between the top of the CGEs and the base of the foundations which provides a load path between the bearing pressures of the shallow foundations and the point-like supports of the cast-in-place ground improvement elements. The LTP may or may not be geosynthetic reinforced, depending on the design provided by the Contractor's Professional Engineer.

1.05 DESIGN CRITERIA:

A. At a minimum, Contractor's CGE system shall satisfy the following minimum design criteria:
1. The Contractor's Professional Engineer shall consider all available subsurface information in the development of the final design soil profile.
2. A detailed explanation of the design parameters and methodology used for the settlement mitigation calculations shall be included in the Final Design Submittal along with calculations that demonstrate that the required settlement tolerances are met under both static and seismic loading.
3. The final design performed by the Contractor's Professional Engineer shall demonstrate that the proposed system will not negatively impact the adjacent existing structures.
4. The final CGE system design shall meet the following structural loading and settlement criteria:
    (1) Allowable Settlement
        (a) Total: 1.0 inch
        (b) Differential: 0.5 inches
    (2) Allowable Bearing Capacity as indicated on the Drawings.
5. The final CGE design shall consider the potential interaction with existing and proposed foundation elements, as indicated on Drawings. Sequencing of CGE installation and other work shall be considered by the Contractor to prevent adverse effects to either system.
6. CGE elements shall be designed to bear in limestone or shale bedrock.
7. Contractor's Professional Engineer shall consider both immediate and consolidation settlement in and below the treated soil zone.
8. The design life of the CGE system shall be 100 years.
9. Contractor shall demonstrate that their proposed ground improvement system has been evaluated by the International Code Council, and are in compliance with the applicable provisions of IBC (2018).

1.06 SUBMITTALS:

A. Submit as specified in DIVISION 01.
B. Bid Submittals:
1. Experience Qualifications.
    a. A list of at least 5 previously completed projects of similar scope and purpose for review. The list shall include a description of the project, relative size, and contact person with current phone number.
    b. Resumes of the management, supervisory, engineering, and other related key personnel, for review as defined in 1.03.
2. CGE System Submittal:

a. Details and all applicable manufacturer data for all materials associated with the proposed CGEs.
b. Type of drilling equipment, including model, torque and crowd of drive head; a description of the leads and torque arm, grout pump make, model and specifications. Contractor shall clearly identify equipment suitable for low overhead and limited access conditions, where applicable.
c. Detailed description of proposed method(s) and sequence of installation, including:
   (1) Drilling, grouting, and reinforcement installation
   (2) Target installation tooling rotation speed
   (3) Drilling penetration rates
   (4) Torque
   (5) Crowd
   (6) Grout pressures
   (7) Estimated production rates
   (8) Details of methods to be used to remove soil and debris from the top of CGE after grouting.
d. Description and specifications of automated installation-monitoring equipment to be used on the project. As a minimum the submittal shall contain the following information:
   (1) Manufacturer and model of the equipment and components.
   (2) Description of equipment function.
   (3) Sample of the information collected and printout provided.
   (4) Certification that the equipment can provide the information outlined in this Section.
   (5) Records indicating that the equipment has been calibrated within the past 6 months.
e. Construction drawings, and shop drawings for review.
f. A detailed installation sequence, procedure and proposed schedule.
g. A work procedures plan outlining the spacing, location, depth and estimated quantity of CGEs to achieve the specified criteria detailed in this Section. Locations of individual CGEs shall be dimensionally referenced to the structural foundation locations indicated on the Drawings.
h. Details of the LTP including components, extents, thickness, installation methods, lift thickness, compaction energy, fill sources, materials, and other pertinent information.
i. Submit details of the proposed quality control test program for the CGE system. C. Design and Pre-Construction Submittals:

1. Final Design Submittal:
   a. Contractor's Professional Engineer shall submit a Final Design Submittal; including sealed calculations, sealed construction drawings, and shop drawings for review at least 3 week(s) prior to the beginning of construction.
   b. Final Design shall demonstrate that all applicable Design Criteria, as outlined in this Section, have been satisfied by the proposed system.
   c. The CGE system shall be designed in accordance with generally-accepted engineering practice and per the requirements of this Section.

d. Design shall explicitly provide all assumed or calculated soil design parameters and methods/references for developing these parameters.

2. Submit details and all applicable manufacturer data for all materials associated with the CGE system.
3. Provide a detailed installation sequence, procedure and proposed schedule.
4. Existing utility facilities shall be included and, after checking their locations by field investigations, the working drawings shall be revised to show the actual locations of facilities, location of excavation supports, interference with the proposed Work, and how Contractor proposes to overcome these interferences.
5. Pre-excavation Survey Report.
6. Professional Liability Insurance:
   a. In addition to any requirements specified elsewhere in the Contract Documents, the Contractor shall also provide evidence of insurance coverage for Errors and Omissions associated with design of the ground improvement work.
   b. The insurance policy should provide a minimum coverage of $3 million per occurrence. Certificate evidencing this coverage shall be provided prior to start of design.

D. Construction and Closeout Submittals:

1. Daily Progress Reports – Furnish daily a complete and accurate record of CGEs.
   a. The record shall indicate the following (as applicable):
      (1) element location,
      (2) element diameter,
      (3) element length,
      (4) type of material(s) used,
      (5) element and material volumes,
      (6) number of lifts,
      (7) number of pump strokes,
      (8) force/pressure during installation,
      (9) final elevations or depths of the base and top of element,
      (10) description of soils penetrated,
      (11) bearing strata encountered,
      (12) nature and location of obstructions, if encountered,
      (13) flow cone time in seconds and size of cone orifice, for each truck,
      (14) grout truck ticket number,
      (15) start and stop time of grouting,
      (16) theoretical CGE volume (based on auger diameter and depth),
      (17) grout calibration factor and date/method of calibration,
      (18) pump calibration,
      (19) number of pump strokes to build initial pressure head,
      (20) grout pump strokes for each maximum 5-foot increment of CGE,
      (21) grout factor per maximum 5-foot increment,
      (22) total pump strokes to complete CGE,
      (23) overall grout factor (actual grout volume pumped into the CGE divided by the theoretical CGE volume; the grout factor shall not include the grout required to fill the lines or auger nor any excess grout pumped at the ground surface),

(24) grout return (auger tip depth at the time that grout is first observed at the ground surface),
(25) amount of grout used for each CGE,
(26) cumulative amount of grout for the day,
(27) quantity and time of grout cube sets made,
(28) as-built elevation data (ground surface, CGE tip and cutoff, and reinforcing steel). Note compliance with installation tolerances,
(29) remarks concerning installation of CGE.

b. Immediately upon completion of grouting for each CGE, Contractor shall submit a report of the automated measuring and recording equipment output to the Owner as described in this Section.

c. Load Transfer Platform placement records including:
(1) Reinforcement type
(2) Reinforcement placement location and methods
(3) Lift material type and source
(4) Lift thickness and compaction

d. Contractor shall immediately report any unusual conditions encountered during installation.

PART 2 - PRODUCTS

2.01 GENERAL:

A. All products used shall be submitted for review at the time of Bid, and shall demonstrate suitable performance during all verification testing and other related quality control testing.

2.02 GROUT:

A. Nonshrink, cement-based grout, consisting of the following materials and so proportioned to produce a hardened mortar with a compressive strength as determined by the design provided by the Contractor's Professional Engineer and as referenced to ASTM C125.
1. Portland Cement: Conforming to ASTM C150.
2. Special Pozzolan: Consisting of a finely powdered siliceous material and conforming to ASTM C618.
3. Grouting Agent: Use a grouting agent (fluidifier) that will reduce the mixing water requirements of the cement mortar, retard the setting time, decrease bleeding, eliminate setting shrinkage, increase fluidity, and conform to ASTM Specifications C494/C494M, C937, C938, C939, C940, C941, C942, C953, and C1107/C1107M. Dry grouting agent shall be powdery and in as-manufactured condition at the time of use. Grouting agent shall be supplied in bags or other suitable containers that provide protection from the weather. Grouting agent that has been exposed to the weather shall not be used.
4. Water: Use fresh clean water free from injurious amounts of sewage, oil, acid, alkali, and organic matter.
5. Fine Aggregate:
a. Meet the requirements of ASTM C33/C33M.
b. Consist of clean, natural sand or of hard, dense, durable, uncoated rock particles and be free from injurious amounts of silt, loam, lumps, soft or flaky particles, shale, alkali, organic matter, mica, chert, and other deleterious substances.

c. Be well graded from coarse-to-fine, with a fineness modulus between 1.40 and 3.40.

B. Mixing:

1. Mix the cement grout with approved equipment and accurately measure all materials by volume or weight. Charge the mixer in the following order: water, grouting agent, and other solids in order of increasing particle size. Rotate mixing drum 25 revolutions following placement of grouting agent or additives in the field, in order to provide proper mixing of grout.
2. Mixing time shall not be less than one minute producing a homogenous grout having a consistency ranging between 16 and 35 seconds when tested with a flow cone having a ½-inch opening, or between 10 and 25 seconds when tested with a flow cone having a ¾inch opening, in accordance with ASTM C939. Provide a flow cone and perform the flow cone test at least once per truck within 30 minutes prior to use of grout from each truck, or as otherwise directed by Owner.
3. The grout shall have a minimum temperature during placement of 40° F and a maximum temperature during placement of 95° F.
4. If grout is agitated continuously and meets temperature and flow requirements, it may be held in the mixer up to 90 minutes after batching prior to placement in CGE. This period may be extended to 2 hours, as approved by Owner.
5. Retempering grout will not be permitted. C. Pumping:

1. Use approved pumping equipment having a screen no larger than 3/8 inch between mixer and pump and having a working pressure gauge in clear view of the operator. The grout pump shall be a positive displacement pump capable of developing displacement pressures at the pump of at least 350 psi. All oil, rust inhibitors and solvents shall be removed from the grout pump and associated grout handling equipment.
2. Perform calibration of the pump in the field prior to installation of CGEs with Owner present to observe, according to the following:
   a. Place grout into the hopper and pump through the line and auger into a large container of known volume not less than 7.0 cubic feet; i.e., a barrel or 55 gallon drum.
   b. Perform calibration of the pump in the field at the beginning of the work, after repairs and/or maintenance that could affect pump performance, once each week provided at least 100 CGEs have been installed using the pump since the previous calibration, and at Owner's request if Contractor changes or varies equipment, or should volumes of grout take calculated during grout placement become suspect due to variations in calculated quantities or due to pump "short stroking" or missing complete strokes.
   c. The pump calibration is performed by recording the number of strokes required to fill at least 75% of the calibration container, and is recorded as cubic feet per stroke. Grout flow shall be determined and recorded at the time of each calibration.
   d. The Owner may require a calibration using a larger sample size (i.e. fully loaded grout trucks) if the reliability of the initial calibration is found to be in question by the Owner.

E. Grout flow cone test results shall be determined and recorded at the time of each calibration.Calibrations as determined in the field will be used in lieu of manufacturer’s rated or factory calibrations.

3. Contractor shall provide a positive means of counting pump strokes. Such methods may include digital or mechanical counters, or other methods approved in advance by Owner.
4. Grout pressure shall be measured at the point where the grout hose enters the tooling. Real-time measurement of grout pressure and depth shall be displayed in the operator's compartment and on a remote display that can be easily viewed by the Owner. D. Grout Sampling and Grout Cube Compression Tests:
    1. A qualified and independent testing laboratory shall be retained and compensated by the Contractor to perform required grout compression tests.
    2. Obtain and furnish brass or stainless-steel cube molds. Prepare cube specimens (2 inches x 2 inches x 2 inches) for sampling and testing in accordance with the provisions of ASTM C1107/C1107M, respectively. Prepare and cure grout cubes in accordance with ASTM C31, ASTM C942 and ASTM C1107/C1107M. Transport the cubes carefully to the laboratory and cure and test grout cubes in accordance with ASTM C1107/1107M and ASTM C109/C109M, as applicable.
    3. Furnish to the testing laboratory 6 test cubes for each 24 cubic yards of grout placed, with a minimum of 6 cubes for each day's placement, if less than 24 cubic yards are placed in a day. Owner may revise this frequency of obtaining and furnishing grout cubes throughout the course of construction, contingent upon Contractor providing uniform consistency of grout.
        a. Owner may reduce frequency to a minimum number of cubes not less than 2 sets of 6 test cubes per day to be obtained at Owner's discretion and generally represent one set of morning and one set of afternoon installation activities.
    4. The Owner may require additional grout sampling and testing from trucks where excessive water is added, or the temperature and/or consistency vary significantly from previously supplied batches for the purpose of confirming grout strength.
    5. Two cubes shall be tested in compression at each of the ages of 7 days, 28 days and two retained for testing at 56 days, if the need is so determined.

2.03 ELECTRONIC MEASUREMENT AND RECORDING EQUIPMENT:

A. Electronic measurement instrumentation shall be supplied by the Contractor to monitor CGE installation. The following measurements shall be recorded versus depth of the auger injection point at minimum 2-foot increments over the entire length of CGE installation:
    1. Installation tooling rotation speed (rpm).
    2. Depth of auger injection point (ft).
    3. Torque delivered to installation tooling (ft-lbs).
    4. Crowd force (lbs).
    5. Incremental and cumulative installation effort, or other torque-based feedback.
    6. Volume of grout for each foot of CGE (ft^3).
    7. Maximum and minimum grout pressures (psi).

B. Calibration shall be made on all measuring and recording equipment at the beginning of the project to demonstrate that the values indicated by the automated equipment are within 3% of the values reported in the output. Calibrations shall be performed in accordance with the equipment manufacturer's specifications. All measuring and recording equipment shall be recalibrated when the Owner suspects that the drilling and grouting performance has changed.

C. Digital records shall be made of all acquired data and made available in the format of raw output data from the monitoring equipment.

D. Grout pressure and grout volume shall be measured versus depth and time via magnetic flow meter.
E. Minimum specified grout ratio or volume per unit CGE length measurement shall be clearly displayed to guide the Contractor during CGE installation.
F. Monitoring equipment shall monitor rate of installation tooling rotation, and hydraulic torque drive pressures.
G. Data printout, in English units, shall include, at a minimum, the following:
    1. CGE name.
    2. Project name.
    3. Date of CGE installation.
    4. Start and stop time of drilling.
    5. Rate of installation tooling rotation vs. depth for every 5-foot increment, or less, of tooling advancement during the drilling process.
    6. Start and stop time of grouting
    7. Volume of grout placed and grout ratio versus depth for every 2-foot increment, or less, of CGE placed.
    8. Average maximum and minimum pump stroke pressures at ground level for every 2-foot increment, or less, of CGE placed.
    9. Angle of CGE installation

PART 3 - EXECUTION:

3.01 SITE PREPARATION:

A. Ground elevations and bottom of footing elevations shall be established by the Contractor in sufficient detail to estimate installation depth elevations to within 3 inches.
B. A working surface shall be established and maintained to provide wet weather protection of the subgrade and to provide access for efficient operation of the CGE installation.
C. Prior to, during and following CGE installation, provide positive drainage to protect the site from wet weather and surface ponding of water.
D. Stockpile spoil materials, as applicable, on site at a location designated by Owner.

3.02 FIELD MARKING AND ELEVATIONS:

A. Contractor shall provide real time depth monitoring for Owner or their representative.
B. Contractor shall provide ground surface elevation reference and mark stem at 1-foot intervals, beginning with installation tooling length at the top of tool and progressing to respectively higher numbers up the length of the stem, to permit determination of the CGE tip depth and elevation.
C. Survey and establish CGE locations in the field, with CGE number and type, and working surface elevation indicated on a pin, flag, or stake in accordance with the Drawings. Replace pins, flags or stakes when damaged during the course of the work.

3.03 CGE DRILLING:

A. A sufficient quantity of grout to complete the CGE shall be on site or in transit prior to the start of drilling.
B. Place the CGEs to the specified tip elevation or penetration. Place CGEs without excessive duration or delay in one continuous operation to the required cutoff elevation or higher, so as to

preclude the possibility of grout setting up prior to the completion of the CGE placement or cold joints forming in the CGE.

C. The installation tooling shall be positioned directly above the staked location, and the mast plumbed using the on-board inclinometer display. Plumbness of the mast shall be checked with a hand level once each day or if there is reason to question the plumbness of the mast.

D. The grout port at the tip of the installation tooling shall be plugged prior to drilling to preclude entrance of soil or water during drilling.

E. Initiate installation by allowing the weight of the suspended tools to bear on the ground surface and beginning rotation. Provide downward force (crowd) as needed to penetrate to the anticipated CGE tip elevations.

F. The use of pressure injection during drilling with water and/or compressed air will not be permitted.

G. Install with a stem system restrained from shifting while drilling.

3.04 CGE PENETRATION:

A. CGE tips shall penetrate into bearing layer and at the depth/elevation shown in the Contractor's design documents.

3.05 GROUT PLACEMENT

A. Upon reaching the required penetration, stop or reduce the rate of rotation. Lift the auger 6 inches and begin pumping cement-based grout under pressure through the hollow stem auger to establish a minimum of 5 feet of grout head above the tip of the auger. Carefully and slowly withdraw auger while pumping to maintain a grout head during withdrawal not less than 5 feet.

B. Place CGEs without excessive duration or delay in one continuous operation to the required cutoff elevation, so as to preclude the possibility of grout setting up prior to the completion of CGE placement or cold joints forming in the CGE.

C. If 5-foot of grout head is not observed (identified as the depth of the tip of the auger when fluid grout appears at the ground surface), the Contractor shall re-drill and re-grout the CGE to the full depth.

D. Auger shall be withdrawn at a smooth, continuous rate. If the auger jumps upward during withdrawal, if the grout pressure decreases, or if the grouting is interrupted for any reason, the auger shall be reinserted to a minimum of 5 feet below the tip depth of the auger when the interruption occurred or to the bottom of the CGE, whichever is less, and the rate of withdrawal shall be decreased to prevent further jumping or pressure decrease. Should any interruption in grouting exceed 30 minutes, Contractor shall re-drill the CGE to the termination depth and restart the grouting operation.

E. Should the auger or hose become plugged during grout placement that requires disconnection of the hose to locate and remove blockage, the CGE shall be rejected, and the pump and system will require repriming prior to resuming CGE installation. If blockage is successfully removed, a sufficient volume of grout equal to the grout volume required to prime the system shall be pumped through the system prior to resuming grouting.

F. Auger shall not be rotated counterclockwise as the auger is withdrawn.

G. Pumping shall be continued until the tip exits the ground surface.

H. The crane leads shall not be lifted until after the auger tip exits the ground surface.

I. Withdraw auger at a rate such that the cumulative grout factor for the total length of CGE shall not be less than 1.15. If any 5-ft increment of CGE is discovered to have a grout factor less

than 1.15, then re-drill the hole to a depth where all of the 5-foot intervals below this zone have a minimum grout factor of 1.15 and restart the grouting operation.

J. When using automated monitoring equipment, the grout factor shall be measured and maintained at 5-foot increments.

K. Adjustment of minimum grout factor may be approved by the Owner based on experience with test CGE installation, consistency of CGE installation technique, grout head and other factors.

L. If calculated quantities of grout volume placed indicate less volume than that calculated as necessary to complete the CGE in place with the minimum grout factors noted above, then redrill the hole to the original tip elevation and restart grouting operation.

M. Volume of grout placed will be as noted on the printout from the automated instrumentation and monitoring equipment, or calculated using the stroke count from a calibrated pump.

N. Equipment or materials made of aluminum shall not be used to transport, convey, form, or place grout.

O. The plan CGE cut-off elevation shall be established while the grout is fresh, unless otherwise directed. The exposed grout surface shall be screened to remove any spoils, and fresh grout removed from the top of the CGE until the approximate plan CGE cut-off elevation is established.

3.06 INSTALLATION TOLERANCE:

A. CGEs shall not exceed a variation from the vertical of more than 1/4-inch per foot of CGE length.

B. The center of the CGE head shall not vary from plan location at cutoff by more than 3 inches.

C. Acceptable tolerance in finished top of CGE elevation relative to that indicated shall not exceed plus or minus 1.0 inch. Contractor may elect to trim CGEs to cutoff elevation and construct the LTPs after installation of all of the CGEs is completed.

3.07 PROTECTION OF EXISTING STRUCTURES:

A. The Contractor is responsible for locating and protecting underground and aboveground utilities and other structures from damage during installation of the CGE system.

B. Protection of adjacent structures from damages due to the ground improvement work shall consider potential damages caused by settlement, vibration, and/or improper spacing of the ground improvement elements.

C. Contractor shall take appropriate corrective actions to prevent damage to adjacent structures, pavement, utilities, and other improvements.

D. Coordinate all excavations made subsequent to CGE installations so that sequence of excavations does not encroach on the structures as shown in the construction drawings. Protection of completed CGEs is the responsibility of the Contractor. In the event that utility excavations are required in close proximity to the installed CGE system, the Contractor shall coordinate with the Contractor's Professional Engineer immediately to develop construction solutions to minimize impacts on the installed CGE system.

3.08 QUALITY CONTROL:

A. The location of the CGE system for this project, including layout of individual CGEs, shall be marked in the field using survey stakes or similar means.

B. Contractor shall have a full-time, on-site Quality Control Technician to verify and report all installation procedures to verify that the production practices meet the design assumptions.

C. Contractor shall immediately report any unusual conditions encountered during installation. The quality control procedures shall include the preparation of Progress Reports completed during each day of installation.

D. The Owner may provide a full-time Geotechnical Representative for continuous observation during drilling operations.
   1. Presence of the full-time Geotechnical Representative does not relieve Contractor of their responsibility to complete the Work as specified and indicated.
   2. Observation may also include verification of the following:
      a. placement locations and plumbness,
      b. element diameters (if applicable),
      c. element lengths,
      d. strata at element's termination depth,
      e. volume of concrete or grout.

E. Contractor shall cooperate with Owner's Quality Assurance personnel.

3.09 COMPLETION OF CGE INSTALLATION

A. Contractor shall supply and operate surveying equipment for the determination of the specified elevations for the CGE top and all reinforcing steel elements.

B. Make all reasonable efforts to adjust the grout level to the plan CGE cut-off elevation while the grout is fresh. The exposed grout surface shall be screened to remove any spoils, and fresh grout removed from the top of the CGE until the plan CGE cutoff elevation is established.

C. Where the planned CGE cutoff elevation is at or above the working grade, or when CGE cutoff elevation is below grade and soils will not stand open without support, temporary casing (i.e. cans or sleeves) shall be installed around the CGE tops to reach the plan CGE cutoff elevation. The grout shall be screened and checked for contamination before and after the installation of the casing.
   1. Temporary casing may consist of steel casing, round fibre form, Sonotube, or formwork.
   2. Temporary steel casing shall have a minimum inside diameter equal to the plan diameter of the CGE.
   3. Temporary casing shall be of sufficient thickness and stiffness to restrain it from excessive deformation during grout placement and to provide adequate support to the entire required grout column during curing.
   4. Temporary casing shall be removed by Contractor prior to placing concrete for mats and/or grade beams.
   5. Contractor shall be responsible for structural adequacy of temporary casing.

D. Subsidence of fresh grout may occur. Monitor CGEs for a minimum of 2 hours after completion or longer if grout subsidence continues. Add grout to the CGE after completion as required to maintain the plan CGE cutoff elevation, but not after the grout surface has hardened to the point where a cold joint would be formed or where soil materials have fallen on top of the CGE.

E. When required, cut off CGEs by methods that shall not damage the grout of the CGE portion left in place.

F. Remove spoils generated by CGE installation activities and dispose of at an off-site location, or as otherwise designated by the Owner.

3.10 PROTECTION OF COMPLETED CGE INSTALLATION:

A. Do not install CGEs within the near vicinity to freshly placed CGEs until 12 hours have elapsed from time of placement or until the freshly placed CGEs have hardened sufficiently as to preclude the possibility of hydrostatic head causing the grout to break through to the hole being drilled, or pumping of grout to impact freshly placed CGEs.

B. Because of potential variations in Site conditions which may exist both in lateral extent and vertical depth, Contractor shall be responsible for determining:
   1. The time at which CGEs have hardened sufficiently if less than 24 hours, and
   2. The minimum acceptable radial distance to which a new CGE can be placed within the near vicinity to freshly placed CGEs.

C. The acceptable radial distance, whether to an immediately adjacent CGE or CGE in close proximity, shall not under any circumstances be less than six (6) CGE diameters in a radial direction from the centerline of freshly placed CGEs.

D. If a freshly placed CGE breaks through to the hole being drilled, regardless of time for curing or radial distance, the freshly placed CGE breaking through will be rejected immediately, and Contractor shall be responsible for replacement of the rejected CGE(s) along with the following:
   1. The hole being drilled shall be re-drilled and completed; and
   2. The CGE to break through shall be brought back up to grade with fresh grout.

E. Any concentrated loads from equipment must be distributed to prevent compressing or shearing the soil in the top area of the CGEs. Concentrated loads must be kept at least 10 feet away from the CGE until final set of the grout has occurred.

F. Prevent all debris and foreign material from falling into fresh grout.

G. Provide hot weather protection to grout mix, installation equipment during placement, and fresh grout during curing in conformance with ACI 305.1, or as directed by Contractor's Professional Engineer and approved by Owner.

H. Provide cold weather protection to grout mix and installation equipment during placement to prevent installation of grout less than 40° F in accordance with ACI 306.1.

I. Provide cold weather protection to all exposed surfaces of fresh grout during curing in conformance with ACI 306.1 or as directed by Contractor's Professional Engineer and approved by Owner.

3.11 LOAD-TRANSFER PLATFORM INSTALLATION

A. Install Load-Transfer Platform (LTP) in accordance with Contractor's Professional Engineer's approved design.

B. LTP soil material shall be free of debris, roots, frozen matter, organic matter, or other deleterious material.

C. LTP soil material shall be placed in lifts not to exceed 8 inches thick and meet the compaction and moisture content requirements of the design.

D. Compaction and moisture content measurements shall be made at the following frequency:
   1. Footings: once per lift
   2. Walls: once every 30 linear feet.

E. If applicable, geosynthetic reinforcement shall be free of damage and installed in accordance with the manufacturer's recommendations.

F. Protect the completed LTP from damage.

3.12 OBSTRUCTIONS

A. An obstruction is defined as a specific object encountered during the installation of a CGE which prevents the advance of the CGE. Obstructions may include boulders, cobbles, logs, concrete, bricks, abandoned foundations or utility lines, or other man-made objects.
B. When efforts to advance past the obstruction prevent placement of the element to the required depth or cause the element to drift from the required location, then the Contractor shall either abandon and relocate the element, or remove the obstruction using specialized techniques, as appropriate for the conditions encountered.
C. When obstructions are encountered, the Contractor shall immediately notify the Owner.

3.13 NON-CONFORMING WORK:

A. Contractor shall be solely responsible for full compliance with the Contract Documents regardless of if and when discrepancies are brought to their attention. Contractor shall be responsible for all re-work necessary to achieve full compliance with the Contract Documents. Repairs or replacement shall be at the sole expense of the Contractor, including the costs to redesign, as required.
B. Owner may employ one or more of their representatives for observation and testing services.
C. Owner may reject any shafts which, in their opinion, do not conform to the Contract Documents.
D. CGEs installed beyond the maximum allowable tolerances or otherwise not in accordance with this specification shall be abandoned and replaced with new elements. All material and labor required to replace rejected CGEs shall be provided at no additional cost to the Owner.

END OF SECTION 31 66 12

SECTION 32 12 17 – HOT-MIX ASPHALT-CONCRETE PAVEMENT

PART 1- GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Hot-mix asphalt paving.

1.03 SECTION REQUIREMENT

A. Product Data and hot mix asphalt design mixes
B. Provide hot-mix asphalt paving according to standard specifications of the Missouri Department of Transportation.
C. Asphalt-Paving Publication: Comply with MS-22, "Construction of Hot Mix Asphalt Pavements," unless more stringent requirements are indicated.

1.04 DEFINITION

A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

1.05 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical performance properties.
   1 Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
   2. Job-Mix Designs: For each job mix proposed for the Work.
   3. Material Certificate: For each paving material, from manufacturer.

1.06 QUALITY ASSURANCER

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction or the MoDOT of state in which Project is located.

1.07 PROJECT CONDITIONS:

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
   1. Prime Coat: Minimum surface temperature of 60 deg F
   2. Tack Coat: Minimum surface temperature of 60 deg F
   3. Slurry Coat: Comply with weather limitations in ASTM D 3910.
   4. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
   5. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.
B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 55 deg F for water-based materials, and not exceeding 95 deg F.

C. Imprinted Asphalt Paving: Proceed with coating imprinted pavement only when air temperature is at least 50 deg F and rising and will not drop below 50 deg F within 8 hours of coating application. Proceed only if no precipitation is expected within two hours after applying the final layer of coating.

PART 2 - PRODUCTS

2.01 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.
B. Coarse Aggregate: Per Missouri Department of Transportation Specification Section 1002.
C. Fine Aggregate: Per Missouri Department of Transportation Specification Section 1002.
D. 6 inch base course of limestone, such as MoDOT Type 5, be placed below all new pavements.

2.02 ASPHALT MATERIALS

A. Asphalt Binder: AASHTO M 320 or AASHTO MP 1a, per APWA. Provide Asphalt Binder that complies with Missouri Department of Transportation Specifications Section. Post a legible copy of the latest bill of lading for the Asphalt Binder on or near the gyratory compactor. Use the mixing and compaction temperatures shown on the bill of lading; however, the maximum mixing or compaction temperature is 340ºF, unless otherwise approved by the Bureau Chief of Materials and Research. Notify the Engineer if the mixing or compaction temperature changes.
B. Asphalt Cement: ASTM D 3381 for viscosity-graded material or ASTM D 946 for penetration-graded material.
C. Tack Coat: ASTM D 977 emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.
D. Water: Potable.

2.03. AUXILIARY MATERIALS

A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.
B. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than 45 minutes.
Color: White.
C. Wheel Stops: Precast, air-entrained concrete, 2500-psi minimum compressive strength, 7 inches high by 8 inches wide by 72 inches long. Provide chamfered corners, drainage slots on underside, and holes for anchoring to substrate.
    1. Dowels: Galvanized steel, 3/4-inch diameter, 10-inch minimum length.

2.04. MIXES

A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction; designed according to procedures in AIMS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types"; and complying with the following requirements:
    1. Base Course: Per Missouri Department of Transportation Specification Section 304 Aggregate Base Course.
    2. Surface Course: Per Missouri Department of Transportation Specification Section 310 Aggregate Surface Course.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.
B. Proceed with paving only after unsatisfactory conditions have been corrected.
C. Roof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
D. Proceed with paving only after unsatisfactory conditions have been corrected.
E. Verify that utilities, traffic loop detectors, and other items requiring a cut and installation beneath the asphalt surface have been completed and that asphalt surface has been repaired flush with adjacent asphalt prior to beginning installation of imprinted asphalt.
    1. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
    2. Transport milled hot-mix asphalt to asphalt recycling facility.
    3. Keep milled pavement surface free of loose material and dust.

3.02. SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
    1. Mix herbicide with prime coat if formulated by manufacturer for that purpose
C. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
    1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
    2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.03 HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
    1. Spread mix at minimum temperature of 265 deg F.
    2. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
    1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.
C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.04 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
   1. Clean contact surfaces and apply tack coat to joints.
   2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
   3. Offset transverse joints, in successive courses, a minimum of 24 inches.
   4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using "bulkhead" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
   5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
   6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.05 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers. Complete compaction before mix temperature cools to 185 degree F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
   1. Average Density: 96 percent of reference laboratory density according to ASTM D 6927, but not less than 94 percent nor greater than 100 percent.
   2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

G. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.06 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
   1. Base Course: Plus or minus 1/2 inch.
   2. Surface Course: Plus 1/4 inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch.
2. Surface Course: 1/8 inch.
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.07 PAVEMENT MARKING

A. White pavement-marking paint shall apply

B. Sweep and clean surface to eliminate loose material and dust.

C. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

3.08 WHEEL STOPS

A. Retain this article if wheel stops are required.

B. Install wheel stops in bed of adhesive as recommended by manufacturer.

C. Securely attach wheel stops to pavement with not less than two galvanized-steel dowels embedded at one-quarter to one-third points. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

3.09 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979.

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
    a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
    b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

E. Replace and compact hot-mix asphalt where core tests were taken.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.10 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow milled materials to accumulate on-site.

END OF SECTION 32 12 17

SECTION 32 15 00 – AGGREGATE SURFACE COURSE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and DIVISION 01 Specification Sections, apply to this Section.

B. Refer to MoDOT DIVISION 300

1.02 SUMMARY

A. This Section includes requirements for aggregate surfacing for roads, streets, parking areas, and other surfaces requiring aggregate surfacing.

1.03 RELATED REQUIREMENTS

A. Section 31 20 50 - Site Preparation and Earthwork.

1.04 REFERENCE STANDARDS

A. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to within the text by the basic designation only.

1. American Society for Testing and Material (ASTM): Equivalent AASHTO Standards may be substituted as approved:
   a. ASTM C117 - Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing.
   b. ASTM C131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
   c. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
   d. ASTM D75/D75M - Standard Practice for Sampling Aggregates.
   e. ASTM D422 - Particle-Size Analysis of Soils.
   f. ASTM D698 - Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3).
   g. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3).
   h. ASTM D2167 - Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
   i. ASTM D4318 - Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
   j. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
2. State of Missouri Standard Specifications for State Road and Bridge Construction.

1.05 QUALITY ASSURANCE

A. Sampling and testing is the responsibility of the Contractor. Submit copies of field test results within 24 hours after the tests are performed. Test results from samples, not less than 30 days before material is required for the Work. Results of laboratory tests for quality control purposes, for approval, prior to using the material. Sampling and testing shall be performed by an approved commercial testing laboratory or by the Contractor, subject to approval. If the Contractor elects to establish its own testing facilities, approval of such facilities will be based on compliance with ASTM D3740.

1.06 WEATHER LIMITATIONS

Aggregate surface courses shall not be constructed when the ambient temperature is below 35ºF (2ºC) or on subgrades that are frozen or contain frost. Surfaces damaged by freeze, rainfall, or other weather conditions shall be brought to a satisfactory condition by the Contractor.

PART 2 - PRODUCTS

2.01 AGGREGATES

A. Provide aggregates consisting of clean, sound, durable particles of crushed limestone or crushed natural gravels, or other approved materials processed and blended or naturally combined. Provide aggregates free from lumps and balls of clay, organic matter, objectionable coatings, and other foreign materials. The Contractor is responsible for obtaining materials that meet the specification and can be used to meet the grade and smoothness requirements specified herein after all compaction [and proof rolling] operations have been completed.

B. The gravel road shall be a total of 8 inches. The base course shall be AB3 and the subsurface course shall be ¾ inch aggregate.

C. The gradation for the base course and the surface course shall be in accordance with the following table:

Sieve Size	Mass Percent Passing		
	SA1 (surface) or SA2 (surface)		AB3 (sub course)
Type	Sand-Gravel	Sand-Gravel	
2 inch			0
1 ½ inch		0	0-5
1 ¼ inch			
1 inch	0	1-15	
¾ inch	0-5		5-30
½ inch			
3/8 inch	0-20		
No. 4			35-60
No. 8			45-70
No. 10			
No. 30			
No. 40			60-84
No. 200			80-92
Fineness Module	4 min	5 min	

D. Refer to the typical section in drawing for gravel road

E. Contractor's facilities have been inspected and approved.

F. Sampling:

1. Take samples for material gradation, liquid limit, and plastic limit tests in conformance with ASTM D75/D75M.

G. Testing:
    1. Gradation:
        a. Aggregate gradation shall be in conformance with ASTM C33,size 67 for ¾ inch maximum size consisting of crushed gravel or crushed stone.

PART 3 - EXECUTION

3.01 STOCKPILING MATERIALS

A. Prior to stockpiling the material, clear and level the storage areas. All materials, including approved material available from excavation and grading, shall be stockpiled in the manner and at the locations designated. Stockpile aggregates in such a manner that will prevent segregation. Aggregates and binders obtained from different sources shall be stockpiled separately.

3.02 PREPARATION OF SUBGRADE

A. Clean of all foreign substances from the subgrade. At the time of surface course construction, the subgrade shall contain no frozen material. The existing roads are in poor shape and will need to be hit with the road grader and crowned. Ruts or soft yielding spots in the subgrade areas having inadequate compaction and deviations of the surface from the requirements set forth herein shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade and recompacting to density requirements specified. The completed subgrade shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the surface course is placed.

3.03 MIXING AND PLACING MATERIALS

A. The materials shall be mixed and placed to obtain uniformity of the material and a uniform optimum water content for compaction. Make adjustments in mixing, placing procedures, or in equipment to obtain the true grades, to minimize segregation and degradation, to obtain the desired water content, and to ensure a satisfactory surface course.

3.04 LAYER THICKNESS

A. Place the aggregate material on the subgrade in layers of uniform thickness. When a compacted layer of 2 inches, the material may be placed in a single layer; when a compacted thickness of more than 2 inches, no layer shall exceed 4 inches nor be less than 3 inches when compacted.

3.05 COMPACTION

A. Degree of compaction is a percentage of the maximum density obtained by the test procedure presented in ASTM D698. Compact each layer of the aggregate surface course with approved compaction equipment, as required in the following paragraphs. The water content during the compaction procedure shall be maintained within 1.5% of optimum. In locations not accessible to the rollers, the mixture shall be compacted with mechanical tampers. Compaction shall continue until each layer through the full depth is compacted to at least 100% of laboratory maximum density. Remove any materials that are found to be unsatisfactory and replace them with satisfactory material or rework them to produce a satisfactory material.

3.06 EDGES OF AGGREGATE-SURFACED ROAD

A. Approved material shall be placed along the edges of the aggregate surface course in such quantity as to compact to the thickness of the course being constructed. When the course is being constructed in two or more layers, at least 1 foot (300 mm) of shoulder width shall be rolled and compacted simultaneously with the rolling and compacting of each layer of the surface course.

3.07 GRADE CONTROL

A. During construction, the lines and grades including crown and cross slope indicated for the aggregate surface course shall be maintained by means of line and grade stakes placed by the Contractor.

3.08 DENSITY TESTS

A. Frequency of tests shall be a minimum of one test for every 2,500 square feet. Measure density in the field in accordance with ASTM D2167.

3.09 MAINTENANCE

A. Maintain the aggregate surface course in a condition that will meet all specification requirements until accepted.

END OF SECTION 32 15 00

SECTION 32 16 00 – CURBS, GUTTERS, SIDEWALKS, MEDIAN AND PAVED DRAINAGE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes concrete curbs, gutters, sidewalks, and paved drainage where indicated.
B. Related Sections include the following:
    1. Section- 31 20 50- Site Preparation and Earthwork.

1.03 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.04 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.
B. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
C. Qualification Data: For manufacturer. Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
D. Material Test Reports: General contractor will engage a qualified testing agency for indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:
    1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.
E. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:
    1. Cementitious materials.
    2. Steel reinforcement and reinforcement accessories.
    3. Fiber reinforcement.
    4. Admixtures.
    5. Curing compounds.
    6. Applied finish materials.
    7. Bonding agent or epoxy adhesive.
    8. Joint fillers.
F. Field quality-control test reports.
G. For places and sidewalks, submit control joint spacing plan for review.
H. Minutes of pre-installation conference.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94 requirements for production facilities and equipment.
    1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
    1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.

C. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
    1. Build mockups of full-thickness sections of concrete paving to demonstrate typical joints; surface finish, texture, and color; curing; and standard of workmanship.
    2. Build mockups of concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Architect and not less than 96 inches by 96 inches.
    3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
    4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Pre-Installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
    1. Before submitting design mixtures, review concrete pavement mixture design and examine for ensuring quality of concrete materials and concrete pavement construction practices. Require representatives, including the following, of each entity directly concerned with concrete pavement, to attend conference:
        a. Contractor's superintendent.
        b. Independent testing agency responsible for concrete design mixtures.
        c. Ready-mix concrete producer.
        d. Concrete pavement subcontractor.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
    1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
    2. Products: Subject to compliance with requirements, provide one of the products specified.
    3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
    4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 FORMS OF MATERIALS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
    1. Use flexible or curved forms for curves with a radius 100 feet or less.
B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.03 STEEL REINFORCEMENT

A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.
C. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A 615/A 615M, Grade 60 deformed bars.
D. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.
E. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.
F. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete, and as follows:
    1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
    2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

J. Zinc Repair Material: ASTM A 780.

2.04 CONCRETE MATERIALS

A. Materials: All materials including but not limited to reinforcing materials, concrete materials, concrete mix, admixtures, curing materials, traffic paint and other related materials used under this section shall conform to the requirements of the State of Maryland Standard Specifications for Construction and Materials. References to a required class of concrete shall correspond to the classes as shown in the State of Maryland Standard Specifications for Construction and Materials Part II, Technical Requirements.

B. Fly ash shall meet the approval of the ASTM C-618 pozzolan Class F and may be used as a partial substitute for cement when approved by the City.

C. The concrete mix used in performing this work shall be per MDSHA mix designs depending on the compressive strength shown on the details and shall meet the approval of the City.

D. The concrete temperature shall not exceed 90°F when delivered to the job-site or at any time prior to placement in the forms.

E. Type I - Portland Cement: Shall be used from October 1 through May 1 and when the air temperature in the shade and away from artificial heat is above 70°F or less, or as directed by the Architect.

F. Type II - Portland Cement: Shall be used from May 1 through October 1 and when the air temperature in the shade and away from artificial heat is above 70°F, or as directed by the Architect.

G. When approved by the Architect, Hi-Early strength concrete may be used. Approval will be on a case by case basis.

H. Water: ASTM C 94/C 94M.

I. Air-Entraining Admixture: ASTM C 260.

J. Chemical Admixtures: Admixtures may only be use with prior approval by the City. Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.05 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
C. Water: Potable.
D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
    1. Available Products:
        - Axim Concrete Technologies; Cimfilm.
        - Burke by Edeco; BurkeFilm.
        - ChemMasters; Spray-Film.
        - Conspec Marketing & Manufacturing Co., Inc.; Aquafilm.
        - Dayton Superior Corporation; Sure Film.
        - Euclid Chemical Company (The); Eucobar.
        - Kaufman Products, Inc.; Vapor Aid.
        - Lambert Corporation; Lambco Skin.
        - L&M Construction Chemicals, Inc.; E-Con.
        - MBT Protection and Repair, ChemRex Inc.; Confilm.
        - Meadows, W. R., Inc.; Sealtight Evapre.
        - Metalcrete Industries; Waterhold.
        - Nox-Crete Products Group, Kinsman Corporation; Monofilm.
        - Sika Corporation, Inc.; SikaFilm.
        - Symons Corporation; Finishing Aid.
        - Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.
E. White Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B.
    1. Available Products:
        - Anti-Hydro International, Inc.; AH Curing Compound #2 WP WB.
        - Burke by Edoco; Resin Emulsion White.
        - ChemMasters; Safe-Cure 2000.
        - Conspec Marketing & Manufacturing Co., Inc.; W.B. Resin Cure.
        - Dayton Superior Corporation; Day-Chem White Pigmented Cure (J10W).
        - Euclid Chemical Company (The); Kurez VOX White Pigmented.
        - Kaufman Products, Inc.; Thinfilm 450.
        - Lambert Corporation; Aqua Kure-White.
        - L&M Construction Chemicals, Inc.; L&M Cure R-2.
        - Meadows, W. R., Inc.; 1200-White.
        - Symons Corporation; Resi-Chem White.
        - Tamms Industries, Inc.; Horncure 200-W.
        - Unitex; Hydro White.
        - Vexcon Chemicals, Inc.; Certi-Vex Enviocure White 100.

2.06 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or pre-molded wood fiber strips (Homex 300) or ASTM D 1752, cork or self-expanding cork.

B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

D. Chemical Surface Retarder: (For exposed aggregate concrete) Water-soluble, liquid-set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch

1. Products:
   a. Burke by Edeco; True Etch Surface Retarder.
   b. ChemMasters; Exposee.
   c. Conspec Marketing & Manufacturing Co., Inc.; Delay S.
   d. Euclid Chemical Company (The); Surface Retarder S.
   e. Kaufman Products, Inc.; Expose.
   f. Metalcrete Industries; Surftard.
   g. Nox-Crete Products Group, Kinsman Corporation; Crete-Nox TA.
   h. Scofield, L. M. Company; Lithotex.
   i. Sika Corporation, Inc.; Rugasol-S.
   j. Vexcon Chemicals, Inc.; Certi-Vex Envioset.

2.07 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.

B. Proportion mixtures to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): Minimum compressive strength of 3,000 psi where not indicated
2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.50.
3. Slump Limit: 2-5, plus or minus 1 inch.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content: 6 percent plus or minus 1.5 percent for 1-inch nominal maximum aggregate size.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
    1. Use water-reducing admixture, plasticizing and retarding admixture in concrete, as required, for placement and workability.
    2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

F. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement according to ACI 301 requirements for concrete exposed to deicing chemicals. Limits shall be as follows per MD SHA requirements:
    1. Fly Ash or Pozzolan: 25 percent.
    2. Ground Granulated Blast-Furnace Slag: 50 percent.

G. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

H. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd..

2.08 CONCRETE MIXING

A Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116 where synthetic fibers are noted on the plans. Furnish batch certificates for each batch discharged and used in the Work.
    1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

2.09 PAVEMENT MARKINGS

A. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type N; colors complying with FS TT-P-1952.
    1. Color: White

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.
    1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
    2. Proof-roll with a loaded 10-wheel tandem-axle dump truck weighing not less than 1 5 tons.
    3. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch require correction.

C. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

3.02 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.03 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.04 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.05 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
    1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.
B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.
    1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
    2. Provide tie bars at sides of pavement strips where indicated.

3. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
4. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
1. Locate expansion joints at intervals of 20 feet, unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4. By default, all isolation joints are scheduled to receive joint sealant. If joint sealant is specifically indicated as not required, place top of joint filler flush with finished concrete surface.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6 Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated for standard sidewalks. For larger sidewalks, width greater than 12' and plazas, submit shop drawing of joint pattern. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 3/8-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groove marks on concrete surfaces.
2. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.06 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.
B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.
C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
E. Do not add water to fresh concrete after testing.
F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
    1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.
H. Screed pavement surfaces with a straightedge and strike off.
I. Commence initial floating using bull floats or derbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
J. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not approved, remove and replace with formed concrete.
K. Slip-Form Pavers: When automatic machine placement is used for pavement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce pavement to required thickness, lines, grades, finish, and jointing as required for formed pavement.
    1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.
L. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.
M. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
    1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
    2. Do not use frozen materials or materials containing ice or snow.
    3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.

N. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
    1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
    2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
    3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.07 FLOAT FINISHING

A. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
    1. Construct test sections of each type of concrete paving, including at least one expansion joint and control joints, for review by CM, Owner and Architect for agreement of finish prior to starting concrete installation. Review will include texture of broom finish, joint striking, picture framing and geometric conformity.
    2. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
    3. Incorporate “picture framing” of concrete in finish within lump sum prices bid.

3.08 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
B. Comply with ACI 306.1 for cold-weather protection.
C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
    1. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
    2. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.09 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows:
    1. Elevation: 1/4 inch.
    2. Thickness: Plus 3/8 inch, minus 1/4 inch.
    3. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/4 inch.
    4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
    5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch.
    6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch.
    7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
    8. Joint Spacing: 3 inches.
    9. Contraction Joint Depth: Plus 1/4 inch, no minus.
    10. Joint Width: Plus 1/8 inch, no minus.
    11. Curbs – vertical ¼” in 10’

3.10 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
B. Allow concrete paving to cure for a minimum of 28 days and be dry before starting pavement marking.
C. Sweep and clean surface to eliminate loose material and dust.
D. Apply paint with mechanical equipment to produce markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
    1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to concrete surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least 1 composite sample for each 100 cu. yd. or fraction thereof of each concrete mix placed each day.
   a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.
   a. compressive-strength test shall be the average compressive strength from specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mix will be satisfactory if average of any 3 consecutive compressive- strength tests equal or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.
H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.12 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.
B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to pavement with epoxy adhesive.
C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 16 00

SECTION 32 31 13 – CHAIN LINK FENCE AND GATES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install the chain link fence and gates as shown on the Drawings and as specified herein.

B. Installation of Temporary Security Fence

1.02 SUBMITTALS

A. Submit as specified in DIVISION 1.

B. Includes, but not limited to, the following:

1. Plan layout.
2. Details illustrating fence height, sizes of posts, rails, braces, gates, and hardware list.
3. Erection procedures.

1.03 REFERENCE STANDARDS

Applicable Standards:

A. Federal Specifications (FS):

1. FF-B-575 - Bolts, Hexagon, and Square.
2. RR-F-191J/GEN - Fencing, Wire and Post, Metal (and Gates, Chain-Link Fence Fabric, and Accessories) (General Specification).
3. RR-F-191/2 - Fencing Wire and Post, Metal (Chain-Link Fence Gates) (Detail Specification).
4. RR-F-191/3 - Fencing Wire and Post, Metal (Chain-Link Fence Posts and Braces) (Detail Specification).

B. ASTM International (ASTM): Equivalent AASHTO standards may be substituted as approved.

1. ASTM DI 784 – The Extruded product meet or exceed the standard.
2. ASTM-F668 - Standard Specification for Polyvinyl Chloride (PVC),
3. ASTM F2919, Specification for Welded Wire Mesh Fence Fabric (Metallic-Coated or Polymer Coated)

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Fences:

1. Anchor Fence Division, Anchor Post Products Inc.
2. U.S. Steel Supply Division, U.S. Steel Corp.
3. Allied Tube & Conduit Corporation.
4. Broski Fence
5. Engineer approved equal.

2.02 GENERAL

Manufacturer's standard materials where such materials conform to these Specifications.

A. Conform to FS RR-F-191J/GEN except as indicated or specified otherwise.

B. Fence Fabric Height: 7-feet.

C. Finish for framework and appurtenances: Galvanized with minimum weight for zinc per square foot as follows:

1. Pipe: Conform to FS RR-F-191/3.
2. Square Tubing: 2.0 ounces.

3. H-Sections: 2.0 ounces.
4. C-Sections: 2.0 ounces.
5. Hardware and accessories: PVC Coated following ASTM DI784 or ASTM F668 specification

2.03 POSTS AND BRACES

Minimum size and weight as follows:

A. Posts:
   1. End, Corner or Pull Posts, Line Posts, and Gate Posts: Conform to FS RR-F-191/3 (Table I).

B. Post Bracing:
   1. Diagonal galvanized truss rods 3/8-inch in diameter equipped with truss tightener.
   2. Horizontal Braces: Size SP1 conforming to FS RR-F-191/3.

C. Stretcher Bars:
   1. One piece. Length to be 1 inch less than fabric height.
   2. 3/16-inch x 3/4-inch, galvanized.

E. Post Tops:
   1. Designed as a weathertight closure cap for tubular posts.
   2. Malleable iron or pressed steel, both galvanized.
   3. Attached to steel posts or intergrate with post top.
   4. Malleable iron or pressed steel, both galvanized.

G. Bolts:
   1. Zinc coated.
   2. Conform to FS FF-B-575.

2.04 FABRIC

A. No. 9-gage, 2-inch diamond mesh chain-link fabric with PVC coated. Minimum breaking strength of the wire shall be 1,200 pounds.
B. Both selvages twisted for fabric 6'-0" and over.
C. Top and bottom selvage knuckled for fabric 5'-0" and under.
D. Fabric fastenings of 9-gage galvanized wire ties.

2.05 Sliding Cantilevered Gate:

A. Framing:
   a) Inverted channel track, roller ball-bearing truck assemblies, guides, stays, bracing, hardware, and accessories as required.
   b) Intermediate horizontal and vertical members for proper gate operation and for attachment of fabric, hardware, and accessories. Space so that frame members are not more than 8 ft. apart unless otherwise indicated.
   c) Frames assembled by welding or watertight galvanized steel rigid fittings.
   d) Diagonal cross bracing of 3/8 inch diameter adjustable truss rods to provide frame rigidity.

B. Slide Gate Motor Operator and Accessories:

1. Motor Operator:
   a) Provide a heavy duty electric-motor operator for operating the sliding cantilevered gate. Operator shall be sized to operate gate specified and indicated.
   b) Suitable for outdoor use with all parts suitably protected against corrosion and with lockable weather-resistant cover.
   c) Operator shall be designed for either left or right hand mounting and shall be designed for pad mounting.
   d) System designed to operate on a 240V, single-phase power supply.
   e) Unit shall consist of instantly reversing motor with overload protection, magnetic brake, safety clutch, and automatic limit switch. Provide with releasing switch in case of power failure.
   f) Provide with mounting channels. Operator enclosure shall be mounted on a concrete pad, size as required.
   g) Flexible hinged connections to conduit, if required.

2. Safety Devices:
   a) Provide gate edges with contact sensors to reverse the gate upon contact with an object.
   b) Provide one loop detector: Used to sense exiting vehicle traffic and provide a request to exit to the gate access control system. Provide all cabling and components for complete installation.
   c) Non-contact sensors, or contact sensors, or a combination thereof, shall be utilized to prevent persons from becoming entrapped in the gate system.
   d) Provide units with adjustable entry and exit timers.
   e) Provide for emergency vehicle entrance through gate via audible siren detector

PART 3 – EXECUTION

3.01 PREPARATION:

A. Perform final grading prior to installation of fence.
B. Follow general contour of ground and properly align fence. Install as indicated.

3.02 INSTALLATION – POSTS AND BRACES

A. Posts:
   1. Set in concrete bases as indicated. Trowel finish tops of footings and dome to direct water away from posts.
   2. Install plumb and in straight alignment.
   3. Space 10 feet center-to-center maximum.
   4. Install pull posts:
      a. Every 300 feet.
      b. At all abrupt changes in grade.
      c. At all changes in direction of 15 degrees or more.
      d. Temporarily brace until concrete in bases has set.

B. Post Bracing:
   1. Install at each end, pull and gate post, and each side of each corner post.
   2. Install after concrete in post bases has set.
   3. Install so posts are plumb when diagonal rod is under tension.

C. Stretcher Bars:
   1. Thread through or clamp to fabric 4 inches oc.
   2. Secure to posts with metal bands spaced 14 inches oc maximum.
   3. Install at each gate, pull and end post, and each side of corner post.

D. Post Tops: Install on each gate post.

3.03 INSTALLATION - FABRIC:

A. Fabric:
   1. Stretch taut with equal tension on each side of line posts.
   2. Fasten to steel posts with wire ties.
   3. Space wire ties at 14 inches oc maximum on posts.
   4. Rolls of fabric shall be joined together by weaving a single strand into the end of the roll to form a continuous piece.

3.04 REPAIRING DAMAGED COATINGS

A. Repair any damaged coatings in the shop or field by recoating with compatible and similar coating.
B. Apply per manufacturer's recommendations.

3.05 MOTOR OPERATED GATES:

A. Install all hardware, tracks, framing, supports, electrical devices, wiring, loop controller, and appurtenances required for a complete system and satisfactory operation.
B. Install to conform to manufacturer’s instructions and as indicated.
C. Test and adjust system for smooth proper operation.

END OF SECTION 32 31 13

SECTION 32 92 00.10 NATIVE GRASSES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following areas of Work:
   1. Seeding for Native Grasses.
   2. Topsoil.
   3. Soil Amendments.
   4. Fertilizer.
   5. Straw Mat.
   6. Erosion Control
   7. Miscellaneous Material
   8. Maintenance.

B. Related Work Specified Elsewhere:
   1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
   2. Section 31 20 50 – Site Preparation and Earthwork.

1.02 REFERENCES

A. Applicable Standards:
   1. American Society for Testing and Materials (ASTM) - Equivalent AASHTO standards may be substituted as approved.

1.03 SUBMITTALS

A. General: Upon completion of the installation, deliver to Landscape Architect the following in accordance with the Conditions of the Contract and Division 1 Specification Sections.
   1. Plant and Material Certificates:
      a. Seed shall be accompanied by certificate from vendors certifying they meet requirements of these Specifications, stating botanical name, percentage by weight, percentage of purity, germination, and weed seed for each grass seed species.
      b. Certificates of inspection as required by governmental authorities.
      c. Certification of grass seed from seed vendor for each grass-seed mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
      d. Vendor must have available seed label for certification of grass seed mixtures. Source must be from an environmentally controlled facility. All seed mixtures must be Blue Tag certified, no exception.
      e. Planting schedule indicating anticipated dates and locations for each type of planting.
      f. Maintenance instructions recommending procedures to be established by Contractor for maintenance of landscaping during an entire year. Submit 3 copies before expiration of required maintenance programs.
      g. Qualification data for firms and persons specified in “Quality Assurance” article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and Owner’s, and other information specified.
      h. Soil amendments
      i. Mulch
      j. Erosion Control

k. Inoculants

1.04 QUALITY ASSURANCE

A. Qualifications:
1. A qualified Contractor shall employ or provide a qualified installation manager who meets any of the required qualifications.
a. Bachelor of Science Degree in Horticulture, Botany, Soil Physics, Agronomy, General Agriculture, Agricultural or Biological Engineering, or a related field.
2. The above-described individual(s) shall be identified by the contractor and shall be on the project during the following installations.
a. Native seed Installation/Maintenance.

B. Installer Qualifications: Engage a single firm specializing in landscape work with experience completing landscaping work similar in material, design, and extent to that indicated for this Project and with a record of successful landscape establishments.
1. Installers Field Supervision: Require installers to maintain an experienced full-time Supervisor on the project site during times that landscaping is in progress.

C. The Contractor shall provided maintenance recommendations to be implemented by the installation and maintenance contractor, in the manner approved by the Landscape Architect as follows:
1. Monthly: For the first three (3) months following completion of each native seeding area.
2. Seasonally: Spring and Fall for a total of 6 reports.

1.05 LANDSCAPING

A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.

1.06 DELIVERY, STORAGE AND HANDLING

A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.

B. Native Seed: Deliver separate containers with sealed labels.

1.07 PROJECT CONDITIONS

A. Utilities: Determine location of above grade and underground utilities and perform work in a manner which will avoid damage. Hand excavate, as required. Maintain grade stakes until removal is mutually agreed upon by parties concerned.

B. Excavation: When conditions are detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Landscape Architect before planting.

1.08 SEQUENCING AND SCHEDULING

A. General Warranty: The special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. For Native Grasses, the Contractor shall provide a warranty period of twelve (12) months.

PART 2 - PRODUCTS

2.01 NATIVE GRASSES

A. Fresh, clean, dry, pure-live seed complying with Missouri Department of Agriculture laws for purity, germination, and noxious weed tolerances.
   1. Seed Components: Provide seed of grass and forb species and varieties, proportions by weight, and minimum percentages of purity, germination, and maximum percentage of weed seed as indicated on Schedules at the end of this Section. Seed lots, unblended, shall be provided to horticulturist in original unopened containers for agro-histological determination and re-testing. The Master label shall be produced by the horticulturist and shall be sealed according to the appropriate laws and regulations.
   2. All seed must be tested by a registered seed technologist per AOSA methods and meet all requirements established by the Missouri Department of Agriculture. The contractor will provide documentation with the seed shipment for the following information.
      a. State of Origin
      b. County of Origin
      c. Year of Harvest
      d. Genus species Identification
      e. Seed Lot #
      f. Packaged Quantity
      g. Identification of Seed Supplier
      h. Supplier Certification Number
      i. State of Supplier Registration
      j. Percent PLS Per Seed Lot
      k. Percent Germination
      l. Percent Hard Seed
      m. Percent Foreign Matter
      n. Percent Weed Seed
      o. Identification of Noxious Weed Seed
      p. Date of Seed Testing
      q. Identification of Seed Testing Company

B. Landscape Architect has final approval, no exceptions.

C. Seed Source: Shall be submitted to Landscape Architect for approval. Seed orgin shall be restricted to within 100 miles of Kansas City, Missouri.

D. Provide fresh, clean, new-crop seed complying with tolerance for purity and germination established by Official Seed Analyst of North America. Provide seed mixture composed of grass and forb species, proportions and minimum percentages purity, germination, and maximum of seed as specified:
   a. Seed Mix: Seeding of this mix should only occur in spring (before June 15th).

Scientific Name	Common Name	Lbs/Acre	% of Mix
Bouteloua curtipendula	Side-oats Grama	60	95%
Bouteloua dactyloides ‘Bowie’	Bowie Buffalo Grass	5	5%
	Total lbs. seed/Acre	65	

E. Cover Crop Seeding
   a. Cover crop seeding shall be installed when seasonal conditions do not allow for seeding of the native grass mix specified above.
   b. Provide fresh, clean, new-crop seed complying with tolerance for purity and germination established by Official Seed Analysts of North America. Provide seed mixture composed of grass species, proportions and minimum percentages

Scientific Name	Common Name	Min. % PLS	Min. % Germination	% of Mix
Avena sativa	Annual Oats	98%	90%	100%
	Total lbs. PLS/Acre			10

c. Cover Crop Application Rate: 10 lbs. PLS per Acre

2.02 TOPSOIL

A. Topsoil Source: Reuse surface soil stockpiled on the site. Verify suitability of surface soil to produce topsoil meeting requirements and amend to achieve required pH and organic content as necessary and recommended through soil tests. Clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth. Soil shall not contain more than 20 stones or other foreign material less than 1 inch (25 mm) in diameter in any one square yard area.

2.03 SOIL AMENDMENTS

A. Peat Humus: Shredded horticultural grade sphagnum peat moss, 90% organic moss peat, with ash content of 10% or less, brown in color.
B. Manure: Well-rotted, unleached stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.
C. Water: Potable.

2.04 FERTILIZER

A. Do NOT use fertilizers in Native Grass seeding areas.

2.05 EROSION CONTROL

A. Erosion control blanket shall be produced from 100% coconut coir fiber, biodegradable double jute netting, with 50% open area, biodegradable jute yarn thread, rated for a 2 year longevity rating.
B. Staple over edges and drape oversides for overlap finish, minimum 6” overlap required.

2.06 MISCELLANEOUS MATERIALS

A. Mycorrhizal Inoculant: The Contractor shall utilize an organic mycorrhizal inoculant for erosion repair. Inoculants shall be used per manufacturer’s specifications.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive landscaping for compliance with requirements and for conditions affecting performance of work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Lay out seeding areas. Stake locations and secure Landscape Architect’s acceptance before the start of planting work. Make minor adjustments as may be required.

3.03 SEEDING COVER CROP, NATIVE GRASSES

A. Sow seeds using seed drill (Truax-type) that accurately meters the seed types and mixes all seeds uniformly during seeding. It should have, at the minimum, two seed boxes to separate fine seeds from large/fluffy seeds. This seed drill should also be equipped with disc furrow openers and a no-till trash plow assembly, which will compact the soil directly over the drill rows. The maximum row spacing for drill seeding should be 8 inches. Fine seeds shall be dropped onto the ground from the fine seed box, while large/fluffy seed should be placed to obtain final planting depth of 1/4-1/2". The path of the drill seeding shall be done at a right angle to that of the drainage patterns.
   1. Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage.

3.04 SOW NATIVE SEED ACCORDING TO THE FOLLOWING SCHEDULES

A. Hand Broadcast or Drill seed Cover crop of Annual Oats, in quantities specified in Part 2, over native seed areas immediately after fine grading is completed.
B. Drill Native Seed, in quantities specified in Part 2, between April 1st through June 18th or October 1st through November 30th after construction operations are complete.
C. Protect all native grass areas on slopes 4:1 and greater using straw mat erosion control blanket installed and stapled according to manufacturer's recommendations.

3.05 NATIVE GRASS AND WILDFLOWER MAINTENANCE

A. Begin maintenance of native grass areas immediately after each area is planted and continue until established and accepted, but for not less than the following periods:
   1. Native grass: Two years after date of Substantial Completion.
   2. The Installer shall be responsible for the proper care until verification that all plant materials (time meander survey) are present in the density and health to ensure self-maintenance.
B. Maintain and establish native grasses by mowing, weeding, trimming, replanting, and other operations as stated below. Re-grade erosion rills, replant bare or eroded areas, and re-mulch to produce a uniform prairie. Landscape installer shall perform maintenance as determined by the horticulturist.
C. Year One:
   1. Maintenance (June-September)
      a. Mow to 8" when plants reach 12" during first complete growing season. After first complete growing season, mow to 8" and remove thatch in late February/March to remove mature top growth.
      b. Weed Control - mowing should keep annual weeds down. Spot spray weeds using Round-Up before first mowing.
      c. Overseed all native prairie and wildflower areas with the same mix and seeding rate as first seeding, 1 year after first seeding.
      d. If first seeding occurs late fall or early winter, overseed in spring.
   2. Monitoring:
      a. Monitor for invasive weeds such as: velvet leaf, brome grass, Johnson grass, crown vetch, clover, prickly lettuce, etc. Spot spray as necessary.
   3. Evaluation and Remediation:
      a. Cover crop should be growing within 2 weeks of planting.
      b. Seedlings spaced 1-6" apart in drill rows.
      c. Native grass seedlings may only be 4-6" tall.
      d. If there is a flush of growth from invasive weeds, mow more frequently.
      e. Fill in and reseed rills caused by erosion (May-July).
      f. As determined by the horticulturist, add new mulch in areas where mulch has been disturbed by wind or maintenance operations sufficiently to nullify its purpose. Anchor as required to prevent displacement.

4. Watering: Provide and maintain temporary piping, hoses, and lawn-watering equipment to convey water from sources and to keep lawns uniformly moist to a depth of 4 inches.
    a. Lay out temporary lawn-watering system and arrange watering schedule to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly seeded areas.
    b. Daily for the first week, 1-1 ½ inch minimum depth.
    c. Every 3-4 days for the second week at the minimum rate of 1 inch per week.
    d. One day a week for the next 60 days at the minimum rate of 1 inch per week.

3.06 SATISFACTORY NATIVE GRASS WILDFLOWER STANDS

A. An acceptable native grass stand will contain no less than 5 healthy mature or developing plants per square foot with a population distribution per 10,000 square feet representative of ratios in the original blend. The result of maintenance shall be that weeds are being controlled through competition with the desired plants, and that mowed bio-mass is not accumulating in such a manner to be detrimental to existing plant materials as determined by the Landscape Architect.

B. An acceptable native grass stand shall control erosion through root mass development. The occurrence of rills and gullies shall be unacceptable.

3.07 PROTECTION

A. Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain barricades throughout maintenance period until lawn is established.

B. Sodded lawns will be acceptable provided requirements, including maintenance, have been complied with and healthy, well-rooted, even-colored, viable lawn is established free of weeds, open joints, bare areas, and surface irregularities.

3.08 CLEANUP

A. Promptly remove soil and debris created by lawn Work from paved areas. Clean wheels of vehicles prior to leaving Site to avoid tracking soil onto surfacing of roads, walks, or other paved areas.

B. Disposal or Surplus and Waste Material
    1. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of it off the Owner's property.

3.09 MEASUREMENT AND PAYMENT

A. Time of Completion: Completion time for seeding shall not apply to provisions for liquidated damages with respect to Contract completion time. Payment for seeding and sodding will be withheld until such Work is accepted.

END OF SECTION 32 92 00.10

SECTION 32 93 00 - TREES AND SHRUBS

PART 1 - GENERAL

1.01 SUMMARY

A. This SECTION includes the following:
   1. Furnishing trees and shrubs.
   2. Preparation of planting pits and beds, including excavation, backfilling, and disposal of surplus and unsuitable excavated material.
   3. Planting of trees and shrubs, including fertilizing, mulching, trimming, guying, and wrapping.
   4. Maintenance of trees and shrubs.

1.02 REFERENCE

A. Applicable Standards:
   1. American National Standards Institute (ANSI):
      a. Z60.1 - Nursery Stock.

1.03 SUBMITTALS

A. Submit as specified in DIVISION 01.

B. General: Upon completion of the installation, deliver to Landscape Architect the following in accordance with the Conditions of the Contract and DIVISION 0I Specification Sections. C. Include, but not limited to, the following:
   1. Product Certification: Certificate of inspection as may be required by governing authorities. For standard products, submit manufacturer's certified analysis. For other materials, submit analysis by a recognized laboratory made in accordance with methods established by Association of Official Agricultural Chemists, wherever applicable.
   2. Manufacturers Literature: Submit three (3) copies of fertilizer manufacturer’s literature along with schedule of maintenance program spanning the life of the guarantee and three (3) copies of a recommended post guarantee maintenance program.
   3. Label data substantiating that trees and shrubs comply with specified requirements.
   4. Materials List: Within 15 days after award of contract, and before any materials are delivered to the job site, submit to Landscape Architect a complete list of all plants including the sizes ordered and the type of equipment to be used on this project.
   5. As-Built Drawings: During course of installation, carefully record in red line on a print of the planting drawings all changes made to the planting system layout during installations; approved by the Landscape architect. Final payment for planting will not be authorized until an accurate and complete as-built is submitted.
   6. Planting Schedule: Proposed planting schedule, indicating dates for each type of landscape work during normal seasons for such work in area of site. Correlate with specified maintenance periods to provide maintenance from date of Substantial Completion. Once accepted, revise dates only as approved in writing, after documentation of reasons for delays.
   7. Maintenance Instructions: Typewritten instructions recommending procedures to be established by Owner for maintenance of landscape work for one full year. Submit prior to expiration of required maintenance period(s).

D. Product Data: Submit product data, supplier sources and small sample of the following:
   1. Shredded Hardwood Mulch
   2. Fertilizer Planting Tablets

3. Steel Edging
4. Weed Barrier
5. Herbicide and Pre-emergent

1.04 QUALITY ASSURANCE

A. Installers Qualifications: Engage a single firm specializing in landscape work with experience completing landscaping work similar in material, design, and extent to that indicated for this project and with a record of successful landscape establishment.
   1. Installers Field Supervision: Require installers to maintain an experienced full-time Supervisor on the project site during times that landscaping is in progress.

B. Source Quality Control.
   1. General: ship landscape materials with certificates of inspection required by governing authorities. Comply with regulations applicable to landscape materials.
   2. Do not make substitutions. If specified landscape material is not obtainable, submit proof of non-availability to Landscape Architect, together with proposal for use of equivalent material.
   3. Topsoil: Topsoil from the project site shall be used for all planting operations. All topsoil used in planting operations shall meet standards as defined in this specification.
   4. Trees and shrubs: Provide trees and shrubs of quantity, size, genus, species, and variety shown and scheduled for landscape work and complying with recommendations and requirements of (ANSI Z60.1-1986) "American Standard for Nursery Stock" for number one grade nursery stock as adopted by the American Association of Nurserymen. Provide healthy, vigorous stock, grown in recognized nursery in accordance with good horticultural practice and free of disease, insects, eggs, larvae, and defects such as knots, sun-scald, injuries, abrasions, and disfigurement.
      a. Measurements: Measure trees and shrubs according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches (150mm) above ground for trees up to 4-inch (100mm) caliper size, and 12 inches (300mm) above ground for larger sizes. Measure main body of tree or shrub for height and spread; do no measure branches or roots tip-to-tip.
   5. Label at least one tree and one shrub of each variety with a securely attached waterproof tag bearing legible designation of botanical and common name.

C. Inspection: The Contractor shall notify the Landscape Architect of the location of plant materials to be used and allow the Landscape Architect the opportunity to inspect them either at the place of growth or at the site before planting, for compliance with requirements for genus, species, variety, size, and quality. The Owner retains the right to further inspect trees and shrubs for size and condition of root balls and root systems, insects, injuries and latent defects, and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from the project site.

D. Preinstallation Conference: Conduct conference at Project Site to comply with requirements of DIVISION 01 SECTION - “Project Meetings”.

1.05 OBSERVATIONS

A. In addition to normal progress observations, schedule, and conduct the following formal observations to verify compliance with the specifications, giving the Landscape Architect at least 24 hours prior notice of readiness for observation.

B. Trees and Shrubs: The Landscape Architect shall observe the trees and shrubs at site before planting for compliance with requirements for genus, species, variety, size, and quality.
   1. If the Contractor requests, the Landscape Architect may observe plant materials at place of growth or storage.
   2. The Contractor shall notify the Landscape Architect 72 hours in advance of when plant material is to be delivered and shall furnish an itemized listing of the actual quantities and size of plant materials to be observed at the point of delivery.
   3. Landscape Architect retains the right to further observe trees and shrubs for size and conditions of balls and root systems, insects, injuries, and latent defects, and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected plants immediately from project site and replace at the Contractor's expense with approved materials.
   4. Landscape Architect further retains the right for:
      a. Observation of labels and the condition of all items delivered to the site.
      b. Observation of any repairs or replacements necessary.
      c. Observe the staking for all trees and shrubs prior to planting.
      d. Observation of bed preparation prior to planting of trees and shrubs.
      e. Observation of plant material at end of plant warranty period.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Provide freshly dug trees and shrubs. Do not prune prior to delivery. Provide adequate protection of root systems and balls from drying winds and sun. Do not bend or bind-tie trees or shrubs in such a manner as to damage bark, break branches, or destroy natural shape. Provide protective covering during delivery. Do not drop balled and burlapped stock during delivery.

B. Deliver trees and shrubs after preparations for planting have been completed, and plant immediately. If planting is delayed more than 6 hours after delivery, set trees and shrubs in shade, protect from weather and mechanical damage, and keep roots moist as follows:
   1. Heel-in bare root stock. Soak roots in water for 2 hours if dried out.
   2. Set balled stock on ground and cover ball with soil, peat moss, sawdust or other acceptable material.
   3. Do not remove container-grown stock from containers until planting time.
   4. Periodically water root systems of trees and shrubs stored on site using a fine mist spray. Water often to maintain root systems in a moist condition.

C. Replacements: In the event of damage or rejection, immediately make all repairs and replacements necessary to the approval of the Landscape Architect and at no additional cost to the Owner.

1.07 JOB CONDITIONS

A. Utilities: determine location of underground utilities and perform work in a manner which will avoid possible damage, hand excavate if conditions require. Maintain grade stakes set until removal is mutually agreed upon by parties concerned.

B. Excavation: When conditions detrimental to plant growth are encountered, such as pebble fill, adverse drainage conditions, or obstructions, notify Landscape Architect before planting.

C. Sequencing and Scheduling:
   1. Planting Time: Proceed with, and complete landscape work as rapidly as portions of site become available, working within seasonal limitations for each kind of landscape work required.

2. All planting shall be performed during favorable weather conditions. The planting operations shall not be performed during times of extreme drought, when ground is frozen, or during times of other unfavorable climatic conditions unless otherwise approved by the Landscape Architect. The Contractor assumes full and complete responsibility for all such plantings and operations.
3. Plant frost-tender trees and shrubs only after danger of frost is past or sufficiently before frost season to allow for establishment before first frost. Do not plant in frozen ground.
4. Dig, ball and burlap deciduous plants only when dormant (before March 15 and after October 15). Such plants may be planted at any time during the same year, subject to the other requirements of the specification.
5. Evergreen plants may be planted in the spring until new growth appears or after new growth has hardened off and any time between September 15 and November 30. If the plants have not been dug, they should not be planted until new growth has hardened off.
6. Recommended dates for tree and shrub planting shall be March 15 - May 31 and September 15 – October 31st or as approved by the Landscape Architect.

D. Plant trees and shrubs after final grades are established and prior to planting of lawns, unless otherwise acceptable to the Landscape Architect. If planting of trees and shrubs occur after lawn Work, protect lawn areas and promptly repair damage to lawns resulting from planting operations.
E. Correlate planting with specified maintenance periods to provide maintenance from date of Substantial Completion.
F. Coordination: All planting work shall be coordinated with all other work included in this contract.

1.08 SPECIAL PROJECT WARRANTY

A. General Warranty: Warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
B. Special Warranty: Warrant the following living planting materials for a period of one (1) year after date of Substantial Completion, against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by the Owner, abnormal weather conditions unusual for warranty period, or incidents that are beyond the Contractor’s control.
   1. Trees
   2. Shrubs
C. Immediately prior to plant warranty observation, the Contractor will be responsible for the removal of all staking material on site.
D. Replacement Trees and Shrubs: The Contractor shall replace once, without cost to Owner, and as soon as weather conditions permit, and within a specified planting period, all dead plants and all plants not in a vigorous, thriving condition as determined by the Landscape Architect during and at the end of the warranty period. The plants shall be free of dead or dying branches and branch tips, and shall bear foliage of a normal density, size, and color.
E. Replacements shall closely match adjacent specimens of the same species. Replacements shall be subject to all requirements stated in the Specifications.
F. The Contractor shall make all necessary repairs to other site and project features due to plant replacements. Such repairs shall be done at no cost to the Owner.

G. Materials and Operations: All replacements shall be plants of the same kind and size specified in the plant schedule. They shall be furnished and planted as specified. The cost shall be borne by the Contractor. After Substantial Completion replacements resulting from the removal, loss, or damage due to occupancy of the project site, vandalism, or acts or neglect on the part of others, or physical damage by animals, may be approved and paid for by the Owner.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide nursery-grown trees and shrubs, grown in a recognized nursery in accordance with good horticultural practice, with healthy root systems developed by transplanting or root pruning. Provide only healthy, vigorous stock grown under climatic conditions similar to conditions in the locality of the Project and free of disease, insects, eggs, larva, and defects such as knots, sun scald, injuries, abrasions, or disfigurement.

B. Provide trees and shrubs of the sizes indicated in planting list and in accordance with dimensional requirements of ANSI Z60.1 for kind and size of trees and shrubs required. Trees and shrubs of larger size than indicated may be used if acceptable to Landscape Architect.

C. Label each tree and shrub with a securely attached waterproof tag bearing legible designation of botanical and common name.

D. Nomenclature: Scientific and common names used for plants are generally in conformity with "Standardized Plant Names." The names of varieties are generally in conformity with the names accepted in nursery trade.

E. Plant material size and measurements shall conform to the “American Standard for Nursery Stock”, ANSI Z60.1-1986.

F. Digging, wrapping, and shipping:

1. Plants shall be dug up and prepared for shipment in a manner that will not cause damage to the branches, shape and future development of the plants after replanting. All plant material being transferred more than two miles shall be covered.

2.02 TREES

A. Trees shall not be pruned before delivery. Trees, which have a damaged or crooked leader or multiple leaders, unless otherwise specified, will be rejected. Trees with abrasion of bark, sunscalds, disfiguring knots, or fresh cuts of limbs over 1 inch in diameter which have not completely calloused will be rejected.

1. Plants shall be measured when branches are in a normal position. If a range of size is given, no plants shall be less than the minimum size and not less than 50% of the plants shall be as large as the upper half of the range specified. The measurements specified are the minimum size acceptable and are the measurements after pruning where pruning is required. Plants that meet the measurements specified, but do not possess a normal balance between height and spread will be rejected.
2. Plants shall be true to species and variety and shall conform to measurements specified in the Plant Schedule except that plants larger than specified may be used if approved by the Landscape Architect. Use of such plants shall not increase the contract price. If larger plants are approved, the ball of earth shall be increased in proportion to the size of the plant according to ANSI Z60.1-1986.

B. Balled and Burlapped Plants:

1. All plants designated "B&B" in the Plant Schedule shall be adequately balled with firm natural balls of earth of a diameter and depth no less than that specified in ANSI 60.11986. Balls shall be firmly wrapped with burlap. All plants which are 2" in caliper or over shall be drum laced. No balled plants shall be planted if the ball is cracked or broken either before or during the process of planting.
2. Container grown plants will be acceptable in lieu of balled and burlapped deciduous plants subject to specified limitations of ANSI Z60.1 for container stock.

C. Protection against drying:
1. Root balls shall be adequately protected at all times from sun and from drying winds. All balled and burlapped plants which cannot be planted immediately upon delivery shall be set on the ground and well protected with soil or other acceptable material. Plants shall not remain unplanted for longer than 3 days after delivery.

D. Where shade trees are required, provide single stem trees with straight trunk and intact leader, free of branches to a point about 50% of their height for the size and kind of trees required.

E. Where small trees of upright or spreading type are required, provide trees with single stem, branched or pruned naturally according to species and type:
1. Where indicated as "multi-stem," provide trees with three canes starting from the ground.

F. Except as otherwise specified or indicated, provide bare root trees. Where indicated as "B&B," provide balled and burlapped trees:
1. Container-grown trees will be acceptable in lieu of balled and burlapped deciduous trees, subject to the specified limitations for container stock.

2.03 DECIDUOUS SHRUBS

A. Provide shrubs of height and size indicated or specified.

B. Provide with not less than the minimum number of canes required by ANSI Z60.1 for the type and height of shrub required.

C. Except as otherwise specified or indicated, provide bare root shrubs. Where specified or indicated as "B&B," provide balled and burlapped shrubs.
1. Container-grown shrubs will be acceptable in lieu of balled and burlapped shrubs subject to specified limitations for container- grown stock.

2.04 CONIFEROUS AND BROADLEAF EVERGREENS

A. Provide evergreens of sizes indicated or specified. Dimensions indicate minimum spread for spreading and semi-spreading evergreens and height for all other types, such as globe, dwarf, cone, pyramidal, broad up-right, and columnar. Provide evergreens with well-balanced form complying with requirements for other size relationships to the primary dimension.

B. Normal quality evergreens unless indicated as "specimen." Where indicated as "specimen," provide exceptionally heavy, well-shaped evergreens of Heavy Grade XXX. C. Provide balled and burlapped evergreens.
1. Container-grown evergreens will be acceptable subject to the specified limitations for container-grown stock.

2.05 TOPSOIL

A. Soil Mix: ASTM D 5268, pH range of 5.5 to 7, 4 percent organic material minimum, free of stones 1/2 inch or larger in any dimension, subsoil, clay lumps, roots, brush, weeds, weed seed, and other extraneous or toxic materials harmful to plant growth. Mix shall contain maximum soluble salts of 500 PPM.

B. Soil Source: Reuse surface soil stockpiled on the site. Verify suitability of surface soil to produce topsoil meeting requirements and amend when necessary. Supplement with imported topsoil when quantities are insufficient. Clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.

2.06 SOIL AMENDMENTS

A. Spaghnum Peat Moss: Peat moss shall be Canadian Sphagnum Peat Moss, which is a light brown, fluffy material. Do not use hypnum, Michigan, or reed sedge peats.

B. Mulch: Aged, shredded hardwood mulch that is free from deleterious materials shall be used for top dressing of trees or shrubs. Size of particles may vary from minimum of ¼ inch to maximum of 2 inches.

C. Commercial Fertilizer: Fertilizer shall be of the grade, type and form specified below and shall comply with the rules of the local governing authority and the following requirements:
   1. The grade of fertilizer will be identified according to the percentage of nitrogen (N), percent available phosphoric acid (P2O5) and percent water soluble potassium (K2O), in that order and approval will be based on that identification.
   2. Fertilizer shall be of a type that can be uniformly distributed either by hand or application equipment.
   3. Fertilizer shall be furnished in dry form.
   4. Fertilizer may be either homogenized or natural organic with at least 25 percent of the total nitrogen in a slow-release form.
   5. Deliver fertilizer in original, unopened and undamaged containers showing weight, analysis and name of manufacturer. Store in manner to prevent wetting and deterioration.

D. Fertilizer applications shall be provided as follows:
   1. For trees and shrubs: Fertilizer shall be 20-10-5 Planting Tablets, and shall be incorporated according to the manufacturer's directions and at the following rates:
      a. Trees: Use 1 21-gram tablet for each 1/2-inch of trunk diameter for each foot of height or spread. Insert 21-gram tablets around the dripline
      b. Shrubs: Use 1 to 2 tablets for each 1 foot of height or spread of shrubs and large perennial grasses.

2.07 MISCELLANEOUS MATERIALS

A. Steel Edging: Commercial steel edging fabricated in sections with loops pressed from or welded to face to receive stakes. Edging tobe 1/8” thick x 4” wide x 10’ lengths, hot rolled low carbon steel (ASTM-A-36, ASTM-A-283, ASTM-A-569), treated with rust preventative and factory finished, (submit sample). Provide minimum 12” integral anchor stakes.

B. Shredded hardwood mulch: Double ground aged brown hardwood mulch.

C. Tree Wrap: Material used in wrapping tree trunks shall be waterproof crepe paper or burlap strips as made and sold for this purpose and shall not be less than 4" or more than 8" wide having qualities to resist insect infestation. Twine for tying shall be a lightly tarred medium or coarse sisal yarn.

D. Pre-Emergent Herbicide. Provide a granular pre-emergent herbicide formulated to prevent germination of weed seeds, suitable for application in landscaped areas as per manufacturer’s recommendations

E. Tree Stakes and Guys:
   1. All trees shall be staked with 3 metal “T” posts. Stakes shall be approximately 2" wide and 6-6.5 feet long. Stakes are to be driven a minimum of 2 feet into undisturbed stable earth.

2. Tree Ties: An acceptable tree tie is one that is easily adjustable, strong in all weather, and is easily attached and removed. Hose and wire are not acceptable for staked trees.

F. Ornamental Aggregate: Provide washed river rock, nominal size 1”-3”, submit sample for final approval by Owner.

G. Water: Upon request of the Contractor, the Owner may approve the use of water from existing hydrants for this work. The Owner may pay for the cost of the water. The Contractor shall provide all needed hose, sprinkler heads and other appurtenances. If the Contractor provides his own water, it shall not contain material injurious to plant growth.

H. Anti-Desiccant: Emulsion type, film-forming agent designed to permit transpiration, but retard excessive loss of moisture from plants. Deliver in manufacturer's fully identified containers and mix in accordance with manufacturer's instructions.

I. Biostimulant: The Contractor shall utilize an organic, biological fungi for soil prep. The material shall be granular and applied according to the manufacturer’s recommendation.

J. Filter Fabric: Geotextiles shall be manufactured from randomly oriented synthetic long chain or continuous polymeric filaments or yarns (such as polypropylene, polyethylene, polyester, polyamide, or polyvinylidene-chloride) bonded together by the needle punched process. In addition, one side may be slightly heat-bonded. The geotextile shall be formed into a stable network of filaments or yarns that retain their relative position to each other; are inert to commonly encountered chemicals; and are resistant to ultraviolet light, heat, hydrocarbons, mildew, rodents and insects. The geotextile shall be free of any chemical treatment or coating the might significantly reduce its permeability and shall have no flaws or defects that significantly alter its physical properties.

K. All other materials, not specifically described but required for a complete and proper installation or construction, shall be as selected by the Contractor subject to the approval of the Landscape Architect.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection:
1. Prior to all landscape installation, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
2. Weeds that have emerged or persisted shall be removed or eradicated.
3. Verify that planting may be completed in accordance with the original design and the referenced standards.

B. Discrepancies:
1. In the event of discrepancy, immediately notify the Landscape Architect.
2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 PREPARATION FOR PLANTING OF TREES AND SRUBS

A. Planting Soil Preparation:
1. Before mixing, clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.

2. Mix soil amendments and fertilizers with topsoil at rates indicated. Delay mixing fertilizer if planting does not follow placing of planting soil within two (2) days.
3. Schedule of Plantings Soil Mixture Requirements
   a. For planting beds, provide not less than the following quantities of specified materials:
      (1) Loose peat humus by volume: 1part
      (2) Well-rotted composted manure by volume: 1 part
      (3) Topsoil (as defined in this specification): 2 parts
      (4) Fertilizer: Incorporate 3 lbs/100sf
   b. For backfill for trees provide specified materials in not less than the following quantities:
      (1) Loose peat humus by volume: 1 part
      (2) Well-rotted cow manure by volume: 1 part
      (3) Topsoil (as defined in this specification): 3 parts
      (4) Place fertilizer tablet in bottom of tree pit.

B. Unless directed by the Landscape Architect, the indication of a plant on the Planting Plan is to be interpreted as including the digging of a hole, furnishing of a plant of the specified size, the work of planting, wrapping and other activities where called for.

C. Planting Coordination:
1. Consult the Plant Schedule for type and size of Trees and Shrubs.
2. The Contractor shall be responsible for selection and tagging at nurseries stocking the specified materials.
3. Contractor shall inform the Landscape Architect three (3) days in advance of when planting will commence, and of anticipated delivery date of material and will furnish an itemized listing of actual quantities of plant materials to be delivered. Failure to notify the Landscape Architect in advance, in order to arrange proper scheduling, may result in loss of time or removal of any plant or plants not installed as specified or directed.

D. Plant Location Staking:
1. The Contractor shall stake on the ground the beginning and ending points of all straight rows of plant materials. Rows will be parallel to adjacent walks, walls, or curbs.
2. The Contractor will stake locations of each plant in all random arrangements of plant materials (with the exception of groundcovers, and annual and perennial flowers) or may set the plants in their intended location, according to the arrangements shown on the plans.
3. The Landscape Architect will observe all plant locations. The Contractor shall not begin excavating plant pits until plant locations have been approved.
4. In case underground obstruction or utilities are encountered, locations shall be changed under the direction of the Landscape Architect without extra charge to the Owner.

3.03 EXCAVATION FOR TREES AND SHRUBS

A. Holes for trees shall be a minimum of 1.5 times greater in diameter than the spread of the root ball and at least 3 inches deeper than the root ball. Holes for shrubs and groundcover shall be a minimum of 1.5 times greater than the spread of the root ball or plant container and at least 3 inches deeper than the bottom of the roots. Thoroughly spade slice the walls and the floor of all planting pits.

B. Testing Plant Materials Holes: If stone, underground construction work, tree roots, poor drainage or obstructions are encountered in the excavation of plat pits, alternate locations may

be selected by the Landscape Architect. Where locations cannot be changed as determined by the Landscape Architect, submit cost required to remove the obstructions to a depth of not less than 6 inches below the required pit depth.

C. Excavate pits, beds, and trenches with vertical sides and with bottom of excavation slightly raised at center to provide proper drainage. Loosen hard subsoil in bottom of excavation:
   1. For bare-root trees and shrubs, make excavations as detailed.
   2. For balled and burlapped trees and shrubs, make excavations as detailed.
   3. For container-grown stock, excavate as specified for balled and burlapped stock, adjusted to size of container width and depth.
   4. Where drain tile is indicated or required under planted areas, excavate to top of porous backfill over tile.
   5. Obstructions: If rock, underground construction, or other obstructions are encountered in excavation for planting of trees or shrubs, notify Landscape Architect. New locations may be selected by Landscape Architect or Change Order may be issued to direct removal of obstructions to depth of not less than 6 inches below required planting depth.
   6. Drainage: If subsoil conditions indicate retention of water in planting areas, as shown by seepage or other evidence indicating presence of underground water, notify Landscape Architect before backfilling. A Change Order may be issued to direct installation of drain tile or other measures beyond drainage requirements indicated.

3.04 PREPARATION OF PLANTING SOIL

A. Before mixing, clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful or toxic to plant growth.
B. Mix soil amendments and fertilizers with topsoil. Delay mixing of fertilizer if planting will not follow placing of planting soil within a few days.
C. For pit- or trench-type backfill, mix planting soil prior to backfilling and stockpile at site.
D. Setting and Backfilling:
   1. Set balled and burlapped stock on layer of compacted planting soil mixture, plumb and in center of pit or trench with top of ball at same elevation as adjacent finished landscape grades. Remove burlap from sides and tops of balls, but do not remove from under balls. When set, place additional backfill around base and sides of ball, and work each layer to settle backfill to eliminate voids and air pockets. When excavation is approximately two thirds full, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing final layer of backfill.
   2. Set bare-root stock on cushion of planting soil mixture. Spread roots and carefully work backfill around roots by hand and puddle with water until backfill layers are completely saturated. Plumb before backfilling and maintain plumb while working backfill around roots and placing layers above roots.
   3. Set container grown stock as specified for balled and burlapped stock, except cut cans on two sides. Carefully remove containers so as not to damage root balls.
   4. Move or set large specimen trees with crane or other recognized tree moving equipment.
   5. Plant Pits
      a. Around the perimeter of the plant pit, build a watering saucer 4 inches above the crown of the plant and shape and slope the surface away from the top of the saucer, approximately 18 inches wide down to existing grade.
      b. Treat entire plant pit or bed with herbicide in accordance with manufacturer's recommendations.

6. Mulching: Apply the specified mulch to a depth as shown on plans, evenly spread over the entire area of each soil basin or plant bed area.
7. Apply antidesiccant using power spray to provide an adequate film over trunks, branches, stems, and twigs for foliage. If deciduous trees or shrubs are moved in full-leaf, spray with antidesiccant at nursery before moving and again 2 weeks after planting.
8. Prune, thin out, and shape trees and shrubs in accordance with standard horticultural practice. Prune shrubs to retain natural character and accomplish their use in the landscape design. Required shrub sizes indicated or specified are the size after pruning.
9. Remove and replace excessively pruned or misformed stock resulting from improper pruning.
10. Paint cuts over 13 mm (1/2 inch) in size with standard tree paint or compound, covering all exposed, living tissue. Use paint which is waterproof, antiseptic, adhesive, elastic, and free of kerosene, coal tar, creosote, and other substances harmful to plants. Do not use shellac.
11. Guy and stake trees immediately after planting and as indicated.
12. Wrap tree trunks of 50-mm (2-inch) caliper and larger. Start at ground and cover trunk to height of first branches and securely attach. Inspect tree trunks for injury, improper pruning, and insect infestation. Take corrective measures required before wrapping.

3.05 INSTALLATION OF MISCELLANEOUS MATERIALS

A. Shredded Hardwood Mulch:
   1. Apply shredded hardwood mulch over the entire area of each soil basin, on all exposed soil surfaces within the perimeter of groupings or rows of trees or shrubs.
   2. The Contractor shall determine his own quantities based on the area, the work and site investigations.
   3. Provide a minimum depth per plans for all trees and shrubs.
B. Steel Edging: Install per plan locations following manufacturer requirements.
C. Filter Fabric: Install per plan locations following manufacturer requirements.
D. Ornamental Aggregate: Install per mow edge areas identified per plan.

3.06 MAINTENANCE

A. Begin maintenance immediately after planting. Maintenance shall continue until time of Substantial Completion, but in no case for less than a period of six months after Substantial Completion.
B. Maintain trees and shrubs by pruning, watering, cultivating, mulching, and weeding for healthy growth. Restore planting saucers. Tighten and repair stake and guy supports and reset trees and shrubs to proper grades or vertical position. Restore or replace damaged wrappings. Spray to keep trees and shrubs free from disease and insects when symptoms are shown. Plants shall be inspected at least once per week by the Contractor and needed maintenance performed promptly.
C. Remove and replace trees and shrubs found to be dying, dead, or in unhealthy condition during the warranty period. Make replacements during the growth season following end of warranty period. Replace trees and shrubs which are in doubtful condition at end of warranty period.

3.07 CLEAN-UP AND PROTECTION

A. During landscape work, keep pavements clean and work area in an orderly condition. Properly dispose of all resultant dirt, debris, and other waste material.

B. Protect landscape work and materials from damage due to landscape operations, operations by other Contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed by the Landscape Architect at no additional cost, unless damage is the result of vandalism.
C. Disposal of Surplus and Waste Materials: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of it off the Owner's property.

3.08 OBSERVATION AND ACCEPTANCE

A. When landscape work is completed, including maintenance, Landscape Architect will, upon request, make an observation to determine acceptability.
    1. Landscape work may be observed for acceptance in portions as agreeable to Landscape Architect, provided each portion of work offered for observation is complete, including maintenance.
B. When observed landscape work does not comply with requirements, replace rejected work and continue specified maintenance until approved by Landscape Architect and found to be acceptable. Remove rejected plants and materials promptly from project site.
C. Trees, shrubs, groundcover, and all other specified plants are to be inspected to certify that all plants have been installed according to plans and are acceptable. Upon satisfactory completion of all replacements and repairs requested, Landscape Architect shall certify granting of Substantial Completion. The warranty will begin on the date of Substantial Completion. Contractor to continue maintenance of all plants for twelve months following Substantial Completion. At end of six 6) month maintenance period, Landscape Architect will inspect plants upon written request by Contractor. Any plant that is dead, or not in satisfactory health as determined by the Landscape Architect will be replaced by the Subs at no cost to the Owner. The Contractor will not be responsible for vandalism or theft.

END OF SECTION 32 93 00

SECTION 32 93 13 - GROUND COVER AND PLANTS

PART 1 - GENERAL

1.01 SUMMARY

A. This SECTION includes ground cover and plants as indicated on Drawings and in schedules. Types of plantings required include the following:
   1. Ground cover
   2. Container Grasses

1.02 REFERENCES

A. Applicable Standards:
   1. American National Standard Institute (ANSI):
      a. ANSI Z60.1 - American Standard for Nursery Stock.
   2. American Society for Testing and Materials (ASTM):
      a. A48/A48M - Gray Iron Castings.

1.03 SUBMITTALS

A. Submit as specified in DIVISION 01.

B. Product Certification: Submit certificates of inspection as may be required by governing authorities to accompany shipments. For standard products, submit manufacturer's certified analysis. For other materials, submit analysis by a recognized laboratory made in accordance with methods established by Association of Official Agricultural Chemists, wherever applicable.

C. Planting Schedule: Submit proposed planting schedule indicating anticipated dates and locations for each type of planting.

D. Maintenance Instructions: Submit instructions recommending procedures to be established by Owner for maintenance of ground cover and plants during entire year. Submit prior to expiration of required maintenance periods.

1.04 QUALITY ASSURANCE

A. Comply with applicable federal, state, county, and local regulations governing landscape materials and Work.

B. Employ only experienced personnel familiar with required Work.

C. Do not make substitutions of ground cover and plant materials. If required materials are not obtainable, submit proof on nonavailability to Landscape Architect, together with proposal for use of equivalent materials.

D. Provide quantity, size, genus, species, and variety of plants as indicated and scheduled and complying with applicable requirements of ANSI Z60.1.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver plants until site conditions are ready for planting. If planting is delayed, heel-in bare rooted or freshly dug plants in bed containing adequate peat moss, or other suitable moisture holding material, to keep roots moist. Separate bundles and trim roots, if long or damaged, using sharp pruning shears. Place plants in flats, pots, or other containers in sheltered location protected from sun, wind, and mechanical damage. Keep roots moist using fine mist spray.

PART 2 - PRODUCTS

2.01 PLANT MATERIALS

A. Ground Cover: Established and well-rooted in pots or similar containers, complying with ANSI Z60.1 and following requirements:
   a. Pot size of 56 mm (2-1/4 inches) with minimum of two runners, not less than 100 mm (4 inches) long.
   b. Pot size of 75 mm (3 inches) with minimum of three runners not less than 150 mm (6 inches) long.
   c. Pot size of 100 mm (4 inches) with minimum of four runners not less than 200 mm (8 inches) long.

B. Container Grasses: Healthy, field-grown plants from a commercial nursery.
   a. Refer to schedule on planting plans, for type, size and condition

2.02 TOPSOIL

A. Soil Mix: ASTM D 5268, pH range of 5.5 to 7, 4 percent organic material minimum, free of stones 1/2 inch or larger in any dimension, subsoil, clay lumps, roots, brush, weeds, weed seed, and other extraneous or toxic materials harmful to plant growth. Mix shall contain maximum soluble salts of 500 PPM.

B. Soil Source: Reuse surface soil stockpiled on the site. Verify suitability of surface soil to produce topsoil meeting requirements and amend when necessary. Supplement with imported topsoil when quantities are insufficient. Clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.

2.03 SOIL AMENDMENTS

A. Spaghnum Peat Moss: Peat moss shall be Canadian Sphagnum Peat Moss, which is a light brown, fluffy material. Do not use hypnum, Michigan, or reed sedge peats.

B. Mulch for planting beds: Double ground aged shredded hardwood mulch that is free from deleterious materials shall be used for top dressing of planting areas. Size of particles may vary from minimum of ¼ inch to maximum of 2 inches, within planting bed areas.

2.04 MISCELLANEOUS MATERIALS

A. Pre-Emergent Herbicide. Provide pre-emergent herbicide Pre M 60 DG (granular). The Landscape Architect will consider an “equivalent” of the brand name specified. Provide the Landscape Architect with a complete description, literature, test reports, etc. on the proposed “equivalent”. The burden of proof regarding the “equivalent” is upon the Contractor. The Landscape Architect will accept the pre-emergent herbicide based on brand name and visual inspection for condition.

2.05 BIOSTIMULANT

A. The Contractor shall utilize an organic, biological fungi for soil prep. The material shall be granular and applied per manufacturer’s recommendation from Myke.

PART 3 - EXECUTION

3.01 PREPARATION OF PLANTING BEDS

A. Prepare planting beds after frost has left ground and when relatively dry.

B. Loosen subgrade of planting bed areas to minimum depth of 6 inches using a cultimulcher or similar equipment. Remove stones over 1/2 inches in any dimension, and sticks, rubbish, and other extraneous matter.
C. Mix soil amendments and fertilizers with topsoil at rates specified. Delay mixing of fertilizer if planting will not follow placing of planting soil within a few days.
D. Spread planting soil mixture to minimum depth required to meet lines, grades, and elevations shown, after light rolling and natural settlement. Do not place frozen material, or place soil if subgrade is frozen. Place approximately one-half of the total amount of planting soil required. Work into top of loosened subgrade to create a transition layer, then place remainder of the planting soil.

3.02 INSTALLATION OF PLANT MATERIALS

A. Layout individual ground cover, plant locations, and areas for multiple plantings. Stake locations, outline areas, and secure Landscape Architect's acceptance before starting planting work. Make minor adjustments to layout as may be requested by Landscape Architect. B. Plant Installation, Including Ground Cover:
   1. Space plants as indicated, scheduled, or specified.
   2. Dig holes large enough to allow for spreading of roots. Backfill with planting soil.
   3. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
   4. Water thoroughly after planting, taking care not to cover crowns of plants with wet soil.
   5. Protect from hot sun and wind; remove protection when plants show evidence of recovery from transplanting shock.
   6. Mulch areas between plants in areas per plans and according to details for depth of mulch cover.

3.03 INSTALLATION OF MISCELLANEOUS MATERIALS

A. Install edging where indicated. Anchor with steel stakes spaced not more than 1 meter (3 feet) oc and drive at least 25 mm (1 inch) below top elevation of edging.
B. Place mulch and geotextile fabric as indicated. Compact soil subgrade before placing gravel. Fill or remove excess soil to bring indicated thickness of bed to required elevation:

3.04 MAINTENANCE

A. Maintain plants by watering, weeding, fertilizing, and other operations to establish healthy, viable plantings for a period of 6 months after Substantial Completion.
B. Remove and replace ground cover and plants found to be dead or in unhealthy condition during the warranty period. Make replacements during growth season following end of maintenance period. Replace ground cover and plants which are in doubtful condition at end of maintenance period; unless, in opinion of Landscape Architect, it is advisable to extend warranty period for a full growing season.

END OF SECTION 32 93 13

SECTION 33 01 30.19 - TEMPORARY BYPASS PUMPING SYSTEMS FOR SEWER PIPELINES

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes requirements for implementing a temporary pumping system for the purpose of diverting existing sewage flow around work area as needed.

B. The Contractor is required to furnish all materials, labor, equipment, power, maintenance, planning, permitting, etc., to implement a temporary pumping system for the purpose of diverting the existing sanitary sewer flows around the work area.

C. The design, installation, and operation of the temporary pumping system shall be the Contractor's responsibility.

D. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.

E. The bypass system is proposed at the existing Todd Creek interceptor to maintain service to the existing interceptor during the tie-in to the proposed Todd Creek Wastewater Treatment Plant.

1.02 QUALITY ASSURANCE:

A. Follow national standards and as specified herein.

B. Perform leakage and pressure tests on discharge piping using clean water before operation. Notify Engineer twenty-four (24) hours prior to testing.

C. Maintain and inspect temporary pumping system every two (2) hours. Responsible operator must be on site when pumps are operating.

D. Keep and maintain spare parts for pumps and piping on site, as required.

E. Maintain adequate hoisting equipment and accessories on site for each pump.

1.03 BYPASS PUMPING PLAN:

A. The Contractor shall prepare a specific, detailed description of the proposed pumping system (Bypass Pumping Plan).

B. The Bypass Pumping Plan shall be submitted and accepted prior to the mobilization of any of the equipment included in the Bypass Pumping Plan.

C. The plan shall include but not limited to the following details:

1. Plan indicating location of bypass pumping lines, pumps, and generators
2. Staging areas for pumps
3. Sewer plugging method and types of plugs
4. Number, size, material, location, and method of installation of suction piping and discharge piping
5. Bypass pump sizes, capacity, and number of each size to be on site and power requirements
6. Calculations of static lift, friction losses, and flow velocity (pump curves showing pump operating range shall be submitted)
7. Standby power generator size and location
8. Downstream discharge plan
9. Procedures to monitor upstream mains for backup impacts
10. Method of protecting discharge manholes or structures from erosion and damage
11. Thrust and restraint block sizes and locations
12. Sections showing suction and discharge pipe depth, embedment, select fill and special backfill
13. Method of noise control for each pump and/or generator
14. Any temporary pipe supports and anchoring required

15. Design plans and computation for access to bypass pumping locations indicated on the drawings
16. Calculations for selection of bypass pumping pipe size
17. Schedule for installation of and maintenance of bypass pumping lines
18. Emergency plan detailing procedures to be followed in event of pump failures, sewer overflows, service backups, and sewage spillage.
    a. Maintain copy of emergency plan on site for duration of project.

1.04 DELIVERY AND STORAGE:

A. Transport, deliver, handle, and store pipe, fittings, pumps, ancillary equipment and materials to prevent damage and follow manufacturer's recommendations.
B. Inspect all material and equipment for proper operation before initiating work.
C. Material found to be defective or damaged due to manufacturer or shipment.
    1. Repair or replacement of defective or damaged material and equipment will be at no cost to Owner.

PART 2 - PRODUCTS

2.01 PUMPS:

A. Temporary bypass pumping shall be a continuous operation. Interruptions due to power outages or any other reason shall not be permitted.
B. All pumps used shall be fully automatic, dry-prime, self-priming units that do not require the use of foot-valves or vacuum pumps in the priming system.
C. The pumps may be electric or diesel powered.
D. All pumps used must be constructed to allow dry running for long periods of time to accommodate the cyclical nature of effluent flows.
E. The Contractor shall provide the necessary stop/start controls for each pump.
F. The Contractor shall include one (1) stand-by pump of each size to be maintained on site.
    1. Back-up pumps shall be on-line, isolated from the primary system by a valve.

2.02 DISCHARGE AND SUCTION PIPING:

A. To prevent the accidental spillage of flows all discharge systems shall be temporarily constructed of rigid pipe with positive, pressure tight, restrained joints.
B. Discharge hose will only be allowed in short sections and by specific permission from the Engineer.
C. Flexible Hoses and Associated Couplings and Connectors:
    1. Abrasion resistant.
    2. Suitable for intended service.
    3. Rated for external and internal loads anticipated, including test pressure.
    4. When subject to traffic loading, compose system, such as traffic ramps or covers.
        a. Install system and maintain H-20 loading requirements while in use or as directed by the Engineer.

2.03 DESIGN REQUIREMENTS:

A. The Contractor shall establish adequate bypass pumping adherent to the conditions in this Specification and anticipate severe weather conditions and increases in peak flows during rain and/or snowmelt events.
    1. Expected max day flow is 5.55 MGD.

B. Available flow data provided (if any), is provided only to the extent such information has been made available to or discovered by the Engineer. It is expected that flow rates have changed since the time data was collected. This information is shown for the convenience of the Contractor but is not guaranteed to be either correct or complete and all responsibility for the accuracy and completeness thereof is expressly disclaimed by Owner and Engineer. The Contractor shall make investigation as necessary to verify correctness and completeness. The Contractor shall, ahead of submitting the Bypass Pumping Plan, verify the actual flow rates of the sanitary sewer segments and designing systems for the actual expected peak flows (including during storm events).
   1. Contractor shall be responsible for coordinating the measurement of primary effluent flows and locations with the Owner.
   2. The Contractor shall provide all pipeline plugs and pumps of adequate size to handle peak flow and temporary discharge piping to ensure that the total flow of the main can be safely diverted around the section to be repaired.
   3. The pumping system shall be of adequate capacity and size to handle at least two (2) times the maximum day flow.
   4. Bypass pumping system shall be designed to be operated twenty-four (24) hours per day.
   5. The Contractor shall have adequate standby equipment available and ready for immediate operation and use in the event of an emergency or breakdown.
      a. One (1) standby pump for each size pump utilized shall be installed at the mainline flow bypassing locations, ready for use in the event of primary pump failure.
   6. Bypass pumping system shall be capable of bypassing the flow around the work area and of releasing any amount of flow up to full available flow into the work area as necessary for satisfactory performances of work.
   7. The Contractor shall make all arrangements for bypass pumping during the time when the main is shut down for any reason. System must overcome any existing force main pressure on discharge.

C. Performance Requirements:
   1. It is essential to the operation of the existing sewerage system that there be no interruption in the flow of sewage throughout the duration of the project.
      a. To this end, the Contractor shall provide, maintain, and operate all temporary facilities such as dams, plugs, pumping equipment (both primary and back-up units as required), conduits, all necessary power, and all other labor and equipment necessary to intercept the sewage flow before it reaches the point where it would interfere with the work, carry it past the Work and return it to the existing sewer downstream of the Work.
   2. The design, installation, and operation of the temporary pumping system shall be the Contractor's responsibility.
   3. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.
   4. The Contractor shall provide all necessary means to safely convey the sewage past the work area. The Contractor will not be permitted to stop or impede the main flows under any circumstances.
   5. The Contractor shall maintain sewer flow around the work area in a manner that will not cause surcharging of sewers, damage to sewers, and that will protect public and private property from damage and flooding.
   6. The Contractor shall protect water resources, wetlands, and other natural resources.

PART 3 - EXECUTION

3.01 FIELD QUALITY CONTROL AND MAINTENANCE:

A. Pressure and Leakage Test:
   1. The Contractor shall perform leakage and pressure tests of the bypass pumping discharge piping using clean water prior to actual operation
      a. A hydrostatic (water) test shall be performed.
      b. Air testing is not an allowable alternative.
   2. The Engineer shall be given at least twenty-four (24) hours' notice prior to testing.
   3. The pressure and leakage test shall be conducted at one-and-a-half times (1.5x) the maximum pressure the system will experience based on the approved Bypass Pumping Plan for a:
      a. Duration of test shall be for a minimum of two (2) hours.

3.02 MONITORING:

A. A responsible monitoring person shall be present when pumps are operating.
   1. The monitoring person shall be properly trained, experienced, and mechanically qualified such that they can quickly and effectively address any potential emergency and non-emergency situations associated with the pumps and bypass pumping system.

3.03 PREPARATION:

A. Precautions:
   1. Contractor is responsible for locating any existing utilities in the area the Contractor selects to locate the bypass pipelines.
   2. The Contractor shall locate bypass pipelines to minimize any disturbance to existing utilities and roadways and shall obtain approval of the pipeline locations from the Engineer.
   3. All costs associated with relocating utilities, closing roads, traffic control, and obtaining all approvals shall be paid by the Contractor.
   4. During all bypass pumping operation, the Contractor shall protect associated Pumping Stations from damage inflicted by any equipment.
      a. The Contractor shall be responsible for all physical damage to associated Pumping Stations caused by human or mechanical failure.

3.04 INSTALLATION AND REMOVAL:

A. The Contractor may remove manhole sections, make connections to the existing sewer, or construct temporary bypass pumping structures only at the access location indicated on the accepted bypass pumping/piping plans.
B. Plugging or blocking of sewage flows shall incorporate a primary and secondary plugging device.
C. When plugging or blocking is no longer needed for performance and acceptance of the Work, it is to be removed in a manner that permits the sewage flow to slowly return to normal without surge, to prevent surcharging or causing other major disturbances downstream.
D. When working inside manhole, sewer lines, or other confined spaces, the Contractor shall exercise caution and comply with OSHA requirements.
E. When the bypass pipeline must cross roads, streets, or driveways, the Contractor must arrange so that at no time, shall bypass pumping or piping systems restrict access to traffic.
   1. The Contractor is responsible for obtaining any approvals for placement of the temporary pipeline within public ways from the appropriate jurisdictional authority.
   2. This may require burying the bypass piping or the use of "road plates".

F. Upon completion of the bypass pumping operations, the Contractor shall remove all plugs, pumps, and piping that was required for the operations.
G. Contractor shall restore all property to pre-construction condition.

3.05 NOTIFICATION:

A. The Contractor shall immediately notify the Owner should a sanitary sewer overflow (SSO) occur and take the necessary action to clean up and disinfect the spillage to the satisfaction of the Owner and/or other governmental agency.

END OF SECTION 33 01 30.19

SECTION 33 11 00 – PRESSURE PIPE

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes all pressure pipe, fittings, specials, and appurtenances.

B. Related Work Specified Elsewhere:

1. Section 09 90 00 - Protective Coatings.
2. Section 33 12 16 - Utility Valves and Accessories.
3. Section 33 31 50 - Pipe Installation.

1.02 REFERENCE STANDARDS:

A. Applicable Standards:

1. American Association of State Highway and Transportation Officials (AASHTO).
2. American Water Works Association (AWWA):
   a. C104 - Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water.
   b. C110 - Ductile Iron and Gray-Iron Fittings.
   c. C111 - Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings.
   d. C115 - Flanged Ductile Iron Pipe with Ductile Iron or Gray-Iron Threaded Flanges.
   e. C150 - Thickness Design of Ductile Iron Pipe.
   f. C151 - Ductile Iron Pipe, Centrifugally Cast, for Water.
   g. C153 - Ductile Iron Compact Fittings.
   h. C200 - Steel Water Pipe 6 Inches and Larger.
   i. C205 - Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 Inch and Larger - Shop Applied.
   j. C207 - Steel Pipe Flanges for Waterworks Service, Sizes 4 Inch Through 144 Inch.
   k. C208 - Dimensions for Fabricated Steel Water Pipe Fittings.
   l. C209 - Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.
   m. C210 - Liquid-Epoxy Coatings and Linings for Steel Water Pipe and Fittings.
   n. C213 - Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
   o. C214 - Tape Coating Systems for Steel Water Pipe.
   p. C215 - Extruded Polyolefin Coatings for Steel Pipe.
   q. C218 - Liquid Coating Systems for the Exterior of Aboveground Steel Water Pipelines and Fittings.
   r. C219 - Bolted, Sleeve-Type Couplings for Plain-End Pipe.
   s. C220 – Stainless Steel Pipe ½ inch and Larger
   t. C303 - Concrete Pressure Pipe, Bar-Wrapped, Steel-Cylinder Type.
   u. C304 - Design of Prestressed Concrete Cylinder Pipe.
   v. C606 - Grooved and Shouldered Joints.
   w. C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings.
   x. M11 - Steel Pipe - A Guide for Design and Installation.
   y. M23 - PVC Pipe-Design and Installation.
   z. M41 - Ductile Iron Pipe Fittings.
3. American National Standards Institute (ANSI):
   a. B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
   b. B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges.
   c. B16.5 – Pipe Flanges and Flanged Fittings
   d. B36.19 – Stainless Steel Pipe
4. ASTM International (ASTM):

a. A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength.
b. A312 – Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipe
c. A403 – Standard Specification for Wrought Austenitic Stainless-Steel Pipe
d. A733 – Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless-Steel Nipples
e. A774 – Standard Specification for Stainless-Steel Pipe Fittings
f. B88-03 - Standard Specification for Seamless Copper Water Tube.
g. D1248 - Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.
h. F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
i. G62 - Standard Test Methods for Holiday Detection in Pipeline Coatings.

5. Federal Specification (FS):
   a. WW-T-799 - Tube Copper, Seamless, Water.
6. National Sanitation Foundation (NSF):
   a. 61 - Drinking Water System Components - Health Effects.
7. Society for Protective Coatings (SSPC):
   a. SP1 - Solvent Cleaning.
   b. SP3 - Power Tool Cleaning.
   c. SP5 - White Metal Blast Cleaning.
   d. SP7 - Brush-Off Blast Cleaning.
   e. SP10 - Near-White Blast Cleaning.
8. American Welding Society (AWS)
9. International Organization for Standardization (ISO)
10. Compressed Gas Association

1.03 SUBMITTALS:

A. Submit as specified in Division 1.
B. Submit the following for acceptance prior to fabrication:
   1. Pipe and joint details.
   2. Special, fitting, and coupling details.
   3. Laying and installation schedule.
   4. Specifications, data sheets, and affidavits of compliance for protective shop coatings and linings.
   5. Manufacturer's design calculations including, but not limited to, wall thickness and deflection under specified live and dead loads.
C. Certificates and Affidavits: Furnish the Following Prior to Shipment:
   1. Affidavit of compliance with applicable standard.
   2. Certificate or origin for all steel flanges. Flanges shall be manufactured in the U.S.A.
   3. Test certificates.

1.04 QUALITY ASSURANCE:

A. Manufacturers shall be experienced in the design and manufacture of pipe, fittings, specials, or appurtenances.
B. All pipe manufactured to AWWA C200 series specifications shall be furnished by a manufacturer certified by the Steel Plate Fabricators Association (SPAA) for steel pipe fabrication.

C. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer.
D. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability. No refurbished material shall be used.

1.05 DELIVERY, STORAGE AND HANDLING:
1. Deliver, store, and handle equipment and materials as specified in Division 1.

PART 2 - PRODUCTS

2.01 PIPE REQUIREMENTS:
A. Furnish pipe of materials, joint types, and sizes as indicated or specified.
B. Pipe shall be designed to withstand all stresses resulting from external loads and internal pressures listed in the table below unless otherwise specified:

Location	Nominal Pipe Size, in	Above Grade Pipe Material	Buried Below Grade Material	Expected Max Working Pressure, psi	Design Max Test Pressure, psi
Screened Influent	20	DIP	DIP or PVC	100	150
Influent Screen Bypass	20	DIP	--	100	150
AGS Influent / Degritted Influent	30	DIP	DIP or PVC	13	20
Grit Slurry	4	DIP	--	33	50
AGS -– Water Level Correction Return	6	DIP	--	33	50
AGS – Sludge Buffer Supernatant Return	8	DIP	--	33	50
AGS – Sludge Buffer WAS Transfer to WAS Holding	4	DIP	DIP or PVC		50

Location	Nominal Pipe Size, in	Above Grade Pipe Material	Buried Below Grade Material	Expected Max Working Pressure, psi	Design Max Test Pressure, psi
ByPass Bypass Thickening to Thick Sludge Holding Tanks	6	DIP	DIP or PVC	33	50
Thickened Sludge Transfer to Thick Sludge Holding Tanks	4	DIP	-----	100	150
Sludge Haul Off Pump Suction	10	DIP	------	20	30
Sludge Haul Off Pump Discharge	8	DIP	DIP--	100	150
AGS Blower Suction Header	24	CS	------	3	5
AGS Air Supply Header	24	CS	------	13	20
AGS Air Supply Dropleg	12	CS	------	13	20
Process Air for Pressurizing WAS Drawoff PipeAGS Air Seal	4	CS	-----	13	20
Thin WAS Blower Suction Header	14	CS	-----	3	5
Thin WAS Blower Supply Header	10	CS	-----	13	20

Location	Nominal Pipe Size, in	Above Grade Pipe Material	Buried Below Grade Material	Expected Max Working Pressure, psi	Design Max Test Pressure, psi
Air Supply-Compressed Air for Large Bubble Mixing for Thickened Sludge Tanks	1.5	SST	-----	100	150
Process Water	4	PVC	PVC	133	200
Sludge	4	DIP	DIP or PVC	33	50
Hydrogen Peroxide Chemical Piping	½"	--	SST	100	150

C. Pipe Marking: All pipe and fittings shall be marked conforming to the applicable standard specification under which the pipe is manufactured and as otherwise specified.

2.02 DUCTILE IRON PIPE:

A. Design and Manufacture of Pipe:
   1. Ductile iron pipe shall conform to AWWA C115, C150 and C151 except as otherwise specified.

B. Dimensions: The minimum thickness as defined by pressure class for mechanical or push-on-type joint ductile iron pipe shall be as described in pipe schedule.
   1. Minimum thickness for ductile iron pipe threaded for screw-on flanges shall be in accordance with AWWA C115.
   2. Pipe with grooved barrel for any type of restrained joint shall have wall thickness increased to provide a minimum wall thickness conforming to AWWA C606 Joints:

C. Joints:
   1. Mechanical and Push-On Type:
      a. Provide mechanical or push-on-type joints for all buried pipe less than 750 mm (30 inches) in diameter unless otherwise specified or indicated. Provide push-on-type joints for sizes 750 mm (30 inches) in diameter and greater.
      b. Joints shall conform to AWWA C111.
   2. Flanged:
      a. Provide flanged joints for all interior and exposed exterior pipe except where otherwise specified or indicated.
      b. Flanges for pipe shall be ductile iron and conform to the applicable provisions of AWWA C110 and C115 and shall be drilled ANSI B16.1 Class 125.
      c. Victaulic type couplings and fittings may be used in lieu of flanged joints. Pipes shall be radius grooved as specified for use with the Victaulic couplings.
   3. Grooved:

a. Provide ductile iron pipe, minimum Class 53, grooved in accordance with AWWA C606. Rigid radius groove dimensions shall be utilized where flexibility is neither required nor desired.
b. Grooved couplings shall be manufactured in two or more segments of cast ductile iron. Gaskets shall be pressure-responsive flush seal type and the elastomeric material (grade) shall be verified as suitable for the intended service. Victaulic Style 31 or engineer approved equal.
c. Grooved flange adapters may be used with AWWA grooved end pipe and fittings, for mating to ANSI Class 125 flanged components. Victaulic Style 341 or engineer approved equal.
d. Grooved couplings may be used as unions or dismantling joints.

4. Sleeved or Coupled:
   a. Provide for sleeves or couplings where indicated.
   b. Furnish pipe ends suitable for receiving style of sleeve or coupling indicated or specified.
   c. Provide anchored couplings where restraint is required to withstand specified operating or hydrostatic test pressure and where indicated.
5. Restrained:
   a. Furnish for all fittings and where joint restraint is required to offset internal pipeline forces.
   b. Provide restrained joints of following approved types:
      (1) Restrained mechanical joint.
      (2) Cut grooved type for rigid joint conforming to AWWA C606.
      (3) Restrained push-on joint.
   c. Mechanical joint retainer glands may be used where joint restraint is required unless otherwise indicated. When indicated, retainer glands shall be Megalug manufactured by EBAA Iron, Inc. or Engineer approved equal.

D. Fittings:
1. Fittings shall conform to AWWA C110 or C153 and shall have a pressure rating of not less than that specified for pipe.
2. Fittings shall be ductile iron.
3. Fittings for pipe with mechanical joint shall have mechanical joints.
4. Fittings for pipe with push-on joints shall be mechanical joint.
5. Fittings for pipe with grooved type joint shall have cut grooved type rigid joints per AWWA C606.
6. Include all specials, taps, plugs, flanges, and wall fittings as required.
7. Provide openings for air valve, drain, sampling, sensing, testing, and other connections with threaded bosses or flange outlets sized and located where indicated.

E. Lining for AGS Effluent, and UV Disinfection Wastewater:
1. All pipe and fittings for shall be cement-mortar lined in accordance with AWWA C104.
2. Refer to Process & Instrumentation Diagrams (P&IDs). Pipe labeled “DIP-C” shall be cement-mortar lined.

F. Lining for Grit Slurry Line as indicated in drawings:
1. Pipe and Fittings:
   a. All pipe and fittings shall be glass lined in accordance with ASTM B1000-15.
   b. The glass lining applied to pipe and fittings shall be hard, smooth, continuous vitreous material which is formulated to prevent the adherence of grease in sludge and scum lines, and to resist the adherence of crystalline metal salt deposits (Struvite and Vivionite) to sludge in sewage and wastewater treatment plants.

c. The glass lining, as supplied from the manufacturer, shall have a density of 2.5 to 3.0 grams per cubic centimeter as measured by ASTM D-792.
d. The entire finished coating shall be a minimum of 10 mils (0.010 inch) as tested with an acceptable Type I or Type II dry film thickness gage as described in ASTM D7091.
e. The finished lining shall be able to withstand a strain of 0.001 inch/inch of the base metal without visible damage to the glass.
f. The glass lining shall have a minimum hardness of 5 on the MOHS hardness scale.
g. The lining shall be capable of withstanding an instantaneous thermal shock from 350°F differential without visible crazing, blistering or spalling.
h. The lining shall be resistant to corrosion of between pH3 and pH10 at 125°F. There shall be no visible loss of surface gloss to the lining after immersing a production sample in an 8 percent sulfuric acid solution at 148 °F for a period of 10 minutes.
i. Factory Testing:
(1) Visual Inspection: The lining shall be of a light, bright color to allow visual detection of defects more easily prior to electronic holiday detection testing. opaque window glass. Pieces with visible pinholes, crazing or fishscales which expose metal shall be rejected.
(2) "Spark Test": The manufacturer shall test all pipe and fittings with a low voltage, wet sponge, non-destructive holiday detection unit. The procedure and acceptance criteria shall be per MP-9.2, Porcelain Enamel Continuity Testing.
(a) The pipe or fitting tested shall be rejected from shipment if testing reveals more than isolated voids due to casting irregularities which represent more than 0.01 percent of the total glassed surface area. Microscopic pinholes detected by the spark test shall be limited to 2 per fitting and 5 per 20 feet of pipe barrel.
(b) Upon request by the Engineer, the manufacturer shall perform jobsite test verification.
(3) Certificates: The manufacturer shall provide certified copies of the test results accompanying each shipment. The test forms shall identify each item by mark number and description and show date of test, inspector identity, and test results.

2. Refer to Process & Instrumentation Diagrams (P&IDs). Pipe labeled "DIP-G" shall be glass lined.

G. Lining for Process, and Raw Wastewater Influent, unless specified elsewhere:
1. Pipe and Fittings:
a. All piping and fittings shall be lined with an amine-cured novalac epoxy containing a minimum of 20% by volume of ceramic quartz pigment. The lining shall be Protecto 401 as manufactured by INDURON Protective Coatings, Birmingham, Alabama or NovoCoat SP-2000W as manufactured by NovoCoat Protective Coatings, Addison, Texas, or approved equal
b. Surface preparation shall consist of grit-shot blasting or sandblasting surface to near-gray finish, comparable to SSPC-SP10.
c. Lining shall be applied within 8 hours of surface preparation. The number of coats of lining applied and the time between coats shall be as recommended by the lining manufacturer.
d. Total Thickness: A nominal 40 mils.

e. Joint surface coating shall be Protecto Joint Compound with Protecto 401 lining system or Novo Coat SP-2000W with Novo Coat lining system. Coal tar is prohibited. Total thickness shall be 6 mils nominal and 10 mils maximum. Flange faces shall not be coated.

f. Testing:

(1) Lining shall be tested over 100% of the pipe barrel and fitting surface with a nondestructive 4,000-volt test.

(2) All holidays shall be repaired per lining manufacturer's recommendation.

(3) A voltage confirmation test shall be performed for each production shift or change in detector operator.

2. Refer to Process & Instrumentation Diagrams (P&IDs). Pipe labeled "DIP-E" shall be epoxy lined.

H. Coating:

1. All iron pipe and fittings shall be coated with manufacturer's standard bituminous paint coating.
2. Flange faces shall be coated in accordance with AWWA C115.

2.03 CARBON STEEL AERATION PIPE:

A. Carbon steel aeration pipe shall be used for interior and exterior piping.

1. All piping, gaskets, couplings, and coatings shall be rated for a temperature of 300 degrees Fahrenheit.
2. Schedule: STD for all pipe sizes.

B. Pipe shall be spiral-weld steel pipe ASTM A139 Grade B21000, STD schedule for all pipe sizes with wall thickness continuous spiral seam welded on inside and outside of pipe, manufactured by Naylor Pipe Company, Armco, or approved equal.

C. Indoor air piping shall be insulated as specified in DIVISION 23.

D. Joints: Shop butt-welded, grooved, or flanged where indicated. Flanges shall be in accordance with ANSI B16.1. Grooved joints shall be in accordance with AWWA C606.

E. Coating: Exposed exterior and exposed interior pipe shall be coated as specified in DIVISION 09.

F. Lining: None.

G. Design of Pipe: Design shall conform to AWWA C200, AWWA M11, and as specified except that hydrostatic test of fitting after fabrication will not be required. Fittings shall be tested by dye penetrant method.

1. Size Indicated or specified shall mean the nominal pipe size.
2. Minimum wall thickness shall be not less than 3/16".

H. Joints:

1. Flanged:
   a. Provide flanged joints for all interior and exposed exterior pipe except where otherwise specified or indicated.
   b. Joints shall conform to AWWA C200 and AWWA C207.
   c. Flanges shall have a pressure rating not less than that required for pipe. Flanges shall be Class D and be drilled ANSI B16.1 Class 125.
   d. Pipe with AWWA C606 grooved type joints may be substituted for Class D flanged pipe.
2. Grooved:
   a. Steel pipe shall be provided with roll-grooved ends per coupling manufacturer's current listed standards.

b. Grooved coupling gaskets for use on aeration piping shall be Grade L Silicone, rated to 350 degrees Fahrenheit.
c. Rigid grooved coupling shall be used to provide system rigidity and support in accordance with ANSI B31.1. Victaulic Style 07/W07 or approved equal.
d. Flexible grooved couplings may be used in locations where thermal movement accommodation and stress relief are required. Victaulic Style 77/W77 or approved equal.

3. Shop welded:
   a. Provide pipe prepared for beveled ends for field-butt welding as indicated or required.
   b. Perform welding by welders qualified in accordance with ANSI B31.1 Paragraph 127.5. Weld piping with wall thickness up to 0.125in with the TIC (GTAW) process. Distribute smooth and evenly weld deposit and provide a crown of no more than 1/16-in on the I.D. and 3/32-in on the O.D. of the piping. Concavity, undercut, cracks, or crevices are not acceptable. Remove excessive weld deposits, slag, spatter, and projections by grinding. Wire-brush outside weld area with brushes of stainless steel that are specifically designed to be used only on stainless steel.
   c. Air Service Coupling:
      (1) Victaulic Style 234 of ASTM A36 carbon steel construction with silicone gasket.
         (a) Restrained type.
         (b) Carbon steel bolts, ASTM A668.
         (c) Maximum pressure: 25 psig.
   d. Air Service Expansion Joint Couplings:
      (1) Victaulic Style 231 Expansion Coupling with silicone gasket.
         (a) Minimum 2” of axial movement accommodation.
         (b) Coupling manufacturer to verify coupling placement and pipe support locations.
      (2) -approved equal.
   e. Pipe supports: see drawings.

2.04 STAINLESS STEEL PIPE:

A. Stainless steel pipe shall be used for all buried air piping and hydrogen peroxide feed tubing.
   1. All aeration piping, gaskets, couplings, and coatings shall be rated for a temperature of 300 degrees Fahrenheit.
   2. Design temperature for hydrogen peroxide stainless steel tubing shall be -20 degrees Fahrenheit to 150 degrees Fahrenheit.
   3. Size indicated or specified shall mean the nominal pipe size.
   4. All pieces shall be clearly marked with gage and type of stainless steel.
   5. Aeration Piping material:
      a. Materials: Type 304 Stainless Steel.
      b. Schedule: STD for all pipe sizes.
      c. Joints: Shop butt welded, flanged where indicated. Flanges shall be in accordance with ANSI B16.1.
      d. Coating: None.
      e. Lining: None.
   6. Hydrogen Peroxide Feed Tubing:
      a. Materials: Type 304 Stainless Steel

b. Schedule: Minimum thickness of 0.035 inches
c. Joints: Socket Weld with Swagelok fittings
d. Coating: None
e. Lining: None

7. Hydrogen Peroxide Carrier Pipe:
   a. Materials: Type 304 Stainless Steel
   b. Schedule: Schedule 10S Minimum
   c. Joints: Shop Butt welded, flanged where indicated. Flanges shall be in accordance with ANSI B16.1.
   d. Coating: None
   e. Lining: None
8. Pipe and fittings used shall be either seamless or welded, austenitic stainless steel Grade 304, conforming respectively to ASTM A312 and ANSI B36.19 and ASTM A403, ANSI B16.9, and shall be suitable for air pipe.
   a. Pipe shall be fabricated by die forming or rolling true to dimension and round within a tolerance of plus or minus 1/16-in. The two edges of sheet shall be brought to line so as not to leave a shoulder on the inside of the pipe. Ends of pipe and fittings shall be perpendicular to the longitudinal axis. Pipe shall be straight within maximum of 1/8-in deviation over 10 feet. All pieces shall be clearly marked with gage and type of stainless steel.
   b. All the pulled tee outlets must be true and perpendicular to the center line axis of the manifolds. Alignment tolerances for centerline of all Pulled Tee outlets and also the centerline of the manifolds to the end of the outlets shall be 1/32-in and shall not be accumulative. The Pulled Tee radius shall be in accordance to ASME B31.1. All Victaulic grooved ends must be suitable for the design pressure.
   c. All welding of pipe, fittings, and subassemblies shall be complete in the factory. Welding shall be performed by qualified welders in accordance with ANSI B31.1 with standard procedures for the application, by the shielded arc, inert gas, MIG or TIG method. Filler wire shall be added to all welds to provide for a cross section and weld metal equal to or greater than the parent metal. Weld deposit shall be smooth, evenly distributed and have a crown of no more than 1/16-in on both sides of the weld. No cracks or crevices shall be allowed. Butt welds shall have full penetration to the interior and exterior of the joint. Excessive weld deposits, slag, spatter, and projections shall be removed by grinding. After all fabrication is completed, all pipe spools shall be pickled and passivated by complete immersion in a solution containing 3% hydrofluoric or citric acid and 6-10% nitric acid with the balance of water and then followed by a fresh water rinse bath. Alternative methods will not be allowed. All pipe spools shall be free of surface iron upon completion of this process. All openings shall be capped after the pickling/passivating process to protect to the inside of the spools from debris and dirt.
   d. Joints for field assembly shall be flanged, grooved, or sleeve type coupling. Pipe components may be shop welded into assemblies for field installation. Flange joints or flange adaptors shall be used at connections to equipment, fittings, and valves. Sleeve type couplings and flange adaptor couplings shall be used as required to allow for expansion, for disassembly of piping, state pipe length for disassembly, for servicing and pipeline flexibility. All other joints shall be welded. Additional flanged, grooved or sleeve type coupling joints shall be provided as required to join welded shop assemblies and allow for installation of shop assemblies into the

structure. All additional flanged, grooved, or sleeve coupling joints required to install and assemble the piping system shall be furnished as part of the work of this Section.

(1) All flanged joints shall be made up with 316L slip-on type with 150 class flanges suitable for the internal design pressures. Flanges shall conform to ASTM A182 in accordance with ANSI B16.5. Bolts and nuts shall conform to ANSI B18.2. Bolt studs and studs shall be of the same quality as machine bolts. All bolting and nuts shall be of Type 316 stainless steel ASTM A193, grade B&M hexhead bolts and ASTM 194 grade 8M hexhead nuts.

(2) Victaulic type couplings and fittings may be used in lieu of flanged joints. Pipes shall be radius grooved as specified for use with the Victaulic couplings. Grooved couplings for aeration shall utilize Grade L silicone gaskets rated to 350 degrees Fahrenheit.

(3) Where plain end pipe is joined by sleeve couplings, these shall be welded-on type 316L stainless steel attachments for joint restraint at all couplings except where tie rods may run from adjacent flanges. Furnish at least two tie rods at all restrained joints. Sleeve-type couplings shall be as manufactured by Dresser Manufacturing Division of Dresser Industries; Smith-Blair, Inc.; R.H. Baker & Co., Inc. equal. Couplings shall be manufactured of Type 316L stainless steel. All couplings shall be furnished with pipe stop removed. Gaskets shall be fluoroelastomer (FKM / Viton) and shall conform with AWWA C111/ANSI A21.11. Couplings shall allow at least 2 degrees angular deflection and at least 3/8 in relative axial motion of adjoining pipe sections. Flange adaptors shall join plain end pipe to flanged with 150 lb or 300 lb flange and shall be equal to Dresser Style 128 and of 316L stainless steel material. Joint restraint shall be provided at all flange adaptors. Flange adaptor couplings may be substituted for flanged joints wherever space permits.

e. Furnish tapped bosses on the pipe locations as may be required by the equipment manufacturer and engineer for the purposes of connecting small tubing and instruments to the pipe. Tapped bosses shall be of the same material as the pipe, welded to the pipe wall and shall have NPT threaded connections.

f. Furnish welded-on tabs or angle ring on pipe wherever vertical pipe is to be supported by a riser clamp, to support the weight of the pipe.

9. Pipe and fittings for the sampling service shall be Schedule 40, socket weld austenitic Type 316L stainless steel pipe conforming to ASTM A312 and ANSI B36.19. Hydrogen peroxide feed tubing shall be at a minimum thickness of 0.035 inches, socket weld 304 stainless steel. Pipe shall be fabricated true to dimension and round. Ends of pipe shall be perpendicular to the longitudinal axis. Pipe shall be straight within maximum 1/8-in deviation over 10 feet. All pieces shall be marked with schedule and type of stainless steel. Fittings to valves, specials, and instrumentation shall be flanged type with fluoroelastomer (FKM / Viton) gaskets and PTFE gaskets servicing the hydrogen peroxide service. Fittings shall be as manufactured by Swagelock or equal.

10. Where connecting pipe joints of different materials, a flange, isolation kit shall be used. The retainer shall consist of G-10 material, seal shall be nitrile, sleeve shall be mylar, and washer shall be G-10 material.

11. Schedule STD pipe shall be used on all roll grooved coupling joints.

B. Field welding:

1. Welding in the field will not be allowed except under special circumstances and shall be done only if approved by the Purchaser. If field welding is approved, field welds shall be made by welders certified under ASME Section IX and be equal in all respects to shop welds. After field welding has been done, all joints shall be thoroughly pickled, passivated, cleaned, and buffed.

2.05 PVC PIPE:

A. Materials:
   1. Materials shall conform to AWWA C900.
   2. Gaskets shall conform to ASTM F477 and be synthetic rubber.
B. Design of Pipe: Design shall conform to AWWA.
C. Dimensions: The minimum pressure class for PVC pipe shall be DR-18.
D. Diameters: PVC pressure pipe shall have Cast-Iron-Pipe-Equivalent (CI) outside diameters.
E. Joints: Pipe shall be furnished with integral bell-type pipe ends designed for joint assembly using elastomeric gaskets.
F. Fittings:
   1. Fittings shall conform to AWWA C110 or C153 and be ductile iron. Fittings shall be mechanical joint or push-on-type joint.
   2. Fittings for 4-inch through 8-inch pipe shall be injection-molded PVC with push-on-type joint, Class 150, conforming to AWWA C907.
G. Marking: Identification markings on pipe shall conform to AWWA C900.

2.06 COPPER PIPE:

A. Pipe used in service line construction (two (2) inch in diameter or less) shall be copper, and shall conform to the following specifications:
   1. Copper Service Pipe shall be Type K soft, conforming to Federal Specification WW-T-799 or ASST, B88-62.
   2. The service line shall be a continuous piece (no splices) from the corporation stop to the curb stop, or as otherwise approved by the Owner and/or Engineer.

2.07 SLEEVES AND COUPLINGS:

A. Sleeves:
   1. AWWA C110 mechanical joint ductile iron solid sleeve type:
      a. Pipe end space shall not exceed one-third of the sleeve laying length.
      b. Interior, exposed, exterior, or buried service as indicated.
B. Couplings:
   1. Center sleeve and compression gland-type end ring conforming to AWWA C219.
   2. Center sleeve shall be without pipe stop.
   3. Couplings for joining concrete or steel pipe shall be steel.
   4. Couplings for joining direct buried, exposed exterior, vault or pit installations of iron, or PVC pipe up to 12-inch diameter shall be iron. Provide lined and coated steel couplings for larger pipe diameters.
   5. Couplings for exposed interior iron or PVC pipe may be steel or iron.
   6. Fastener bolts shall be ductile iron or stainless steel for iron couplings and high-strength, low-alloy steel for steel couplings. Bolts for direct buried coupling installations shall be stainless steel.
   7. Center sleeve and end rings shall be:
      a. Ductile or malleable iron for iron couplings.
      b. Steel for steel couplings.

8. Lining and Exterior Coating:
    a. Use for all steel couplings intended for direct bury, exposed exterior, vault or pit installations.
    b. Completely coat center sleeve and end rings.
    c. Two-part epoxy or nylon fuse-coated to a minimum 10 mils thickness.
    d. Line interior of all steel couplings intended for exposed-interior installations. Coat exterior with normal shop coating.

C. Flanged Coupling Adapters:
1. Flanged end and body to be one unit conforming to AWWA C219. Coupling end to be compression gland type with follower ring.
2. Adapters for joining direct buried, exposed exterior, vault or pit installations of iron pipe shall be iron.
3. Adapters for joining exposed interior iron pipe may be steel or iron.
4. Flanged end bolt circle, bolt size, and spacing shall conform to the applicable provisions of ANSI B16.1 and shall be drilled Class 125 for iron adapters. Flanges on steel adapters shall be AWWA C207, Class D, drilled ANSI B16.1 Class 125.
5. Bolts and nuts shall be ductile iron for iron adapters and high-strength, low-alloy steel for steel adapters.
6. Anchor studs shall not be used where joint restraint is required. Furnish adapters with tie rod harness assemblies where indicated.
7. Lining and Exterior Coating for Steel Adapters:
    a. Two-part epoxy or nylon fuse-coated to a minimum 10 mils thickness.
    b. Completely coat adapter sleeve and end follower gland plus line interior for adapters intended for exposed exterior, vault or pit installations.
    c. Line interior of all adapters intended for exposed interior installations. Coat exterior with normal shop coating.
8. Grooved flange adapters shall be used in lieu of flanged coupling adapters when the piping system is grooved.

D. Expansion Joint Couplings:
1. Furnish single-end and double-end steel pipe expansion joints where indicated.
2. Slip-pipe's exterior section, which is in contact with the packing, is to be hard chrome-plated on a machined surface.
3. Furnish with limit rods where joint restraint is required.
4. Lining and Exterior Coating:
    a. Normal shop coating.
    b. Line slip-pipe with epoxy.
    c. Line body-pipe with epoxy.
5. Bolts and limit rods shall be stainless steel.
6. Acceptable manufacturers are as follows:
    a. Dresser Industries, Inc. - Type 1, 2, 3, and, Style 63.
    b. Victaulic Style 231S Expansion Coupling.
    c. Rockwell International Corp. – Type 611 and 612.
    d. Ford Style FEJ, Ford Meter Box Company, Inc.
    e. Engineer approved equal.

E. Anchored Couplings:
1. Furnish where joint restraint required to offset internal pipeline forces.
2. Provide harnessed sleeve couplings and flanged coupling adapters with tie rod harnesses where indicated.

a. Harnesses shall consist of lugs or clamps welded or otherwise securely fastened to opposite joint elements with tie bolts between opposing lugs. "Dog ear" lugs shall be fabricated as indicated.
b. Design of harnesses for steel pipe shall conform with applicable provisions of AWWA M11.

3. Provide expansion couplings with limit rods.
4. Provide couplings for grooved and shouldered type joints conforming to AWWA C606.
   a. Furnish cut grooved ends on ductile iron end pipe.
   b. Furnish roll grooved ends on steel pipe.
5. Mechanical joint retainer glands shall not be used where joint restraint is required unless indicated. When indicated, retainer glands shall be Megalug manufactured by EBAA Iron, Inc.

F. Insulated Couplings:
1. Couplings shall be insulated to prevent electrical conductivity where indicated.
2. Insulated coupling design shall be otherwise conforming to the standard types and styles specified.

G. Dismantling Joint:
1. Consists of a mechanical joint fitting located between two pipe flanges with restraining rods across the mechanical joint section, providing a restrained system with integral space for removal of adjacent equipment.
2. Shall conform to AWWA C219.
3. Materials shall be steel.
4. When connected to ductile iron pipe system, install insulating flange kit.
5. Grooved couplings may be used in lieu of traditional dismantling joints.

2.08 COMPRESSION FITTINGS:

A. Acceptable Manufacturers:
1. A.Y. McDonald 74758-22.
2. Mueller H-15403N.
3. Engineer Approved Equal.

2.09 GASKETS AND BOLTING MATERIALS:

A. Provide all gaskets, bolts, lubricant, and other accessories required to install pipe, fittings, and specials complete and ready for service.

B. Gaskets for flanged joints shall conform to ANSI B16.21, 1/8-inch thick full-face elastomer or American Cast Iron Pipe Company Toruseal 1/8-inch thick full-face gasket or U.S. Pipe Company Flange-Type 1/8-inch thick ring gasket. Provide full-face gaskets for all pump and equipment connections.
1. Flanged joints in blower air service shall be provided with Fluoroelastomer gaskets.

C. Gaskets for ductile iron flanged pipe and fittings 12 inch and smaller shall have "nominal" inside diameters, not the larger inside diameters per ANSI B16.21.

D. Bolts for flanged joints shall conform to ASTM A307, Grade B. Nut and bolt heads shall be hexagonal.

E. Gaskets and bolts for other than flanged joints shall be as otherwise specified for pipe and pipe joints.

2.10 TRACER WIRE:

A. Tracer wire shall be provided as indicated.
1. Minimum AWG 10 solid copper

2. 30 mils of green PE insulation

B. Tracer wire tape shall be as follows:
   1. 2-inch-wide vinyl plastic electrical tape
   2. 7 mils in thickness

C. Where connections to existing tracer wire are required or where connections to newly installed tracer wire (tees, end of rolls, etc.) are required, tracer wire shall be spliced with:
   1. DryConn Direct Bury Lug Aqua waterproof connector.
   2. Engineer Approved Equal.

2.11 JOINT BONDING:

A. Joint bonding shall be provided as indicated.

B. Bonding shall be accomplished:
   1. With No. 2 insulated, stranded, soft annealed copper wire attached to pipe cylinder by thermic weld.
   2. With manufacturer's standard subject to Engineer's approval.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Specified in Section 33 31 50 - Pipe Installation.

3.02 FIELD TESTING:

A. Specified in Section 33 31 50 - Pipe Installation.

3.03 TRACER WIRE:

A. Install according to Section 33 31 50 - Pipe Installation.

3.04 FIELD PROTECTIVE COATING:

A. Specified in Section 09 90 00.

END OF SECTION 33 11 00

SECTION 33 12 16 - UTILITY VALVES AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes all valves and accessories.

B. Related Work Specified Elsewhere:

1. Section 09 90 00 - Protective Coatings.
2. Section 33 31 50 - Pipe Installation.

1.02 REFERENCES:

A. Applicable Standards:

1. American National Standards Institute (ANSI):
   a. B16.1 - Cast-Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.
2. ASTM International (ASTM):
   a. A126 - Gray Iron Castings for Valves, Flanges and Pipe Fittings.
   b. A276 - Stainless and Heat Resisting Steel Bars and Shapes.
   c. A536 - Ductile Iron Castings.
   d. A564 - Hot-Rolled and Cold-Finished Age-Hardening Stainless and Heat Resisting Steel Bars and Shapes.
3. American Water Works Association (AWWA):
   a. C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   b. C207 - Steel Pipe Flanges for Waterworks Service - Sizes 4 Inch Through 144 Inch.
   c. C500 - Metal-Seated Gate Valves for Water Supply Service.
   d. C502 - Dry-Barrel Fire Hydrants.
   e. C504 - Rubber-Seated Butterfly Valves.
   f. C507 - Ball Valves, 6 Inch Through 48 Inch.
   g. C508 - Swing-Check Valves for Waterworks Service, 2 Inch through 24 Inch NPS.
   h. C509 - Resilient-Seated Gate Valves for Water Supply Service.
   i. C512 - Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service.
   j. C540 - Power-Actuating Devices for Valves and Sluice Gates.
   k. C550 - Protective Epoxy Interior Coatings for Valves and Hydrants.
   l. C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
   m. C606 - Grooved and Shouldered Joints.
4. National Fire Protection Association (NFPA):
   a. 1963 - Screw Threads and Gaskets, Fire Hose Connections.

1.03 SUBMITTALS:

A. Submit as specified in Division 1.

B. Include, but not limited to, the following:

1. Catalog data or illustrations showing principal dimensions, parts, and materials.
2. Spare parts list referenced to illustration of parts.
3. Assembly and disassembly or repair instructions.
4. Dimensions of the clearance required for butterfly valve discs.

C. Certificates and Affidavits: Furnish prior to shipment. Include the following:

1. Test certificates.
2. Affidavit of compliance with applicable AWWA Standard.

1.04 QUALITY ASSURANCE:

A. Manufacturers shall be experienced in the design and manufacture of specific valves and accessories.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Deliver, store, and handle equipment and materials as specified in Division 1.

1.06 RESPONSIBILITY:

A. Actuators, their controls, and accessories shall be the responsibility of the valve manufacturer for sizing, assembly, certification, field testing, and any adjustments necessary to operate the valve as specified.

PART 2 - PRODUCTS

2.01 BUTTERFLY VALVES:

A. Acceptable Manufacturers for process related valves (See Table 1 and Table 2 below for process butterfly valves):
   1. DeZURIK/Sartell - Model BAW
   2. Henry Pratt Company
   3. Val-matic

B. Acceptable Manufacturers for utility related valves (See Civil Drawings for utilities valves):
   1. SPX/DeZurik – Style BOS.
   2. Tyco-Keystone – Figure AR2.

C. Design:
   1. Conform to AWWA C504, AWWA C540, and as specified.
   2. Suitable for type of installation specified.
   3. Conform to criteria indicated in Design Data and Valve Schedule.
   4. All valve end flanges shall conform to the following:
      a. ANSI B16.1, Class 125 for cast-iron body, Class 25A through Class 150B valves.
      b. AWWA C207, Class D with ANSI B16.1 Class 125 drilling for steel body, Class 25A through Class 150B valves.
      c. ANSI B16.1, Class 250 for ductile-iron body, Class 250 valves.
      d. AWWA C207, Class E for steel body, Class 250 valves.
   5. Mechanical or push-on type rubber-gasket joint ends shall conform to AWWA C111.
   6. Valves with a stop or lug cast integrally or mechanically secured to the body for the purpose of limiting disc travel will not be acceptable.

D. Design Data: Refer to Drawings for Valve Schedule.

E. Materials and Construction:
   1. Body shall be of cast iron for Class 25A through Class 150B valves and ductile iron for Class 250 valves or fabricated steel, as indicated in the Valve Schedule.
   2. Shafts shall be ASTM A276 Type 304 or 316 stainless steel for Class 25A through Class 150B valves and ASTM 564 Type 630 stainless steel for Class 250 valves. Design velocity for Class 250 valves shall be 16 fps.
   3. Disc shall be cast or ductile iron for Class 25A through Class 150B valves and ductile iron for Class 250 valves or steel for fabricated steel valves.
   4. Seats shall be synthetic rubber and be body mounted. Provide field replaceable and adjustable seat accessible from down-pressure side of valve for sizes 30-inch and larger. Mating seat surface shall be stainless steel or Monel. Sprayed or plated mating surfaces are not acceptable.

5. Shaft seals shall be designed for use of standard self-adjusting split-V-type packing or standard O-ring seals. Pull-down packing is not acceptable.

F. Actuators:
   1. Manual Actuators:
      a. All valves shall open counterclockwise.
      b. Provide indicators to show position of disc except on buried actuators. Provide handwheels with raised cast arrow and word OPEN on rim oriented to specified opening direction.
      c. Actuators shall be oil or grease-lubricated, totally-enclosed compound lever, traveling nut type to provide characterized closure. Actuator shall be self-locking at all variable opening positions.
      d. Travel limiting stop nuts or collars installed in the actuating mechanisms shall be field adjustable and shall be locked in position by means of a removable roll pin, cotter pin, or other positive locking device. Clamps or setscrews are not acceptable.
      e. Actuators and handwheels shall be located in positions indicated or as otherwise determined when manufacturer's drawings are submitted.
      f. Furnish actuators with AWWA operating nuts for all buried installations unless otherwise scheduled.
      g. Exposed buried actuator case, supports, and connection to the valve shall be cast iron.
      h. Exposed, buried service actuator shafting, bolts, and fastening hardware shall be stainless steel.
      i. Hand chains shall be cadmium plated or stainless steel.
   2. Motor Actuators:
      a. Provide electric motor actuators as specified in sub-section 2.12 ELECTRIC MOTOR ACTUATORS herein.

G. Valve Controls:
   1. Operate valve actuator to perform control function required.
      a. Open or close valve.
      b. Modulating.
   2. Include all pilot valves, needle valves, strainers, interconnecting piping, fittings, positioners, solenoid valves, limit switches, and other accessories essential to valve function factory-assembled on valve body or actuator.
      a. Small control valves shall be bronze or brass; and piping shall be copper.
      b. Provide solenoid valves, limit switches, positioners, and other accessories as required for proper operation.
   3. Equip actuators with heavy-duty, screw type terminal strip assemblies, designed to accept ring-tongue terminals for minimum size number 14 AWG wire.

H. Testing: Furnish certified copies of results of performance, leakage, and hydrostatic tests performed in compliance with Section 5, AWWA C504.

I. Shop Painting: Paint exterior surface of valves in compliance with AWWA C504 for installation as noted. Apply interior coating conforming to AWWA C550 to exposed ferrous metal surfaces. Provide affidavit or certificate of compliance per AWWA C550.

J. Valve Schedule:

Table 1: Butterfly Valves Provided by Contractor

Tag	Size (in)	Max P (psig)	Max T (deg F)	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
AGS-VLV-104	14"	20	300	Air	Flg x Flg	Chainwheel	Vert	CS Vert	O/C	Y402	AGS West Wall Exterior Above Grade ~6.5 ft grade to valve CL
AGS-VLV-106	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y402	AGS West Walkway Exterior Above Grade
AGS-VLV-107	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y402	AGS West Walkway Exterior Above Grade
AGS-VLV-112	4"	20	300	Air	Flg x Flg	Handwheel / Lever	Horiz	CS Vert	O/C	Y402	AGS West Walkway Exterior Above Grade
AGS-VLV-204	14"	20	300	Air	Flg x Flg	Chainwheel	Vert	CS Vert	O/C	Y402	AGS West Wall Exterior Above Grade ~6.5 ft grade to valve CL
AGS-VLV-206	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y402	AGS West Walkway Exterior Above Grade
AGS-VLV-207	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y402	AGS West Walkway Exterior Above Grade
AGS-VLV-212	4"	20	300	Air	Flg x Flg	Handwheel	Horiz	CS Horiz	O/C	Y402	AGS West Walkway Exterior Above Grade
AGS-VLV-304	14"	20	300	Air	Flg x Flg	Chainwheel	Vert	CS Vert	O/C	Y403	AGS West Wall Exterior Above Grade ~6.5 ft grade to valve CL
AGS-VLV-306	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y403	AGS West Walkway Exterior Above Grade
AGS-VLV-307	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y403	AGS West Walkway Exterior Above Grade
AGS-VLV-312	4"	20	300	Air	Flg x Flg	Handwheel	Horiz	CS Horiz	O/C	Y403	AGS West Walkway Exterior Above Grade

Tag	Size (in)	Max P (psig)	Max T (deg F)	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
AGS-VLV-404	14"	20	300	Air	Flg x Flg	Chainwheel	Vert	CS Vert	O/C	Y403	AGS West Wall Exterior Above Grade ~6.5 ft grade to valve CL
AGS-VLV-406	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y403	AGS West Walkway Exterior Above Grade
AGS-VLV-407	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y403	AGS West Walkway Exterior Above Grade
AGS-VLV-412	4"	20	300	Air	Flg x Flg	Handwheel	Horiz	CS Horiz	O/C	Y403	AGS West Walkway Exterior Above Grade
AGS-VLV-913	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y407	Blower BuildingInterior Above Grade
AGS-VLV-923	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y407	Blower Building Interior Above Grade
AGS-VLV-933	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y407	Blower Building Interior Above Grade
AGS-VLV-943	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y408	Blower Building Interior Above Grade
AGS-VLV-953	12"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y408	Blower Building Interior Above Grade
UV-VLV-001	36"	10	100	Effluent WW	MJ x MJ	Buried Nut w/ Extension	Horiz	DIP Horiz	O/C	Y601	Yard @ UV Structure Buried
UV-VLV-002	36"	10	100	Effluent WW	MJ x MJ	Buried Nut w/ Extension	Horiz	DIP Horiz	O/C	Y601	Yard @ UV Structure Buried
UV-VLV-003	36"	10	100	Effluent WW	MJ x MJ	Buried Nut w/ Extension	Horiz	DIP Horiz	O/C	Y601	Yard @ UV Structure Buried
PW-VLV-112	4"	190	100	Effluent WW	Flg x Flg	Handwheel	Vert	DIP Horiz	O/C	Y601	UV Building Interior Above Grade
PW-VLV-122	4"	190	100	Effluent WW	Flg x Flg	Handwheel	Vert	DIP Horiz	O/C	Y601	UV Building Interior Above Grade
PW-VLV-132	4"	190	100	Effluent WW	Flg x Flg	Handwheel	Vert	DIP Horiz	O/C	Y601	UV Building Interior Above Grade

Tag	Size (in)	Max P (psig)	Max T (deg F)	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
PW-VLV-101	4"	190	100	Effluent WW	Flg x Flg	Handwheel	Vert	DIP Horiz	O/C	Y601	UV Building Interior Above Grade
PW-VLV-102	4"	190	100	Effluent WW	Flg x Flg	Handwheel	Horiz	DIP Vert	O/C	Y601	UV Building Interior Above Grade
WAS-VLV-411	10"	-5 to 0	105	Air	Flg x Flg	Chainwheel	Vert	CS Horiz	O/C	Y705	Solids Processing Bldg Interior Above Grade ~5.85 ft FF to valve CL
WAS-VLV-421	10"	-5 to 0	105	Air	Flg x Flg	Chainwheel	Vert	CS Horiz	O/C	Y705	Solids Processing Bldg Interior Above Grade ~5.85 ft FF to valve CL
WAS-VLV-431	10"	-5 to 0	105	Air	Flg x Flg	Chainwheel	Vert	CS Horiz	O/C	Y705	Solids Processing Bldg Interior Above Grade ~5.85 ft FF to valve CL
WAS-VLV-413	8"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y705	Solids Processing Bldg Interior Above Grade
WAS-VLV-423	8"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y705	Solids Processing Bldg Interior Above Grade
WAS-VLV-433	8"	20	300	Air	Flg x Flg	Handwheel	Vert	CS Horiz	O/C	Y705	Solids Processing BldgInterior Above Grade
WAS-VLV-401	10"	20	300	Air	Flg x Flg	Handwheel	Horiz	CS Vert	O/C	Y705	Solids Processing Bldg Interior Above Grade
WAS-VLV-402	10"	20	300	Air	Flg x Flg	Handwheel	Horiz	CS Vert	O/C	Y705	Solids Processing Bldg Interior Above Grade

Table 2: Butterfly Valves provided by Granular Sludge Biological Treatment System Supplier (Section 46 54 60)

Tag	Size (in)	Max P (psig)	Max T (deg F)	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
AGS-VLV-105	10"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Horiz	CS Horiz	Air	Y402	AGS West Walkway Exterior Above Grade
AGS-VLV-108	4"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Vert	CS Horiz	Air	Y402	AGS West Walkway Exterior Above Grade
AGS-VLV-109	4"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Vert	CS Horiz	Air	Y402	AGS West Walkway Exterior Above Grade
AGS-VLV-205	10"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Horiz	CS Horiz	Air	Y402	AGS West Walkway Exterior Above Grade
AGS-VLV-208	4"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Vert	CS Horiz	Air	Y402	AGS West Walkway Exterior Above Grade
AGS-VLV-209	4"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Vert	CS Horiz	Air	Y403	AGS West Walkway Exterior Above Grade
AGS-VLV-305	10"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Horiz	CS Horiz	Air	Y403	AGS West Walkway Exterior Above Grade
AGS-VLV-308	4"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Vert	CS Horiz	Air	Y403	AGS West Walkway Exterior Above Grade
AGS-VLV-309	4"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Vert	CS Horiz	Air	Y403	AGS West Walkway Exterior Above Grade
AGS-VLV-405	10"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Horiz	CS Horiz	Air	Y403	AGS West Walkway Exterior Above Grade

Tag	Size (in)	Max P (psig)	Max T (deg F)	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
AGS-VLV-408	4"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Vert	CS Horiz	Air	Y403	AGS West Walkway Exterior Above Grade
AGS-VLV-409	4"	20	300	Air	Flg x Flg or Lug	Motor Actuator	Vert	CS Horiz	Air	Y403	AGS West Walkway Exterior Above Grade

2.02 ECCENTRIC PLUG VALVES:

A. Acceptable Manufacturers:
   1. DeZurik
   2. Nordstrom
   3. Walworth
   4. Henry Pratt Company

B. Design:
   1. Quarter-turn nonlubricated eccentric type with resilient faced plug. Valves with vane type seat rings are not acceptable. Shutoff up to scheduled rating with pressure in reverse direction where scheduled.
   2. Conform to criteria indicated in Valve Schedule table.
   3. Flanged valve ends shall be faced and drilled to conform to ANSI B16.1, Class 125 for thickness and drilling.
   4. Mechanical or push-on type rubber-gasketed joint ends shall conform to AWWA C111.
   5. Port areas for valves through 500 mm 20-inch shall be at least 80% of full pipe area. Port areas of 24-inch and larger valves shall be at least 70% of full pipe area.
      a. Valves specified as “Full Port”: Bodies shall be Cast Iron ASTM A126 Class B. Ports shall be rectangular and 100% Port Area. The valve port area shall meet or exceed standard pipe area per ASME/ANSI B36.10M.
   6. Plugs shall be eccentric type with no backing ring or frame.
   7. Valve body cavity shall be smooth without protrusions or baffles.
   8. Design velocity for valves shall be 12 fps.

C. Materials and Construction:
   1. Bodies shall be of ASTM A126, Class B cast iron.
   2. Valve plug shall be ASTM A126, Class B cast iron or ASTM A536 ductile iron. Resilient plug facing or replaceable style body seats shall be synthetic rubber, neoprene, or Buna N compound suitable for use with water and wastewater applications.
   3. Seat rings shall be threaded or welded of corrosion-resistant 18-8 stainless steel, nickel, or Monel conforming to AWWA C504. Sprayed or plated mating seat surfaces are not acceptable.
   4. Bearings shall be replaceable. Sleeve type and thrust bearings in the upper and lower journals shall be corrosion-resistant stainless steel or bronze.
   5. Shaft seals shall be multiple O-ring, self-adjusting U-cup or chevron type packing conforming to AWWA C504. Pull-down packing is not acceptable.
   6. Shaft seals shall be field adjustable or replaceable without valve disassembly.
   7. All exposed fastening hardware shall be zinc plated or stainless steel. Provide stainless steel for buried service.

D. Actuators:
   1. Manual Actuators:
      a. All valves shall open counterclockwise.
      b. Provide indicators to show position of plug except on buried actuators.
      c. Nut operators shall be AWWA 2-inch size for operation by valve key, wrench head lever, or a chain lever. Furnish one lever for each valve.
      d. Hand chains shall be cadmium plated or stainless steel.
      e. Worm gear actuators shall be totally enclosed, grease sealed, gear type furnished with AWWA nut, crank, handwheel, or chainwheel. All buried valves shall be provided with worm gear actuators, AWWA nut, and enclosed cover plate. All

valves with reverse pressure capacity requirement shall be provided with worm gear actuators. Worm gear actuators shall be self-locking at all variable opening positions and sized to meet the torque ratings of AWWA C504. The shaft in a worm gear actuator shall have a nonmetallic or bronze sleeve type bearing. Submit manufacturer's parts and materials drawings.

f. Handwheels shall be located in positions indicated or as otherwise determined when manufacturer's drawings are submitted.

2. Motor Actuators:
   a. Provide electric motor actuators as specified in sub-section 2.12 ELECTRIC MOTOR ACTUATORS herein.

E. Valve Controls:
1. Operate valve actuator to perform control function required.
   a. Open or close valve.
   b. Modulating.
2. Include all pilot valves, needle valves, strainers, interconnecting piping, fittings, positioners, solenoid valves, limit switches, and other accessories essential to valve function factory-assembled on valve body or operator.
   a. Small control valves shall be bronze or brass; piping shall be copper.
   b. Provide solenoid valves, limit switches, positioners, and other accessories as required for proper operation.
3. Equip actuators with heavy-duty, screw type terminal strip assemblies, designed to accept ring tongue terminals for minimum size number 14 AWG wire.

F. Testing: Furnish certified copies of results of tests prior to shipment. All valves shall be subjected to an AWWA C504 procedure cycle life and pressure leak test at 150 psi and a body hydrostatic test at 300 psi. Valves shall be capable of providing drip-tight shutoff up to the full leak test rating. Certify reverse pressure capacity.

G. Shop Painting: Apply interior coating conforming to AWWA C550 to exposed ferrous metal surfaces. Provide affidavit or certificate of compliance per AWWA C550.

H. Valve Schedule:

Table 3: Plug Valves Provided by Contractor

Tag	Size (in)	Max P (psig)	Max T (deg F)	Full Port?	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
IPS-VLV-101	20”	120	100	No	Influent Wastewater	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y202	IPS Valve Vault Interior Below Grade
IPS-VLV-102	20”	120	100	No	Influent Wastewater	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y202	IPS Valve Vault Interior Below Grade
IPS-VLV-103	20”	120	100	No	Influent Wastewater	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y202	IPS Valve Vault Interior Below Grade
IPS-VLV-112	14"	120	100	No	Influent Wastewater	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y202	IPS Valve Vault Interior Below Grade
IPS-VLV-122	12"	120	100	No	Influent Wastewater	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y202	IPS Valve Vault Interior Below Grade
IPS-VLV-132	14"	120	100	No	Influent Wastewater	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y202	IPS Valve Vault Interior Below Grade
IPS-VLV-142	12"	120	100	No	Influent Wastewater	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y202	IPS Valve Vault Interior Below Grade
IPS-VLV-152	14"	120	100	No	Influent Wastewater	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y202	IPS Valve Vault Interior Below Grade
GRSC-VLV-001	20"	120	100	No	Influent Wastewater	MJ x MJ	Buried Nut w/ Extension	Horiz	DIP Horiz	O/C	Y301	Yard Exterior of Headworks Buried ~5.9 ft CL of valve to grade
GRSC-VLV-002	20"	120	100	No	Influent Wastewater	FLG x FLG	Chainwheel	Horiz	DIP Vert	O/C	Y301	Headworks First Floor Interior Above Grade ~10 ft FF to CL of valve
GRSC-VLV-003	20"	120	100	**YES**	Influent Wastewater	FLG x FLG	Chainwheel	Horiz	DIP Vert	O/C	Y301	Headworks First Floor Interior Above Grade ~10 ft FF to CL of valve

Tag	Size (in)	Max P (psig)	Max T (deg F)	Full Port?	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
GRSC-VLV-004	20"	120	100	No	Influent Wastewater	FLG x FLG	Chainwheel	Horiz	DIP Vert	O/C	Y301	Headworks First Floor Interior Above Grade ~14.7 ft FF to CL of valve
GRSC-VLV-005	20"	120	100	No	Influent Wastewater	FLG x FLG	Chainwheel	Horiz	DIP Vert	O/C	Y301	Headworks First Floor Interior Above Grade ~14.7 ft FF to CL of valve
GRSC-VLV-103	6"	10	100	No	Influent Wastewater	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y301	Headworks First Floor Interior Above Grade ~13.5 ft FF to CL of valve
GRSC-VLV-203	6"	10	100	No	Influent Wastewater	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y301	Headworks First Floor Interior Above Grade ~13.5 ft FF to CL of valve
PSEW-VLV-101	8”	60	100	No	Plant Sewer Return	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y301	Headworks First Floor Interior Above Grade ~2 ft FF to CL of valve
PSEW-VLV-102	8”	60	100	No	Plant Sewer Return	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y301	Headworks First Floor Interior Above Grade ~5 ft FF to CL of valve
PSEW-VLV-103	8”	60	100	No	Plant Sewer Return	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y301	Headworks First Floor Interior Above Grade ~8 ft FF to CL of valve
PSEW-VLV-104	8”	60	100	No	Plant Sewer Return	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y301	Headworks First Floor Interior Above Grade ~12 ft FF to CL of valve
GRSC-VLV-311	4"	15	100	**YES**	Grit Slurry	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y302	Headworks First Floor Interior Above Grade
GRSC-VLV-313	3"	15	100	No	Grit Slurry	FLG x FLG	Handwheel	Horiz	DIP Vert	O/C	Y302	Headworks First Floor Interior Above Grade

Tag	Size (in)	Max P (psig)	Max T (deg F)	Full Port?	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
GRSC-VLV-315	4"	15	100	**YES**	Grit Slurry	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y302	Headworks First Floor Interior Above Grade ~9 ft FF to CL of valve
GRSC-VLV-316	4"	15	100	**YES**	Grit Slurry	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y302	Headworks First Floor Interior Above Grade ~9 ft FF to CL of valve
GRSC-VLV-317	4"	15	100	**YES**	Grit Slurry	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y302	Headworks First Floor Interior Above Grade ~9 ft FF to CL of valve
AGS-VLV-601	8"	10	100	No	Supernatant	FLG x FLG	Handwheel	Vert	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-602	8"	10	100	No	Supernatant	FLG x FLG	Handwheel	Vert	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-603	8"	30	100	No	Supernatant	FLG x FLG	Chainwheel	Vert	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade ~6.3 ft FF to CL of valve
AGS-VLV-611	8"	10	100	No	Supernatant	FLG x FLG	Handwheel	Vert	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-621	8"	10	100	No	Supernatant	FLG x FLG	Handwheel	Vert	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-631	8"	10	100	No	Supernatant	FLG x FLG	Handwheel	Vert	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-613	8"	30	100	No	Supernatant	FLG x FLG	Chainwheel	Vert	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade ~6.3 ft FF to CL of valve
AGS-VLV-623	8"	30	100	No	Supernatant	FLG x FLG	Chainwheel	Vert	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade ~6.3 ft FF to CL of valve

Tag	Size (in)	Max P (psig)	Max T (deg F)	Full Port?	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
AGS-VLV-633	8"	30	100	No	Supernatant	FLG x FLG	Chainwheel	Vert	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade ~6.3 ft FF to CL of valve
AGS-VLV-701	4"	10	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-702	4"	10	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-703	4"	30	100	No	Sludge	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y405	AGS Pump RoomInterior Above Grade~4.5 ft FF to CL of valve
AGS-VLV-711	4"	10	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-721	4"	10	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-731	4"	10	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-713	4"	30	100	No	Sludge	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade ~4.5 ft FF to CL of valve
AGS-VLV-723	4"	30	100	No	Sludge	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade ~4.5 ft FF to CL of valve
AGS-VLV-733	4"	30	100	No	Sludge	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y405	AGS Pump Room Interior Above Grade ~4.5 ft FF to CL of valve
AGS-VLV-811	6"	10	100	No	Supernatant	FLG x FLG	Handwheel	Vert	DIP Horiz	O/C	Y406	AGS Pump Room Interior Above Grade
AGS-VLV-821	6"	10	100	No	Supernatant	FLG x FLG	Handwheel	Vert	DIP Horiz	O/C	Y406	AGS Pump Room Interior Above Grade

Tag	Size (in)	Max P (psig)	Max T (deg F)	Full Port?	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
AGS-VLV-813	6"	30	100	No	Supernatant	FLG x FLG	Chainwheel	Vert	DIP Horiz	O/C	Y406	AGS Pump Room Interior Above Grade ~5.9 ft FF to CL of valve
AGS-VLV-823	6"	30	100	No	Supernatant	FLG x FLG	Chainwheel	Vert	DIP Horiz	O/C	Y406	AGS Pump Room Interior Above Grade ~5.9 ft FF to CL of valve
AGS-VLV-001	6"	30	100	No	Supernatant	FLG x FLG	Chainwheel	Vert	DIP Vert	O/C	Y401	AGS Utility Corridor Interior Above Grade ~5.6 ft FF to CL of valve
WAS-VLV-101	4"	30	100	No	Sludge	FLG x FLG	Extended w/ Handwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Below Grade ~2 ft CL of valve to walkway above
WAS-VLV-201	4"	30	100	No	Sludge	FLG x FLG	Extended w/ Handwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Below Grade ~2 ft CL of valve to walkway above
WAS-VLV-301	8"	10	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Vert	O/C	Y702	Solids Processing Building Interior Above Grade
WAS-VLV-302	8"	10	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Vert	O/C	Y702	Solids Processing BuildingInterior Above Grade
WAS-VLV-303	8"	10	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade
WAS-VLV-304	8"	10	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade
WAS-VLV-311	6"	10	100	No	Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade
WAS-VLV-321	6"	10	100	No	Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade
WAS-VLV-331	6"	10	100	No	Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade

Tag	Size (in)	Max P (psig)	Max T (deg F)	Full Port?	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
WAS-VLV-313	6"	10	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade
WAS-VLV-323	6"	50	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade
WAS-VLV-333	6"	50	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade
WAS-VLV-305	6"	50	100	No	Sludge	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade ~12 ft FF to CL of valve
WAS-VLV-305A	6”	50	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade ~3 ft FF to CL of valve
WAS-VLV-305B	6”	50	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade ~3 ft FF to CL of valve
WAS-VLV-306	6"	50	100	No	Sludge	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade ~12 ft FF to CL of valve
WAS-VLV-306A	6"	50	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade ~3 ft FF to CL of valve
WAS-VLV-306B	6"	50	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade ~3 ft FF to CL of valve
WAS-VLV-307	6"	50	100	No	Sludge	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade ~13 ft FF to CL of valve

Tag	Size (in)	Max P (psig)	Max T (deg F)	Full Port?	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
WAS-VLV-308	6"	50	100	No	Sludge	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade ~13 ft FF to CL of valve
STH-VLV-101	6"	50	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Vert	O/C	Y702	Solids Processing Building Interior Above Grade
STH-VLV-201	6"	50	100	No	Sludge	FLG x FLG	Handwheel	Horiz	DIP Vert	O/C	Y702	Solids Processing Building Interior Above Grade
SCIN-VLV-101	6"	50	100	No	Sludge	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing Building Interior Above Grade ~13 ft FF to CL of valve
SCIN-VLV-201	6"	50	100	No	Sludge	FLG x FLG	Chainwheel	Horiz	DIP Horiz	O/C	Y702	Solids Processing BuildingInterior Above Grade~13 ft FF to CL of valve
STH-VLV-132	4"	90	100	**YES**	Thickened Sludge	FLG x FLG	Handwheel	Horiz	DIP Vert	O/C	Y703	Solids Processing Building Interior Above Grade
STH-VLV-232	4"	90	100	**YES**	Thickened Sludge	FLG x FLG	Handwheel	Horiz	DIP Vert	O/C	Y703	Solids Processing Building Interior Above Grade
SCIN-VLV-102	6"	90	100	No	Thickened Sludge	FLG x FLG	Handwheel	Horiz	DIP Vert	O/C	Y703	Solids Processing Building Interior Above Grade
SCIN-VLV-202	6"	90	100	No	Thickened Sludge	FLG x FLG	Handwheel	Horiz	DIP Vert	O/C	Y703	Solids Processing Building Interior Above Grade
SCIN-VLV-001	18"	15	100	No	Thickened Sludge	FLG x FLG	Extended w/ Handwheel	Horiz	DIP Horiz	O/C	Y704	Solids Processing Building Interior Below Grade ~2.1 ft CL of valve to walkway above
SCIN-VLV-111	10"	10	100	No	Thickened Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y704	Solids Processing Building Interior Below Grade
SCIN-VLV-211	10"	10	100	No	Thickened Sludge	FLG x FLG	Handwheel	Horiz	DIP Horiz	O/C	Y704	Solids Processing Building Interior Below Grade

Tag	Size (in)	Max P (psig)	Max T (deg F)	Full Port?	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
SCIN-VLV-112	8"	60	100	No	Thickened Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Vert	Modulating	Y704	Solids Processing Building Interior Below Grade
SCIN-VLV-212	8"	60	100	No	Thickened Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Vert	Modulating	Y704	Solids Processing Building Interior Below Grade
SCIN-VLV-113	8"	60	100	No	Thickened Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	Modulating	Y704	Solids Processing Building Interior Below Grade
SCIN-VLV-213	8"	60	100	No	Thickened Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	Modulating	Y704	Solids Processing Building Interior Below Grade
PSEW-VLV-112	8"	120	100	No	Return Wastewater	FLG x FLG	Handwheel	Horiz	DIP Vert	O/C	Y801	Headworks First Floor Interior Above Grade
PSEW-VLV-122	8"	120	100	No	Return Wastewater	FLG x FLG	Handwheel	Horiz	DIP Vert	O/C	Y801	Headworks First Floor Interior Above Grade

Table 4: Plug Valves provided by Granular Sludge Biological Treatment System Supplier (Section 46 54 60)

Tag	Size (in)	Max P (psig)	Max T (deg F)	Full Port?	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
AGS-VLV-101	30"	20	100	No	Influent Wastewater	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y401	AGS Utility Corridor Interior Above Grade
AGS-VLV-103	30"	20	100	No	Influent Wastewater	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y401	AGS Utility Corridor Interior Above Grade
AGS-VLV-201	30"	20	100	No	Influent Wastewater	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y401	AGS Utility Corridor Interior Above Grade
AGS-VLV-203	30"	20	100	No	Influent Wastewater	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y401	AGS Utility Corridor Interior Above Grade
AGS-VLV-301	30"	20	100	No	Influent Wastewater	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y401	AGS Utility Corridor Interior Above Grade
AGS-VLV-303	30"	20	100	No	Influent Wastewater	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y401	AGS Utility Corridor Interior Above Grade
AGS-VLV-401	30"	20	100	No	Influent Wastewater	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y401	AGS Utility Corridor Interior Above Grade
AGS-VLV-403	30"	20	100	No	Influent Wastewater	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y401	AGS Utility Corridor Interior Above Grade
AGS-VLV-110	20"	10	100	No	Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	Modulating	Y402	AGS Utility Corridor Interior Above Grade
AGS-VLV-111	20"	10	100	No	Supernatant	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	Modulating	Y402	AGS Utility Corridor Interior Above Grade

Tag	Size (in)	Max P (psig)	Max T (deg F)	Full Port?	Media	Valve Ends	Actuator Type	Actuator Shaft Position	System Pipe	Service	PID	Installation
AGS-VLV-210	20"	10	100	No	Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	Modulating	Y402	AGS Utility Corridor Interior Above Grade
AGS-VLV-211	20"	10	100	No	Supernatant	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	Modulating	Y402	AGS Utility Corridor Interior Above Grade
AGS-VLV-310	20"	10	100	No	Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	Modulating	Y403	AGS Utility Corridor Interior Above Grade
AGS-VLV-311	20"	10	100	No	Supernatant	FLG x FLG	Motor Actuator	Horiz	DIPHoriz	Modulating	Y403	AGS Utility CorridorInterior Above Grade
AGS-VLV-410	20"	10	100	No	Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	Modulating	Y403	AGS Utility Corridor Interior Above Grade
AGS-VLV-411	20"	10	100	No	Supernatant	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	Modulating	Y403	AGS Utility Corridor Interior Above Grade
AGS-VLV-511	20"	10	100	No	Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y405	AGS Utility Corridor Interior Above Grade
AGS-VLV-521	20"	10	100	No	Sludge	FLG x FLG	Motor Actuator	Horiz	DIP Horiz	O/C	Y405	AGS Utility Corridor Interior Above Grade

2.03 STANDARD SWING CHECK VALVES:

A. Acceptable Manufacturers less than 4-inches in diameter:
   1. Crane Valve Company - Model: Number 36
   2. Lunkenheimer Company - Model: Figure 554Y

B. Acceptable Manufacturers 4-inches and greater in diameter:
   1. Kennedy Valve Company – Model: 159
   2. M&H – Model 159
   3. Mueller Company – Model A-2600
   4. Apco Willamette Valve and Primer Corporation – Model 250

C. Design:
   1. Conform to AWWA C508 and as specified.
   2. Iron body, bronze mounted, full opening.
   3. Extended stainless steel hinge pin with outside lever and weight.
   4. Design velocity shall be 12 fps.

D. Materials and Construction:
   1. Body and cover shall be cast iron. Flanges shall be ANSI B16.1, Class 125.
   2. Valve disc shall be bronze faced cast iron.
   3. Rubber faced discs or disc rings shall be Buna N for liquid applications and Viton for compressed air applications.
   4. Suitable for listed operating pressure.

E. Valve Schedule:

Table 5: Check Valves Provided by Contractor

Tag	Size (in)	Max P (psig)	Max T (deg F)	Media	Valve Ends	System Pipe	PID	Installation
IPS-VLV-111	14"	120	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y202	IPS Valve Vault Interior Below Grade
IPS-VLV-121	12"	120	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y202	IPS Valve Vault Interior Below Grade
IPS-VLV-131	14"	120	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y202	IPS Valve Vault Interior Below Grade
IPS-VLV-141	12"	120	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y202	IPS Valve Vault Interior Below Grade
IPS-VLV-151	14"	120	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y202	IPS Valve Vault Interior Below Grade
AGS-VLV-102	30"	20	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y401	AGS Pump Room Interior Above Grade
AGS-VLV-202	30"	20	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y401	AGS Pump Room Interior Above Grade
AGS-VLV-302	30"	20	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y401	AGS Pump Room Interior Above Grade
AGS-VLV-402	30"	20	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y401	AGS Pump Room Interior Above Grade
AGS-VLV-612	8"	30	100	Supernatant	FLG x FLG	DIP Horiz	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-622	8"	30	100	Supernatant	FLG x FLG	DIP Horiz	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-632	8"	30	100	Supernatant	FLG x FLG	DIP Horiz	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-712	4"	30	100	Sludge	FLG x FLG	DIP Horiz	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-722	4"	30	100	Sludge	FLG x FLG	DIP Horiz	Y405	AGS Pump Room Interior Above Grade

Tag	Size (in)	Max P (psig)	Max T (deg F)	Media	Valve Ends	System Pipe	PID	Installation
AGS-VLV-732	4"	30	100	Sludge	FLG x FLG	DIP Horiz	Y405	AGS Pump Room Interior Above Grade
AGS-VLV-812	6"	30	100	Supernatant	FLG x FLG	DIP Horiz	Y406	AGS Pump Room Interior Above Grade
AGS-VLV-822	6"	30	100	Supernatant	FLG x FLG	DIP Horiz	Y406	AGS Pump Room Interior Above Grade
PW-VLV-111	4"	30	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y601	UV Disinfection Bldg Interior Above Grade
PW-VLV-121	4"	30	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y601	UV Disinfection Bldg Interior Above Grade
PW-VLV-131	4"	30	100	Influent Wastewater	FLG x FLG	DIP Horiz	Y601	UV Disinfection Bldg Interior Above Grade
WAS-VLV-312	6"	50	100	Sludge	FLG x FLG	DIP Horiz	Y702	Solids Processing Interior Above Grade
WAS-VLV-322	6"	50	100	Sludge	FLG x FLG	DIP Horiz	Y702	Solids Processing Interior Above Grade
WAS-VLV-332	6"	50	100	Sludge	FLG x FLG	DIP Horiz	Y702	Solids Processing Interior Above Grade
STH-VLV-131	4"	30	100	Thickened Sludge	FLG x FLG	DIP Horiz	Y703	Solids Processing Interior Above Grade
STH-VLV-231	4"	30	100	Thickened Sludge	FLG x FLG	DIP Horiz	Y703	Solids Processing Interior Above Grade
PSEW-VLV-111	8"	120	100	Returned Wastewater	FLG x FLG	DIP Vert	Y801	Headworks Building Interior Above Grade
PSEW-VLV-121	8"	120	100	Returned Wastewater	FLG x FLG	DIP Vert	Y801	Solids Processing Interior Above Grade

2.04 BALL VALVES:

A. Acceptable Manufacturers for Ball Valves less than 6-inches in diameter:
   1. Conbraco Industries, Inc. – Apollo Valves.
   2. Metso Automation/Jamesbury.
   3. NIBCO, Inc.
   4. Flow-Tek, Inc.

B. Operational Requirements:
   1. Suitable for isolation service.
   2. Operation of the valve will be continuous.
   3. Operational pressures will be as follows:
      a. Normal system range 0 to 200 psi.

C. Design: Conform to AWWA C507, AWWA C540 and as specified.
   1. Valves shall consist of essentially three main parts:
      a. Body with full unrestricted circular inlet and outlet with diameter equal to rated size of valve.
      b. A moveable plug having a full, unobstructed circular waterway opening equal to valve body opening.
      c. A totally-enclosed operating mechanism mounted on and attached to valve body.
   2. Seats shall consist of flexible metal on the ball or resilient rubber on the body and rigid stainless steel seats opposite and located on both ends of valve.
   3. Shaft seals shall be self-adjusting split-V-type or rubber O-ring type designed for replacement under line pressure.
   4. Valve body shall have flanged ends. Flanges shall be ANSI B16.1, Class 125.

D. Materials and Construction:
   1. Valve body and plug shall match or be compatible with pipe material.
   2. Valve shall be furnished complete with operating mechanism and accessories suitable for accomplishing specified operations.

E. Valve Operating Mechanism:
   1. Valve shall be equipped with a traveling cross-head type operator and shall operate plug by means of a cross-head linked to a rotator lever.
   2. Rotator lever shall impart rotary motion to plug shaft.
   3. Provide an indicator to show position of plug with respect to body opening.

F. Actuators:
   1. Manual Actuators:
      a. Valve shall open counterclockwise.
      b. Provide non-rising stem mechanism self-locking in all positions.

G. Testing: Furnish certified copies of results of tests performed in compliance with Section 13, AWWA C507.

H. Valve Schedule: Refer to Drawings for Valve Schedule.

I. Shop Painting: Apply interior epoxy coating conforming to AWWA C550 and NSF to exposed ferrous metal surfaces. Provide affidavit or certificate of compliance per AWWA C550 and NSF.

J. Valve Schedule:

VALVE TAG	SIZE (IN)	OPERATING PRESSURE (PSI)	LOCATION	INSTALLATION	VALVE ENDS	ACTUATOR			MEDIA	SYSTEM PIPE
						Mechanism	Shaft Position	Function		
STH-VLV-102	3	75	Solids Handling Building	Above Grade	FLG X FLG	Handwheel/ Lever	Horizontal	Open/Close	Process Water	Copper
STH-VLV-202	3	75	Solids Handling Building	Above Grade	FLG X FLG	Handwheel/ Lever	Horizontal	Open/Close	Process Water	Copper
POL-VLV-103	1	65	Solids Handling Building	Above Grade	FLG X FLG	Handwheel/ Lever	Vertical	Open/Close	Polymer	DIP
POL-VLV-203	1	65	Solids Handling Building	Above Grade	FLG X FLG	Handwheel/ Lever	Vertical	Open/Close	Polymer	DIP
SCIN-VLV-301	1 1/2	200	Solids Handling Building Blower Room	Above Grade	FLG X FLG	Lever	Horizontal	Open/Close	Compressed Air	CS
SCIN-VLV-311	1 1/2	200	Solids Handling Building Blower Room	Above Grade	FLG X FLG	Lever	Horizontal	Open/Close	Compressed Air	CS
SCIN-VLV-321	1 1/2	200	Solids Handling Building Blower Room	Above Grade	FLG X FLG	Lever	Horizontal	Open/Close	Compressed Air	CS
POL-VLV-101	1/2	2.2	Solids Handling Building	Above Grade	Threaded	Lever	Horizontal	Open/Close	Polymer	Poly

2.05 PINCH VALVES:

A. Acceptable Manufacturers:
   1. Onyx Valve Company.
   2. Red Valve Company.
   3. RF Valves.

B. Design:
   1. Valves shall be full cast metal body mechanical pinch type with integral flanges on body and flexible sleeve.
   2. All internal metal parts are to be isolated from the process fluid by the flexible rubber sleeve.

C. Materials and Construction:
   1. Valve body shall be ductile iron, stem and pinch bar shall be stainless steel, and sleeve shall be rubber.
   2. Suitable for 150 psi operating pressure.
   3. Valve body shall have flanged ends. Flanges shall be ANSI B16.1, Class 125.

D. Valve Operating Mechanism:
   1. The steel mechanism shall be double acting with pinching of the sleeve trim occurring equally from two sides.
   2. Rotating the handle counterclockwise shall lower a pinch bar above the sleeve, while raising a pinch bar below the sleeve, pinching the sleeve closed at the center of the valve.

E. Actuators:
   1. Manual Actuators:
      a. Valve shall open counterclockwise.
      b. Provide non-rising stem mechanism.
   2. Motor Actuators:
      a. Provide electric motor actuators as specified in sub-section 2.12 ELECTRIC MOTOR ACTUATORS herein.

F. Testing: Furnish certified copies of results of tests prior to shipment.

G. Valve List:

Parameter	**GRSC-VLV-312**	**GRSC-VLV-314**
Size, (in)	4”	4”
Max P (psig)	15	15
Max T (deg F)	100	100
Full Port?	Yes	Yes
Media	Grit Slurry	Grit Slurry
Valve Ends	FLG x FLG	FLG x FLG
Actuator Type	Handwheel	Motor Actuator
Actuator Shaft Position	Horizontal	Horizontal
System Pipe	DIP Vertical	DIP Vertical
Service	Open/Close	Open/Close
PID	Y302	Y302
Installation	Headworks Building Interior Above Grade	Headworks Building Interior Above Grade

2.06 PRESSURE REDUCING VALVES:

A. Provided as indicated on Contract Drawings.

B. Acceptable Manufacturers less than 3-inches in diameter:
   1. Watts Automatic Control Valve Company – Model 500 Series LF223
   2. Wilkins – Model 500 Series
   3. Engineer-approved equal.

C. Acceptable Manufacturers 3-inches and larger in diameter:
   1. Watts Automatic Control Valve Company – Model ACV Series 115
   2. Cla-Val Company – Model 90-01
   3. Engineer-approved equal.

D. Design:
   1. Valves shall be of flanged globe body type.
   2. Inlet flange shall be ANSI B16.1, Class 125. Outlet flange shall be ANSI B16.1, Class 125.
   3. Suitable for operation as follows:
      a. Maximum flow rate condition: 215 GPM.
      b. Normal system inlet pressure: 75 psi to 135 psi.
      c. Regulate downstream pressure at Headworks: 85 psi.
      d. Regulate downstream pressure at Solids Handling Building: 85 psi.
   4. Such that internal main valve assembly can be dismantled without removing valve body from pipeline.

E. Materials and Construction:
   1. Body shall be cast iron, ductile iron, or stainless steel.
   2. Trim shall be bronze or stainless steel.
   3. Seats shall be leather or other resilient material and shall be replaceable.

F. Operational Requirements:
   1. Suitable for pressure-reducing service.
   2. Operation of the valve will be frequent.
   3. Cushioned to permit operation without causing shock or water hammer.
   4. Operate without continuous waste of water.
   5. Provide tight closure when shut and full pipeline opening when open.
   6. The valve shall maintain accurate control of the downstream pressure regardless of fluctuation in flow or upstream pressure.
   7. Adjustable for speed of open and close operation and control pressure.

G. Valve Controls:
   1. Control Function:
      a. Pressure regulation - maintain preadjusted downstream pressure for varying rates of flow and upstream pressure.
      b. Open and close according to downstream pressure transmitter indication.
   2. Include all pilot valves, needle valves, strainers, interconnecting piping, fittings, cylinders, positioners, solenoid valves, limit switches, and other accessories essential to valve function factory assembled on valve body.
      a. Pilot shall be self-cleaning and self-flushing by locating the outlet in the bottom of the pilot ninety degrees to the inlet
      b. Small control valves shall be bronze or brass; pilot tubing shall be stainless steel braided with Teflon lining. Copper/brass fittings and pilot.

2.07 PRESSURE SAFETY VALVES:

A. Provided as indicated on Contract Drawings.

B. Acceptable Manufacturers:
   1. Watts Automatic Control Valve Company – Model ACV Series 116
   2. Cla-Val Company - Model 50-01
   3. Engineer-approved equal.

C. Design:
   1. Valves shall be of flanged globe body pattern.
   2. Inlet and outlet flanges shall be 6-inch ASME B16.1 Class 125.
   1. Valves shall be external pilot actuated with spring to adjust pressure setting.
   2. Provide indicator rod to show position of opening of the piston or diaphragm.
   3. Suitable for operation as follows:
      a. Pump shutoff head 360-460 feet (155-200 psi).
      b. Normal system operating pressure 75 psi to 150 psi.
      c. Open at 160 psi.
   4. Such that internal main valve assembly can be dismantled without removing valve body from pipeline.
   5. Provide shutoff cocks and Y-strainers on control tubing.
   6. Valve shall have a protective fusion bonded epoxy coating internally and externally. The coating shall conform to AWWA C116.

B. Materials and Construction:
   1. Body shall be cast iron, ductile iron, or stainless steel.
   2. Trim shall be bronze or stainless steel.
   3. Seats shall be EPDM rubber and shall be replaceable.

D. Operational Requirements:
   1. Suitable for pressure-reducing service.
   2. Operation of the valve will be intermittent.
   3. Cushioned to permit operation without causing shock or water hammer.
   4. Operate without continuous waste of water.
   5. Provide tight closure when shut and full pipeline opening when open.
   6. Adjustable for speed of open and close operation and control pressure.

E. Valve Controls:
   1. Control Function:
      a. Open when line pressure exceeds preset value.
   2. Include all pilot valves, needle valves, strainers, interconnecting piping, fittings, cylinders, positioners, solenoid valves, limit switches, and other accessories essential to valve function factory assembled on valve body.
      a. Small control valves shall be bronze or brass; piping shall be copper.
      b. Provide orifice plate assembly for flow control function.

2.08 TELESCOPING VALVES:

A. Telescoping Valves shall be specified herein and have the characteristics and dimensions as shown in the drawings

B. Acceptable Manufactures
   1. Watermann Valves
   2. Whipps, Inc
   3. Troy Valve

C. Design

1. The valve shall utilize a low friction seal to mount to engage the slip tube and mount to the flange of the receiving pipe.
2. All welds shall be performed by welders with AWS certification.
3. Finish: Mill finish on stainless steel. Welds shall be sandblasted to remove weld burn and scale.

D. Slip Tube and Bail
1. The slip tube shall be constructed of Schedule 10 minimum thickness stainless steel pipe. The the overflow end slip tube shall be fitted with a V-notch weir and shall be Schedule 10 stainless steel.
2. The bail shall be constructed of stainless steel and shall be bolted to the stem and welded to the slip tube. The bail style shall be comptible for v-notch weir slipe tube.
3. The maximum travel distance of the slip tube shall be 48 inches. The maximum depth of slip tube shall extend more than 12 inches past the center line of the receiving flange into the recieving pipe at a travel distance of 0 inches.
4. Slip tubes shall be equipped with a grease fitting to allow the operator to apply grease to the slip tube from the operator level.

E. Seal Flange
1. The telescoping valve shall be provided with a self-adjusting seal system to restrict leakage between the slip tube and the receiving pipe.
2. If a neoprene seal and separate companion flange is provided, the neoprene seal shall have a minimum thickness of 1/4-inch and the companion flange shall be stainless steel and shall have a minimum thickness of 3/8-inch.
3. The slipe tube gasket shall be replaceable without the rmeoval of the slip tube assmbly from the reciver pipe, or actuator.
4. The companion flange shall be provided with a bolt pattern suitable for attachment to the flange on the receiving pipe.

F. Stem
1. A threaded operating stem shall be utilized to connect the operating mechanism to the bail which in turn is attached to the slip tube. The threaded portion of the rising stem valves shall engage the operating nut in the manual operator and shall provide autmoatic self-locking, infinite valve positioning.
2. The threaded portion of the stem shall have a minimum outside diameter of 1-1/2 inches. Stem extension pipes are not acceptable.
3. The stem shall be constructed of solid stainless steel bar for the entire length, the metal having a tensile strength of not less than 75,000 psi.
4. Maximum L/R ratio for the unsupported part of the stem shall not exceed 200.
5. In compression, the stem shall be designed for a critical buckling load caused by a 40 lb effort on the handwheel with a safety factor of 2, using the Euler column formula.
6. The stem shall be designed to withstand the tension load caused by the application of a 40 lb effort on the handwheel without exceeding 1/5 of the ultimate tensile strength of the stem material.
7. The threaded portion of the stem shall have machine rolled double lead threads of the full Acme type with a 16 microinch finish or better. Stub threads are not acceptable.
8. Stems shall be provided with adjustable stop collars to prevent over travel.

G. Stem Guides
1. Stem guide shall be provided when necessary to ensure that the maximum L/R ratio for the unsupported part of the stem is 200 or less.
2. Stem guide brackets shall be fabricated of stainless steel and shall be outfitted with UHMW or bronze bushings.

3. Adjustable in two directions.

H. Anchor Bolts
1. Anchor bolts shall be provided by the valve manufacturer for mounting the pedestal and appurtenances.
2. Quantity and location shall be determined by the valve manufacturer.

I. Materials of Construction
1. Slip tube and bail shall be stainless steel, Type 304L
2. Stem shall be stainless steel, Type 304L
3. Anchor Studs, Fasteners and Nuts shall be stainless steel, Type 316
4. Seal shall be Urethane, Neoprene or Buna-N
5. Lift Nuts shall be stainless stainless steel, Type 304.
6. Pedestals and wall bracks shall be stainless steel, Type 304L
7. Operator Housing shall be cast aluminum
8. Stem cover shall be a clear plastic Butyrate
9. Companion flange shall be cast iron

J. Valve Operator
1. Valves shall be operated by a manual handwheel. The operator shall be mounted on a pedestal
2. The valve manufacturer shall select the proper gear ratio to ensure that the valve can be operated with no more than a 40 lb effort.
3. An arrow with the word "OPEN" shall be permanently attached or cast onto the operator to indicate the direction or rotation to open the valve
4. Handwheel operators shall be fully enclosed and shall have a cast aluminum housing.
5. The handwheel shall be removable. Pedestals shall be constructed of stainless steel. Aluminum pedestals are not acceptable.
6. The pedestal height shall be such that the handwheel is located approximately 36-in above the top of the tank walls.
7. Operators shall be equipped with fracture-resistant clear butyrate.
   a. The top of the stem cover shall be closed.
   b. The bottom end of the stem cover shall be mounted in a housing or adapter for easy field mounting.
   c. Stem covers shall be complete with a mylar strip type position indicator, calibrated in ¼ inch increments to illustrate valve position. The mylar strip, provided by the manufacturer, will be affixed by the CONTRACTOR after installation to provide a true and accurate indication of the tube elevation by comparing it to the top of the rising stem.
8. Valve Schedule:

Parameter	**WAS-VLV-001**	**WAS-VLV-002**
Size, (in)	6”	6”
Max T (deg F)	100	100
Media	Thin Sludge Decant	Thin Sludge Decant
Actuator Type	Manual, Handwheel	Manual, Handwheel
System Pipe	DIP Vertical	DIP Vertical
Service	Open/Close	Open/Close
PID	Y401	Y401
Installation	Exterior-Exposed	Exterior-Exposed

2.09 TAPPING SADDLES:

A. Provide tapping saddles for services as indicated on the Contract Drawings.
B. Acceptable Manufacturers:
   1. A.Y. McDonald 73805
   2. Ford S90-xxx-NL
   3. Mueller
      a. H-13000 Series
      b. H-13400 Series
      c. S-13000 Series
   4. Engineer approved equal.

2.10 CORPORATION STOPS:

A. Provide corporation stops for service reactivations as indicated on the Contract Drawings.
B. Acceptable Manufacturers:
   1. A.Y. McDonald 74701
   2. Cambridge Brass 302NL Series
   3. Ford FB-600-x-NL
   4. Mueller B25000N
   5. Engineer approved equal.

2.11 SAMPLE/DRAIN TAPS:

A. Provide sample/drain taps on all suction and discharge pump connections and on all common pump headers after last pump connection to main header.
B. Connecting fittings and pipe shall of the same material as the receiving pipe and rated for 150 psi service.
C. Sample/drain taps shall be 1 inch and connected through corporation stops.
D. Isolation valves shall be provided with all sample/drain taps and shall be Crane bronze ball valves or Engineer-approved equal.

2.12 ELECTRIC MOTOR ACTUATORS:

A. Provide factory-mounted electric motor actuators conforming to AWWA C540 for open-close and modulating service to operate on 480V, 3 phase, 60-hertz, ac supply. Motor and control compartment enclosure shall be totally enclosed rated NEMA 4X.
C. For valves installed in Class 1, Division 1 or Class 1, Division 2 areas, motor and control compartment enclosures shall be explosionproof and listed for the classification of the area. Refer to Contract Drawings' Hazardous Area Classification Site Plan for requirements.
D. Motor shall be AC induction type, TEFC, rated 460V.
E. Duration for actuator to move from fully-open to fully-closed position, or reverse as indicated:
   1. Approximately 30 Seconds for eccentric plug valves.
   2. Approximately 5 seconds per diameter inch, but not less than 20 seconds for air service butterfly valves.
F. Equipped with a direct position readout at the valve by means of a mechanical dial-position indicator showing percent of valve opening.
G. Provide with manual handwheel operator and lockable de-clutch mechanism. Handwheel shall not rotate when electrically driven.
H. Provide the following integral accessories:
   1. Integral reversing motor starter.

2. Separate non-fused disconnects. Disconnects shall be operable from outside the enclosure and shall be integral to the assembly. Disconnect enclosure rating shall conform to the valve enclosure rating.
3. Local/Off/Remote (LOR) selector switch with auxiliary remote status contact.
4. Open/Close pushbuttons to operate actuator when LOR is in "Local".
5. Hard-wired I/O points as indicated on the Contract Drawings' Control Diagrams and Section 40 61 96A - I/O List. Discrete outputs shall be provided by dry contacts, rated minimum 2A at 120Vac.
6. Butterfly valves:
   a. Internal 480V to 24VDC power supply (PS).
      (1) PS shall be sized to operate starter, local indicating lights, internal heating systems, and provide sufficient volt-amperes to field power two digital inputs and two digital outputs to PLC.
7. Eccentric plug valves:
   a. Internal 480V to 120VAC control power transformer (CPT).
      (1) CPT shall be sized to operate starter, local indicating lights, internal heating systems, and provide sufficient volt-amperes to field power two digital inputs and two digital outputs to PLC.
8. Modulating Valves:
   a. Shall accept a 4-20mA input signal for position control.
   b. Shall provide an isolated 4-20mA isolated output signal (with integral power supply) for position indication.
9. Open/Close Valves:
   a. Provide with two indicating lights in limit switch compartment cover.
      (1) One red light indicating valve is fully open.
      (2) One green light indicating valve is fully closed.
      (3) Both lights shall be on while valve is in travel
   b. Provide 4 train mechanically driven limit switches and overtorque switches.
   c. Switches shall be gear driven from the actuator gear train, electronic switches with battery pack shall not be allowed.
10. Internal heater to prevent condensation.

I. Products of the following manufacturers shall be acceptable:
   a. Auma Actuators, Inc.
   b. Limitorque Corporation.
   C. Rotork Controls, Incorporated.

2.13 COMBINATION AIR VALVES:

A. Acceptable Manufacturers:
   1. Multiplex Manufacturing Co. Model: Crispin SA Series.
   2. Valve and Primer Corp., DeZurik/APCO Model: Series 401.

B. Design: Conform to AWWA C512 and as specified.
   1. Valve shall be heavy-duty combination air release, water style.
   2. Body and cover shall be cast or ductile iron.
   3. Float shall be stainless steel.
   4. All internal parts shall be stainless steel.

C. Operation:
   1. Release air when filling line.
   2. Admit air when emptying line.
   3. Release accumulated air while pipeline is full and operating under pressure.

D. Connection:
   1. Connect air valves 2 inches and smaller to pipeline through corporation stops.
   2. Connecting fittings and pipe shall be bronze, brass, or copper rated for 250 psi service.
   3. Isolation valves shall be provided for all air valves and shall be bronze gate valves for sizes 3 inches and smaller unless otherwise noted.
      a. Acceptable Manufacturers:
         (1) Crane Model: Figure 431.
         (2) Jenkins Model: Figure 47.
         (3) Lunkenheimer Co. Model: Figure 2151.
   4. Couplings or unions indicated between pipeline and air valve piping shall be insulated style.

2.14 FIRE HYDRANTS:

A. Acceptable Manufacturers:
   1. American Flow Control.
   2. Mueller Company, model Centurion.
   3. Engineer Approved Equal

B. Design:
   1. Conform to AWWA C502 and as specified.
   2. Provide compression type main valve designed to open against pressure. Valve facings shall be of nontoxic materials suitable for potable water service.
   3. Provide internal main valve seat opening of not less than 5 inches diameter.
   4. Design to open counterclockwise.
   5. Provide dry-type bonnet with lubricant reservoir protected by O- or Quad-ring seals.
   6. Provide mechanical joint bell on shoe.
   7. Furnish for minimum bury depth of 3.5 feet. Include extensions as required for blow-offs.
   8. Furnish with two 2-1/2-inch hose nozzles and one 4-1/2-inch pumper nozzle with NFPA 1963 standard threads. Nozzle caps shall be chained to hydrant.
   9. Provide traffic break-off joint located above and near ground surface designed to minimize accident repairs.

C. Shop Painting:
   1. Shop paint exterior of hydrants red.
   2. Interior Coating:
      a. Conform to AWWA C550.
      b. Apply to exposed interior ferrous metal surfaces.

2.15 CORPORATION STOPS:

A. Provide corporation stops as specified to isolate air valves or as manual air release or inlet valves.

B. Mueller Company Style H-10003, H-10013, or H-10045 or Engineer-approved equal as applicable.

2.16 CURB STOPS:

A. Provide curb stops for service isolation.

B. Acceptable Manufacturers:
   1. A.Y. McDonald 74701.
   2. Cambridge Brass 302NL Series.
   3. Ford FB-600-x-NL.

4. Mueller B25000N.

2.17 VALVE BOXES:

A. Acceptable Manufacturers:
   1. Clay and Bailey Manufacturing Company.
   2. Dresser Industries, Inc.
   3. Mueller Company.
   4. Neenah Foundry Company.
   5. Tyler Company.
   6. Engineer Approved Equal
B. Provide for all buried valves.
C. Design:
   1. Boxes shall consist of a cast-iron cover, lid, and base castings with 6-inch cast-iron pipe shaft.
   2. Provide extension stem to bring operating nut within 2 feet of valve box top.
   3. Drop cover shall be marked for the appropriate system (i.e., "WATER", “SEWER”).

2.18 CURB STOP SERVICE BOXES:

A. Provide curb stops and service boxes for all curb stops installed.
B. Acceptable Manufacturers:
   1. Tyler Union, Star Pipe, Castings – SB94ES, SB95ES.

2.19 VALVE IDENTIFICATION TAGS:

A. Exposed interior or exterior valves: Provide heavy duty, permanent plastic ID tags with valve number printed on tag using indelible ink and contrasting colors. Minimum tag size shall be 2"x3" and minimum letter height shall be 1". Tag shall be easily removable and shall be mounted so as not to interfere with normal valve operations. Valve ID shall be as identified in the valve schedule.
B. Vault or Pit Installed Valves: Provide a cast bronze floor plate to be anchored into the top concrete slab of pit or valve adjacent to the floor box or floor stand. Plate shall be minimum of 4"x3"x 3/16". Valve number shall be engraved in plate with minimum letter height of 1 1/2". Plate shall be anchored into concrete using threaded lugs with split stud anchor or other suitable anchoring device. Valve number shall be as identified in the valve schedule.

2.20 VALVE ACCESSORIES:

A. Post Indicator:

2.21 SHOP PAINTING:

A. Prepare surfaces and paint or coat all valves, fire hydrants, floor stands, valve boxes, corporation stops, and all related accessories standard of the manufacturer unless otherwise specified herein.
B. Paint and coatings shall be suitable for the service intended.
C. Submit type of paint or coating proposed with drawings and data for Engineer approval prior to fabrication.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Comply with provisions of AWWA C600 and as specified.

B. Thoroughly clean and remove all shipping materials prior to setting. Operate all valves from fully opened to totally closed.
C. Install eccentric plug valves in reverse position, flow and pressure against the plug face when closed, in lines with solids or stringy materials. When installed horizontally with shaft in the horizontal, the plug shall rotate open to the top recess of the valve body.
D. Install double-door wafer check valves with hinge pin in the vertical position for horizontal flow applications.
E. Install single-door wafer swing check valves with hinge pin in the horizontal position for horizontal flow applications.
F. Equip with anchorage where indicated.
G. Set fire hydrants with lowest nozzle 18 inches above finished grade. Check and fill stem bonnet lubricant reservoir.

3.02 FIELD TESTING:

A. Perform on piping and valves as specified in Section 33 31 50 - Pipe Installation and for the following:
    1. Gate valves.
    2. Butterfly valves.
    3. Check valves.
    4. Eccentric plug valves.
    5. Ball valves.
    6. Air and air/vacuum valves.
    7. Fire hydrants.

END OF SECTION 33 12 16

SECTION 33 12 41 – VERTICAL TURBINE PUMPS

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes the furnishing and installation of three vertical turbine centrifugal water pumps to be operated with variable speed drives (provided by others) with open line shafts, multistage, above surface discharge. These pumps will be installed in a new wet well for the process water system.

B. Related Work Specified Elsewhere:
   1. Protective Coatings: Section 09 90 00.
   2. Common Motor Requirements: Section 46 05 13.
   3. Process Control Panels and Hardware: Section 40 67 01.
   4. Air Vacuum Valves: Section 33 12 16.

1.02 REFERENCES:

A. Applicable Codes and Standards: Design, fabricate, assemble, and test Equipment and Materials so that upon installation in accordance with the manufacturer's recommended procedures for this application, the Equipment will conform to the requirements of the Federal Occupational Safety and Health Standards and the applicable provisions of:
   1. American Bearing Manufacturer's Association (ABMA).
   2. American National Standards Institute (ANSI).
   3. American Society for Testing and Materials (ASTM).
   4. American Water Works Association (AWWA).
   5. American Welding Society (AWS).
   6. Hydraulic Institute Standards (HIS).
   7. Institute of Electrical and Electronic Engineers (IEEE).
   8. National Electrical Manufacturers Association (NEMA).
   9. NSF International:
      a. NSF Standard 372, Drinking Water System Components – Lead Content.

B. Factory Tests and Reports:
   1. Perform tests on each pump in accordance with Hydraulic Institute Standards except as otherwise specified.
   2. Submit results of factory tests.
   3. Perform standard tests on all motors in accordance with IEEE.

1.03 SUBMITTALS:

A. Submit as specified in Division 1.

B. Submit all documentation as specified in Section 46 05 13.

C. Submittals shall include, but not be limited to, the following:
   1. Standard performance curves for each pump furnished. Curves shall cover range from shutoff through the available operating range of the pump and for the following parameters as a function of pump capacity and speed at design temperature.
      a. Total developed head.
      b. Net positive suction head (NPSH3).
      c. Efficiency.
      d. Required brake horsepower.
      e. Minimum recommended submergence.
      f. Allowable and preferred operating ranges.
      g. Provide head-capacity curves for variable speed units at 60, 70, 80, 90, and 100 percent pump design speed, including allowable and preferred operating ranges.

h. Provide level 1 lateral/structural and torsional calculations per ANSI/HI 9.6.8. Verify the system's above and belowground natural frequencies are outside of the pump operating speed range prior to installation.

2. Submit layout, dimensional, and cross-section drawings.
3. Materials of construction.
4. Motor performance data and results of shop test.
5. Manufacturer's standard protective coating system.
6. Nameplate data.
7. Weights:
   a. Total each unit.
   b. Bowl assembly.
   c. Motor.
   d. Column.
   e. Lineshaft.
   f. Coupling.
8. Equipment instruction books.
9. Maximum height required for disassembling each pump.

D. Submit shop test reports and performance data specified in paragraph 1.04A below.

E. Submit complete operation and maintenance manuals for all equipment.

1.04 QUALITY ASSURANCE:

A. Factory Tests and Reports:
1. Include all manufacturer's standard factory tests on Equipment and Material.
2. Factory shall utilize motor for project or equivalent factory motor for all testing.
3. Test all impellers for dynamic balance.
4. Assemble all pumps completely in the shop including motors, couplings, and related items to ensure component fit-up.
5. Conduct "running test," "hydrostatic test of discharge head," and "hydrostatic test of bowl assembly" for each pump in accordance with Hydraulic Institute Standards.
6. Perform all manufacturer's standard tests to determine the performance of the motors.
7. Pumps shall be tested in position as they will be installed in the field with no exceptions. Factory testing may take place without column between discharge head and pump bowls to allow for testing facility restrictions; however, test reports shall take into account the anticipated difference in losses between the test and final configuration.
8. Perform non-witnessed tests for capacity, power requirements, and efficiency, including wire-to-water, at specified rated head, shutoff head, operating head extremes, and at as many other points as necessary for accurate performance curve plotting per HI Standard section 14.6.3.4 to acceptance grade 1U and at full speed. Include hydrostatic test of at least 150% of shutoff head for bowl assembly and discharge head. Refer to HI Standard 14.6 Appendix B for required test duration.
9. Actual tests cover all data called for with the anticipated performance curves.
10. Submit a written test report and graphic representation(s) of the test results. Submit test logs containing raw test data. Test report data collected and provided shall meet the minimums of Hydraulic Institute Standards.
11. The written test reports shall be provided within seven days after completion of the final test. Retesting will be required if written test reports are not received in timeframe indicated or if tests fail requirements.
12. Submit test reports to Engineer.

B. Balance:

1. All rotating parts shall be accurately machined and shall be in as nearly perfect rotational balance as practicable. Balance shall meet the requirements for ISO 1940 Grade G6.3 or superior. Excessive vibration shall be sufficient cause for rejection of the equipment.
2. Pumps will comply with ANSI/HI 9.6.4 standard after installation.

1.05 FACTORY ASSEMBLY:

A. Pump and motor units shall be completely shop assembled and aligned prior to testing.
B. After completion of the specified factory tests, assemblies shall be prepared for shipment with the minimum amount of disassembly, and such that no field disassembly, cleaning, or flushing is required.
C. Any components removed for shipping shall be match-marked prior to removal and shipment.
D. Prepare surfaces and provide paint system standard of the manufacturer and suitable for service intended. Submit paint type and manufacturer's specification for Engineer's approval.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. Manufacturer is responsible for freight to site. Delivery, storage, and handling shall conform to the following requirement:
   1. Ship equipment as completely assembled as is possible.
   2. Tag each item of equipment.
   3. Protect connections with suitable pipe end protection.
   4. Cover flanged openings with ½ inch plywood covers attached with a minimum of four bolts.
   5. Plug or cap screwed connections with standard fittings.
   6. Provide all temporary covers and bracing required for shipment and handling at the project site.
   7. Complete instruction for handling and storage shall be provided prior to shipping of the equipment. All equipment shall have adequate provisions for handling by overhead crane or fork lift truck.

1.07 WARRANTY:

A. The Manufacturer shall warrant that all Equipment shall be free of defects caused by faulty material or workmanship for a minimum period of one (1) year.
B. Multiple warranties for individual components shall not be acceptable.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Flowserve.
B. Goulds Pumps, Inc.
C. Grundfos Peerless.
D. Pentair Fairbanks Nijhuis.

2.02 PUMPS:

A. Operating Conditions:
   1. Liquid to be pumped is treated wastewater effluent.
   2. Three pumps shall be designed for variable speed operation.
   3. Pumping operations shall be continuous.

4. Pumping controls shall be designed to provide manual operation locally at the face of each pump VFD, and both manual and automatic operation remotely from the plant control system.
5. Pumps shall be operated independently and in parallel.
6. Design to conform to the following:

Number Required	Three
Design Capacity (gpm)	195 gpm, each
Turndown Capacity (gpm)	70 gpm, each, at reduced speed
Total Dynamic Head (ft)	341 ft
Minimum Efficiency at Design Point (percent)	72 percent
Maximum Motor Size (BHP)	25 hp
Maximum Motor Speed (rpm)	1800 rpm
Shutoff Head (feet):	
Maximum	460 ft
Minimum	385 ft
Elevations (feet):	
Centerline Discharge Connection El.	859.0~~916.5~~ ft
Pump Station Floor El.	858.0~~915.5~~ ft
Max. Water Surface El.	~~913.0~~855.0 ft
Min. Water Surface El.	~~908.3~~850.0 ft
Wet Well Floor El.	847.0~~904.5~~ ft
Min. Available Submergence	2.5 ft above lip of suction bell
Discharge Connection Size (inches)	4”

7. Head-capacity curves shall be constantly falling from shutoff head.
8. Brake horsepower of motors furnished shall not be exceeded at any point on the head-capacity performance curves.
9. Total height and assembly clearances shall be compatible with operating room and intake structure.

B. Design:
1. General:
   a. Open line shaft type vertical turbine pumps.
   b. Above surface discharge heads.
   c. Multiple stage as required.
   d. Vertical hollow shaft motor.
   e. Easily accessible adjusting assembly shall be provided for vertical adjustment of pump shaft to properly position impellers.
   f. Hydraulically stable both axially and radially at all outputs.
   g. Capable of preventing damage to the pump or driver created by reverse rotation due to water receding in the discharge column or an upthrust condition.
   h. Provide locking plates or lock-tite on all bolts in the pump bowls or other portions of the pumps where the bolts can enter the pump suction if they become loose.
   i. Accurately and carefully finish all pump surfaces in contact with the fluid.
   j. Provide pumps with lifting lugs or eyebolts to lift the entire pump assembly.
2. Discharge Head:
   a. Fabricated steel type.
   b. Aboveground discharge head.
   c. Provide flange discharge connections of 125-pound class, as required, conforming to ANSI B16.1 for all cast-iron heads.

d. Provide flange discharge connections of 150-pound class, flat faced, as required, conforming to ANSI B16.5 for fabricated steel heads.
e. Adequate openings to permit easy access to the shaft coupling.
f. Include all necessary openings:
   (1) For venting, drainage, water or oil lubrication, and other purposes.
   (2) Tapped for standard pipe openings.
   (3) Tap in flange for pressure gauge connection.
g. Design and construct the discharge head to carry the complete pump and motor weight and completely cover the openings in the base plate.

3. Base Plate:
   a. Cast-iron or fabricated steel type.
   b. Designed to give rigid support to the total weight of the pump, motor, column, discharge head, and fittings.
   c. With an opening to permit removal of pump without requiring removal of base plate after grouting.
   d. With machined surfaces of contact between discharge head and base plate.
   e. Supplied with dowels, shims, bolts and all other devices required for proper installation, alignment and anchoring of units.
4. Stuffing Box:
   a. Stuffing box shall be made of cast iron and shall contain a minimum of five rings of graphite packing with bronze bushing or sleeve bearing.
   b. Be accessible through openings in the discharge head or motor stand.
   c. Top shaft shall have renewable shaft sleeve where it interfaces with packing.
5. Provide stuffing box drain connection and connection in base for piping leakage to pump wet well.
6. Bowl Assembly:
   a. Constructed of cast iron free of blow and sand holes, with minimum tensile strength of 30,000 psi.
   b. Provide flanged bowl connections with bolted stage connections.
   c. Bronze or stainless-steel impellers smoothly finished throughout, secured to a stainless-steel impeller shaft using keys, tapered collets, or threaded-type lock collets to prevent loosening in the event of reverse rotation or thermal expansion.
   d. With replaceable bronze bowl and impeller wear rings on impellers. Wear rings shall be of dissimilar materials or have a minimum hardness difference of 50 BHN.
   e. Assembly shall be dynamically balanced to eliminate vibration.
   f. Bronze sleeve bearings lubricated by liquid pumped.
7. Suction Bell:
   a. Cast iron.
   b. Design and size the suction bells to assure proper hydraulic performance under all operating conditions.
   c. Suction case bearings shall be bronze with permanently lubricated water-resistant grease.
8. Line Shaft:
   a. Design and construct the pump line shaft to run without whip or vibration under all operating conditions.
   b. Provide screwed shaft couplings of the same or better material as the line shaft.
   c. Interchangeable sections having lengths not exceeding 10 feet. Provide bearings on a maximum of 10-foot centers.
   d. Provide line shaft bearings of bronze, cutless rubber, or Engineer-approved equal.

9. Discharge Column:
    a. Discharge column pipe shall be steel with flanged connections.
    b. Interchangeable sections having length not exceeding 10 feet.

2.03 PUMP MOTORS:

A. Provide motors and accessories as specified in Section 46 05 13.
B. Rated for 460-volt, 3 phase, 60-hertz operation. Designed for operation with variable frequency drive.
C. Provide two normally closed temperature switches embedded in each phase winding for high temperature protection. Switches shall be rated for use with 120Vac.
D. Provide factory installed, maintenance free, circumferential, conductive micro fiber shaft grounding ring to discharge shaft currents to ground.
E. Provide motor with service factor of 1.15.
F. The manufacturer of the pumps is responsible for furnishing the motors, and for matching the motor and the drive, and for coordinating the collection of data and the design effort to limit harmonics.

2.04 MATERIALS:

A. The materials specified below indicate a standard of quality. Substitutions may be made or recommended by manufacturer upon approval of Engineer, if deemed necessary due to the quality of the fluid being pumped, start-up system flushing chemical additives, or other reasons.
    1. Base plate: Carbon steel structural plate or cast iron.
    2. Discharge Head: Fabricated carbon steel.
    3. Support Column: ASTM A53 carbon steel pipe.
    4. Bowl: ASTM A48 Class 30 or superior cast iron.
    5. Bowl Wear Rings: Bronze.
    6. Impellers: ASTM B584 bronze. Manufacturer standard impeller material may be acceptable if approved by Engineer.
    7. Suction Bell: ASTM A48 Class 30 or superior cast iron.
    8. Line Shaft, Pump Shaft, and Coupling: ASTM A276 Type 410 or 416 stainless steel.
    9. Shaft Sleeves: ASTM A276, Type 416 with 350 minimum BHN, or Type 304 or Type 316 stainless steel.
    10. Line Shaft Bearings: Bronze or cutless rubber.
    11. Impeller Wear Rings: Bronze.
    12. Bowl Bearings: Bronze.
    13. Suction Bell Bearing: Bronze.
    14. Bolting: ASTM A276 Type 316 stainless steel.

2.05 ANCHOR BOLT ASSEMBLY:

A. Complete anchor bolt assembly (studs, nuts, washers, etc.) to be designed by the manufacturer. Assembly not provided by the manufacturer. Anchor material shall be 316 SST. Anchor size and embedment shall be clearly shown on the equipment drawings.

2.06 MOUNTING: Contractor to mount as indicated on contract drawings.

2.07 SPARE PARTS:

A. One complete set for one pump of the following spare parts shall be furnished:
    1. Complete set of lineshaft bearings.

2. Complete set of bowl bearings.
3. Complete set of wear rings, if applicable.
4. Shaft sleeve.
5. Gaskets and complete set of packing.
6. Complete set of motor bearings.
7. Lubricants for a complete drain and refill of motor.

B. All parts supplied with the equipment shall be properly labeled for ease of identification and to permit the shortest possible time to repair. Any parts that come from a sub-supplier shall be labeled with that manufacturer's name and part number.

C. Manufacturer shall warrant that all parts shall be available for a minimum of ten years.

2.08 PROTECTIVE COATINGS:

A. Shop Painting:
1. Manufacturer shall prepare surfaces, prime and finish paint all iron and steel surfaces with manufacturer's standard coating system suitable for intended service and in accordance with Section 09 90 00.
2. All stainless-steel surfaces shall not be painted.

B. Field Painting:
1. Contractor shall touch up coatings damaged during shipment and installation.
2. Pump manufacturer shall furnish Contractor with an adequate quantity of touch-up paint.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Refer to "Manufacturers Field Services" in Division 1 for requirements for startup.

B. Perform all installation and finishing requirements as specified in Section 46 05 13.

C. Installation, start-up, and testing of all Equipment and associated construction shall conform to manufacturer's recommendations.

D. Manufacturer's field representative shall meet with Contractor to give guidelines for installation of Equipment.

E. Manufacturer's field representative shall inspect Equipment after the Equipment has been installed and prior to start-up. A written report of the inspection shall be submitted to Owner (with a copy to Engineer).

3.02 FIELD TESTING:

A. As specified in Division 1.

B. Conduct in the presence of Owner and/or Engineer.

C. Equipment Tests:
1. Performed by certified factory representative(s).
2. Check performance of all components as a functioning unit.
3. Verify factory tests as well as possible with facilities available at the Site of installation.
4. Provide for testing calibrated gauges (within 3 months).
5. Field Balance and Vibration Testing:
a. Test in accordance with ANSI/HI 9.6.4 standard.
b. Perform both Static Bump Test and Dynamic Vibration Testing to determine vibration characteristics of the pumps.
(1) Static bump test shall be performed to determine the natural frequencies of the pump.

(a) Vibration measuring device shall be compatible with test being performed.
(b) Perform static test at pump discharge.
1) Mount vibration probe as indicated by ANSI/HI discharge in Y direction as defined in ANSI/HI Figure 9.6.4.3.2.1.
2) Through use of dead blow hammer, strike pump to excite natural frequency of pump.
3) Average results from four tests to determine natural frequency in Y direction.
4) Repeat steps 1 through 3 as specified above in the X direction as defined in ANSI/HI Figure 9.6.4.3.2.1.
(c) Perform static test on top of motor.
1) Mount vibration probe on top of motor in Y direction as defined in ANSI/HI Figure 9.6.4.3.2.1.
2) Through use of dead blow hammer, strike pump to excite natural frequency of pump.
3) Average results from four tests to determine natural frequency in Y direction.
4) Repeat steps 1 through 3 as specified above in the X direction as defined in ANSI/HI Figure 9.6.4.3.2.1.
(d) Perform at other locations as determined by manufacturer.

(2) Dynamic Vibration Testing shall be performed as follows:
(a) Manufacturer shall define the minimum operating speed/flow for safe pump operation and shall coordinate with the contractor in the field to determine the resultant VFD frquency setting that results in this condition with one pump operating as installed.
(b) Dynamic vibration tests shall be taken at the following points:
1) At the frequency representing the maximum operating speed (100%) of the pump and motor.
2) At 6 Hz step downs in VFD frequency until the minimum operating frequency as determined above in the field is reached. Regions with reonsance concerns should have readings in 1 Hz increments.
3) At the vane pass frequency, if not covered during the frequency step-down testing.

(3) If vibration is outside of acceptable limits as defined by ANSI/HI 9.6.4, submit recommendations for additional testing and/or pump modifications in test report.
(a) Report shall contain the following, at a minimum:
1) Determine speed (frequency) avoidance bands that pump should not operate due to excessive vibration.
2) Provide recommendations for structural modification to pump that would allow the pump to operate at all speeds without speed avoidance bands.

D. Operational Tests:
1. Conduct such operational tests as necessary to determine that the performance of equipment and controls is as specified.
2. Tests will generally consist of placing Equipment in operation under varying conditions and observing performance.

3. Test reports will include flowrate, speed, current draw, pump discharge pressure, and sump water level under varying conditions from 50% (or minimum flowing speed based on field conditions) to 100% speed, at minimum 10% intervals.

E. Provide Field Quality Control as specified in Section 46 05 13.
F. Make all necessary Equipment adjustments and corrective work indicated by tests.
G. Submit a written test report to Owner (with one copy to Engineer) in a letter form showing operations performed and results obtained for each unit.

3.03 MANUFACTURER TRAINING: As specified in Division 1 and as follows:

A. The on-site services provided by the factory-trained representative shall include training.
B. The representative shall provide two complete training sessions to the Owner operating personnel in equipment operation and maintenance. Sessions shall be a minimum of two hours in length, or as required to complete the entire training.
C. One of the sessions shall be recorded, placed on a USB drive, and transmitted to Owner for use in training future personnel.

3.04 INSPECTION:

A. Recheck all units for alignment after Equipment has been placed in operation for approximately 30 days.
B. An inspection of each pumping unit by Equipment manufacturer's representative shall be performed approximately 60 days prior to date of warranty expiration.
   1. Ascertain or appraise the following:
      a. Status of Equipment and installation after normal usage.
      b. Adherence to manufacturer's recommended operation and maintenance of Equipment.
   2. Check the following:
      a. Alignment.
      b. Vibration.
   3. Make adjustments as necessary to restore Equipment within original tolerances.
   4. Submit a written report within 7 days to Owner (with a copy to Engineer) covering all inspection items and including recommendations when applicable.

END OF SECTION 33 12 41

SECTION 33 31 50 - PIPE INSTALLATION

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes handling, installation and testing of pipe, fittings, specials, and appurtenances as indicated or specified.

B. Related Work Specified Elsewhere:
   1. Section 31 20 50 – Site Preparation and Earthwork
   2. Section 31 23 33 – Trenching and Backfilling for Open-Cut Construction
   3. Section 33 11 00 - Pressure Pipe.
   4. Section 33 33 11 - Gravity Piping.

1.02 REFERENCES:

A. Applicable Standards:
   1. ASTM International (ASTM):
      a. D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
      b. D2774 - Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
      c. F1417 - Standard Practice for Installation Acceptance of Plastic Non-pressure Sewer Lines Using Low-Pressure Air.
   2. American Water Works Association (AWWA):
      a. C105 - Polyethylene Encasement for Ductile Iron Pipe Systems.
      b. C203 - Coal-Tar Protective Coatings and Linings for Steel Water Pipelines -Enamel and Tape- Hot-Applied.
      c. C205 - Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 Inch and Larger - Shop Applied.
      d. C206 - Field Welding of Steel Water Pipe.
      e. C209 - Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.
      f. C600 - Installation of Ductile Iron Water Mains and Their Appurtenances.
      g. C651- Disinfecting Water Mains.
      h. M9 - Concrete Pressure Pipe.
      i. M11 - Steel Pipe - A Guide for Design and Installation.
      j. M23 - PVC Pipe - Design and Installation.
      k. M55 - PE Pipe - Design and Installation.
   3. Federal Specifications (FS):
      a. SS-S-00210 - Sealing Compound, Preformed Plastic, For Expansion Joints and Pipe Joints.

1.03 DELIVERY, STORAGE AND HANDLING:

A. Handle in a manner to ensure installation in sound and undamaged condition.
   1. Do not drop or bump.
   2. Use slings, lifting lugs, hooks, and other devices designed to protect pipe, joint elements, linings, and coatings.

B. Ship, move, and store with provisions to prevent movement or shock contact with adjacent units.

C. Handle with equipment capable of work with adequate factor of safety against overturning or other unsafe procedures.

D. Pipe openings shall be covered during shipment.
E. Inside of pipe shall kept clean and free of debris during on-site storage.
F. Staged PVC Pipe shall remain covered and protected from ultraviolet light (sun) until it is prepared for installation.

PART 2 - PRODUCTS Specified in respective Sections, this Division.

PART 3 - EXECUTION

3.01 EXCAVATION, TRENCHING, BEDDING, AND BACKFILLING:

A. Conform to Section 31 23 33 and as follows:
1. Limit trench excavation ahead of last pipe installed to not more than 200 feet.
2. Over-excavate unsuitable material as determined by Engineer and backfill to bottom of bedding grade with approved compacted material, at no additional expense to Owner.
3. Maintain trenches in a dewatered condition from start of trench to completed backfill.
4. Use, install, and remove sheeting as specified in Section 31 20 50.
5. All joints not previously pressure tested shall be left uninsulated and exposed for examination prior to backfill. Code provided exceptions to visual examination prior to backfill shall be approved by Engineer prior to commencing excavation.
6. Limit open trench behind pipe installation to not more than 200 feet.
7. Ensure that the embedment material is carefully worked and compacted under the haunches of the pipe.
8. Place remainder of backfill and compact as specified in Division 31.
9. During compaction, take care to prevent direct contact with the pipe by tools or mechanical equipment and avoid impacting or deflecting the pipe by placement of compaction equipment directly over the pipe.
10. Perform all Work under and adjacent to buildings as specified in Division 01.
11. Use sheeting and bracing as needed to protect existing structures and facilities.
12. Take special care when performing Work immediately adjacent to existing structures and facilities. Structures and facilities damaged by Contractor's operations shall be replaced by Contractor at no cost to Owner.

3.02 INSTALLATION - GENERAL:

A. Use equipment, methods, and materials ensuring installation to lines and grades indicated.
1. Maintain within tolerances specified or acceptable laying schedule.
a. Alignment: ±1 inch per 100 feet.
b. Grade: ±1 inch per 100 feet.
2. Do not lay on blocks unless pipe is to receive total concrete encasement.
3. Accomplish horizontal and vertical curve alignments with bends, bevels, and joint deflections.
a. Limit joint deflection with ductile iron pipe to conform to AWWA C600.
4. Obtain acceptance of method proposed for transfer of line and grade from control to the Work.
B. Install pipe of size, materials, strength class, and joint type with embedment indicated for plan location.
C. Clean interior of all pipe, fittings, and joints prior to installation. Exclude entrance of foreign matter during installation and at discontinuance of installation.
1. Close open ends of pipe with snug-fitting closures.

2. Do not let water fill trench. Include provisions to prevent flotation should water control measures prove inadequate.
3. Remove water, sand, mud, and other undesirable materials from trench before removal of end cap.

D. Brace or anchor as required to prevent displacement after establishing final position.
E. Perform only when weather and trench conditions are suitable. Do not lay in water, snow, or ice.
F. Observe extra precaution when hazardous atmospheres might be encountered.

3.03 JOINTING:

A. General Requirements:
1. Locate joint to provide for differential movement at changes in type of pipe embedment, impervious trench checks, and structures.
a. Not more than 8 inches from structure wall, or
b. Support pipe from wall to first joint with concrete cradle structurally continuous with base slab or footing.
c. As indicated.
2. Perform conforming to manufacturer's recommendations.
3. Clean and lubricate all joint and gasket surfaces with lubricant recommended.
4. Use methods and equipment capable of fully seating or making up joints without damage.
5. Check joint opening and deflection for specification limits.

B. Special Provisions for Jointing Ductile Iron Pipe:
1. Conform to AWWA C600.
2. Visually examine while suspended and before lowering into trench.
a. Paint bell, spigot, or other suspected portions with turpentine and dust with cement to check for cracks invisible to the eye.
b. Remove turpentine and cement by washing when test is satisfactorily completed.

C. Special Provisions for Jointing Steel Pressure Pipe:
1. Conform to AWWA M11.
2. Check for holidays in coating and make repairs as required.
3. Weld pipe and fittings to conform to AWWA C206.
4. Grout inside joints of welded pipe and fittings mortar lined conforming to AWWA C205.
5. Apply epoxy coating to inside of welded joints in pipe 24 inches and larger.
6. Apply cold tape coating conforming to AWWA C209 to buried exterior connections, special sections, fittings, couplings, and bare metal.

D. Special Provisions for Jointing PVC Pipe and Composite Sewer Pipe:
1. Conform to ASTM D2321. Pressure pipe installation shall also conform to AWWA M23.
2. Excavate bell holes at each joint or coupling to provide full length barrel support of the pipe and to prevent point loading at the bells or couplings.
3. Seal cut face of any joint of Composite Sewer Pipe installed to prevent exfiltration during air testing.
4. Connect pipe to new or existing rigid structures or manhole tie-ins with manhole couplings.

E. Special Provisions for Grooved-End and Shouldered Type Joints:
1. Use fittings and couplings that are made by the same manufacturer that are listed for use together.

2. Assemble joints with coupling, gasket, lubricant, and bolts according to manufacturer's written instructions.

3.04 ELECTRICAL BONDING AND INSULATION:

A. Electrically bond adjacent lengths of pipe and fittings unless otherwise indicated.
B. Use materials specified in Section 33 11 00 - Pressure Pipe applied to conform to manufacturer's instructions.
C. Install insulated joints of dielectric materials.
   1. Where indicated.
   2. Between dissimilar materials which could cause galvanic action.
   3. Conform to manufacturer's instructions.

3.05 CUTTING:

A. Cut in neat manner without damage to pipe.
B. Observe Contract Specifications regarding joint locations.
C. Cut ductile iron and steel pipe with carborundum saw or other acceptable method per manufacturer's instructions.
   1. Smooth cut by power grinding to remove burrs and sharp edges.
   2. Repair lining as required and approved.

3.06 CLOSURE PIECES:

A. Connect two segments of pipeline or a pipeline segment and existing structure with short sections of pipe fabricated for the purpose.
B. Observe Contract Specifications regarding location of joints, type of joints, pipe materials, and strength classifications.
C. Field-fabricated closures, where required, shall be concrete encased between adjacent flexible joints.
D. May be accomplished with sleeve coupling:
   1. Of length such that gaskets are not less than 3 inches from pipe ends.
   2. Wrap exterior of buried steel couplings with polyethylene encasement conforming to AWWA C105.

3.07 TEMPORARY PLUGS:

A. Furnish and install temporary plugs at each end of Work for removal by others when completed ahead of adjacent contract.
B. Plugs:
   1. Test plugs as manufactured by pipe supplier.
   2. Fabricated by Contractor of substantial construction.
   3. Secured in place in a manner to facilitate removal when required to connect pipe.

3.08 CONNECTIONS TO EXISTING STRUCTURES:

A. Connect pipe to existing structures and pipelines where indicated.
B. Prepare structure by making an opening with at least 3 inches clearance all around fitting to be inserted.
C. Observe pertinent articles of Contract Specifications pertaining to joint locations and closures.
D. Repair wall opening with nonshrinking grout.

3.09 POLYETHYLENE ENCASEMENT:

A. Encase pipe, fittings, valves, and other appurtenances with polyethylene film as indicated or specified.
B. Materials:
   1. Polyethylene material shall be as follows:
      a. Conform to AWWA C105.
      b. Class C (Black).
   2. Adhesive tape shall be as follows:
      a. Approximately 2 inches wide and plastic backed.
      b. Capable of bonding securely to metal surfaces and/or polyethylene material.
      c. Polyken No. 900, Scotchrap No. 50, or Engineer approved equal.
C. Installation:
   1. Perform to conform to AWWA C105.
   2. Use adhesive tape to fasten polyethylene film in place.
   3. Minimize exposure of polyethylene film to sunlight.
   4. Wrap pipe, valves, fittings, and couplings per AWWA C105 installation standards.
   5. Repair any cuts, tears, punctures, or damage to polyethylene film with PVC tape or short length of polyethylene sheet or cut open tube, wrapped around pipe to cover damaged area and secure in place.
   6. Prevent damage to film by assuring that backfill material is free from cinders, refuse, boulders, rocks, stoned or other material that could damage the film. Follow AWWA C600 for backfilling.

3.10 TRACER WIRE:

A. All utility main installations shall include the installation of a single tracing wire taped to the top of the pipe.
   1. Tracer wire shall be secured at no less than three locations per length of pipe and at every fitting or change in direction.
B. The tracing wire shall be installed in a continuous run and the ends of the tracer wire shall be brought to the surface in test stations.
   1. Trace wire shall be routed around manholes/vaults and brought up into test stations/tracer wire boxes located adjacent to the utility marker posts and secured with a stainless steel strap or as otherwise directed by Owner and/or Engineer.
C. Wire splices shall be accomplished using a mechanical connector and sealed with an epoxy type material.

3.11 FIELD TESTING:

A. Acceptance Tests for Gravity and Low-Pressure Pipelines:
   1. Alignment:
      a. Sewer shall be inspected by flashing a light between manholes or by physical passage where space permits.
      b. Contractor shall clean pipe of excess mortar, joint sealant, and other dirt and debris prior to inspection.
      c. Determine from Illumination or Physical Inspection:
         (1) Presence of any misaligned, displaced, or broken pipe.
         (2) Presence of visible infiltration or other defects.
      d. Correct defects as required prior to conducting leakage tests.
   2. Leakage Test:
      a. Contractor shall perform by exfiltration method on all pipe installed.
      b. Furnish water and all facilities required including:

(1) Necessary piping connections.
(2) Test pumping equipment.
(3) Water meter.
(4) Pressure gauge.
(5) Bulkheads.
(6) All miscellaneous items required.

c. Obtain acceptance of equipment and acceptance of methods proposed for use.
d. Conduct initial test on first section of pipe laid and then every 500 feet of installed pipe
(1) Include a minimum of 10 lengths of pipe but not to exceed 300 feet.
(2) Perform before backfilling.
(3) Satisfactorily complete test before crew is permitted to continue pipe installation.
e. Test remaining pipe in sections determined by Contractor and approved by Engineer.
f. Perform at test pressures specified as measured: Ductile iron, RCP, PVC, and Composite Pipe, not less than 4 feet of water above the invert of the sewer at the upstream manhole nor more than 20 feet of water.
g. Maintain test as necessary to locate all leaks but not less than two hours.
h. Repeat as necessary after repair of leaks and defects until leakage as measured does not exceed limits listed in gallons per inch of internal diameter per hour per 100 feet of pipe length:

	Gallons
(1) Sanitary and industrial waste sewer	0.15

i. Protect manholes and other structures by means of bulkheads to prevent bursting pressures from being applied inside the structure.
j. Dewater pipe and manholes upon completion of testing.

3. Deflection Testing for Gravity Pipelines:
a. All systems flowing by gravity and constructed of PVC pipe shall be tested for vertical ring deflection using a properly sized "Go, No-Go" Mandrel, or sewer ball.
b. Maximum allowable vertical ring deflection shall be 5% of the pipe mean internal diameter.
c. Pipe shall be tested after backfill and compaction has been in place for 30 days.
d. Mandrel shall be suitable for the pipe type installed and maximum allowed deflection specified.
e. Any pipe not meeting deflection limits shall be removed and replaced.

B. Acceptance Tests for Pressure Pipelines:
1. Perform hydrostatic pressure and leakage tests.
a. Conform to AWWA C600 procedures.
(1) As modified herein.
(2) Shall apply to all pipe materials specified.
b. Perform after backfilling.
2. Test separately in segments between sectionalizing valves, between a sectionalizing valve and a test plug, or between test plugs.
a. Select test segments such that adjustable seated valves are isolated for individual checking.
b. Contractor shall furnish and install test plugs.
(1) Including all anchors, braces, and other devices to withstand hydrostatic pressure on plugs.

(2) Be responsible for any damage to public or private property caused by failure of plugs.

3. Limit fill rate of line to available venting capacity. Fill rate shall be regulated to limit velocity in lines when flowing full to not more than 0.05 to 1 fps.
4. Owner shall make water for testing available to Contractor at nearest source.
5. Pressure and Leakage Test:
   a. Test pressure shall not be less than 1.5 times the working pressure at the highest point along the test section.
   b. Be at least 2-hour duration. Maintain pressure throughout test $\pm$5 psi of test pressure.
   c. Leakage test shall be conducted concurrently with the pressure test.
   d. Acceptable when leakage does not exceed that determined by the following formula:

$$L = 0.0000075\ SD(P)^{1/2}$$

L = allowable leakage (gallons per hour)
S = length of pipe tested (feet)
D = nominal diameter of the pipe (inches)
P = average actual leakage test pressure (psig)

   e. These formulas are based on an allowable leakage of 11.65 gpd/mile/in of nominal diameter at a pressure of 150 psi.
   f. When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gal/hr/in of nominal valve size shall be allowed.
   g. When hydrants are in the test section, the test shall be made against the main valve in the hydrant.
   h. Repeat test as necessary.
      (1) After location of leaks and repair or replacement of defective joints, pipe, fittings, valves or hydrants. All visible leaks are to be repaired regardless of the amount of leakage.
      (2) Until satisfactory performance of test.
   i. Owner and/or Engineer will witness pressure and leakage test.
6. Soil Corrosion Testing
   a. Perform electrical conductivity test on bonded pipe segments.
   b. Perform pipe-to-soil potential surveys.
   c. Submit 3 copies of test and survey reports to Engineer.

END OF SECTION 33 31 50

SECTION 33 32 22 - SUBMERSIBLE PUMPS

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section covers furnishing and installing submersible influent wastewater pumps and the plant sewer pumps as indicated and specified.

B. Submersible pumps shall be furnished complete with pump casings, shafts, bearings, seals, lubrication, piping assemblies, guide rails, anchor bolts, motors, controls, power cable, and all other parts and accessories indicated, specified, or required for proper installation, operation, and maintenance.

C. Pumps shall be capable of pumping influent wastewater.

D. Related Work Specified Elsewhere:
   1. Protective Coatings: Division 9.
   2. Electrical: Division 26.
   3. Motors: Section 46 05 13 – Common Motor Requirements for Water and Wastewater Equipment.
   4. Instruments and Control Systems: Division 40.
   5. Manufacturer's Field Services: Division 1.
   6. Piping and Accessories: Division 33.

1.02 REFERENCES:

A. Applicable Standards:
   1. American National Standards Institute (ANSI):
      a. B16.1 - Cast-Iron Pipe Flanges and Flanged Fittings.
   2. American Society for Testing and Materials (ASTM):
      a. A48 – Gray Iron Castings.
   3. American Iron and Steel Institute (AISI).
   4. American Bearing Manufacturer's Association (ABMA).
   5. Hydraulic Institute Standards (HIS).
   6. National Electrical Manufacturer's Association (NEMA).
   7. Institute of Electrical and Electronics Engineers (IEEE).
   8. National Fire Protection Association (NFPA):
      a. 70 - National Electrical Code (NEC).
   9. Underwriters Laboratories, Inc (UL):
      a. 508 - Industrial Control Equipment.

1.03 SUBMITTALS:

A. Submit as specified in Division 1.

B. Submittals shall include, but not be limited to, the following:
   1. General arrangement drawing of pump, motor and base with proposed equipment data highlighted. Manufacturer shall submit statement indicating that proposed installation is in compliance with HI and manufacturer requirements. All units shall be in English Units.
   1. Standard performance curves for each pump model furnished. Curves shall cover range from shutoff through the pump’s complete allowable operating range at the conditions specified, and shall be submitted for the following parameters as a function of pump capacity and speed at design temperature:
      a. Total developed head.
      b. Required brake horsepower.

c. Pump efficiency.
d. Net psositive suction head (NPSH3).
e. Minimum recommended submergence.

2. Mechanical details including impellers, bearings, couplings and seals.
3. Submit layout, dimensional and cross-section drawings.
4. Manufacturer's standard protective coating system.
5. Motor performance data and results of shop test.
6. Pump nameplate data.
7. Motor nameplate data.
8. Base elbow details.
9. Weights:
   a. Total each unit.
   b. Pump.
   c. Motor.
   d. Base elbow.
10. Bearing life calculations showing the pump meets or exceeds the L-10 life specified in part 2.06.E.1 of this specification section.

C. Perform witnesed factory performance test for each pump in accordance with HI 14.6. Pumps shall meet 1U test tolerance per HI 14.6.3.4.
   1. Provide all factory test logs showing flow, discharge pressure, brake horsepower, input power, and pump efficiency. Provide sample calculations and instrument calibration information.

D. Perform hydrostatic test on each pressure-containing component per HI 14.6 appendix B.

E. Operation and Maintenance Manual includes, but not limited to, the following:
   1. Special shipping, storage, protection, and handling instructions including dimensions of each container or package shipped.
   2. Recommended unloading method at project site including implement (e.g., forklift, etc.) and maximum container or package weight.
   3. Manufacturer’s printed installation instructions.
   4. The manual shall be prepared specifically for this installation and shall include all required cuts, drawings, wiring diagrams, equipment lists, descriptions, etc. that are required to instruct operating and maintenance personnel unfamiliar with such equipment. The maintenance instructions shall include trouble shooting data, full preventative mainteance schedule and complete spare parts lists with order information. In addition the manuals shall include the following at a minimum:
      a. Complete parts list cross-referenced to an exploded biew assemby or equivalent drawing.
      b. Dimensional drawings of all provided equipment with component weights.
      c. Complete preventative maintainence procedures (including reccomended intervals).

F. Certifications:
   1. Manufacturer’s or Manufacturer Representative’s Certificate of proper installation and start-up.
   2. Field performance test procedures.
   3. Submit complete, signed report of results of field inspection, operation, adjustments, and tests. Include the Manufacturer’s certificate that the equipment is ready for permanent operation and that nothing in installation will affect Manufacturer’s warranty in any manner, or render warranty null and void.

1.04 QUALITY ASSURANCE:

A. All items of equipment specified herein shall be furnished by one Manufacturer. This Manufacturer shall have the responsibility of providing the equipment, accessories, controls, installation supervision, and testing services required to provide a functioning system.
B. Like items of equipment provided hereunder shall be the end products of one Manufacturer in order to achieve standardization for appearance, operation, maintenance, spare parts, and Manufacturer's service.
C. Manufacturer to provide specific standard factory tests and reports for each pump.
D. The contractor shall provide all piping and appurtenances for the suction and discharge piping shown on the Drawings. The contractor shall make any necessary adjustments to the suction and discharge piping based on the selected pump manufacturer at no additional cost to the Owner.

1.05 FACTORY ASSEMBLY:

A. Pump/motor units shall be completely shop assembled and aligned prior to shipping.
B. After completion of the specified factory tests, pumps shall be prepared for shipment with the minimum amount of disassembly, and such that no field disassembly, cleaning, or flushing is required.
C. Any components removed for shipping shall be match-marked prior to removal and shipment.
D. Prepare surfaces and provide paint system standard of the manufacturer and suitable for service intended. Submit paint type and manufacturer’s specification with Submittals.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. Shall be as specified in Division 1.

1.07 WARRANTY:

A. The Manufacturer shall warrant that all Equipment shall be free of defects caused by faulty material or workmanship for a minimum period of one (1) year.
B. Multiple warranties for individual components shall not be acceptable.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Ebara.
B. Flygt, a Xylem brand.
C. HOMA.
D. KSB.
E. Sulzer - ABS.

2.02 GENERAL REQUIREMENTS:

A. Submersible pumps shall be furnished complete with pump casings, shafts, bearings, seals, lubrication, piping assemblies, guide rails, anchor bolts, motors, power cable, and all other parts and accessories indicated, specified, or required for proper installation, operation, and maintenance.
B. Provide totally sealed submersible electrically operated pump capable of pumping raw wastewater.
C. Provide pump capable of operating continuously for extended periods of time without damage.
D. Pump design point shall fall within the preferred operating range.

E. Pump shall operate at or near maximum efficiency at operating conditions.
F. Pump head-capacity curve shall be continuously falling from shutoff head.
G. Pump discharge connection elbow and discharge piping shall be installed such that pump will automatically connect and seal to discharge connection elbow when lowered into place.
H. Pump shall be easily removable for inspection or service.
I. Provide guide rail system and pump rail guide bracket to raise or lower pump unit by Type 316 stainless steel chain or cable..
J. Guide entire weight of pump unit with a minimum of two single-piece guide bars.
K. Seal interface of the pump and discharge elbow by metal-to-metal contact or profile gasket.
L. Motor shall be suitable for use with variable speed drive.
M. Pumps shall be able to pump 3-inch diameter solids.
N. Motor shall be inverter duty rated.
O. Influent pumping will require automatic operation 24 hours per day, 7 days a week.
P. Plant sewer pumping will require automatic operation 24 hours per day, 7 days a week.
Q. All electrical equipment to be rated for installation in a Class 1, Division 1, Group D area.
R. For the Influent Pumps, provide an integral closed loop cooling system that circulates glycol through a jacket surrounding the motor designed for a wet well elevation at the top of the pump volute without requiring the liquid level in the wet well for cooling.
    1. A stainless steel cooling jacket shall encircle the stator housing, providing for dissipation of motor heat regardless of the type of pump installation.
    2. An impeller, integral to the cooling system and driven by the pump shaft, shall provide the necessary circulation of the cooling liquid through the jacket.
    3. The cooling liquid shall pass about the stator housing in the closed loop system in turbulent flow providing for heat transfer.
    4. The cooling system shall have one fill port and one drain port integral to the cooling jacket. Cooling jackets with internal cooling or using pumpage in a cooling jacket is unacceptable.

2.03 DESIGN REQUIREMENTS – INFLUENT HIGH FLOW PUMPS: Pumps shall be designed for the following:

A. Number of Units: 3
B. Equipment Tags: IPS-PMP-110, IPS-PMP-120, IPS-PMP-150
C. Design Capacity, Pump Station Peak Flow
    1. Static Head: 84.33 feet
    2. Total Dynamic Head: 101.6 feet
    3. Flow: 3,150 gpm
    4. Minimum Overall Efficiency: 73%
D. Design Capacity, One Pump Operating at Max Flow
    1. Static Head: 82.13 feet
    2. Total Dynamic Head: 90.5 feet
    3. Flow: 3,810 gpm
    4. Minimum Overall Efficiency: 73%
E. Shutoff Head (minimum): 150 feet.
F. Runout Head (maximum): 60 feet
G. Maximum Motor Speed: 1,800 rpm
H. Maximum Motor Horsepower: 150 hp
I. Pump Volute Discharge Diameter: 10-inch
J. Maximum Water Depth in Wet Well: 11 feet
K. Minimum Water Depth in Wet Well: 2.5 feet

2.04 DESIGN REQUIREMENTS – INFLUENT LOW FLOW PUMPS: Pumps shall be designed for the following:

A. Number of Units: 2
B. Equipment Tags: IPS-PMP-130, IPS-PMP-140
C. Design Capacity, Pump Station Peak Flow
   1. Static Head: 84.33 feet
   2. Total Dynamic Head: 99.6 feet
   3. Flow: 1,180 gpm
   4. Minimum Overall Efficiency: 65%
D. Design Capacity, One Pump Operating at Max Flow:
   1. Static Head: 81.83 feet
   2. Total Dynamic Head: 86.2 feet
   3. Flow: 1,490 gpm
   4. Minimum Overall Efficiency: 65%
E. Shutoff Head (minimum): 150 feet
F. Runout Head (maximum): 60 feet
G. Maximum Motor Speed: 1,800 rpm
H. Maximum Motor Horsepower: 50 hp
I. Pump Volute Discharge Diameter: 6-inch
J. Maximum Water Depth in Wet Well: 11 feet
K. Minimum Water Depth in Wet Well: 2.5 feet

2.05 DESIGN REQUIREMENTS – PLANT SEWER PUMPS: Pumps shall be designed for the following:

A. Number of Units: 2
B. Equipment Tags: PSEW-PMP-110, PSEW-PMP-120
C. Design Capacity, One Pump Operating at Max Flow
   1. Static Head: 48 feet
   2. Total Dynamic Head: 63 feet
   3. Flow: 860 gpm
   4. Minimum Overall Efficiency: 63%
D. Maximum Motor Speed: 1,800 rpm
E. Maximum Motor Horsepower: 25 hp
F. Pump Volute Discharge Diameter: up to 6-inch
G. Maximum Water Depth in Wet Well: 9.25 feet
H. Minimum Water Depth in Wet Well: 2.5 feet

2.06 MATERIALS AND CONSTRUCTION:

A. Construct motor housing, pump casing, and major pump components of cast iron conforming to ASTM A48 Class 30 or superior.
B. Provide bolts, nuts, and washers of AISI Series 300 stainless steel.
C. Impeller:
   1. Cast iron. Manufacturer standard impeller material may be acceptable if approved by Engineer.
   2. Nonclog design.
   3. Secured to shaft with key and self-locking device to prevent slipping in either direction.
   4. Balanced statically and dynamically to the ISO 1940 standard Grade G6.3 or superior to eliminate vibration and minimize hydraulic end thrust.
   5. Castings shall not have been repaired by plugging, welding, or other means.

6. Provide renewable stainless steel or bronze casing wearing ring for efficient sealing between volute and impeller for enclosed impellers. Provide impeller wear rings on impellers. Wear rings shall be of dissimilar materials or have a minimum hardness difference of 50 BHN.

D. Shaft:
1. Ample diameter to assure first critical speed will occur at not less than 150 percent of rated pump speed.
2. Manufacturer's standard stainless steel.

E. Bearings:
1. Minimum L-10 life of 100,000 hours at the design point(s).
2. Pump shaft to rotate on two (upper and lower) permanently lubricated bearings without end movement.

F. Shaft Seal:
1. Two mechanical seals in oil bath reservoir shall seal pumped liquid from motor compartment.
2. Moisture detector shall be installed in oil seal chamber and connected to pump controls.
3. Seal faces shall be made of tungsten carbide, carbon, ceramic, or silicon carbide.

2.07 ACCESSORIES:

A. Pump Discharge Connection:
1. Connected to discharge piping and anchored to sump floor with stainless-steel anchor bolts.
2. Designed to receive pump discharge connection without bolts.
3. Integral with guide rail.
4. Cast or ductile iron.
5. Flanges shall conform to ANSI B16.1.

B. Guide Supports:
1. Fasten stainless-steel guide supports so that no lifting loads are applied to pump or motor housing.

C. Lifting Chain and/or Cable:
1. Provide one stainless-steel chain or cable for each pump.
2. Design to raise and lower pump with additional safety factor for overcoming force of pump hang-ups.
3. Provide hook for chain or cable when not in use.
4. Provide chain and/or cable with length as needed for each pump's wet well. Refer to contract drawings for wet well dimensions.

D. Guide Rails:
1. 316 Stainless-steel pipe and shall be one continous pipe.
2. All 316 stainless steel, including rails, brackets, and anchor bolts.
3. Size as recommended by pump manufacturer.
4. Shall not support any portion of the pump weight.
5. Provide a minimum of two guide rails.

E. Cables and Accessories:
1. Provide continuous cables from the motor to the indicated motor terminating junction box or power disconnect switch when the motor is in operating position.
2. The outer jacket of the cable shall be UV/sunlight, oil, water and hydrogen sulfide resistant and shall be capable of continuous submerged operation underwater to a depth of 65 feet.
3. Cables shall be sized according to NEC and CSA Standards.

4. Cables shall be easily adjusted to pumping level without splices.
5. Provide stainless steel grip holders for pump and control cables.
6. Pump power cables shall include overall copper shielding for entire length of cable.

2.08 ELECTRICAL EQUIPMENT:

A. Conform to NEC, NEMA, IEEE and Divisions 26 and 40 on all electrical equipment and controls.
B. Provide motors and accessories as specified in Section 46 05 13.
C. Rated for 460-volt, 3 phase, 60-hertz operation. Designed for operation with variable frequency drive.
D. Provide motor with service factor of 1.15.
E. Motors shall be equipped with thermal sensors attached to or imbedded in the motor windings and connected to pump controls.
F. Motors shall be equipped with a moisture sensor and connected to pump controls.
G. For motors larger than 50 HP:
    1. Provide motor housing leak detection.
    2. Provide PT100 sensor in lower bearing.
H. Motors shall be equipped with additional standard sensors, as recommended by the manufacturer.
I. Each pump shall be supplied with a manfacturer's standard protection relay, rated for 120Vac operation. Coordinate with the Contractor to install the relay at the motor starter and provide the following functions:
    1. Monitor pump motor temperature switch. Shutdown pump on high temperature.
    2. Detect moisture inside pump motor. Initiate warning signal on moisture detection.
    3. Monitor any additional sensors. Shutdown pump or initiate warning signal, as recommended by the manufacturer.
J. Provide each pump with with inlet and receptacle pair(s) for complete electrical disconnect of the pump motor and accessories.
    1. Provide inlet and receptacle with the following quantity of pins:
        a. Power contacts: 3 phases and ground.
        b. Instrumentation contacts:
            (1) Provide auxiliary contacts as required for connection to the pump's moisture and thermal protection elements.
                (a) Include 2 additional auxiliary contacts for the plant sewer pumps. Contacts shall be jumpered within inlet to indicate disconnect of pump motor.
            (2) If quantity of required auxiliary contacts is not available for the disconnecting assembly, provide the following:
                (a) Additional inlet and receptacle pair for disconnect of all moisture and thermal protection elements.
                (b) Additional pump control cable for all moisture and thermal protection elements.
    2. Provide power inlet as follows:
        a. Pump power cable overall shield and ground conductor shall be terminated to the ground contact.
        b. Metal handle.
        c. Cable reducers as necessary.
        d. Protective inlet cap.
    3. Provide power receptacle as follows:

a. Designed for connection to inlet.
b. Angle - 60°.
c. Cable reducers as necessary.
d. Padlockable pawl with locking pin.

4. The above requirements are minimum. Provide inlet and receptacle pairs with all parts required for a complete installation.
5. Provide the pump power inlet and receptacle pairs as follows:
   a. Influent Pumps – Meltric, DR400 or Engineer-approved equal.
   b. Plant Sewer Pumps – Meltric DSN60 or Engineer-approved equal.

2.09 ANCHOR BOLT ASSEMBLY:

A. Complete anchor bolt assembly (studs, nuts, washers, etc.) to be designed and provided by the Manufacturer. Anchor material shall be 316 SST. Anchor size and embedment shall be clearly shown on the equipment drawings.

2.10 SPARE PARTS:

A. The following shall be provided:
   1. A complete set of bearings.
   2. A complete set of case and impeller wear rings.
   3. A complete upper and lower mechanical seal or a seal repair kit.
B. All parts supplied with the equipment shall be properly labeled for ease of identification and to permit the shortest possible time to repair. Any parts that come from a sub-supplier shall be labeled with that manufacturer's name and part number.
C. Manufacturer shall warrant that all parts shall be available for a minimum of ten years.

2.11 PROTECTIVE COATINGS:

B. Shop Painting:
   1. Prepare surfaces, prime, and finish paint all iron and steel surfaces as specified in Section 09 90 00.
   2. Prepare surface of damaged and uncoated areas and touch-up as required for complete protection
   3. All nameplates, bronze or stainless steel surfaces shall not be painted.

PART 3 - EXECUTION

3.01 INSTALLATION, START-UP, AND TESTING:

A. All Work shall conform to manufacturer's recommendations and the requirements of Division 1.
B. Perform all installation and finishing requirements as specified in Section 46 05 13.
C. Make all electrical and control connections.
D. Provide all necessary lubrication for initial start-up, testing and as required for final acceptance.
E. Provide a complete unit with all materials, components and adjustments as required for successful operation.
F. Installation, start-up and testing of all equipment and associated construction shall conform to manufacturer's recommendations.
G. Do not place grout for pump pedestal bases until pumps are complete aligned.
H. Install pipe and pipe appurtenance supports to minimize stresses being placed on pump.

3.02 MANUFACTURER'S FIELD SERVICE:

A. Provide installation, start-up, and testing services for all Equipment as specified in Division 1.
B. Manufacturer shall certify in writing that equipment has been inspected, is properly installed, and is ready for initial startup. Manufacturer shall be present for testing as indicated in the applicable portion of this specification.
C. Provide a minimum of four (4) hours of service for training of Owner's personnel. Training shall include:
    1. Operation, start-up, shut-down, lock-out, emergency operating procedures, contol, adjustment, maintenance, assembly, disassemblu, and repair of the equipment including control sequences, identification systems, materials, spare parts, special tools, lubricants and fuels.
    2. Technical repair manual.
    3. Cleaning.
    4. Lubrication of equipment.
    5. Optimizing equipment and system performance.
    6. Capabilities of equipment and systems.
    7. Operational safety of equipment and systems.
    8. Emergency situation response of equipment and systems.

3.03 PERFORMANCE TESTS:

A. As specified in Division 1.
B. Conduct in the presence of General Contractor, Owner, and/or Engineer.
C. Provide Field Quality Control as specified in Section 46 05 13.
D. Equipment Tests:
    1. Check performance of all components as a functioning unit.
    2. Megger stator and power cables.
    3. Check seal lubrication.
    4. Check for proper rotation.
    5. Check power supply voltage.
    6. Measure motor operating load and no load current.
    7. Motors: Insulation (megger) test, rotational direction (bump) test and visual inspections required by NETA ATS.
E. Operational Tests:
    1. Conduct such operational tests as necessary to determine that the performance of Equipment and controls is as specified.
    2. Tests will generally consist of placing Equipment in operation under varying conditions and observing performance.
    3. Test reports will include flowrate, speed, current draw, pump discharge pressure, and sump water level under varying conditions from 50% (or minimum flowing speed based on field conditions) to 100% speed, at minimum 10% intervals.
F. Make all necessary Equipment adjustments and corrective work indicated by tests.
G. Submit a written test report to Owner with one copy to Engineer in a letter form stating operations performed and results obtained for each unit.

3.04 INSPECTION:

A. Inspection:
    1. Perform on Equipment unit by manufacturer's representative.
    2. Perform within 60 days prior to date of warranty expiration.
    3. Ascertain or appraise the following:

a. Status of Equipment and installation after normal usage.
b. Adherence to manufacturer's recommended maintenance and operation of Equipment.

4. Include the following:
   a. Alignment checks.

B. Make adjustments necessary to restore Equipment within original tolerances.

C. Submit a written letter report to Owner with copy to Engineer covering the inspection items and including recommendations where applicable.

END OF SECTION 33 32 22

SECTION 33 31 11 – GRAVITY PIPING

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes all gravity pipe, fittings, and specials.

B. Related Work Specified Elsewhere:

1. Section 31 20 50 - Site Preparation and Earthwork.
2. Section 33 39 00 - Utility Structures.

1.02 REFERENCES:

A. Applicable Standards:

1. ASTM International (ASTM):
   a. C76 – Standard Specification for Reinforced Concrete Culvert, Storm Drain.
   b. D1248 – Polyethylene Plastics Molding and Extrusion Materials.
   c. D1784 – Rigid Poly(Vinyl Chloride) and Chlorinated Poly(Vinyl Chloride) Compounds.
   d. D2241 – Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
   e. D2321- Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
   f. D2412 – Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
   g. D2683 – Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
   h. D2774 – Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
   a. D3035 – Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter.
   i. D3212 – Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
   j. E3261 – Standard Specification for Butt Heat Fusion Polyethylene Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
   k. D3350 – Standard Specification for PE Pipe & Fittings Material.
   l. F412 – Standard Terminology Relating to Plastic Piping Systems.
   m. F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
   n. F714 – Standard Specification for PE Pipe (DR-PR) Based on Outside Diameter.
   o. F1417 – Standard Practice for Installation Acceptance of Plastic Non-pressure Sewer Lines Using Low-Pressure Air.
   p. F1803 – Poly (Vinyl Chloride) (PVC) Closed Profile Gravity Pipe and Fittings Based on Controlled Inside Diameter.
   q. F2026 – Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings.
   r. F2206 – Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene (PE).
   s. F2620 – Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings.
   t. F3124 – Standard Practice for Data Recording the Procedure Used to Produce Heat Butt Fusion Joints in Plastic Piping Systems or Fittings.
   u. F3183 – Standard Practice for Guided Side Bend Evaluation of Polyethylene Pipe Butt Fusion Joint.

v. F3190 - Standard Practice for Heat Fusion Equipment (HFE) Operator Qualification on Polyethylene (PE) and Polyamide (PA) Pipe and Fittings.

2. American Water Works Association (AWWA):
   a. C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. for Water Transmission and Distribution.
   b. C906 – Polyethylene (PE) Pressure Pipe & Tubing, 4-Inch Through 63-Inch for Waterworks.
   c. M23 – PVC Pipe-Design and Installation.
   d. M55 – Manual for the Design and Installation of Polyethylene Pipe in water Applications.
3. Plastic Pipes Institute (PPI):
   a. Handbook of Polyethylene Pipe (latest edition).
   b. MS-3 – HDPE Pipe and Fittings Specification for Buried Potable Water.
   c. TR-3 – Policies and Procedures for Developing Hydrostatic Design Basis (HDB), Pressure Design Basis (PDB), Strength Design Basis (SDB), and minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe.
   d. TR-4 – HDB/SDB/PDB/MRS Listed Materials, PPI Listing of Hydrostatic Design Basis (HDB), Strength Design Basis (SDB), Pressure Design Basis (PDB), and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe.
   e. TR-9 – Recommended Design Factors for Pressure Applications of Thermoplastic Pressure Pipe Materials.
   f. TR-33 – Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe.
   g. TN-42 – Recommended Minimum Training Guidelines for PE Pipe Butt Fusion Joining Operators for Municipal and Industrial Projects.
4. Uni-Bell PVC Pipe Association:
   a. UNI-B-6-98 – Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe.

1.03 SUBMITTALS:

A. Submit as specified in Division 1.
B. Submit the following for acceptance prior to fabrication:
   1. Pipe and joint details.
   2. Special, fitting, and coupling details.
   3. Laying and installation schedule.
   4. Specifications, data sheets, and affidavits of compliance for protective shop coatings and linings.
   5. Manufacturer's design calculations including, but not limited to, wall thickness and deflection under specified live and dead loads.
C. Certificates and Affidavits:
   1. Submit as specified in Division 1.
   2. Furnish the following prior to shipment:
      a. Affidavit of compliance with applicable standard.
      b. Test certificates.
D. Provide Manufacturer's Certification that the material was manufactured and tested in accordance with the specifications.
E. Qualifications:

1. Furnish prior to joint fusion:
   a. Fusion technician qualifications per ASTM F3190 from the pipe supplier for the size and type of fusible pipe being installed.

1.04 QUALITY ASSURANCE:

A. Manufacturer:
   1. Experienced in the design, manufacture, and commercial supply of the specific material.
   2. Experienced in the design, manufacture, and commercial supplying of the specific size of pipe.
   3. Certify to above minimum experience requirements.

1.05 DELIVERY, STORAGE AND HANDLING:

1. Deliver, store, and handle equipment and materials as specified in Division 1 and in accordance with the pipe manufacturer's recommendations.

PART 2 - PRODUCTS

2.01 PIPE REQUIREMENTS:

A. Furnish pipe of materials, joint types, sizes, and strength classes indicated or specified. Higher strengths may be furnished at Contractor's option. Furnish maximum pipe lengths produced by the manufacturer.

B. The pipeline manufacturer shall verify and attest to the fact that their pipe is good at all depths scheduled for installation.
   a. Shop drawings and pipe wall thickness calculations certifying that pipe is good at all depths scheduled for installation shall be submitted to the Engineer for review prior to pipe installation.

C. Pipe shall be designed to withstand all stresses resulting from external loads at depths shown on the Contract Drawings and H-20 live loadings in roadways.

D. Pipe Bedding: As specified.

E. Pipe Color: Pipe interior and exterior shall be green, blue pipe is not acceptable for PVC carrying untreated water.

F. Pipe Marking:
   1. All pipe, fittings and specials shall be marked conforming to the applicable standard specification under which the pipe is manufactured and as otherwise specified.
   2. Mark field location of fittings and specials by station.

G. Pipe Gaskets: All elastomeric gaskets and seals shall be synthetic rubber.

H. Each pipe or fitting shall have plainly and permanently marked on the pipe wall the pipe class and size, date of manufacturer, manufacturer's name or trade mark, and deflection angle for bends.

2.02 DUCTILE IRON PIPE:

A. For ductile iron gravity pipe, refer to Section 33 11 00 - Pressure Pipe.

2.03 PVC GRAVITY PIPE:

A. Design of Pipe: Design shall conform to AWWA C900 and as specified:
   1. External Loading:

GRAVITY PIPING SCHEDULE				
SIZE (in)	LINE	DESCRIPTION	MATERIAL	CLASS
36	EFFL	EFFLUENT-1, EFFLUENT-2	DIP/PVC	150/SDR 26
36	EFFL	EFFLUENT-3	PVC	DR-32.5
48	INFL	INFLUENT	PVC	DR-32.5
36	SB	SCREEN BYPASS	PVC	DR-32.5

      a. Earth dead load cover at 120 pcf plus AASHTO H-20 live loads.
      b. 5% deflection limit.
      c. Bedding condition as indicated.
   2. Joints:
      a. Compression-type with the elastomeric ring gasket confined in the annular space between the bell end or socket and the spigot end of pipe.
      b. Elastomeric gasket ring joints shall conform to the requirements of ASTM D3212 or ASTM F477. Gaskets shall be neoprene or other synthetic rubber material.
      c. Must be water tight based on high head condition.
      d. Plain end of pipe shall be marked with a reference line to facilitate assembly inspections.
   3. Fittings:
      a. Fittings shall conform to AWWA C110 or AWWA C153
      b. Fittings shall be mechanical joint or push-on-type joint
      c. Fittings shall have pressure rating of not less than that specified for the pipe.
   4. Connections: Furnish any special flexible couplings required for manhole tie-ins or connections to other rigid structures.

B. Inspection and Testing:
   1. Primarily by manufacturer's testing laboratory and quality control personnel.
   2. Perform to avoid, insofar as possible, delivery of defective pipe.
   3. May be witnessed by Owner, Engineer, or approved independent testing laboratory.
      a. Independent testing laboratory, when used, shall be retained by Owner at no expense to Contractor.
      b. Contractor and manufacturer shall cooperate with Owner's inspection and test personnel. Permit unrestricted access, furnish reasonable space and facilities, and provide 5 working days advance notice of test schedule.
   4. Contractor shall provide 3 copies each of certified test reports to Engineer.
      a. Include stiffness and deflection, dimension, and hydrostatic joint tests per ASTM D3034, D3212, F679, F794, and F949.
      b. Furnish prior to delivery.

C. Handling and Delivery:
   1. Do not deliver until tests on representative specimens have been performed.
   2. Use equipment and methods adequate to preserve quality of pipe and to protect joint elements.

2.04 PVC SEWER PIPE:

A. Specified in KC Water Standard Specification Section 02624 – PVC Gravity Sewer Pipe

2.05 REINFORCED CONCRETE PIPE – STORMWATER PIPE (RCP):

A. Specified in KC Water Standard Specifications Section 02630 – Stormwater Pipe and Structures

2.06 GASKETS AND BOLTING MATERIALS:

A. Provide all gaskets, bolts, lubricant, and other accessories required to install pipe, fittings, and specials complete and ready for service.

2.07 TRACER WIRE:

A. Tracer wire shall be provided as indicated.
   1. Minimum AWG 10 solid copper
   2. 30 mils of green PE insulation

B. Tracer wire tape shall be as follows:
   1. 2-inch-wide vinyl plastic electrical tape
   2. 7 mils in thickness

C. Where connections to existing tracer wire are required or where connections to newly installed tracer wire (tees, end of rolls, etc.) are required, tracer wire shall be spliced with:
   1. DryConn Direct Bury Lug Aqua waterproof connector.
   2. Engineer Approved Equal.

2.08 WARNING TAPE:

B. Shall be at 6 inches in width.

C. Shall be green in color.

D. Shall have black lettering stating, “CAUTION BURIED SEWER BELOW.”
   1. Lettering shall be imprinted at 20 to 30-inch intervals.

PART 3 - EXECUTION

3.01 INSTALLATION - GENERAL:

A. Reference Section 33 31 50 - Pipe Installation for installation and testing procedures.

3.02 DUCTILE IRON PIPE INSTALLATION:

A. Install according to Section 33 11 00 - Pressure Pipe and Section 33 31 50 - Pipe Installation.

3.03 PVC SEWER PIPE INSTALLATION:

A. Install according to KC WATER Section 02624 – PVC Gravity Sewer Pipe

3.04 PVC PIPE INSTALLATION:

A. Install according to Section 33 31 50 - Pipe Installation.

3.05 REINFORCED CONCRETE PIPE (RCP) STORMWATER PIPE INSTALLATION:

A. Install according to KC Water Standard Specification Section 0230 – Stormwater Pipe and Structures

B. Prior to constructing new sewers, the Contractor shall physically locate all utilities within ten (10) feet of the proposed sewers. If there is a utility conflict with the proposed sewers, the Contractor shall notify the City/Design Professional and survey the existing service top

elevation and horizontal coordinates. Certified as-built redlines and the utility investigation surveying are the sole responsibility of the Contractor.

C. The Contractor is responsible for determining all conflicted crossings for the proposed storm sewer and submit their service-relocation shop drawings and/or certified sketches for the City/Design Professional's review and approval. (Contractor is also responsible for providing field electronic data such as the location coordinates and spot elevations for the City/Design Professional's use.) It shall be the responsibility of the Contractor to obtain necessary field information for aiding in determining the required minimum length of the existing sanitary or any other services necessary to clear for the construction of proposed sewers.

3.06 TRACER WIRE:

A. Install according to Section 33 31 50 - Pipe Installation.

3.07 WARNING TAPE:

A. Underground marking tape shall be installed at least 18 inches above utility.

END OF SECTION 33 33 11.

SECTION 35 20 16 – SLIDE GATES

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes slide gates, electric motor operators, manual operators, and accessories.
B. Furnish the number and type of gates and operators as specified and indicated.

1.02 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
B. Applicable Standards:
   1. American Water Works Association (AWWA):
      a. AWWA C542 - Electric Motor Actuators for Valves and Slide Gates - First Edition.
      b. AWWA C561 - Fabricated Stainless Steel Slide Gates.
   2. ASTM International (ASTM):
      a. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
      b. ASTM A276/A276M REV A - Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes.
      c. ASTM B21/B21M - Standard Specification for Naval Brass Rod, Bar, and Shapes.
      d. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.
      e. ASTM D2000 – Standard Classification System for Rubber Products in Automotive Applications.
   3. Society for Protective Coatings (SSPC):
      a. SSPC SP5 - White Metal Blast Cleaning.

1.03 SUBMITTALS:

A. Submit as specified in Division 1.
B. Include, but not limited to, the following:
   1. Catalog data or illustrations showing principal parts and materials.
   2. Spare parts list.
   3. Assembly and disassembly or repair instructions.
   4. Detailed layout dimensions.
   5. Protective coating system.
   6. Leakage testing procedures.
   7. Electric motor operator product data.
   8. Schematic and wiring drawings.
   9. Instruction books and installation, operation, and maintenance manuals.

1.04 QUALITY ASSURANCE:

A. Manufacturers shall be experienced in the design and manufacture of Equipment and accessories.
B. Manufacturer shall have proof of design test records in accordance with AWWA on file available for submittal.
C. Manufacturer shall be experienced and in regular production of gates and water control equipment.
D. The gate shall be fully shop assembled, adjusted, inspected, and tested for operation and leakage before shipment.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Shall be as specified in Division 1.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Fabricated Slide Gates:
   1. Hydro Gate Corporation.
   2. Fontaine-Aquanox.
   3. Rodney Hunt.
   4. Waterman Industries, Inc.
   5. Whipps, Inc.
   6. Golden Harvest, Inc.

B. Slide Gate Electric Motor Operators:
   1. Auma.
   2. Limitorque Corporation.
   3. Rotork Incorporated.

2.02 FABRICATED SLIDE GATES:

A. Design:
   1. Size, seating and unseating heads, and gate centerline elevations in accordance with Table 1:
   2. Conform to applicable provisions of AWWA C561.

B. Materials:
   1. Slide, reinforcing, and frame: Stainless steel, ASTM A276/A276M REV A, Type 304.
   2. Stem: Stainless steel, ASTM A276/A276M REV A, Type 304.
   3. Seals: Neoprene, ASTM D2000, Grade 1BE625.
      a. The seal material for slide gates in the coarse screening structure (IPS-GATE- 011, IPS-GATE-012, IPS-GATE-021, IPS-GATE-022, IPS-GATE-031, IPS-GATE-032) shall be EPDM, ASTM D2000.
   4. Fasteners and anchor bolts: Stainless steel, Type 316.
   5. Actuator lift nut: Bronze, ASTM B584.
   6. Wheel or crank operator: Cast iron, ASTM A126, Class B, or aluminum.
   7. Seats: Ultra-high molecular weight (UHMW) polymer.
   8. Stem guide brackets required for slide gates in the coarse screening structure (IPS-GATE- 011, IPS-GATE-012, IPS-GATE-021, IPS-GATE-022, IPS-GATE-031, IPS-GATE-032) shall be Stainless steel, 316.
   9. Stop collar: Naval Bronze, ASTM B21/B21M, or cast aluminum.

C. Frames:
   1. Machine all surfaces forming joints or bearings.
   2. Machined from a one-piece integral casting, no bolted legs or guides permitted.
   3. Guide grooves machined on all bearings and contact faces.
   4. Guide grooves long enough to support at least one half of the slide in full open position.
   5. Capable of taking the total thrust produced by water pressure or wedging action.

D. Guides:
   1. Shall be one piece designed to withstand the total thrust due to water pressure and acting wedge action.
   2. Machine all bearing and contact surfaces.

3. Shall be of such length as to retain and support at least on half the disc in the full open position.
4. Shall be integrally cast with or attached to the frame with stainless steel studs and nuts and will be dowelled to prevent any relative motion between the guides and frame.

E. Construction
1. Integral slide, seat, and frame unit.
2. Guide extrusions shall act as guides for the slide and shall have high-density polymer seats securely fastened to the guides in contact with both the upstream and downstream.
3. Self-contained frame of sufficient strength to withstand the thrust developed.
4. Deflection of slide under full load head shall be limited to 1/360 of the span or 1/16", whichever is less. Reinforce slide with structural shapes, if required.
   a. Provide a connector welded to the slide assembly to receive the stem.
   b. Bolt stem to connector with a minimum of two bolts.
   c. Design connector pocket to take the full thrust developed during gate operation.
5. Provide solid seals anchored to each side guide and bottom sill:
   a. Type "P" and "J" or self-adjusting UHMW seat/seals.
   b. Slide shall make uniform contact with seal when it is closed without damaging seal surface.
6. Size stem to be of adequate diameter to safely withstand twice the force created by a 40-pound pull on the handwheel.
   a. Stem shall have a minimum diameter of 1 ½" and shall have machine rolled full depth ACME threads.
   b. Supported by guides spaced to provide a 1/r ratio of less than 200.
   c. Provide single stem.
   d. Provide clear butyrate plastic stem cover with Mylar tape to indicate slide "open" and "closed" positions.
      (1) Attach securely to handwheel with noncorrosive materials.
7. Anchor Bolt Assembly:
   a. Complete anchor bolt assembly (studs, nuts, washers, etc.) to be designed and provided by the manufacturer. Anchor material shall be 316 SST. Anchor size and embedment shall be clearly shown on the equipment drawings.

F. Operators:
1. Provide operator type and mounting as indicated in Table 1. Each gate shall be equipped with electric motor operator. Furnish auxiliary handwheel for manual operation of electric motor operators to open counterclockwise for each operator.
2. For floor stand mounted operators, pedestal height shall be approximately 3 feet from bottom of pedestal to centerline of driver. For operators for gates IPS-GATE-101, IPS-GATE-102, and IPS-GATE-103, pedestal height shall be such that centerline of driver is at a minimum elevation of 828.00 ft.
3. Operators to be oil filled.
4. Electric Operator:
   a. Provide A/C electric motor operators in accordance with AWWA C542 for stop-close-open service for all designated motorized gates to operate on 480V, 3-phase, 60 Hz, with position indicators.
   b. Shall be equipped with field terminals for all discrete and analog I/O as specified.
   c. Provide integral full voltage reversing magnetic starters and shall be pedestal or rack mounted. Include control power transformer sized for all control features specified.

d. Electric motor operator shall move gate from fully open to fully closed position within 15 minutes and reverse at same speed.
e. Furnish limit switches for electric motor operators mounted in the assembly containing the motor and gearing as follows:
    (1) Torque responsive limit switch:
        (a) To be operative during the entire opening and closing travel of the gate.
        (b) Of adjustable type not requiring auxiliary relays or devices.
    (2) Intermittent gear type limit switches:
        (a) Governed by rotation of the driving mechanism.
        (b) Adjustable in both the opening and closing directions.
        (c) Provided to stop gate travel in both directions and operate indicating lights.
f. Furnish enclosure, mounted on the pedestal for electric motor operators with the following:
    (1) LED or LCD graphical display, which shall show the following:
        (a) Gate position within 0.1% increments.
        (b) Alarms and warnings.
        (c) Settings menu.
        (d) Others as recommended by the manufacturer.
    (2) Push buttons marked “open”, “stop” and “close” on all operators.
    (3) “Local-Off-Remote” selector switch.
    (4) Heavy-duty, weatherproof or explosion type as indicated or specified.
    (5) Double o-ring seals to eliminate water ingress.
    (6) Strip heaters to prevent condensation.
    (7) Additional switches for remote green and red indicating lights.
g. Unless otherwise specified or indicated, provide operators with the following NEMA enclosure:
    (1) Non-classified, outdoor areas:
        (a) Weatherproof/hosedown – NEMA 4.
    (2) Classified, indoor and outdoor areas:
        (a) Explosionproof – NEMA 7.
h. Electric motor operator signals, at minimum:
    (1) Discrete outputs:
        (a) Dry contacts rated 5A, 120Vac.
        (b) Signals:
            1). Open limit switch.
            2). Closed limit switch.
            3). Common alarm.
            4). In-Remote mode.
    (2) Discrete inputs:
            1). Close.
            2). Open.
            3). Stop.
    (3) Analog output:
        (a) 4-20mA range
            1). Position feedback.
i. Totally enclosed gearing with lubrication fittings.
j. Provide pedestal shop prime coated and painted in accordance with AWWA C560.
k. Mechanical seals or grease lubrication system.

l. Self-locking at any position of the stem travel.

5. Handwheel Operator:
   a. Shall be top mounted on the head frame.
   b. Furnish grease fittings.
   c. Handwheel shall be in vertical position.
   d. Handwheel shall have a maximum required effort of 40 pounds to operate gate.
   e. Provide a solid rim handwheel with an arrow to show direction of opening. The centerline of the handwheel operator shall be approximately 36 inches above the operating floor elevation.

G. Painting:
   1. Exposed and enclosed machined or bearing surfaces shall be shop coated with manufacturer's standard water-resistant grease or rust-preventive compound before shipment.
   2. Stainless steel surfaces shall not be painted.

TABLE 1
FABRICATED SLIDE GATES (OPEN CHANNEL / WEIR SERVICE)

Tag No.	Material	Service[1]	Opening Size (WxH)	Slide C.L. El. (ft msl)	Max Seating Head (ft)	Max Unseating Head (ft)	Operating Floor Elevation (ft msl)	Frame Type [2]	Operator Type [3]	Operator Mounting [4]	Rising Stem?
IPS-GATE-001 [8]	SST	WS	3'x6'	817.67'	5'	6'	856.00'	FMNSC	E	YM	Yes
IPS-GATE-002 [8]	SST	WS	3'x6'	817.67'	5'	6'	856.00'	FMNSC	E	YM	Yes
IPS-GATE-011[7]	SST	SO	3'x8'	817.67'	3'	3'	856.00'	ESC	E	YM	Yes
IPS-GATE-012[7]	SST	SO	3'x8'	817.67'	3'	3'	856.00'	ESC	E	YM	Yes
IPS-GATE-022[7]	SST	SO	3'x8'	817.66'	3'	3'	856.00'	ESC	E	YM	Yes
IPS-GATE-021[7]	SST	SO	3'x8'	817.67'	3'	3'	856.00'	ESC	E	YM	Yes
IPS-GATE-031[7]	SST	SO	3'x8'	817.67'	3'	3'	856.00'	ESC	E	YM	Yes
IPS-GATE-032[7]	SST	SO	3'x8'	817.67'	3'	3'	856.00'	ESC	E	YM	Yes
IPS-GATE-101	SST	SO	2'x3'	809.57'	5'	5'	856.00'	FMNSC	E	YM	Yes
GRSC-GATE-101	SST	SO	6'x6'	892.00'	6'	6'	895.00'	ESC	E	YM	Yes
GRSC-GATE-201	SST	SO	6'x6'	892.00'	6'	6'	895.00'	ESC	E	YM	Yes
GRSC-GATE-102	SST	SO	6'x6'	892.00'	6'	6'	895.00'	ESC	E	YM	Yes
GRSC-GATE-202	SST	SO	6'x6'	892.00'	6'	6'	895.00'	ESC	E	YM	Yes
GRSC-GATE-301	SST	SO	5'x5'	892.00'	5'	5'	895.00'	FMSC	E	YM	Yes
GRSC-GATE-302	SST	SO	4'x5'	892.00'	5'	5'	895.00'	FMSC	E	YM	Yes
GRSC-GATE-303	SST	SO	4'x5'	892.00'	5'	5'	895.00'	FMSC	E	YM	Yes
GRSC-GATE-304	SST	SO	3.5'x8'	890.17'	5'	3'	895.00'	FMSC	E	YM	Yes
UV-GATE-101[5]	SST	SO	3'x7.67'	854.17'	4'	4'	858.00'	FMSC	E	YM	Yes
UV-GATE-201[5]	SST	SO	3'x7.67'	854.17'	4'	4'	858.00'	FMSC	E	YM	Yes
UV-GATE-001	SST	SO	0.83'x0.83'[6]	848.42'	8'	8'	858.00'	FMNSC	E	YM	Yes

Notes:
(1) SO = shut off, WS = weir service.
(2) Frame type abbreviations:
FMNSC = Face-mounted, non-self contained
ESC = Embedded, self contained.
FMSC = Face mounted, self contained.
BGBS = Bevel geared, bench stand.
-WB = Wall bracket required.
(5) Gate details are based on channel dimensions needed for ultraviolet light disinfection equipment as furnished by Trojan Technologies. If another

(3) Operator type abbreviations:
CO = crank operated.
HW = Handwheel.
E = Electric.
(4) Operator mounting abbreviations:
FS = floor stand.
BGFS = Bevel geared floor stand.
YM = Yoke mounted.

manufacturer is furnished for the disinfection system, all modifications (if any) to the gate required to accommodate the equipment furnished shall be the responsibility of the Contractor.
(6) Gates to be face-mounted over pipe openings. Coordinate final dimensions based on inner diameter of pipe type for each gate.
(7) Support brackets for stem will need to be provided intermittently as determined by slide gate manufacturer.
(8) Gates to be downward opening weir gates.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Comply with provisions of AWWA C540, AWWA C562, and as specified.

B. The mechanism shall be installed in accordance with the manufacturer's recommendations as approved by the Engineer. Prior to start-up a factory trained field service engineer shall inspect the equipment, make necessary final adjustments and certify the equipment ready for operation.

3.02 MANUFACTURER'S FIELD SERVICES:

A. The equipment shall be started by a manufacturer's representative, who shall certify to the Engineer that all equipment is properly installed, and the plant operator has been instructed concerning proper operation and maintenance. Operator training shall include all items contained in the operation and maintenance manual.

B. Manufacturer's Authorized Representative: Present at work site or classroom designated by the Owner, for the minimum person-days listed below, travel time excluded.

   a. Two (2) person-days for installation assistance, inspection, training, testing and certification of installation.

C. Perform equipment tests during and after start-up to determine if equipment is performing as specified.

D. Furnish and dispose of water required for leakage tests in a manner approved by Engineer.

E. Lubricate all stem threads, bearings and gears before placing gates in operation.

F. Leakage Test: Leakage shall not exceed the limits established by AWWA C562.

   1. Contractor shall furnish bulkheads as required.
   2. Minimum seating head shall be as specified.
   3. Minimum test duration shall be two hours.

3.03 SUPPLIER'S FIELD SERVICES: Provide installation, start-up, and testing services for all Equipment as specified in Division 1.

3.04 PERFORMANCE TESTS:

A. Leakage Test: Perform field leakage test per AWWA C561 and submit certified test results per Division 1.

END OF SECTION 35 20 16

DIVISION 40 – PROCESS INTEGRATION

SECTION 40 60 00 – PROCESS CONTROLS AND INSTRUMENTATION – GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:
- A. This Division includes instruments, control devices, control panels, computer hardware and system programming as specified in Sections 40 60 00 – 40 70 00.
- B. Related Work Specified Elsewhere:
  1. Interconnections and control of equipment: All applicable Divisions.

1.03 RELATED REQUIREMENTS:
- A. Division 26: All applicable Sections.

1.04 REFERENCE STANDARDS:
- A. National Fire Protection Association (NFPA):
  1. NFPA 70 – National Electrical Code (NEC).
- B. Other standards as specified in applicable Sections.

1.05 SUBMITTALS:
- A. Submit as specified in Division 01.
- B. Manufacturer with prime responsibility shall assume responsibility for all Compliance Submittals.
- C. Qualifications Submittal:
  1. Submit SI qualifications package with experience, resumes, and certifications for each member of the SI team responsible for the project.
- D. Additional submittals as specified in each applicable Section, this Division.

1.06 QUALITY ASSURANCE:
- A. General:
  1. The Contractor shall provide the services of a single pre-qualified System Integrator (SI), to provide the material, equipment, labor, and services specified in Sections 40 60 00 – 40 70 00. The SI shall be subcontracted and under the direct supervision of the Contractor.
- B. Acceptable System Integrators (SI):
  1. The communication, instrument and control systems may use Equipment of different manufacturers, but the System Integrator Subcontractor shall assume prime responsibility for the complete instrumentation and control system.
  2. No Bidder shall be required to employ any Subcontractor, other person, or organization against whom Bidder has reasonable objection.
  3. The SI shall be one of the following prequalified companies:
     a. R.E. Pedrotti Company, Inc
        (1) 5855 Beverly Ave, Suite A, Mission, KS 66202. Ph: 913.677.3366.
     b. Integrated Controls, Inc.

(1) 15707 Mahaffie St., Olathe, KS 66062. Ph: 913.782.9600.

c. Durkin, Inc.

(1) 2383 Chaffee Dr., St. Louis, MO 63146. Ph: 314.432.2040.

4. If Contractor wishes to utilize a System Integrator not listed, it shall submit qualification documentation for review and approval demonstrating the experience requirements of this article a minimum of two weeks prior to bid opening. As a minimum the following information shall be submitted:
   a. Evidence of sufficient financial resources to perform the required work. This evidence may be in the form of a certified financial report for the latest fiscal year.
   b. Verification of all items listed under the system integrator qualifications paragraph.
   c. Name the key project staff who will be responsible for office engineering and project management; software configuration; field testing, calibration and start-up; and operator instruction and maintenance training. Include an organization chart of key project staff and detail availability of each staff assigned.
   d. Provide resumes of proposed key project staff that demonstrate project experience with the control system products specified for the project.
   e. Provide references for at least five (5) projects where the following tasks were performed by personnel directly employed by the firm as a SI; system engineering and documentation including panel assembly, schematics, and wiring diagrams; software configuration and documentation; field testing, calibration, and start-up; and operating instructions and maintenance training. Project references shall include contact information for owners and consulting engineers.

C. System Integrator Qualifications:
   1. The instrumentation, control and communications system shall be furnished by a System Integrator (SI) who shall assume responsibility for the satisfactory performance of the entire plant control system. Only those SI who can demonstrate that they possess the prerequisite capabilities and experience shall be considered. The System Integrator subcontractor must meet the following minimum criteria:
      a. The SI Company shall have been in business performing SI work on water and wastewater treatment projects, and have control systems technicians with experience with installation, testing, calibrating and startup of industrial control and automation systems.
      b. The SI Company shall demonstrate the number of competent and experienced office staffing, field technicians, and service personnel are available to support this project.
      c. The SI Company shall have specific training and experience with the following:
         (1) Rockwell PlantPAx, FactoryTalk View SE, and associated system architecture.
         (2) Allen-Bradley ControlLogix and CompactLogix Programmable Automation Controllers and associated RSLogix 5000 programming software.
         (3) Ethernet network setup and configuration including managed switch configuration.
         (4) Instrumentation setup and calibration.
      d. The SI shall hold current certifications for the Rockwell software and hardware specified herein. Additional certifications for industrial and enterprise networks as specified in Section 40 66 00 – Process Control Networks.
      e. The SI shall be capable of providing control panels produced in a UL 508 authorized manufacturing facility and listed accordingly.

1.07 SEQUENCING AND SCHEDULING:

A. Coordinate the installation of Equipment and Materials specified in this Division with construction schedule.

PART 2 - PRODUCTS

2.01 GENERAL:

A. Products as specified in Sections 40 60 00 – 40 70 00.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Verify site conditions are suitable for installation of equipment and systems specified in this Division.

3.02 INSTALLATION:

A. System Integrator shall be responsible for all cabling terminations at instruments, control panels and devices supplied by the System Integrator.
B. Refer to Section 26 05 19 – Low Voltage Cable for additional cable termination requirements.

3.03 FIELD QUALITY CONTROL:

A. Manufacturer's field services:
   1. As specified in each applicable Section, this Division.
B. Field Testing:
   1. General Requirements:
      a. Conform to requirements as specified in Division 01.
      b. Conduct all tests in the presence of Engineer under the supervision of Equipment manufacturer's field engineer.
      c. Notify Engineer two weeks prior to the commencement of all tests.
      d. Include all tests recommended by the Equipment manufacturer unless specifically waived by Engineer.
      e. Include all additional tests recommended by Engineer that he deems necessary because of field conditions, to determine that Equipment and Materials and systems meet requirements of Contract Documents.
      f. Be responsible for all damage to Equipment and Materials due to improper test procedures or test apparatus handling.
   2. Test Reports:
      a. Submit test reports as specified in Division 01.
      b. Maintain a written record of all tests showing date, personnel making tests, equipment or material tested, tests performed, and results.

3.04 TRAINING:

A. The System Integrator shall provide formal training for operators, maintenance, and service personnel.
B. A training schedule and log shall be developed. The training schedule shall identify scheduled dates and times for all training sessions specified in this Division. The training log shall identify dates for training and record training session attendees.

C. Training sessions shall be scheduled with the Owner a minimum of two weeks prior to occurrence and a training schedule shall be maintained and communicated to the Owner on a routine basis.
D. Contractor shall make digital video recordings of all on-Site training for training purposes. Any charges for this video recording shall be included.
E. Provide training as specified in each applicable Section, this Division.

END OF SECTION 40 60 00

SECTION 40 61 96 – PROCESS CONTROL SOFTWARE PROGRAMMING AND REPORTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes control descriptions and requirements for Programmable Logic Controllers (PLCs) and the Plant Control System (PCS) software programming.
B. The Systems Integrator shall be responsible for all PLC and PCS programming.
C. PLCs and Human Machine Interface (HMI) touchscreens associated and supplied with the process equipment skids shall be programed by the equipment supplier. Equipment supplier shall conform to HMI standards as defined herein.
D. Related Work Specified Elsewhere:
   1. All applicable Divisions.

1.03 RELATED REQUIREMENTS:

A. Section 40 60 00 – Process Control and instrumentation General Requirements
B. Section 40 66 00 – Network and Communications Equipment.
C. Section 40 67 00 – Process Control Panels and Hardware.
D. Section 40 70 00 – Instrumentation for Process Systems.

1.04 REFERENCE STANDARDS:

A. International Society of Automation (ISA).
   1. 101.01 – Human Machine Interfaces for Process Automation Systems.
B. Kansas City MO Water Services.
   1. Wastewater SCADA System Software Standards and Conventions.

1.05 SUBMITTALS:

A. Submit as specified in Division 01.
B. Manufacturer with prime responsibility shall assume responsibility for all Compliance Submittals.
C. Product Data: Submit for each type of product specified and included the following as minimum:
   1. A complete listing of all proposed HMI screens and the corresponding points and parameters that will be displayed on each screen.
   2. Proposed standard HMI and PLC objects for the project (i.e. pump control, valve control, etc.). Inputs and outputs that will be developed for each object shall be identified.
   3. Complete list of network connected devices requiring IP Address assignments.
D. Special Procedure Submittals:
   1. Power Failure and Restoration:
      a. Provide a complete description of the power failure and restoration mode programming.
   2. Test Plan:
      a. Provide a complete and detailed testing plan for the control system.
      b. Provide procedures and forms for the following:
         (1) Factory acceptance test (FAT)
         (2) Site acceptance test (SAT)
   3. Syllabus for Owner training.

E. Closeout Submittals: Final documentation shall include the following as minimum:
   1. Operation and Maintenance Manuals including the following:
      a. Provide O&M manuals in electronic and hardcopy format including as a minimum the above information and the following:
   2. Soft copies of complete PLC program including all program comments.
   3. Soft copies of all final HMI screens and applications.

F. Maintenance Material Submittals:
   1. Software:
      a. Assemble and submit all software and program copies.
   2. Organize, label, and submit on flash media or solid-state drive.

1.06 QUALITY ASSURANCE:

A. Programmer Qualifications:
   1. Programming shall be by a Systems Integrator specializing in plant control system integration for the water/wastewater industry.
   2. The Programmer shall be trained on the software specified for this project including, but not limited to: Rockwell Automation PlantPAx and FactoryTalk applications, RSLogix applications, RSLinx, ACP Thinmanager, and other applicable software packages.

PART 2 - PRODUCTS

2.01 GENERAL:

A. Products as specified in Division 40.

PART 3 - EXECUTION

3.01 GENERAL:

A. The intent of the control system specified and indicated is to provide complete control and monitoring capabilities for the Todd Creek Wastewater Treatment Plant Expansion.
B. The PLCs and other associated networked equipment shall be programmed to communicate the required data to the associated PlantPAx servers via EtherNet/IP protocols.
C. The control system shall be connected to KC Water's SCADA fiber network as indicated to provide remote monitoring and control capabilities. Connection details of this fiber network shall be coordinated with KC Water.
D. Operator Workstation screens shall be developed for control interface and monitoring of the systems described.
E. All set points and time delays described in the sequence of operation are initial values and shall be adjustable by users with the appropriate user security group at the associated Operator Workstation screens.
F. The Systems Integrator shall coordinate with equipment manufacturers for communication of specified points between the PCS and the manufacturer supplied PLC's. Operator workstation screens shall be developed to display status and provide control interfaces for the manufacturer supplied equipment as specified.
G. Coordination with AGS System Supplier:
   1. The HMI screens associated with the AGS system shall be developed by the AGS System supplier.
   2. The Systems Integrator shall be responsible for coordinating with the AGS System supplier to establish HMI development standards to ensure the HMI screens developed by

the AGS supplier and the Systems Integrator share the same typical graphics, faceplates, and function blocks to meet the project standards.

3. The Systems Integrator and AGS supplier shall work together to ensure required control and monitoring signals are communicated correctly between the AGS PLC and the plant PLCs.
4. The AGS system "Nereda Controller" shall be supplied by the AGS System Supplier in the form of a rack mounted host server. The server shall be installed and connected to the network by the SI. The AGS supplier shall be responsible for programming and configuration of the server. Coordination shall be provided for this work as required.
5. The Systems Integrator shall work with the AGS system supplier to establish communication with the aeration drive VFDs.
6. As a minimum the AGS system supplier and Systems Integrator shall participate in three web conferences setup by the Systems Integrator and attended by the Engineer to determine programming standards, verify proper application of the standards and coordinate communicated signals.
    a. The first web conference shall occur a minimum of one month prior to the Systems Integrator or AGS system supplier starting system development and shall serve to discuss development standards and develop an action item list for information needed to properly develop the systems.
    b. The second web conference shall occur one week prior to the AGS system supplier starting system development and shall serve as the meeting to communicate development standards to all parties.
    c. The third web conference shall occur after the oxidation system supplier has completed their initial screen development and PLC program and shall serve as a review meeting to verify that proper standards have been followed and proper points are being communicated.
    d. Follow up conferences shall occur as required during development and after initial development is completed to ensure the agreed to standards are being followed, discuss progress, verify communicated points and address any outstanding communication questions.

3.02 HARDWARE AND SOFTWARE CONFIGURATION:

A. A fault tolerant server (ftServer) with hardware redundancy shall be rack mounted and configured as a redundant system. The Process Automation System Server(s) (PASS) shall be virtualized to provide the necessary software configuration for redundancy and instant failover capability. The PASS servers shall communicate with the plant PLCs on the network as necessary.
    1. If the primary server failure occurs, the secondary server shall automatically assume the roles performed by the primary server until the primary server can be brought back online. Procedures for identifying and transitioning between primary and secondary servers shall be described by the SI in the submitted O&M manual.
    2. If the primary or secondary server fails, the operator shall be alarmed.
B. The desktop mounted operator workstation clients and panel mounted clients indicated shall be configured as industrial thin clients. The system shall utilize Thin Manager Server to provide I/O data to the thin clients. The Thin Manger servers shall be configured as redundant on the system.
C. A FactoryTalk Historian server shall be provided and implemented for the system.
D. Additional servers shall be as specified this section.

E. The host server shall be configured with a minimum of 10 virtual machines (VMs) and configured with the software and dedicated hardware resources as listed below. The provided configuration is recommended based on Owner's standards. Coordinate with the Owner's latest standard VM configurations for final VM builds and associated licensing:
   1. Virtual Machine No. 1 (VM1, HOST 1):
      a. Shall be configured as the primary HMI I/O Server with Data Center and Historian Data Interface.
      b. OS: Windows Server 2019.
         (1) Computer Name: WW715-PASS01.
         (2) Domain: kcwtc.loc.
      c. Hardware Configuration:
         (1) CPU: 4-Core.
         (2) Memory: 16 GB.
         (3) Storage: 100 GB.
      d. Software Load:
         (1) FTView SE 12.0.
            (a) Unlimited display.
            (b) 10 client licenses.
         (2) FTView Historian Data Link.
         (3) FTView Historian Live Data Interface.
         (4) PI Interface Configuration for redundancy to Historian Server with buffering.
         (5) FTView Activation Manager.
         (6) Microsoft Office 2019.
         (7) Adobe Reader.
         (8) Install all the latest patch rollouts.
   2. Virtual Machine No. 2 (VM2, HOST 2):
      a. Shall be configured as the secondary HMI I/O Server with Data Center and Historian Data Interface.
      b. OS: Windows Server 2019.
         (1) Computer Name: WW715-PASS02.
         (2) Domain: kcwtc.loc.
      c. Hardware Configuration:
         (1) CPU: 4-Core.
         (2) Memory: 16 GB.
         (3) Storage: 100 GB.
      d. Software Load:
         (1) FTView SE 12.0.
            (a) Unlimited display.
            (b) 10 client licenses.
         (2) FTView Historian Data Link.
         (3) FTView Historian Live Data Interface.
         (4) PI Interface Configuration for redundancy to Historian Server with buffering.
         (5) FTView Activation Manager.
         (6) Microsoft Office 2019.
         (7) Adobe Reader.
         (8) Install all the latest patch rollouts.
   3. Virtual Machine No. 3 (VM3, HOST 1):
      a. Shall be configured as the Historian Server.

b. OS: Windows Server 2019.
   (1) Computer Name: WW715-APP01.
c. Hardware Configuration:
   (1) CPU: 4-Core.
   (2) Memory: 16 GB.
   (3) Storage: 700 GB.
d. Software Load:
   (1) FT Historian SE 7.0.
      (a) 2,500 Tag Count.
   (2) Microsoft Office 2019.
   (3) Adobe Reader.

4. Virtual Machine No. 4 (VM4, HOST 1):
   a. Shall be configured as the SQL Data Server.
   b. OS: Windows Server 2019.
      (1) Computer Name: WW715-SQL01.
   c. Hardware Configuration:
      (1) CPU: 4-Core.
      (2) Memory: 24 GB.
      (3) Storage: 700 GB.
   d. Software Load:
      (1) MS SQL Server 2019 (64bit) Full Version.
      (2) Historian Asset Framework.
      (3) Microsoft Office 2019.
      (4) Adobe Reader.
5. Virtual Machine No. 5 (VM5, HOST 1):
   a. Shall be configured as the local Domain Controller.
   b. OS: Windows Server 2019.
      (1) Computer Name: WW715-DC01.
      (2) Root Domain Name: kcwtc.loc.
   c. Hardware Configuration:
      (1) CPU: 4-Core.
      (2) Memory: 12 GB.
      (3) Storage: 80 GB.
   d. Software Load:
      (1) Adobe Reader.
      (2) Coordinate with KC Water IT for configuration of Active Directory.
         (a) Sync to existing Active Directory at Blue River WWTP.
6. Virtual Machine No. 6 (VM6, HOST 1):
   a. Shall be configured as the Factory Talk Directory and Activation Server for PlantPax.
   b. OS: Windows Server 2019.
      (1) Computer Name: WW715-FTD01.
   c. Hardware Configuration:
      (1) CPU: 4-Core.
      (2) Memory: 12 GB.
      (3) Storage: 80 GB.
   d. Software Load:
      (1) FTView Service Platform.

(2) FTView Activation Manager.
(3) Adobe Reader.

7. Virtual Machine No. 8 (VM8, HOST 1):
   a. Shall be configured as the primary Thin Manager Server.
      (1) Redundant ThinManager Rockwell License
      (2) Configure for Instant Failover.
   b. OS: Windows Server 2019.
      (1) Computer Name: WW715-TM01.
   c. Hardware Configuration:
      (1) CPU: 6-Core.
      (2) Memory: 24 GB.
      (3) Storage: 80 GB.
   d. Software Load:
      (1) Thin Manager 13.0.
      (2) FTView SE Client 12.0
      (3) Microsoft Office 2019.
      (4) Adobe Reader.
8. Virtual Machine No. 9 (VM9, HOST 2):
   a. Shall be configured as the primary Thin Manager Server.
      (1) Redundant ThinManager Rockwell License
      (2) Configure for Instant Failover.
   b. OS: Windows Server 2019.
      (1) Computer Name: WW715-TM02.
   c. Hardware Configuration:
      (1) CPU: 6-Core.
      (2) Memory: 24 GB.
      (3) Storage: 80 GB.
   d. Software Load:
      (1) Thin Manager 13.0.
      (2) FTView SE Client 12.0
      (3) Microsoft Office 2019.
      (4) Adobe Reader.
9. Virtual Machine No. 10 (VM10, HOST 1):
   a. Shall be configured as the Windows OS/RDS Licensing Server.
      (1) Quantity of 10 RDS licenses per each ThinManager server (20 total for redundant configuration).
   b. OS: Windows Server 2019.
      (1) Computer Name: WW715-LIC01.
   c. Hardware Configuration:
      (1) CPU: 4-Core.
      (2) Memory: 12 GB.
      (3) Storage: 80 GB.
   d. Software Load:
      (1) Adobe Reader.
10. Virtual Machine No. 11 (VM11, HOST 1):
   a. Shall be configured as the Engineering Workstation Server.
   b. OS: Windows Server 2019.
      (1) Computer Name: WW715-EWS01.

c. Hardware Configuration:
   (1) CPU: 4-Core.
   (2) Memory: 24 GB.
   (3) Storage: 100 GB.
d. Software Load:
   (1) FTView SE Studio 12.0
   (2) RSLogix5000/Studio5000 v.21-33.
   (3) DriveExecutive.
   (4) RSLinx Classec (ETH-1 Driver only).
   (5) FTView SE Client 12.0
   (6) Microsoft Office 2019.
   (7) PI Excel add-on.
      (a) PI to interface with Historian.
   (8) Adobe Reader.

3.03 HMI STANDARDS AND SCREEN DEVELOPMENT:

A. General:
1. HMI screens shall be developed for control interface and monitoring of systems and facilities and related equipment.
2. Where possible, standard objects shall be developed and utilized throughout the project. Objects shall be developed for flexibility with nested blocks within blocks where necessary and with the worst-case scenario in mind to allow blocks to be adaptable throughout the project. Proposed blocks shall be submitted as specified.
3. All screens shall be developed using graphics and icons from the PlantPAx library when possible. The graphic displays shall be developed using design elements and concepts intended to enhance the operator's "Situational Awareness". The development, design, and implementation of the system displays shall comply with ISA 101.01 – Human Machine Interfaces for Process Automation Systems.
4. HMI screens shall be developed based upon a 1920x1080 (16:9) ratio and shall allow for multi-monitor display.
5. All HMI screens shall be developed with input from the Owner and Engineer and all screens shall be approved by the Owner prior to startup of the system.
   a. The Systems Integrator shall schedule necessary meetings with the Owner and Engineer to properly coordinate screen development standards, layout, and other required work to ensure the developed screens and systems best meet the needs and desires of the Owner for operating the facility.
6. All analog values shall be trended and recorded in the historical database.
7. Low, low-low, high and high-high and loss of signal alarm points shall be programmed and available to set for all analog points. The operators shall be able to set values for or disable the alarm points from the HMI screens. If alarm range settings are not provided the alarm settings shall be adjustable over the entire range of the associated analog value.
8. A minimum of one decimal point of accuracy shall be provided for all analog points displayed on the HMI. Additional decimal places shall be provided where applicable.
9. All automatic control such as start/stop, speed control, flow control, and similar shall be programmed into the nearest local PLC processor. All manual controls such as start/stop, open/close, speed control, etc. shall be incorporated into the PLC programming and screens as described this section. All control shall take place in the PLC with the

applicable computer servers, workstations, and HMI screens maintained for operator interface only.

10. Provide run time totalization for all equipment in the nearest local PLC processor and display the current value on the relevant screen(s).

B. Security Access Groups:
   1. Security access groups and their assigned permissions shall match those defined by KC Water SCADA System Software Standards and Conventions and consist of the following security groups:
      a. Operators, Operating Supervisor, Maintenance, Maintenance Supervisor, Engineering, and Administrator.

C. Display Hierarchy:
   1. HMI screens shall be organized in a hierarchical manner and designed to allow efficient movement between each of the levels within the hierarchy. Each screen shall also implement relational links between nodes of a specific process when applicable, e.g. through process piping or flow interconnections. The relational links should allow the user to navigate the various screens by following the process flow stream.
   2. The display hierarchy levels shall comply with the following table:

Display Level	Display Type	Description
1	Facility Overview	Provides an overview for the entire facility geographically and/or in process flow diagram format. Identifies major valves, abnormal status, and key process parameters for the facility.
	Alarm Summary	Identifies all top priority alarms, alarm history, and acknowledged status.
	Historical Trends	Displays of embedded or full-screen trends.
2	Process Displays	Designed to be the primary operating display for normal operation and monitoring of a specific process. Includes equipment, associated status, alarm, and instrumentation.
3	System or Subsystem Detail Displays	Displays interfaces necessary for equipment control, indicators, switching, and setpoint adjustment (when applicable). Includes all associated status and alarm conditions for the equipment providing sufficient information for process diagnostics.
4	Diagnostic and Informational Displays	Provides operational procedures and/or help information such as interlocks and permissive information. Not intended for process or system control. Generally displayed in the form of faceplates or popups.

D. Display Presentation and Content:
   1. The presentation for each screen shall be designed to maximize the user's ability to navigate, enter data, and monitor the associated information.
   2. Displays shall include global navigation with all pull down menus, pop-up windows, buttons, etc. following a standard template for the project.

3. The displays shall always include navigation across the bottom of the screen and the display title information centered at the top.
4. The graphic displays shall generally follow the process flow from left to right. If specific types of screens benefit from a geographical layout (e.g. overview screens), exceptions shall be reviewed and approved by the Owner and Engineer.
5. The Systems Integrator shall establish the philosophy of each screen layout and review with the Owner and Engineer during the preliminary screen development phase.
6. The display graphics presented shall represent all major pieces of equipment including vessels, pumps/motors, piping, valves, gates etc. Any equipment that can be controlled by the system shall be represented on the HMI screens.
7. Equipment not automatically controlled, such as manual gates and valves, should be minimally shown. These elements shall only be shown when provided for informational guidance for the operator to assist in equipment selections and modes of operation.
8. Equipment shall have the written description and equipment tag displayed above the associated graphic.
9. Vessels and similar tankage should be depicted in similar shape to their actual physical shape. Shapes should typically be two-dimensional, keeping details to a minimum. Size should reflect importance and/or be representative of the vessel physical size in relationship to other vessels shown within the display. Dynamic elements should be located within the vessel shapes such as bar graphs and/or embedded trends when process variables such as level, flow, or similar is being monitored for the associated vessel.
10. Protocol shall be established which animates alarms prior to being acknowledged and maintains alarm display until the alarm condition is removed or the alarm is inhibited. Alarms, alarm acknowledgement, and inhibits shall be recorded to an event log.
    a. Screens shall be developed to allow an operator with the appropriate access level to inhibit alarm points.

E. Display Elements and Color Conventions:
1. Colors shall be used to enhance the user's ability to recognize the importance of key information such as alarms and other abnormal conditions.
2. Color selection shall be used to distinguish the type of information being displayed with higher priority information being emphasized using the most noticeable colors.
3. Color shall be used conservatively and consistently throughout the displays.
4. Colors used for alarms shall not be used for any other purpose to ensure their meaning is strengthened.
5. Colors shall be based on the PlantPAx library. Color usage, color name and color RGB definitions can be found in KC Water's SCADA System Software Standards and Conventions.
6. Static Display Elements:
    a. Static display elements and process flow streams shall conform to the table below.

Static Elements	Color
Graphic Display Background	Light Gray
Static Text: Display Titles Equipment Identifiers Equipment Symbol Outlines	Black and Dark Gray

Static Elements	Color
Static Equipment Symbols: Isolation Valves Flow Meters Similar Devices Process Symbol Outlines	Dark Gray
Static Process Symbols: Basins Filters Vessels	Gray
Primary/Major Process Flow Streams:	Dark Gray
Secondary/Minor Process Flow Streams:	Dark Gray
Chemical Feed Systems:	Gray
Compressed Air, Instrument Air	Gray

7. Lines and Arrows:
   a. Lines and arrows used for the primary process flow shall be easily distinguished from building and equipment lines or secondary flows and instrumentation.
   b. Process lines shall be shown as solid 2D graphic line with the color black.
   c. Line crossings shall give precedent to the primary process flow with the secondary lines being split.
   d. Each process flow line shall be labeled at the entrance and exit of each display and identify flow direction.
   e. When the flow line continues to another display, the entrance and exit of each flow line shall include a link to the next display associated with the flow.
   f. Arrows used for links shall be distinguished in appears from non-linked arrows.
   g. Line weights and patterns shall be as follows:
      (1) Primary Process Flow: Line width of 2, black.
      (2) Structure Lines: Line width of 1, dark gray.
8. Dynamic Display Elements:
   a. Dynamic symbol and text elements, both discrete and analog, shall conform to the requirement as specified below.
   b. Color for dynamic elements shall be used for process variables, warning, and alarm conditions. Colors shall be used to represent the priority of the associated condition, e.g. low, high, critical, etc.
   c. The dynamic elements used shall place emphasis and promote situational awareness for the operator.
   d. Equipment modes shall indicate whether the equipment is in local, off, or remote.
   e. Equipment status shall indicate running and stopped, open and closed, etc.
   f. The quality of the signal shall be represented to indicate out-of-service, inhibited alarm, bad data or communication failure.
   g. Symbols shall be emphasized using a separate colorized flashing box around the object to indicate unacknowledged alarms, signals out of range, and those not having proper communication. If the specific project implementation requires more

than two priorities (warning and alarm), the flashing box shall also include a priority identification symbol attached to the box.

9. Control Function Interfaces:
   a. Control functions requiring operator interaction or input such as hand-off-auto selection, mode selection, setpoint input, and similar shall be presented in a control panel pane integrated into the associated display windows when possible. A pop-up window or side panel shall be used if space is limited on the equipment display. The appearance of the operator interfaces shall be consistent in either presentation.
   b. PID tuning parameters and other setpoints shall be made available through this control panel interface when applicable. If the security access level is not sufficient, the parameters shall be hidden or made unavailable for user interaction.
   c. Buttons and setpoint entry fields used for process control shall be designed with a raised appearance or perceived depth to allow immediate recognition of its function by the Operator.
   d. Setpoint entry fields shall be clearly labeled with the appropriate units displayed.
   e. Navigational buttons should be distinct from buttons used for process control.
   f. Button colors and data field colors shall be as identified by KC Water's SCADA System Software Standards and Conventions.
10. Dynamic Text and Bar Graphs:
   a. Dynamic text shall be used to represent a discrete or analog signal on the operator HMI.
      (1) Dynamic text elements shall be colorized to distinguish them from static text, in addition to flashing boxes used for identifying warning and alarm conditions.
   b. Bar graphs may be utilized in addition to dynamic text elements to represent process variables.
      (1) Bar graphs may be used for process variables such as level, speed, and other analog instrumentation.
      (2) The bar graph shall be segmented to identify the variable setpoint, warning and alarm ranges in addition to the current value.
      (3) Bar graphs shall not change color or flash to represent a warning or alarm condition. Like other dynamic elements, a colored box around the associated bar shall be used for this purpose.
   c. Color conventions for dynamic text and bar graph elements shall be as identified in KC Water's SCADA System Software Standards and Conventions.
11. Display Text:
   a. Both dynamic and static text elements shall be consistent for all displays.
   b. Refer to KC Water's SCADA System Software Standards and Conventions for font style and colors.
   c. Labels and other static text element colors not defined shall utilize shades of dark gray and black to sufficiently contrast against the light gray background.
12. Alarm Text:
   a. In addition to the warning and alarm condition box animations defined in previous sections, alarms shall be displayed in text form in the alarm window. The alarm

display text colors conventions shall be as defined in KC Water's SCADA System Software Standards and Conventions.

F. Screen Development: As a minimum the following screens shall be developed for the project:
   1. System Overview Screen (Level 1):
      a. Diagrammatic Overview: Diagrammatically indicates the complete Wastewater Treatment Plant including all major structures, pump stations, storage basins, and major interconnecting piping.
      b. Dashboard Overview: Consist of a dashboard style layout for each structure with specific plant Key Point Indicators (KPIs) visible. Final screen style shall be based on Owner preferences.
      c. Displays for this screen shall at a minimum include the status of each facility, influent and effluent flow rates, and daily flow totals for the plant.
      d. Allow the operator to point and click to open a detailed screen for the associated system or structure.
   2. Detailed System Screens (Level 2):
      a. A detailed screen shall be developed for each process system.
      b. The detailed screens shall display all monitored parameters and allow for the adjustment of the control and alarm associated with the system.
      c. If a particular system requires additional screens to clearly identify and display all control and status points for the system equipment, the Detailed Screen and Overview Screen shall include links to the additional subsystem screens.
      d. Links shall be established between related screens and between each screen and the system overview screen. Relational links shall also be provided for process piping continuations between screens.
      e. A detailed screen shall be developed for each system including, but not limited to, the following:
         (1) Existing Screens and Diversion Boxes.
         (2) Influent Pump Station.
         (3) Influent Screens.
         (4) Grit Removal System.
         (5) AGS Basins (Typical of 4).
         (6) AGS Sludge Buffer Tanks and Pumping System.
         (7) AGS Water Level Correction.
         (8) Aeration Blowers.
         (9) Chemical Feed Systems.
            (a) Supplemental BOD (Carbon).
            (b) Aluminum Sulfate (Alum).
         (10) UV Disinfection System and Effluent Flow.
         (11) Process Water Pump Station.
         (12) Solids Handling Overview.
         (13) Thin Sludge Storage and Pumping.
            (a) Thin Sludge Blowers.
         (14) Sludge Thickening and Pumping.
            (a) Polymer Feed System.
         (15) Thickened Sludge Holding and Loadout Pumping.
         (16) Thickened Sludge Mixing.
         (17) Plant Sewer Pump Station.
         (18) Odor Control System.

3. Building and Structure Screens:
   a. A detailed screen shall be developed for each building or structure.
   b. The detailed screens shall display all monitored parameters including electrical and mechanical systems and allow for the adjustment of alarm points associated with the building or structure.
   c. If a particular building or structure requires multiple screens to clearly indicate the associated control and status points an overview screen shall be developed which indicates the general status of the components. The overview screen shall provide links to the associated detailed screens.
4. Electrical System Screen:
   a. Shall include a graphical depiction of the electrical one-line diagram for the plant.
   b. Shall provide display panels for monitored breaker status, bus Voltage, Amps, Watts, and Vars as applicable for each monitored circuit.
   c. Shall include the main switchboards, MCCs, and utility auto-throwover system.
   d. Provide the following screens as minimum:
      (1) Main Switchboard Auto-Throwover System (Typical of 3).
      (2) General Mechanical, Electrical, UPS, and power monitoring.
5. Communications Status Screen:
   a. Shall graphically depict the entire Ethernet network showing all PLC's, Switchboards, MCC's, network switches, graphic terminals, servers, and PC workstations in the system.
   b. Shall indicate communication system status for all switches, PLC's, and other networked equipment.
   c. Shall indicate UPS and power supply status points.
   d. Shall provide links to embedded web pages associated with each intelligent device on the network including but not limited to PLCs, power monitors, VFDs, intelligent overload relays, network switches, and UPSs. Required web browser program shall be launched when links are activated.
6. Alarm and Event Management Screens:
   a. Shall display alarms and events.
   b. Shall list the discrete alarm points and allow the operator to inhibit the alarm and select whether the alarm point causes the audible alarm to sound.
   c. Shall allow the operator to set the parameters associated with the audible alarms.
   d. Shall allow the operator to place the associated equipment alarms into "Out Of Service" mode to prevent out of service equipment from triggering alarms.
   e. Color schemes and display properties shall be as defined by KC Water SCADA Software Standards and Conventions.
7. Event Notification:
   a. The following methods shall be used for notification of alarms:
      (1) Alarm screens and alarm box animations for each process variable displayed.
8. Maintenance Screens:
   a. Maintenance screens shall be developed for each system and associated equipment.
   b. The maintenance screens shall provide links to electronic O&M materials and As-Built drawings stored in PDF format for the associated treatment plant systems and equipment.
   c. The PDF's shall be supplied as part of the manufacturers O&M material and final documentation. The systems integrator shall assemble all of the electronic documents in a common area on the control system server.

d. Specific portions of the electronic documents to be accessed more frequently should be pulled from the full O&M documents and stored as separate PDF files for quicker access. The specific portions to be separately stored shall include, but not be limited to, to following items:
   (1) Wiring diagrams.
   (2) Pump Curves.
   (3) Manufacturer's recommended maintenance schedules.
   (4) Other items as requested by the Owner.

e. As-Built drawing PDF's shall be supplied by the Engineer after the plant construction is completed. The Systems Integrator shall utilize the "For Construction" drawing PDF's for the initial development. After the As-Built PDF's are supplied the systems integrator shall replace the contract drawing PDF files with the final As-Built files.

3.04 REPORTS:

A. Reports shall be developed with input from the Owner for specific formatting and data presented.

B. Reports shall be designed in a professional manner with Titles, Headings, Dates, and other relevant information, which describe in detail the reported information.

C. Reports shall be developed utilizing XL Reporter, Ocean Data Systems Dream Reports, Microsoft Excel, or equivalent as required by the Owner's reporting standards. Coordinate with the Owner's existing reporting standards as required.

D. As a minimum the following reports shall be developed for each plant:
   1. Daily Flow Report shall include the following for all flow meters:
      a. Daily Minimum Flows.
      b. Daily Maximum Flows.
      c. Daily Average Flows.
      d. Daily Flow Totals.
   2. Daily Chemical Usage Report shall include the following:
      a. Pounds per day usage for each chemical used.
   3. Monthly Flow Report shall include the following for the influent, effluent, WAS, RAS, and other metered flows:
      a. Daily Flow Totals.
      b. Monthly Flow Totals.
      c. Daily flow rate minimum and maximum.
      d. Monthly flow rate minimum and maximum.
   4. Monthly Chemical Usage Report shall include the following:
      a. Pounds per day usage for each chemical.
      b. Monthly total usage for each chemical.
   5. Yearly Flow Report shall include the following for the influent, effluent, WAS, RAS, and other metered flows:
      a. Monthly Flow Totals.
      b. Yearly Flow Totals.
      c. Monthly flow rate minimum and maximum.
      d. Yearly flow rate minimum and maximum.
   6. The Monthly Runtime Report shall include monthly run times for all monitored equipment.

7. The Yearly Runtime Report shall include monthly and yearly run times for all monitored equipment.
8. Operator initiated report listing all operator adjustable set points. The report shall include both control and alarm values with headings indicating associated equipment.
9. Reporting information as required by Owner.
    a. Assume a minimum of five (5) additional reports to be developed based upon input from Owner.
    b. Report formatting and style shall be coordinated with the Owner and Engineer during development. The final reports shall be submitted for review and approval by the Owner and Engineer.

E. Reports shall be generated automatically on the defined periodic basis and saved in Excel format to a common directory on the server or NAS device. The operator shall be able to initiate a report to generate at any time by manually initiating the particular report. File naming convention shall be intuitive and define the report name, date, and applicable saved data.

3.05 NETWORK CONFIGURATION:

A. The plant control system Ethernet network shall be configured as specified in Section 40 66 00 – Network and Communications Equipment and as indicated on the Contract Drawings.
B. The Systems Integrator shall be responsible for programming and verifying the IP Addresses, Subnet, and Default Gateways, when applicable, for all devices on the network.
C. Coordinate IP Addressing standards with the Owner's IT Department.
D. Final IP Address scheme shall be submitted to Owner and Engineer for review.
E. VLANs shall be established for the plant network to divide the physical network into specific logical networks for increased performance and traffic isolation.
    1. The following VLANs shall be established as a minimum.
        a. VLAN 10: Servers, operator thin clients, and workstations.
        b. VLAN 11: PLCs and associated OITs.
        c. VLAN 12: (Reserved)
        d. VLAN 13: Device level I/O network: MCCs, VFDs, UPS, etc.
    2. Additional VLANs shall be configured as required for specific traffic segregation requirements.

3.06 PROGRAMMABLE LOGIC CONTROLLER (PLC) PROGRAMMING:

A. The PLCs shall be programmed utilizing the latest version of RSLogix Studio 5000 software as applicable for the specific PLCs.
B. Software and firmware versions shall be consistent across the project site. Systems Integrator shall coordinate versions with the equipment vendors to ensure conformance to the project standards.
C. The PLC program shall be thoroughly documented with explanations in the PLC program of the operation performed in each program line or rung.
D. Where possible the PLCs shall be programmed utilizing object-oriented programming (OOP) blocks and user defined data types (UDT) to maintain consistency throughout the PLC program. Programming blocks shall be developed with the worst-case scenario in mind to allow blocks to be adaptable throughout the project. The PLC object blocks shall be coordinated with the PlantPAx objects. The proposed blocks shall be submitted for review.

E. The PLC shall be programmed to perform the required logic for proper operation of the associated equipment.
F. The PLC shall monitor communications status on the network and alarm if communication failures occur.
G. The PLC shall monitor power status of the building or structure power supply.
   1. Logic shall be implemented that shall clear run contacts or shut down equipment when power to the facility is lost and perform routine startup of equipment after power restoration.
   2. Operator adjustable time delays shall be established between the restarting of motor driven equipment.
H. Systems Integrator shall be responsible for establishing the network IP Addresses for the system within the ranges provided by the Owner's IT Department
   1. The Systems Integrator shall provide a range of IP Addresses to each equipment manufacturer with networked components.
I. Each alarm point shall have a programmed 2 second time delay to prevent "nuisance" or "false" alarms.
J. Momentary start contacts shall be programmed to close for 2 seconds and then open. Momentary stop contacts shall be programmed to open and stay open until shutdown of the motor is detected.
K. All required field programming and tuning of the control loops shall be included.

3.07 ELECTRICALLY ACTUATED VALVES - GENERAL:

A. System Components and Functions:
   1. Typical for all actuated valves. Specific valve requirements and valve functions are described within each process control description herein.
B. Description of Operation:
   1. Electrically actuated valves shall be capable of being controlled locally at the valve actuator or remotely at the operator workstation.
   2. Local Control:
      a. Valve shall be opened and closed by manually actuating the handwheel or the open/close controls at the actuator control station.
   3. Remote Control:
      a. Valves shall be opened and closed by the PCS.
      b. For modulating valves, the valve position (0-100%) shall be controlled by the PCS through the indicated 4-20mA signal where 4mA is fully closed and 20mA is fully open.
      c. HMI screens shall be developed to allow the operator to select from two modes of operation for each valve.
         (1) Remote Manual Control Mode:
            (a) Valves opened and closed by the operator at the associated OIT.
            (b) Valve position shall be based on the operator input setpoint when applicable for modulating valves.
         (2) Automatic Control Mode:
            (a) The valve shall be controlled by the PCS.
            (b) Refer to process descriptions herein for specific automatic valve control requirements.

4. Valve position feedback and position limit switch monitoring:
    a. The open and closed status from valve limit switches and valve position feedback (when applicable) shall be displayed on the operator workstations.
    b. Programming shall be provided for all valve function blocks to include fail to open and fail to close alarms based on the specified feedback signals.
    c. If a valve is signaled to open or closed, the feedback limit switches and position shall be monitored for proof of valve response. If the open or closed limit switch does not provide positive feedback within a pre-programmed delay time, an alarm shall be sent to the operator workstation.
    d. If a process control sequence is in automatic mode, the program shall pause the sequence when possible system upsets can occur.

C. Setpoints and Ranges:
1. Valve position: 0-100%.
2. Valve Open Delay: [Valve opening time + 10%] (seconds).
    a. Systems Integrator shall coordinate with specific valves supplied to determine valve opening times.
3. Valve Close Delay: [Valve close time + 10%] (seconds).
    a. Systems Integrator shall coordinate with specific valves supplied to determine valve closing times.

D. System Upsets and Procedures for Recovery:

E. If a valve fails to open or close, the control system shall alarm the operator via the operator workstation.

3.08 ELECTRICALLY ACTUATED SLIDE GATES - GENERAL:

A. System Components and Functions:
1. Typical for all actuated slide gates. Specific gate requirements and gate functions are described within each process control description herein.

B. Description of Operation:
1. Electrically actuated gates shall be capable of being controlled locally at the gate actuator or remotely at the operator workstation.
2. Local Control:
    a. The gate shall be opened and closed by manually actuating the handwheel or the open/close controls at the actuator control station.
3. Remote Control:
    a. The gates shall be opened and closed by the PCS.
    b. The gate position (0-100%) shall be controlled by the PCS through the indicated open/close contact outputs.
    c. HMI screens shall be developed to allow the operator to select from two modes of operation for each gate.
        (1) Remote Manual Control Mode:
            (a) Gates opened and closed by the operator at the associated OIT.
            (b) Gate position shall be based on the operator input setpoint when applicable.
        (2) Automatic Control Mode (When Applicable):
            (a) The gate shall be controlled by the PCS.
            (b) Refer to process descriptions herein for specific automatic gate control requirements.

4. Gate position feedback and position limit switch monitoring:
    a. The gate position feedback shall be displayed on the operator workstations.
    b. Programming shall be provided for all gate function blocks to include fail to open and fail to close alarms based on the specified feedback signals.
    c. If a gate is signaled to open or closed, the feedback limit switch(es) and position feedback shall be monitored for proof of response. If the system does not provide positive feedback or limit switch proof of close within a pre-programmed delay time, an alarm shall be sent to the operator workstation.
    d. If a process control sequence is in automatic mode, the program shall pause the sequence when system upsets can occur.

C. Setpoints and Ranges:
1. Gate position: 0-100%.
2. Gate Open Delay: [Gate opening time + 10%] (seconds).
    a. Systems Integrator shall coordinate with specific gates supplied to determine opening times.
3. Gate Close Delay: [Gate close time + 10%] (seconds).
    a. Systems Integrator shall coordinate with specific gates supplied to determine closing times.

D. System Upsets and Procedures for Recovery:
1. If a gate fails to open or close, the control system shall alarm the operator via the operator workstation.

3.09 COARSE SCREEN SYSTEM:

A. System Components and Functions:
1. Screen System Main Control Panels IPS-MCP-010 and IPS-MCP-020.
    a. Manufacturer provided control panels for control of screen IPS-MCP-010 and IPS-MCP-020, respectively, containing starters, relays, circuit breakers, screen system PLC, operator interface, and other ancillaries necessary for control of the equipment.
2. Screen IPS-SCR-010 and IPS-SCR-020.
    a. Mechanical bar screens designed to remove solids and debris from the liquid stream.
3. Level Transmitter IPS-LT-010A and IPS-LT-010B.
    a. Radar level transmitters for measuring the screen and IPS-SCR-010 upstream and downstream channel levels respectively.
4. Level Transmitter IPS-LT-020A and IPS-LT-020B.
    a. Radar level transmitters for measuring the screen and IPS-SCR-020 upstream and downstream channel levels respectively.
5. Level Switch IPS-LSH-010 and IPS-LSH-020.
    a. Provides a high-level alarm for the screen IPS-SCR-010 and IPS-SCR-020 channels, respectively.

B. Description of Operation:
    a. The manufacturer provided control panel shall be equipped with HAND/OFF/AUTO switches, status indicating lights, and fail indicating lights.
        (1) When the switch is in the HAND position, the corresponding piece of equipment shall be started and stopped at the control panel or remotely mounted control station.

(2) The Plant Control System shall provide a System Inhibit signal to the manufacturer provided control panel. The signal shall prevent operation of the screen system equipment.
(3) When the switch is in the AUTO position the screen shall operate automatically as described below.
(a) The screen shall be started and stopped by the screen system main control panel based upon channel head differential across the screen as measured by the corresponding level transmitter.
(b) The screen system main control panel shall be programmed by the screen system manufacturer. Refer to Section 46 21 13 for the screen system description of operation.
(c) High Flow Mode and Remote Cycle:
1). While in AUTO, the screen system shall accept a start signal from the plant control system for remote start capability.
2). The operator screen shall include a Screen Cycle Test pushbutton and a Screen Continuous Run - High Flow Enable/Disable selector switch and a High Flow Setpoint.
a). When the cycle pushbutton is depressed the PCS shall enable the remote call to run bit in the Screen System PLC to initiate a cycle.
b). When the High Flow Enable/Disable selector is in the Disable position, the remote call shall not be automatically initated.
c). When the High Flow Enable/Disable selector is in the Enable position, the PCS shall automatically initiate the remote call to run bit when the plant flow reaches an operator adjustable setpoint.

b. Refer to System Upsets and Procedures for Recovery Section for additional programming requirements.
c. The status points and alarms for the screen shall be displayed on the operator workstation. Alarm and status points shall be communicated to the Plant Control System through the control system Ethernet network. Refer to the I/O list at the end of this Section and corresponding control drawings for I/O status and alarm points.

C. Setpoints and Ranges:
1. Level Transmitter IPS-LIT-010 and IPS-LIT-020.
a. Level transmitters are provided by the screen system manufacturer.
b. Calibration ranges for the associated upstream and downstream sensors shall be as recommended by the system manufacturer.
2. Level Switches IPS-LSH-010 and IPS-LSH-020:
a. Point level switch provided by the screen system manufacturer.
b. High Level Alarm level switches initially set at 819.67' msl or as recommended by the screen system manufacturer.
3. Operator Workstation:
a. Display range for each level transmitter shall be coordinated with the screen manufacturer.
b. Differential level alarm shall be adjustable.
c. High level alarm based on IPS-LSH-010 and IPS-LSH-020.

d. Screen Continuous Run - High Flow adjustable setpoint initially set at 9.0 MGD.

D. System Upsets and Procedures for Recovery:
1. If a screen failure occurs, the control system shall alarm the operator via the operator workstation.
2. If a power failure occurs, the equipment that was in operation prior to the power failure shall be automatically restarted by the manufacturer-provided control panel.
3. If a level transmitter signal is lost, the control system shall alarm the operator via the operator workstation.
4. If a jam or over-torque condition occurs in the screen that cannot be cleared by the system, the associated equipment shall automatically stop and initiate a failure alarm at the operator workstation.
5. Safety Devices:
a. Emergency stop push buttons and pull cord switches, as applicable, shall be interlocked with the corresponding screen starting circuit.
b. In the event of an emergency stop push activation, the corresponding equipment will shut down and alarm the operator. The emergency stops shall require a manual reset to restart the equipment.
c. An emergency stop condition shall initiate an e-stop alarm at the operator workstation.

3.10 HYDROGEN PEROXIDE STORAGE AND FEED SYSTEM

A. Hydrogen Peroxide Main Control Panel (H202-MCP-100):
1. The Hydrogen Peroxide Main Control Panel is the dedicated, skid-mounted controller that monitors bulk tank level, chemical storage and feed instrumentation, and operates the pumps.

B. Hydrogen Peroxide Bulk Tank
1. System Components and Functions:
a. Hydrogen Peroxide Bulk Tank H2O2-TNK-101.
b. Level Transmitter H202-LT-101.
(1) Measures level in the Hydrogen Peroxide Bulk Tank H2O2-TNK-101.
c. Level Indicator H2O2-LI-101.
(1) Display of the Hydrogen Peroxide Bulk Tank H2O2-TNK-101 level on the tank pad.
2. Description of Operation:
a. Tank Level:
(1) The level of the tank shall be measured by its associated level transmitter H202-LIT-101.
(2) The level of the tank shall be displayed in feet to the nearest tenth on the operator workstation.
(3) The volume of liquid shall be calculated and displayed in gallons to the nearest tenth on the operator workstation.
(4) Level alarms and loss of signal alarms shall be set for each tank.
(5) The levels shall be trended.
3. Set Points and Ranges:
a. Level Transmitter H202-LT-101:
(1) Level transmitter with integral display.
(2) Exact ranges will be dependent on dimensions of the tanks provided by the Contractor. Setpoints and ranges provided are approximate.

b. Level Indicator H202-LI-101:
(1) Large display level indicator.
(2) Calibration range of 0-100%.

4. Operator Workstation:
a. Display range of 0-13.5 feet and 0-6,500 gallons for each tank.
b. Low level warning adjustable between 0-5 feet initially set at 2.0 feet.
c. Low-low level alarm adjustable between 0-5 feet initially set at 1.0 feet.
d. High level alarm adjustable between 6-13.5 feet initially set at 9 feet.

5. System Upsets and Procedures for Recovery:
a. If a tank level signal is lost or out of range, the control system shall alarm the operator via the operator workstation.

C. Hydrogen Peroxide Feed System

1. System Components and Functions:
a. Hydrogen Peroxide Metering Pumps H202-PMP-110 and H202-PMP-110.
(1) Pumps Hydrogen Peroxide into the off-site upstream manhole. One pump shall be the duty and one pump shall be the standby.
b. Metering Skid Pressure Indicating Transmitter H202-PIT-101.
(1) Measures the pressure on the Hydrogen Peroxide metering skid discharge line. Range shall be coordinated with the chemical feed manufacturer.
c. Metering Skid Pressure Indicating Transmitter H202-FIT-101.
(1) Measures the flow from the Hydrogen Peroxide metering skid discharge line. Range shall be coordinated with the chemical feed manufacturer.

2. Description of Operation:
a. The pumps shall be capable of being controlled locally at the associated integral operator interface display and keypad or remotely by the plant control system when the pump control LOCAL/OFF/REMOTE selection is in Remote control.
b. Local Control:
(1) When the pumps are in LOCAL control, starting and stopping of the pumps and the feed rate of the pumps shall be controlled at the associated pump local control panel display/keypad.
c. Remote Control:
(1) When the pumps are in REMOTE control, starting and stopping of the pumps, and the feed rate of the pumps shall be controlled by the plant control system PLC.
(2) Remote Manual Control Mode:
(a) The plant control system PLC shall start and stop each pump and adjust the speed of the pump using a 4-20 mA signal correlating to 0 to 100% speed as manually entered by the operator at the operator workstation.
(3) Remote Automatic Control Mode:
(a) The chemical feed skid's main control panel (MCP) shall start and stop each pump and adjust the speed of the pump based on 4-20 mA influent flow and dosing rate signals provided by the plant control system PLC.
1). The pump speed signal shall be calculated by the MCP using a chemical feed calculation based on flow and a dosing rate input by the operator at the operator workstation.
2). The feed rate in gallons per hour of the metering pump shall be calculated by the following equation:

$$\frac{(Q_{RAW}\ in\ MGD) \times (peroxide\ dose\ rate\ in\ \frac{mg}{L}) \times 1.04}{\left(\frac{soln\ conc}{100}\right) \times (SG) \times 24\ {}^{hrs}/_{dy}}$$

Where: Q_{RAW} is the raw water flow as measured by GRSC-FIT-001, *soln conc* is the solution concentration entered by the operator, and *SG* is the specific gravity entered by the operator.

d. If one pump fails, the plant control system shall automatically start the standby pump and alarm the operator through the operator workstation.
e. The pumps shall have a relay output to the PLC representing a general failure alarm. The operator may view the specific alarm type at the pump's integral display.
f. The run status, fail status and remote status shall be displayed on the operator workstation for each metering pump.
g. If the influent signal is lost, the output signal shall remain at the last detected signal and alarm the operator at the operator workstation.
h. If low pump discharge pressure is detected, the plant control system shall automatically stop the feed pumps. The low pressure setpoint shall be operator adjustable.
i. Feed rate for the pumps shall be trended.
j. Refer to the I/O list at the end of this section and corresponding control drawings for I/O status and alarm points.

3. Set Points and Ranges:
   a. Hydrogen Peroxide Metering Pumps:
      (1) Feed rate range of 0-30 gallons per hour. Range shall be coordinated with the chemical feed manufacturer
   b. Dosage Setpoints
      (1) The Dosage Setpoint is adjustable from 0.001 to 30 mg/L, with an initial setting of 5 mg/L.
   c. Pressure Alarms
      (1) Operator adjustable range of 0-100 psi, initially set at 40 psi.
      (2) Low Pressure Alarm initially set at 40 psi or as recommended by the feed system manufacturer.
   d. Pressure Indicating Transmitter:
      (1) Adjustable range of 0-100 psi. Range shall be coordinated with the chemical feed manufacturer.
   e. Flow Indicating Transmitter:
      (1) Adjustable range of 0.0 to 40.0 GPH. Range shall be coordinated with the chemical feed manufacturer.
   f. Operator Workstation:
      (1) Feed rate range of 0-30 (mg/Las H2O2)
      (2) Bulk Tank low level shutdown adjustable between 0-1,000 gallons, initially set at 200 gallons.
4. System Upsets and Procedures for Recovery:
   a. If a pump fault alarm occurs or signal has been lost, the control system shall alarm the operator via the operator workstation.
   b. If the bulk tank level signal is lost, the control system shall alarm the operator via the operator workstation.

3.11 SCREENING ODOR CONTROL:

A. System Components and Functions:
   1. Odor Control Main Control Panel ODR-MCP-200
      a. Manufacturer provided control panel.

B. Odor Control:
   a. Refer to Section 44 31 19 – Odor Control System for description of operation of the odor control system.
   b. A system inhibit shall be provided to the main control panel PLC via the PCS network. If the inhibit is active, the odor control system shall be not be allowed to run.

3.12 COARSE SCREENING BUILDING COMBUSTIBLE AND OZONE GAS DETECTION:

A. System Components and Functions:
   1. Gas Detection Control Panel IPS-AIT-001:
      a. Indicating and annunciating controller located in the Coarse Screening Building electrical room.
   2. Remote Gas Transmitter IPS-AE-001:
      a. Methane gas level transmitter and sensor located in the Coarse Screening Building's screen room.
   3. Remote Gas Transmitter IPS-AE-003:
      a. Hydrogen Sulfide gas level transmitter and sensor located in the Coarse Screening Building's screen room.
   4. Ozone Detection Control Panel IPS-AIT-002:
      a. Ozone gas level transmitter and sensor located in the Coarse Screening Building electrical room. Ozone is pumped from the element locations to the ozone gas transmitter via an integral sample pump. The sample gas is processed by an internal scrubber and exhausted to the exterior of the building.
   5. Remote Gas Sensing Elements IPS-AE-002A/B/C:
      a. Ozone gas sampling inlets located in the Coarse Screening Building's screen room.
   6. Strobes IPS-STB-001, IPS-STB-003:
      a. Interior and exterior mounted strobe lights for visual annunciation of combustible gas alarm and ventilation failure.
   7. Strobes IPS-STB-002, IPS-STB-004:
      a. Interior and exterior mounted strobe lights for visual annunciation of ozone gas alarm.
   8. Horn IPS-HRN-001, IPS-HRN-002:
      a. Interior and exterior mounted horn for audible annunciation of ozone gas alarm, combustible gas alarm, and ventilation failure.

B. Description of Operation:
   1. Combustible Gas and Hydrogen Sulfide Gas:
      a. The combustible and hydrogen sulfide gas levels in the Coarse Screening Building area shall be measured by combustible gas level sensors IPS-AE-001 and IPS-AE-003, respectively.
      b. The sensor shall transmit the corresponding gas level to the gas detection control panel IPS-AIT-001 via analog (4-20mA) signals.
      c. The alarm relay in combustible gas detector control panel shall be set to close at 10% LEL for combustible gas and 10 PPM for hydrogen sulfide sensor channels. The alarm relay shall be wired to specified strobes and horns. The strobes and

horns shall annunciate and alert personnel of high combustible gas levels or a failure of the ventilation system within the Coarse Screening Building area.

d. The operator workstation shall include alarm indicators to distinguish between a ventilation failure and a high combustible gas level.

e. A test switch shall be installed in the face of the PLC control panel to allow testing functions of the Audible/Visual warning system.

f. The gas levels shall be displayed locally at the gas detection control panel IPS-AIT-001 and on the operator workstation. High level and loss of signal alarms shall be programmed.

g. Gas levels shall be trended.

2. Ozone Gas:

a. The ozone gas level in the Coarse Screening Building area shall be measured by combustible gas level sensor IPS-AIT-002.

b. The sensor shall transmit the corresponding gas levels to the IPS-PLC-061 via analog (4-20mA) signals.

c. The alarm relay in the ozone gas detector control panel shall be set to close at 0.1 PPM for all sensor channels. The alarm relay shall be wired to specified strobes and horns. The strobes and horns shall annunciate and alert personnel of high ozone gas levels or a failure of the ventilation system within the Coarse Screening Building area.

d. Upon detection of an operator-adjustable ozone level alarm, an inhibit signal shall be sent to the odor control system (ODR-MCP-200) to prevent the system from running.

(1) The inhibit signal shall be an optional operational mode, selectable on the operator workstation.

e. A test switch shall be installed in the face of the PLC control panel to allow testing functions of the Audible/Visual warning system.

f. The ozone gas level shall be displayed locally at the ozone gas detection transmitter IPS-AIT-002 and on the operator workstation. High level and loss of signal alarms shall be programmed.

g. Ozone gas levels shall be trended.

3. A test switch shall be installed in the face of the PLC control panel to allow testing functions of the Audible/Visual warning system.

C. The gas detection system status points and alarms shall be displayed on the operator workstation. Refer to the I/O list at the end of this Section and corresponding control drawings for I/O status and alarm points.

D. Set Points and Ranges:

1. Gas Transmitter IPS-AE-001:

a. Combustible gas transmitter with integral display.

b. Refer to Section 40 70 00A Instrument List for calibration ranges.

c. High level alarm set at 10% LEL.

2. Gas Transmitter IPS-AIT-002:

a. Ozone gas transmitter with integral display.

b. Refer to Section 40 70 00A Instrument List for calibration ranges.

c. High level alarm set at 0.1 PPM.

3. Gas Transmitter IPS-AE-003:

a. H2S gas transmitter with integral display.

b. Refer to Section 40 70 00A Instrument List for calibration ranges.

c. High level alarm set at 10 PPM.

4. Operator workstation:
   a. Display range of 0-100% LEL for each combustible gas transmitter.
   b. Display range of 0-0.2 PPM for each ozone gas sample channel.
   c. Display range of 0-200 PPM for each H2S gas transmitter.

E. System Upsets and Procedures for Recovery:
1. If the combustible gas detector signal is lost, the control system shall alarm the operator via the operator workstation.

3.13 HEADWORKS COMBUSTIBLE GAS DETECTION:

A. System Components and Functions:
1. Gas Detection Control Panel GRSC-AIT-001:
   a. Indicating and annunciating controller located in the headworks electrical room.
2. Remote Gas Transmitter GRSC-AE-001:
   a. Methane gas level transmitter and sensor located in the headworks area first level.
3. Remote Gas Transmitter GRSC-AE-002:
   a. Methane gas level transmitter and sensor located in the headworks area second level.
4. Strobe GRSC-STB-401, GRSC-STB-402, and GRSC-STB-403:
   a. Interior and Exterior mounted strobe lights for visual annunciation of gas alarm and ventilation failure.
5. Horn GRSC-HRN-401:
   a. Exterior mounted horn for audible annunciation of gas alarm and ventilation failure.

B. Description of Operation:
1. The combustible gas level in the headworks area shall be measured by combustible gas level sensor GRSC-AE-001 and GRSC-AE-002.
2. The sensors shall transmit the corresponding gas level to the gas detection control panel GRSC-AIT-001 via analog (4-20mA) signals.
3. The alarm relay in combustible gas detector control panel shall be set to close at 10% LEL for all sensor channels. The alarm relay shall be wired to specified strobes and horns. The strobes and horns shall annunciate and alert personnel of high combustible gas levels or a failure of the ventilation system within the headworks area.
4. The operator workstation shall include alarm indicators to distinguish between a ventilation failure and a high combustible gas level.
5. A test switch shall be installed in the face of the PLC control panel to allow testing functions of the Audible/Visual warning system.
6. The combustible gas level shall be displayed locally at the gas detection control panel GRSC-AIT-001 and on the operator workstation. High level and loss of signal alarms shall be programmed.
7. Combustible gas levels shall be trended.

C. The gas detection system status points and alarms shall be displayed on the operator workstation. Refer to the I/O list at the end of this Section and corresponding control drawings for I/O status and alarm points.

D. Set Points and Ranges:
1. Gas Transmitter GRSC-AE-001 and GRSC-AE-002:
   a. Combustible gas transmitter with integral display.
   b. Refer to Section 40 70 00A Instrument List for calibration ranges.
   c. High level alarm set at 10% LEL.

2. Operator workstation:
    a. Display range of 0-100% LEL for each gas transmitter.

E. System Upsets and Procedures for Recovery:
1. If the combustible gas detector signal is lost, the control system shall alarm the operator via the operator workstation.

3.14 INFLUENT PUMP STATION:

A. The Influent Pump Station is composed of two sides, each with submersible pumps. In normal operation, the sides are equalized, and the automatic pumping sequence utilizes all pumps in concert. The sides may be isolated from each other using motorized gates. In isolation mode, only one side's pumps are available for automatic operation while the opposite side's pumps are taken out of service.

B. System Components and Functions:
1. Influent Wet Well No. 1:
    a. Influent Pump No. 1: IPS-PMP-110.
        (1) Submersible pump controlled by a VFD.
    b. Influent Pump No. 2: IPS-PMP-120.
        (1) Submersible pump controlled by a VFD.
    c. Influent Pump No. 3: IPS-PMP-130.
        (1) Submersible pump controlled by a VFD.
    d. Level Indicating Transmitter: IPS-LIT-101.
        (1) Radar level transmitter used for measuring the Influent Wet Well No. 1 level.
2. Influent Wet Well No. 2:
    a. Influent Pump No. 4: IPS-PMP-140.
        (1) Submersible pump controlled by a VFD.
    b. Influent Pump No. 5: IPS-PMP-150.
        (1) Submersible pump controlled by a VFD.
    c. Level Indicating Transmitter: IPS-LIT-102.
        (1) Radar level transmitter used for measuring the Influent Wet Well No. 2 level.
3. Level Float Switches: Located in the influent pump station wet wells.
    a. Influent Wet Well No. 1:
        (1) IPS-LSH-101.
            (a) High level float switch used for pump control interlock and warning.
        (2) IPS-LSHH-101.
            (a) High-high level float switch used for pump control interlock and alarm.
        (3) IPS-LSL-101.
            (a) Low level float switch used for pump control interlock and warning.
        (4) IPS-LSLL-101.
            (a) Low-low level float switch used for pump shut-down interlock and alarm.
    b. Influent Wet Well No. 2:
        (1) IPS-LSH-102.
            (a) High level float switch used for pump control interlock and warning.
        (2) IPS-LSHH-102.
            (a) High-high level float switch used for pump control interlock and alarm.
        (3) IPS-LSL-102.
            (a) Low level float switch used for pump control interlock and warning.
        (4) IPS-LSLL-102.

(a) Low-low level float switch used for pump shut-down interlock and alarm.

4. Influent Flow Transmitter: GRSC-FIT-001.
   a. Magnetic flow meter measures Influent Pump Station discharge flow.

C. Description of Operation:
1. Wet Well Level:
   a. The level in the wet wells shall be measured by level transmitters IPS-LIT-101 and IPS-LIT-102.
   b. The two level transmitters shall serve as redundant devices and the HMI screen shall allow the operator to select which transmitter is currently being utilized for control.
   c. The levels from both transmitters shall be displayed on the operator workstation and high-high, high, low, and low-low level and loss of signal alarms shall be set. The level alarms shall be based upon the measurement from the selected transmitter.
   d. The redundant transmitter levels shall be compared under normal operating conditions by the following formula:
      (1) $$\frac{|(IPS{-}LIT{-}101) - (IPS{-}LIT{-}102)|}{\{[(IPS{-}LIT{-}101) + (IPS{-}LIT{-}102)] \div 2\}}$$
      (2) If the difference percentage results in a value initially set at 10%, an operator warning shall be initiated. The percentage setpoint shall be operator adjustable.
      (3) If one of the transmitters is disabled by the operator, the warning shall be disabled.
   e. If a loss of signal alarm is detected the control system shall automatically switch to the other transmitter and alert the operator at the operator workstation.
   f. The levels shall be displayed in feet to the nearest tenth on the operator workstation.
   g. The levels for both transmitters shall be trended.
2. Influent Pump Station Flow:
   a. The influent pump station flow shall be measured by flow transmitter GRSC-FIT-001.
   b. The flow shall be displayed in gpm (gallons per minute) and MGD (million gallons per day) on the operator workstation.
   c. High flow and loss of signal alarms shall be programmed.
   d. The influent flow shall be trended.
3. Influent Pumps:
   a. The pumps shall be capable of being controlled locally at the associated pump VFD or remotely by the plant control system when the LOCAL/OFF/REMOTE switch is in REMOTE.
   b. Level control for the pumps shall be based on the signal from the selected level transmitter.
   c. Local Control:
      (1) When the pumps are in LOCAL control, starting and stopping of the pumps and the speed of the pumps shall be controlled at the associated VFD.
   d. Remote Control:
      (1) When the pumps are in REMOTE control, starting and stopping of the pumps, and the speed of the pumps shall be controlled by the plant control system PLC.

(2) When the start/stop contact associated with the pump is closed to the VFD, the corresponding pump shall start and run. When the start/stop contact is opened to the VFD, the corresponding pump shall stop.
(3) HMI screens shall be developed to allow the operator to select from two modes of operation.
(4) Remote Manual Control Mode:
  (a) Starting and stopping of each of the pumps initiated by the operator at the operator workstation.
  (b) The operator shall set the speed as a percentage of full speed for each of the VFD controlled pumps.
(5) Remote Automatic Control Mode:
  (a) Control of each pump will be determined by the status of the VFD and BYPASS inputs determined by the VFD-OFF-BYPASS switches located on the face of the VFD enclosures.
  (b) VFD Control Mode:
    1). The plant control system PLC shall automatically start and stop pumps and adjust the speed of the pumps to maintain the level set point in the wet well.
    2). The measured flow rate shall be based on flow meter GRSC-FIT-001 and shall be utilized for conditional high flow control.
    3). The pumps shall be rotated automatically by the control system or manually by the operator. Selections shall be made available on the operator workstation screen for this function.
    4). Pumps IPS-PMP-110, IPS-PMP-130, and IPS-PMP-150 shall be rotated for service within Pump Group 2.
    5). Pumps IPS-PMP-120 and IPS-PMP-140 shall be rotated for service within Pump Group 1.
    6). Rotation shall be automatic within each group by the system after an operator adjustable time period or after each pump cycle. The rotation timer shall automatically reset if the pumps rotate because of a pump cycle.
    7). The pump(s) speed shall be controlled using a PID algorithm to maintain a Level Setpoint in the wet well.
    8). Sequence of Operation:
      a). Seven (7) pump combinations shall be programmed for the system as follows:
      b). Step 1: One pump from Pump Group 1.
      c). Step 2: One pump from Pump Group 2.
      d). Step 3: One pump from Pump Group 1 and one pump from Group 2.
      e). Step 4: Two pumps from Pump Group 2.
      f). Step 5: One pump from Pump Group 1 and two pumps from Pump Group 2.
      g). Step 6: Two pumps from Pump Group 1 and two pumps from Pump Group 2.
      h). Step 7 (if one of Pump Group 1 pumps out of service): Three Pumps from Pump Group 2.

i). When the wet well level rises above the design level setpoint to the Step 1 Pump Start, the associated pump shall start. The pump speed shall be modulated to maintain the level set point.

j). If the Step 1 pump is operating at 100% speed and the wet well level rises to the Step 2 start setpoint, the next pump in the sequence shall start after a Pump Start time delay. If the level falls below the Step 2 start setpoint prior to the time delay expiration, the timer shall be reset.

k). When the next pump is called to start, it shall ramp to 100% speed to match the operating pump speed and the pump combination shall be modulated together to maintain the level set point.

l). If flow into the wet well increases, this sequence shall continue through all assigned pump steps until the wet well level is maintained.

m). If flow into the wet well decreases, the pump combination is operating at minimum speed, and the associated Step Off setpoint is reached, the designated pump shall ramp down to zero speed and shut down. The pumps lead/lag role shall be rotated at this time.

n). The pumps in each pump group shall automatically rotate after each start/stop cycle or once every 24-hour time period, whichever occurs first. The rotation time shall be operator adjustable.

o). The remaining pumps shall continue to modulate to achieve the level set point.

p). As flow continues to decrease to a point that only one pump is operating (Step 1), the pump shall operate until the following pump shutdown conditions are met:

q). All other pumps are off.

r). The pump is running at the associated minimum speed.

s). The wet well level reaches the Step 1 Stop set point.

(6) Wet Well Isolation Mode

(a) The Wet Well Isolation Mode is intended to be a supplementary mode to allow either wet well side to be taken out of service, while the other wet well side remains in service.

1). While this mode is active, a descriptive notification popup shall be displayed on the operator screen.

(b) Prior to the activation of the Wet Well Isolation mode, the following gates must be closed by the operator at the operator workstation:

1). Wet Well No. 1 Isolation: Operator shall close IPS-GATE-101 and IPS-GATE-001. These gates shall be interlocked to not allow Wet Well No. 1 to be isolated if the gates are open.

2). Wet Well No. 2 Isolation: Operator shall close IPS-GATE-101 and IPS-GATE-002. These gates shall be interlocked to not allow Wet Well No. 2 to be isolated if the gates are open.

(c) Pump Status:

1). All pumps associated with the wet well to be isolated must be stopped and taken out of the automatic control sequence.
a). Wet Well No. 1: IPS-PMP-110, IPS-PMP-120, IPS-PMP-130.
b). Wet Well No. 2: IPS-PMP-140, IPS-PMP-150.

(d) The operator must manually select and activate the specific "Wet Well Isolation Mode" (e.g., "Wet Well 1 Isolation Mode" or "Wet Well 2 Isolation Mode") via the operator workstation HMI.

(e) Once the isolation mode has been selected, the following pump control shall occur:
1). Wet Well No. 1 Isolation:
a). All influent flow will be directed to Influent Wet Well No. 2.
b). Only pumps IPS-PMP-140 and IPS-PMP-150 shall be available for automatic or manual control. The pump control logic shall utilize these two pumps through the pump sequence.
2). Wet Well No. 2 Isolation:
a). All influent flow will be directed to Influent Wet Well No. 1.
b). Only pumps IPS-PMP-110, IPS-PMP-120 and IPS-PMP-130 shall be available for automatic or manual control. The pump control logic shall utilize these two pumps through the pump sequence.

(f) Level Indicating Transmitters:
1). The control system shall rely solely on the level indicating transmitter (LIT) of the active wet well.
2). Wet Well No. 1 Isolation: IPS-LIT-102 shall be selected for level control.
3). Wet Well No. 2 Isolation: IPS-LIT-101 shall be selected for level control.
4). The redundant transmitter error calculation for the isolated wet well shall be suspended while Wet Well Isolation Mode is activated.

(g) High, high-high, low, and low-low level alarms shall be active only for the non-isolated wet well and its corresponding level transmitter. High and high-high level control backup modes, as described below, shall be active only for the pumps associated with the active wet well.
1). Wet Well No. 1 Isolation Level Alarms and Backup Control: IPS-LSH-102, IPS-LSHH-102, IPS-LSL-102, IPS-LSLL-102.
2). Wet Well No. 2 Isolation Level Alarms and Backup Control: IPS-LSH-101, IPS-LSHH-101, IPS-LSL-101, IPS-LSLL-101.

(h) The pump status points and alarms shall be displayed on the operator workstation. Refer to the I/O list at the end of this section and corresponding control drawings for I/O status and alarm points.

(7) High Level Control Backup Mode:
(a) The High Level Control Backup Mode is intended to be a supplementary mode to ensure the pumps operate in the event the primary and secondary level transmitters are not functional or reading incorrect wet well levels.

1). While this mode is active, a descriptive notification popup shall be displayed on the operator screen.

(b) If the wet well level rises above the high level set point (IPS-LSH-101), the control system shall automatically call for the next Step in the operating sequence to begin after a high level pump start delay.

(c) All operational pumps will operate at 100% speed.

(d) As long as the wet well level is above the high level set point, the control system will continue to call for the next Step (following a pump start delay for each transition) in the operating sequence until the pump shut off level is reached.

(e) Once the pumps shut off, control will revert back to the Remote Automatic Control Mode.

(8) High High Level Control Backup Mode

(a) The High-High Level Control Backup Mode is intended to be a supplementary mode to ensure the pumps operate in the event the primary and secondary level transmitters are not functional or reading incorrect wet well levels.

1). While this mode is active, a descriptive notification popup shall be displayed on the operator screen.

(b) If the wet well level rises above the high-high level set point (IPS-LSHH-101), the control system shall automatically call for the Next Step in the operating sequence to begin after a high high level pump start delay.

(c) All operational pumps will operate at 100% speed.

(d) As long as the wet well level is above the high level set point, the control system will continue to call for the next Step (following a pump start delay for each transition) in the operating sequence until the pump shut off level is reached.

(e) Once the pumps shut off, control will revert back to the Remote Automatic Control Mode.

(9) VFD Bypass Control Mode:

1). If a pump is in VFD bypass mode, that pump shall remain available in the control sequence and will be energized and de-energized when the program calls for the pump to start or stop, respectively. Speed control will not be available while the pump is in VFD Bypass. Otherwise, pump control shall conform to Remote-Automatic VFD mode requirements.

(b) Refer to System Upsets and Procedures for Recovery this Section for additional programming requirements.

e. The pump status points and alarms shall be displayed on the operator workstation. Refer to the I/O list at the end of this section and corresponding control drawings for I/O status and alarm points.

D. Setpoints and Ranges:

1. Level Indicating Transmitter IPS-LIT-101 and IPS-LIT-102:
   a. Level transmitter with integral display.
   b. Refer to Section 40 70 00 for instrument calibration ranges.
2. Influent Pump Variable Frequency Drives:
   a. Ramp up time: Adjustable setpoint initially set at 10 seconds.

b. Ramp down time: Adjustable setpoint initially set at 10 seconds.
c. Minimum Speed: 75% initial.
(1) Final setpoint shall be determined during system startup.

3. Timer Set Points:
a. Pump Start Delay (adjustable) initially set at: 15 seconds.
b. Pump Rotation time (adjustable) initially set at: 24 hours.
c. High Level Pump Start Delay (adjustable) initially set at 30 seconds.
d. High High Level Pump Start Delay (adjustable) initially set at 10 seconds

4. Operator Workstation:
a. Wet Well Level Setpoints (Adjustable over the range of the instrument.):
(1) Zero level for the level transmitters shall be at elevation 803.66' msl.
(2) Step 1 Start set point initially set at: 5.00 feet (808.66' msl).
(3) Step 2 Start set point initially set at: 6.00 feet (809.66' msl).
(4) Step 3 Start set point initially set at: 6.50 feet (810.16' msl).
(5) Step 4 Start set point initially set at: 7.00 feet (810.66' msl).
(6) Step 5 Start set point initially set at: 7.00 feet (810.66' msl).
(7) Step 6 Start set point initially set at: 7.50 feet (811.16' msl)
(8) Step 1 Stop set point initially set at: 3.50 feet (807.16' msl).
(9) Step 2 Stop set point initially set at: 4.00 feet (807.66' msl).
(10) Step 3 Stop set point initially set at: 4.00 feet 807.66' msl).
(11) Step 4 Stop set point initially set at: 4.00 feet (807.66' msl).
(12) Step 5 Stop set point initially set at: 4.00 feet (807.66' msl).
(13) Step 6 Stop set point initially set at: 4.00 feet (807.66' msl).
(14) High-High Level Alarm initially set at: 11.00 feet (814.66' msl).
(15) High Level Warning initially set at: 8.50 feet (812.16' msl).
(16) Low Level Warning initially set at: 3.00 feet (806.66 msl).
b. Minimum Speed Setpoints:
(1) Step 1 minimum speed: Initially set at 83%.
(2) Step 2 minimum speed: Initially set at 88%.
(3) Step 3 minimum speed: Initially set at 90%.
(4) Step 4 minimum speed: Initially set at 93%.
(5) Step 5 minimum speed: Initially set at 94%.
(6) Step 6 minimum speed: Initially set at 95%.
(7) Minimum pump speed setpoints shall be tested and confirmed during pump commissioning to ensure observed positive flow at minimum level setpoint conditions.
c. Flow Transmitter: GRSC-FIT-001.
(1) Display range of 0.0-12,500 gpm.
(2) Display range of 0.00-18.00 MGD for total flow.
(3) High flow setpoint initially set at: 12.5 MGD.
d. Pressure Transmitters: IPS-PIT-110, IPS-PIT-120, IPS-PIT-130, IPS-PIT-140, IPS-PIT-150.
(1) Display range of 0.0-150 psig.
(2) High pressure setpoint (adjustable) initially set at 90 psig.
(3) High pressure alarm shall include respective pump in notification (for example, "High Pressure IPS Pump No. 1").

E. System Upsets and Procedures for Recovery:
1. If a pump failure occurs, the control system shall alarm the operator via the operator workstation.
2. If the primary level signal is lost or out of range, the control system shall alarm the operator via the operator workstation.
3. If the flow signal is lost or out of range, the plant control system shall alarm the operator via the operator workstation.
4. If a reverse flow is detected, the plant control system shall alarm the operator via the operator workstation.
5. If any wet well isolation gate is closed while a Wet Well Isolation Mode is not active, , the plant control system shall alarm the operator via the operator workstation.
6. System in Remote Automatic control mode:
a. Loss of Level Signal:
(1) If the level signal from the selected instrument is lost or out of range, the system shall maintain the pumps at current speed and alarm the operator via the operator workstation.
b. If a low level is detected by the level transmitter, all pumps shall be called to stop pumping. The pumps shall be allowed to run when the level rises above the pump run setpoint.
c. If a low low level is detected by the level switch, all pumps shall be called to stop pumping. The pumps shall be allowed to run if the low level switch returns to normal state, the alarm is cleared at the operator workstation, and level rises above the pump run setpoint.
d. If the high or high-high point level switches are activated, the system shall alarm the operator and shall perform in backup level control mode as described in the High Level Control Backup Mode and High-High Level Control Backup Mode.
e. In the event a pump in the sequence becomes unavailable, fails to start, or drops off-line, the next available pump in the sequence shall be automatically selected to operate.

3.15 SCREEN SYSTEM:

A. System Components and Functions:
1. Screen System Main Control Panels GRSC-MCP-100 and GRSC-MCP-200.
a. Manufacturer provided control panel for control of screen GRSC-SCR-110 and GRSC-SCR-210, respectively, containing starters, relays, circuit breakers, screen system PLC, operator interface, and other ancillaries necessary for control of the equipment.
2. Screen GRSC-SCR-110 and GRSC-SCR-210.
a. Mechanical perforated screen designed to remove solids and debris from the liquid stream.
3. Screening Auger Conveyor GRSC-AUG-120 and GRSC-AUG-220.
a. Auger Conveyor for handling screenings discharge and conveying to the screenings dumpster.
4. Level Transmitter GRSC-LE-100A and GRSC-LE-100B.
a. Ultrasonic level transmitters for measuring the screen GRSC-SCR-110 upstream and downstream channel levels respectively.
5. Level Transmitter GRSC-LE-200A and GRSC-LE-200B.

a. Ultrasonic level transmitters for measuring the screen GRSC-SCR-210 upstream and downstream channel levels respectively.

6. Level Switch GRSC-LSH-100 and GRSC-LSH-200.
   a. Provides a high-level alarm for the screens GRSC-SCR-110 and GRSC-SCR-210 channels, respectively.

B. Description of Operation:
   a. The manufacturer provided control panel shall be equipped with HAND/OFF/AUTO switches, status indicating lights, and fail indicating lights.
      (1) When the switch is in the HAND position, the corresponding piece of equipment shall be started and stopped at the control panel or remotely mounted control station.
      (2) The Plant Control System shall provide a System Inhibit signal to the manufacturer provided control panel. The signal shall prevent operation of the screen system equipment.
      (3) When the switch is in the AUTO position the screen shall operate automatically as described below.
         (a) The screen shall be started and stopped by the control panel based upon channel head differential across the screen as measured by the corresponding level transmitter.
         (b) A backup timer and high-level switch shall be provided to operate the screen periodically if a failure occurs with the level controls.
         (c) The parameters for the channel head differential and period of time between operations shall be set by the manufacturer.
         (d) High Flow Mode and Remote Cycle:
            1). While in AUTO, the screen system shall accept a start signal from the plant control system for remote start capability.
            2). The operator screen shall include a Screen Cycle Test pushbutton and a Screen Continuous Run - High Flow Enable/Disable selector switch and a High Flow Setpoint.
               a). When the cycle pushbutton is depressed the PCS shall enable the remote call to run bit in the Screen System PLC to initiate a cycle.
               b). When the High Flow Enable/Disable selector is in the Disable position, the remote call shall not be automatically initated.
               c). When the High Flow Enable/Disable selector is in the Enable position, the PCS shall automatically initiate the remote call to run bit when the plant flow reaches an operator adjustable setpoint.
   b. Refer to System Upsets and Procedures for Recovery Section for additional programming requirements.
   c. The status points and alarms for the screen shall be displayed on the operator workstation. Alarm and status points shall be communicated to the Plant Control System through the control system Ethernet network. Refer to the I/O list at the end of this Section and corresponding control drawings for I/O status and alarm points.

C. Setpoints and Ranges:
   1. Level Transmitter GRSC-LIT-100A and GRSC-LIT-100B.

a. Ultrasonic level transmitters are provided by the screen system manufacturer.
b. Calibration ranges for the associated upstream and downstream transducers shall be as recommended by the system manufacturer.

2. Level Switches GRSC-LSH-100 and GRSC-LSH-200:
   a. Float level switch provided by the screen system manufacturer.
   b. High Level Alarm level switches initially set at 937.00' msl or as recommended by the screen system manufacturer.
3. Operator Workstation:
   a. Display range for each level transmitter shall be coordinated with the screen manufacturer.
   b. Differential level alarm shall be adjustable.
   c. High level alarm based on GRSC-LSH-100 and GRSC-LSH-200.
   d. Screen Continuous Run - High Flow Setpoint initially set at 9.0 MGD.

D. System Upsets and Procedures for Recovery:
1. If a screen or auger conveyor failure occurs, the control system shall alarm the operator via the operator workstation.
2. If a power failure occurs, the equipment that was in operation prior to the power failure shall be automatically restarted by the manufacturer provided control panel.
3. If a level transmitter signal is lost, the control system shall alarm the operator via the operator workstation.
4. If a jam or over-torque condition occurs in the screen or auger conveyor that cannot be cleared by the system, the associated equipment shall automatically stop and initiate a failure alarm at the operator workstation.
5. Safety Devices:
   a. Emergency stop push buttons and pull cord switches, as applicable, shall be interlocked with the corresponding screen starting circuit.
   b. In the event of an emergency stop push activation, the corresponding equipment will shut down and alarm the operator. The emergency stops shall require a manual reset to restart the equipment.
   c. An emergency stop condition shall initiate an e-stop alarm at the operator workstation.

3.16 SCREEN SYSTEM WASH WATER:

A. System Components and Functions:
1. Screen Systems.
   a. See “Screen System” sub-section for description of operation, devices, and setpoints.
2. Heated Water Valves.
   a. GRSC-VLV-125.
   b. GRSC-VLV-225
   c. Three-way valves for supplying wash water to the screen systems' washer/compactors. The valves will switch wash water supply between heated potable water and un-heated process water.
3. Plant Control System GRSC-PLC-061.
   a. Controls the position of the heated wash water solenoid valves.

B. Description of Operation:
1. The heated water valves shall be capable of being controlled remotely by the plant control system.

2. Remote Control:
   a. When the heated water valves are in REMOTE control, opening and closing of the valves shall be controlled by the plant control system PLC.
   b. When the heated water valves are in REMOTE control, only one valve shall be open at a time.
   c. Remote Manual Control Mode:
      (1) Opening and closing of each of the heated water valves initiated by the operator at the PCS OIT or operator workstation.
   d. Remote Automatic Control Mode:
      (1) Remove Automatic Timer Control Mode:
         (a) Opening of each of the heated water valves initiated by the operator at the PCS OIT or operator workstation.
         (b) The plant control system PLC shall automatically close the valves based on a timer.
         (c) Sequence of Operation:
            1). The valve shall remain open for an adjustable number of hours prior to automatic closing of the valve. The timer shall be adjustable by the operator and initially set at 4 hours. The timer shall automatically reset if the valve is manually closed by the operator prior to automatic closing by the plant control system PLC.
            2). The timer for each valve shall not allow both valves to be open at the same time.
      (2) Remote Automatic Control Mode:
         (a) The plant control system PLC shall automatically open and close the heated water valves daily based on an adjustable schedule.
         (b) Sequence of Operation:
            1). GRSC-VLV-125 shall open at an adjustable time. The time shall be adjustable by the operator and initially set at 06:00.
            2). GRSC-VLV-125 shall close at an adjustable time. The time shall be adjustable by the operator and initially set at 10:00.
            3). GRSC-VLV-225 shall open at an adjustable time. The time shall be adjustable by the operator and initially set at 14:00.
            4). GRSC-VLV-225 shall close at an adjustable time. The time shall be adjustable by the operator and initially set at 18:00.
            5). The valves shall be rotated automatically by the PCS or manually by the operator. Selections shall be made available on the PCS OIT or operator workstation screen for this function.
            6). The schedule for each valve shall not allow both valves to be open at the same time.
   e. Refer to System Upsets and Procedures for Recovery this Section for additional programming requirements.

C. Setpoints and Ranges:
   1. Heated Water Valves GRSC-VLV-125 and GRSC-VLV-225:
      (1) Heated water valve open and close.
   2. Operator Workstation:
      a. Timer Set Points:
         (1) Valve Open Delay (adjustable from 0-60 seconds) initially set at: 15 seconds.

(2) Valve Close time (adjustable from 0-24 hours) initially set at: 4 hours.

b. Schedule Set Points:

(1) GRSC-VLV-125 Open time (adjustable from 00:00-24:00) initially set at: 06:00.

(2) GRSC-VLV-125 Close time (adjustable from 00:00-24:00) initially set at: 10:00.

(3) GRSC-VLV-225 Open time (adjustable from 00:00-24:00) initially set at: 14:00.

(4) GRSC-VLV-225 Close time (adjustable from 00:00-24:00) initially set at: 18:00.

D. System Upsets and Procedures for Recovery:

1. If both valves are open at the same time, the system shall close the valve that was opened first and alarm the operator via the operator workstation.
2. Loss of open/close signal:
   a. If the open/close signal is lost or out of range, the system shall maintain the open/close status of the valve and alarm the operator via the operator workstation.

3.17 GRIT REMOVAL SYSTEM:

A. System Components and Functions:

1. Grit System Main Control Panel GRSC-MCP-300.
   a. Manufacturer provided control panel for control of the grit removal system containing starters, relays, circuit breakers, PLC, operator interface, and other ancillaries necessary for control of the equipment.
2. Stacked Tray Grit Removal System and associated Grit Pump GRSC-PMP-310.
   a. Designed to segregate particulate materials from the influent flow with grit pump to pump settled grit material for further classification and dewatering. Pump speed controlled by a Variable Frequency Drive.
3. Grit Washer Classifier and Conveyor GRSC-CONV-330.
   a. Designed to classify and dewater grit for discharge into a grit dumpster. Consists of the “Teacup”, and “Grit Snail” clarifier to settle and escalate grit from the clarifier pool. Grit conveyor “Snail” is speed controlled using a Variable Frequency Drive.
4. Influent Flow Transmitter: GRSC-FIT-001.
   a. Magnetic flow meter measures Influent Pump Station discharge flow.
   b. Communicated through the PCS Ethernet/IP network.
5. Grit Pump Flow Transmitter: GRSC-FIT-311.
   a. Magnetic flow meter measures Grit Pump discharge flow.
   b. Communicated through the PCS Ethernet/IP network.
6. Additional control valves required for this system are not described in this Section. Refer to P&IDs and manufacturer’s literature for a complete listing of equipment.

B. Description of Operation:

1. The manufacturer provided control panel shall be equipped with HAND/OFF/AUTO switches, status indicating lights, and fail indicating lights.
   a. When the switch is in the HAND position, the corresponding piece of equipment shall be started and stopped at the control panel or remotely mounted control station.
   b. When the switch is in the AUTO position the grit system shall be operated automatically by the grit system main control panel PLC as described by the manufacturer’s sequence of operation.

2. A DRY/WET/REMOTE selector switch shall be provided and include the following function:
    a. When the DRY mode is selected, the system shall operate using the manufacturer's automatic dry mode sequence.
    b. When the WET mode is selected, the system shall operate using the manufacturer's automatic wet mode sequence.
    c. When the REMOTE mode is selected, the system WET mode shall be initiated from the Plant Control System.
        (1) Plant Control System Wet Mode Initiation:
            (a) The Wet Mode shall be initiated by the plant control system via a Wet Mode Manual-Enable/Auto-Enable selection on the operator workstation screen.
                1). When the selection is Manual-Enable, the PCS shall enable the Grit System PLC wet mode bit through the communication network.
                2). When the selection is Auto-Enable, the PCS shall automatically enable the Grit System PLC wet mode bit when the plant flow reaches an operator adjustable setpoint.
    d. Additional Wet/Dry sequences shall be as described by the manufacturer's control sequence of operation.
3. The PCS shall provide an ENABLE/DISABLE permissive to the Grit System Main Control Panel PLC to prohibit the Grit Pump from operation during times of low plant flow.
    a. Provide a Grit System Enable/Disable Permissive selector switch on the operator workstation screen for Automatic and Manual functionality. The switch shall include three positions: "Auto", "Manual–Enable" and "Manual–Disable"
    b. Auto Mode:
        (1) The permissive shall be based on the Influent Flow Meter GRSC-FIT-001. The permissive shall remain enabled during normal flow conditions. If the flow is zero, the ENABLE permissive shall be removed.
4. The Grit Snail shall be equipped with a LOCAL/REMOTE selection for speed control and include the following function:
    a. When the switch is in the LOCAL position, the speed of the grit snail shall be set based on the potentiometer or OIT setpoint on the grit system main control panel.
    b. When the switch is in the REMOTE position, the speed of the grit snail shall be set based on the Plant Control System. An operator speed setpoint shall be provided for this function.
5. Refer to System Upsets and Procedures for Recovery Section for additional programming requirements.
6. The status points and alarms for the grit system shall be displayed on the operator workstation. Alarm and status points shall be communicated to the Plant Control System through the control system Ethernet network. Refer to the I/O list at the end of this Section and corresponding control drawings for I/O status and alarm points.

C. Setpoints and Ranges:
1. Operator Workstation:
    a. Wet Mode Flow Setpoint shall be adjustable, initially set at 9.0 MGD. Coordinate with Screen Continuous Run - High Flow setpoint this Section.

b. Grit Snail Speed Setpoint shall be adjustable, initially set based on manufacturer's startup recommendations.
(1) Range for speed setpoint shall have a limited range for minimum and maximum speeds. The range shall be as recommended by the manufacturer.

2. Additional manufacturer setpoints and ranges shall be adjustable at the grit system main control panel operator interface and shall be as recommended by the grit system manufacturer.

3.18 AGS SYSTEM:

A. System Components and Functions:
1. Equipment denoted with an "*" symbol is to be provided by the Granular Sludge Biological Treatment Package Equipment Supplier. Refer to Section 46 53 60 for additional equipment requirements.
2. AGS Main Control Panel AGS-MCP-001*.
a. Manufacturer provided control panel for control of the AGS system containing a PLC, operator interface, and other ancillaries necessary for control of the equipment.
3. AGS Nereda Controller AGS-SVR-001*:
a. Software based controller running on a host server located in the electrical room network rack.

B. Description of Operation:
1. Refer to Section 46 53 60 – Granular Sludge Biological Treatment Package for description of operation of the AGS System.

C. Setpoints and Ranges:
1. Manufacturer setpoints and ranges shall be adjustable at the AGS main control panel operator interface and shall be as recommended by the AGS manufacturer.

3.19 UV DISINFECTION SYSTEM:

A. System Components and Functions:
1. Flow Indicating Transmitter UV-FIT-301:
a. Radar flow transmitter for the effluent flume.
2. UV System Control Center UV-MCP-001:
a. Manufacturer provided control panel that provides control and operator interface for Channels No. 1 and No. 2 UV equipment.
3. UV System Power Distribution UV-LCP-110:
a. Manufacturer provided control panel that provides power distribution for the Channel No. 1 UV equipment.
4. UV System Power Distribution and Control Center UV-LCP-210:
a. Manufacturer provided control panel that provides power distribution for the Channel No. 2 UV equipment.
5. Channel No. 1 UV Module No.1A, Module No. 1B:
a. Provides UV disinfection to water flowing through Channel No. 1.
6. Channel No. 2 UV Module No.2A, Module No. 2B:
a. Provides UV disinfection to water flowing through Channel No. 2.
7. UV Transmittance Analyzer (UV-AIT-010):
a. Displays and transmits UVT to the plant control system PLC for the UV system influent.
b. UV-AE-011:

(1) UVT sensing probe for measuring the UV transmittance of the UV system influent. Connected to transmitter UV-AIT-010.

8. UV Channel No. 1 Low Level Switch (UV- LSL-101):
   a. Detects low water level in UV Channel No. 1.
9. UV Channel No. 2 Low Level Switch (UV- LSL-201):
   a. Detects low water level in UV Channel No. 2.
10. Plant Control System UV-PLC-061:
   a. Monitors the associated UV system equipment and provides effluent flow and UVT signals to the UV system PLC(s).

B. Effluent Flow Metering:
1. The effluent flow shall be measured by UV-FIT-301.
2. The flow signal shall be communicated to the UV system via the PCS.
3. Loss of signal alarms shall be programmed.
4. The flow shall be trended, totalized, and displayed on the PCS HMI screen.

C. Description of Operation
1. The UV system consists of a PDC control panel for each channel equipped with a PLC and operator interface terminal. The PDC(s) shall provide status and local control interface for the UV system. The PDC(s) shall monitor and control all equipment associated with the UV system.
2. The following description is supplemental to the manufacturer's standard operating description and provided to define basic operation of the UV system equipment and define interactions required with the plant control system. Refer to the UV system equipment specifications for additional requirements.
3. The Plant Control System shall provide a System Inhibit signal to the manufacturer provided control panel. The signal shall prevent operation of the UV system equipment.
4. The manufacturer provided PLC(s) shall be programmed to communicate the indicated and specified control and status points to the plant control system over the Ethernet/IP network. HMI screens shall be developed to display the control and status points.
5. UV Intensity:
   a. The UV intensity for each UV lamp bank shall be measured by the corresponding module intensity meter.
   b. The UV intensities shall be displayed in units of milliwatts per square centimeter on the operator HMI.
   c. The UV intensities shall be recorded to the historical database.
   d. The UV intensities shall be trended.
6. UV Lamps:
   a. The operation of the UV lamps shall be controlled by the associated UV control panel.
   b. Each UV control panel shall be equipped with a HAND/AUTO switch. When the switch is in the HAND position the UV system shall be started and stopped at the UV system control panel HMI. When the switch is in the AUTO position the UV system shall be started and stopped by the associated UV control panel PLC automatic sequence.
      (1) Hand Control:
         (a) The UV system shall be capable of being controlled manually or automatically from the operator interface terminal located on the face of the associated UV control panel.

1). Manual Control:
a). The operator shall start and stop the lamp banks manually and set the intensity of the lamp bank.
2). Automatic Control:
a). The UV control system shall automatically start and stop lamp banks and control the intensity of the UV lamps to provide the required dosing based upon the flow rate as measured by the effluent flow transmitter UV-FIT-301 and the UVT analyzer UV-AIT-010.
b). The flow rate pacing signal and UVT signal shall be communicated to the UV system PLC(s) through the plant control system network.
c). The UV control system shall automatically rotate the operation of the lamp banks to provide uniform lamp runtime for each of the banks. The time period between rotations shall be as recommended by the UV system manufacturer.

c. The associated status points, local/remote status, and failure alarms shall be displayed on the operator HMI and the plant control system operator workstation.
d. Refer to System Upsets and Procedures for Recovery for additional requirements.

D. Set Points and Ranges:
1. UV Intensity Transmitter(s):
a. Range as recommended by manufacturer.
2. Low Level Switches UV-LSL-101 and UV-LSL-201:
a. Set points shall be as recommended by manufacturer.
3. UVT Analyzer UV-AIT-010:
a. Range as recommended by manufacturer.
4. Operator HMI:
a. Display ranges and setpoints as recommended by manufacturer.
5. Operator Workstation:
a. Display ranges and setpoints as recommended by manufacturer.

E. System Upsets and Procedures for Recovery:
1. If the flow signal is lost, the control system shall alarm the operator via the operator HMI and operator workstation.
2. If a low water level is detected by the low level switch, the associated lamp banks shall be shut down and the control system shall alarm the operator via the operator HMI and operator workstation. If the water level rises, the system shall resume normal operation.
3. Automatic Mode:
A. If the flow signal is lost, the UV lamps shall go to full power output.

3.20 PROCESS WATER PUMP STATION:

A. System Components and Functions:
1. Process Water Pump No. 1: PW-PMP-110.
a. Vertical turbine pump controlled by a VFD.
2. Process Water Pump No. 1: PW-PMP-120.
a. Vertical turbine pump controlled by a VFD.
3. Process Water Pump No. 1: PW-PMP-130.
a. Vertical turbine pump controlled by a VFD.

4. Pressure Indicating Transmitters:
    a. PW-PIT-101
        (1) Pressure transmitter used for measuring the process water pumping header pressure upstream of the duplex strainer.
    b. PW-PIT-103
        (1) Pressure transmitter used for measuring the process water bladder tank pressure, downstream of the duplex strainer.
    c. GRSC-PIT-001
        (1) Pressure transmitter used for measuring the Headworks Building process water pressure.
    d. SPB-PIT-001
        (1) Pressure transmitter used for measuring the Solids Processing Building process water pressure.
5. Pressure Switches:
    a. GRSC-PSL-001
        (1) Low pressure switch used for alarm when Process Water pressure at Headworks Building is low.
    b. SPB-PSL-001
        (1) Low pressure switch used for alarm when Process Water pressure at Solids Processing Building is low.
6. Level Float Switches: Located in the process water wet well.
    a. PW-LSH-101.
        (1) High level float switch used for alarm.
    b. PW-LSL-101.
        (1) Low level float switch used for pump shut-down interlock and alarm.
7. Process Water Flow Transmitter: PW-FIT-101.
    a. Magnetic flow meter measures the pump station discharge flow to the Process Water System.
8. Plant Control System:
    a. UV-PLC-061.
        (1) Controls Process Water Pumps' starting, stopping, and speed while in remote mode.
    b. GRSC-PLC-061.
        (1) Monitors the Headworks Building process water pressure transmitter GRSC-PIT-001.
    c. SPB-PLC-061.
        (1) Monitors the Solids Processing Building process water pressure transmitter SPB-PIT-001.

B. Description of Operation:
1. Process Water Pump Station Flow:
    a. The pump station flow shall be measured by flow transmitter PW-FIT-101.
    b. The flow shall be displayed in gpm (gallons per minute) and MGD (million gallons per day) on the operator workstation.
    c. High flow, reverse flow, and loss of signal alarms shall be programmed.
    d. The pump station flow shall be trended.
2. Process Water Pump Station Pressure:
    a. The pump station header pressure shall be measured by pressure transmitter PW-PIT-101.

b. The pressure shall be displayed in psi on the operator workstation.
c. High pressure, low pressure, and loss of signal alarms shall be programmed.
d. The pump station pressure shall be trended.

3. Process Water Pumps:
   a. The pumps shall be capable of being controlled locally at the associated pump VFD or remotely by the plant control system when the LOCAL/OFF/REMOTE switch is in REMOTE.
   b. Pressure control for the pumps shall be based on the signal from the Headworks Building or Solids Processing Buildings pressure transmitters.
   c. Local Control:
      (1) When the pumps are in LOCAL control, starting and stopping of the pumps and the speed of the pumps shall be controlled at the associated VFD.
   d. Remote Control:
      (1) When the pumps are in REMOTE control, starting and stopping of the pumps, and the speed of the pumps shall be controlled by the plant control system PLC.
      (2) When a run command associated with the pump is communicated to the VFD, the corresponding pump shall start and run. When a stop command associated with the pump is communicated to the VFD, the corresponding pump shall stop.
      (3) HMI screens shall be developed to allow the operator to select from two modes of operation.
      (4) Remote Manual Control Mode:
         (a) Starting and stopping of each of the pumps initiated by the operator at the operator workstation.
         (b) The operator shall set the speed as a percentage of full speed for each of the VFD controlled pumps.
      (5) Remote Automatic (Operator Selected PIT) Control Mode:
         (a) The plant control system PLC shall automatically start and stop pumps and adjust the speed of the pumps to maintain the pressure set point referenced to the Headworks Building or Solids Processing Building.
            1). The referenced pressure rate shall be operator selected from one of the of the following Pump Control pressure transmitters:
               a). Headworks Building pressure transmitter GRSC-PIT-001.
               b). Solids Processing Building pressure transmitter SPB-PIT-001.
            2). The pump speed shall be controlled using a PID algorithm to maintain a Pressure Set Point at the measurement location selected.
            3). When a Pump Control pressure transmitter has been operator selected as the measurement reference, the selected transmitter shall control until the operator changes the control mode or selects another transmitter.
         (b) The pumps shall be rotated in a lead/lag/standby fashion automatically by the control system or manually by the operator. Selections shall be made available on the operator workstation screen for this function.
         (c) The pumps shall be alternated as Lead, Lag, and Standby automatically by the system after an operator adjustable time period and each time a

pump is stopped. The rotation timer shall automatically reset if the pumps rotate because of a pump shutdown. The rotation of pumps while any pumps are in operation shall not cause a loss of system pressure.

(d) Sequence of Operation:

1). When the system pressure falls below the Lead Pump Start Set Point, the Lead pump shall start. The pump speed shall be modulated to maintain the pressure set point.

2). If the Lead pump is operating at 100% speed and the pressure is below the Lag Pump Start set point, the Lag pump shall start after a Pump Start time delay. If the pressure rises above the Lag1 Start set point prior to the time delay expiration, the timer shall be reset.

3). When the Lag 1 pump is called to start, it shall ramp to 100% speed to match the Lead pump speed and the Lead pump and Lag pump speeds shall be modulated together to maintain the pressure set point.

4). If the Lead and Lag 1 pump combination is operating at the associated minimum speed set point and the pressure reaches the Pump Stop (Lag) set point, the Lead Pump shall ramp down to zero speed and shut down. The pump lead/lag role shall be rotated at this time.

a). The pumps shall automatically rotate for the lead pump position after each start/stop cycle or once every 24-hour time period, whichever occurs first. The rotation time shall be operator adjustable.

5). The Lead pump shall continue to modulate to achieve the pressure set point.

6). The Lead pump shall operate until the following Lead pump shutdown conditions are met:

a). All other pumps are off.

b). The Lead pump is running at the associated minimum speed.

c). The process water flow falls below the operator-adjustable Pump Stop (Lead, Flow) set point for an operator-adjustable timer OR the measured pressure rises above the operator adjustable Pump Stop (Lead, Pressure) set point for an operator-adjustable timer.

(e) Refer to System Upsets and Procedures for Recovery this Section for additional programming requirements.

(6) Remote Automatic (Automatically Selected PIT) Control Mode:

(a) The plant control system PLC shall automatically start and stop pumps and adjust the speed of the pumps to maintain the pressure set point referenced to the Headworks Building or Solids Processing Building.

1). The referenced pressure rate shall be automatically selected from the lesser value of the following Pump Control pressure transmitters:

a). Headworks Building pressure transmitter GRSC-PIT-001.

b). Solids Processing Building pressure transmitter SPB-PIT-001.

2). The pump speed shall be controlled using a PID algorithm to maintain a Pressure Set Point at the measurement location with the lowest pressure value.

3). When a Pump Control pressure transmitter has been automatically selected as the measurement reference, the following checks shall prevent selection of another pressure transmitter:

a). An operator-adjustable Pressure Transmitter Selection timer shall prevent selection of a new pressure transmitter for the duration of the timer. The timer shall be reset after a new pressure transmitter has been selected.

b). An operator-adjustable Pressure Transmitter Selection dead-band shall prevent selection of a new pressure transmitter while both pressure transmitters are measuring within the dead-band range.

(b) The pumps shall be rotated in a lead/lag/standby fashion automatically by the control system or manually by the operator. Selections shall be made available on the operator workstation screen for this function.

(c) The pumps shall be alternated as Lead, Lag, and Standby automatically by the system after an operator adjustable time period and each time a pump is stopped. The rotation timer shall automatically reset if the pumps rotate because of a pump shutdown. The rotation of pumps while any pumps are in operation shall not cause a loss of system pressure.

(d) Sequence of Operation:

1). When the system pressure falls below the Lead Pump Start Set Point, the Lead pump shall start. The pump speed shall be modulated to maintain the pressure set point.

2). If the Lead pump is operating at 100% speed and the pressure is below the Lag Pump Start set point, the Lag pump shall start after a Pump Start time delay. If the pressure rises above the Lag1 Start set point prior to the time delay expiration, the timer shall be reset.

3). When the Lag 1 pump is called to start, it shall ramp to 100% speed to match the Lead pump speed and the Lead pump and Lag pump speeds shall be modulated together to maintain the pressure set point.

4). If the Lead and Lag 1 pump combination is operating at the associated minimum speed set point and the pressure reaches the Pump Stop (Lag) set point, the Lead Pump shall ramp down to zero speed and shut down. The pump lead/lag role shall be rotated at this time.

a). The pumps shall automatically rotate for the lead pump position after each start/stop cycle or once every 24-hour time period, whichever occurs first. The rotation time shall be operator adjustable.

5). The Lead pump shall continue to modulate to achieve the pressure set point.

6). The Lead pump shall operate until the following Lead pump shutdown conditions are met:

a). All other pumps are off.

b). The Lead pump is running at the associated minimum speed.
c). The process water flow falls below the operator-adjustable Pump Stop (Lead, Flow) set point for an operator-adjustable timer OR the measured pressure rises above the operator adjustable Pump Stop (Lead, Pressure) set point for an operator-adjustable timer.

(e) Refer to System Upsets and Procedures for Recovery this Section for additional programming requirements.

e. The pump status points and alarms shall be displayed on the operator workstation. Refer to the I/O list at the end of this section and corresponding control drawings for I/O status and alarm points.

C. Setpoints and Ranges:
1. Pressure Indicating Transmitters:
a. PW-PIT-101
(1) Refer to the instrument list for ranges.
b. GRSC-PIT-001
(1) Refer to the instrument list for ranges.
c. SPB-PIT-001
(1) Refer to the instrument list for ranges.
d. Pressure transmitters with integral displays.
e. Refer to Section 40 70 00 for instrument calibration ranges.
2. Process Water Pump Variable Frequency Drives:
a. Ramp up time: Adjustable setpoint initially set at 5 seconds.
b. Ramp down time: Adjustable setpoint initially set at 5 seconds.
c. Minimum Speed: 70% initial.
(1) Final setpoint shall be determined during system startup. Final setpoint shall be above the minimum continuous safe flow for the pump. Systems Integrator to coordinate with Contractor, Engineer, and pump Manufacturer accordingly.
3. Timer Set Points:
a. Pump Start Delay (adjustable) initially set at: 15 seconds.
b. Pump Rotation time (adjustable) initially set at: 24 hours.
c. Pump Stop (Lead, Flow) time (adjustable) initially set at: 5 seconds.
d. Pump Stop (Lead, Pressure) time (adjustable) initially set at: 5 seconds.
e. Pressure Transmitter Selection Delay (adjustable) time initially set at: 15 seconds.
4. Dead-Band Set Point:
a. Pressure Transmitter Selection Delay (adjustable) range initially set at: 5 psi.
5. Operator Workstation:
a. System Setpoints (adjustable over the range of the instruments):
(1) Lead Pump Start set point initially set at: 80 psig.
(2) Lag Pump Start set point initially set at: 75 psig.
(3) Pump Stop (Lead, Flow) set point initially set at: 55 gpm.
(4) Pump Stop (Lead, Pressure) set point initially set at: 100 psig.
(5) High-High Pressure Alarm (PW-PIT-101) initially set at: 155 psig.
(6) High Pressure Warning (PW-PIT-101) initially set at: 140 psig.
(7) Low Pressure Warning (PW-PIT-101) initially set at: 55 psig.
(8) High Pressure Warning (GRSC-PIT-001) initially set at: 90 psig.
(9) Low Pressure Warning (GRSC-PIT-001) initially set at: 50 psig.
(10) High Pressure Warning (SPB-PIT-001) initially set at: 90 psig.

(11) Low Pressure Warning (SPB-PIT-001) initially set at: 50 psig.
(12) High Flow Warning (PW-FIT-101) initially set at: 425 gpm.

b. Minimum Speed Setpoints:
(1) Pump Operating minimum speed: Initially set at 75%.

c. Flow Transmitter: PW-FIT-101.
(1) Display range of 0.0-695 gpm.
(2) Display range of 0.00-1.00 MGD for total flow.

D. System Upsets and Procedures for Recovery:
1. If a pump failure occurs, the control system shall alarm the operator via the operator workstation.
2. If a pressure signal is lost or out of range, the plant control system shall alarm the operator via the operator workstation.
3. If the flow signal is lost or out of range, the plant control system shall alarm the operator via the operator workstation.
4. If a low pressure is detected, the control system shall alarm the operator via the operator workstation.
5. If a high pressure is detected, the control system shall alarm the operator via the operator workstation.
6. If a high-high pressure is detected, the control system shall alarm the operator via the operator workstation.
7. If a low level is detected, the control system shall alarm the operator via the operator workstation.
8. If a high level is detected, the control system shall alarm the operator via the operator workstation.
9. If a reverse flow is detected, the control system shall alarm the operator via the operator workstation.
10. System in Remote Automatic control mode:
a. If a wet well low level is detected by the low level switch, all associated pumps shall be called to stop pumping. The process water pumps shall be allowed to run if the level switch returns to normal state and the alarm is cleared at the operator workstation.
b. If a high-high pressure is detected by any of the associated pressure transmitters, all associated pumps shall be called to stop pumping. The process water pumps shall be allowed to run if the pressure falls below the Pump Run (Lead) set point.
c. Loss of Pressure Signal:
(1) Operator Selected PIT mode:
(a) If GRSC-PIT-001 or SPB-PIT-001 signal is lost or out of range, , the system shall maintain the pumps at current speed and alarm the operator via the operator workstation.
(2) Automatically Selected PIT mode:
(a) If the automatically selected pressure signal is lost or out of range, the system shall select the secondary pressure transmitter as reference. If both Pump Control pressure signals are lost, the system shall refer to the pressure signal at the wet well (PW-PIT-001).
(b) If all Pump Control pressure signals are lost or out of range, the system shall maintain the pumps at current speed and alarm the operator via the operator workstation.

d. In the event the lead pump becomes unavailable, fails to start, or drops off-line, the next available pump in the starting sequence shall be automatically selected to operate as the lead pump. If a lag pump is unavailable, fails to start, or drops off-line the next pump in the starting sequence shall be automatically selected to operate as the lag pump.

3.21 THIN SLUDGE HOLDING TANKS AND SLUDGE BLOWERS:

A. System Components and Functions:
1. Plant Control System SPB-PLC-061.
a. Controls blowers' starting, stopping, and speed while in remote mode.
2. Thin Sludge Tanks:
a. Thin Sludge Tank No. 1
b. Thin Sludge Tank No. 2
c. Holds waste sludge pumped from AGS Sludge Buffer Tanks.
3. Sludge Blowers:
a. WAS-BLOW-410
(1) Associated with Thin Sludge Tank No. 1
b. WAS-BLOW-420
(1) Associated with either Thin Sludge Tank No. 1 or Thin Sludge Tank No. 2, dependent on position of manual blower valves and Operator selection at HMI.
c. WAS-BLOW-430
(1) Associated with Thin Sludge Tank No. 2
d. Positive displacement blowers controlled by variable speed drives. Aerates Thin Sludge Tanks No. 1 and No. 2.
4. Level Switch WAS-LSL-101
a. Provides a low level alarm for Thin Sludge Tank No. 1.
5. Level Switch WAS-LSH-101
a. Provides a high level alarm for Thin Sludge Tank No. 1.
6. Level Switch WAS-LSL-201
a. Provides a low level alarm for Thin Sludge Tank No. 2.
7. Level Switch WAS-LSH-201
a. Provides a high level alarm for Thin Sludge Tank No. 2.

B. Thin Sludge Tank Level Monitoring:
1. The sludge level of Thin Sludge Tank No. 1 shall be measured by WAS-LIT-101.
2. The sludge level of Thin Sludge Tank No. 2 shall be measured by WAS-LIT-201.
3. Loss of signal alarms shall be programmed.

C. Thin Sludge Tank Dissolved Oxygen (DO) Monitoring:
1. The dissolved oxygen of Thin Sludge Tank No. 1 shall be measured by analytical probe and controller WAS-AE-101 and WAS-AIT-101, respectively.
2. The dissolved oxygen of Thin Sludge Tank No. 2 shall be measured by analytical probe and controller WAS-AE-201 and WAS-AIT-201, respectively.
3. Loss of signal alarms shall be programmed.
4. The dissolved oxygen levels shall be trended.

D. Thin Sludge Tanks:
1. Each Thin Sludge Tank shall have the option to be placed out of service by operator selection on the PCS HMI screen.

a. A warning pop-up shall be programmed to ensure the operator has confirmed the manual valve changes for the selected tank being placed out of service. The pop-up shall read as follows:
   (1) Warning: Tank status change requires operator confirmation of manual valve positions for intended usage! Are valve positions correct (Yes) (No)?"
   (2) If "Yes" is selected the status change request shall be executed. If "No" is selected the status change request shall be ignored, and remain unchanged.

E. Sludge Blowers:
1. The blowers shall be capable of being controlled locally at the associated blower VFD or remotely by the plant control system when the LOCAL/OFF/REMOTE switch is in REMOTE.
2. Level controls for the blowers shall be based on the signal from the thin sludge tank level transmitters.
3. Local Control:
   a. When the blowers are in LOCAL control, starting and stopping of the blowers and the speed of the blowers shall be controlled at the associated VFD.
4. Remote Control:
   a. When the blowers are in REMOTE control, starting and stopping of the blowers, and the speed of the blowers shall be controlled by the plant control system PLC, SPB-PLC-061.
   b. When a run command associated with the blower is communicated to the VFD, the corresponding blower shall start and run. When a stop command associated with the blower is communicated to the VFD, the corresponding blower shall stop.
   c. HMI screens shall be developed to allow the operator to select from the following modes of operation.
   d. Remote Manual Control Mode:
      (1) Starting and stopping of each of the blowers initiated by the operator at the PCS OIT or operator workstation.
      (2) The operator shall set the speed as a percentage of full speed for each of the VFD controlled blowers.
   e. Remote Automatic Control Mode:
      (1) The PCS shall automatically start and stop blowers and adjust the speed of the blowers in response to each blower's associated tank DO.
      (2) No more than one (1) blower shall be called to start at a time. An operator-adjustable timer shall elapse before the next blower will be allowed to start.
      (3) The blower speed shall be controlled using a PID algorithm to maintain a DO Setpoint.
      (4) Sequence of Operation:
         (a) If DO falls below the low DO setpoint, the associated blower shall start.
         (b) The blower shall modulate speed based on output of PID control, with a minimum run time of 10 minutes. The minimum run time shall be required for each blower regardless of the DO concentration.
         (c) If DO rises above the high DO setpoint, the associated blower shall stop.
         (d) If tank liquid level falls below the low level setpoint, the blower shall stop and not be allowed to start until level rises above the low level setpoint.
         (e) If the low level switch is proven low, the blower shall stop and not be allowed to start until the switch returns to normal state.

(f) While in DO control mode, the blowers shall not be idle for more than a 24-hour period regardless of the DO concentration. A timer shall be used to monitor the blower system off status. If the 24-hour timer elapses, the blower shall be started and operate for a minimum duration of 10 minutes. After the blower operates, the minimum cycle timer shall be reset.

(5) Sludge Blower No. 2 (WAS-BLOW-420) operation:

(a) The HMI screen shall allow the operator to select the tank with which the blower is associated. The allowable assignments shall be as previously defined in the System Components and Functions.

1). A warning pop-up shall be programmed to ensure the operator has confirmed the manual valve changes for the selected blower assignment. The pop-up shall read as follows:

a). Warning: Blower assignment change requires operator confirmation of manual valve positions for intended usage! Are valve positions correct (Yes) (No)?"

b). If "Yes" is selected the assignment change request shall be executed. If "No" is selected the assignment change request shall be ignored, and remain unchanged.

(b) When two (2) blowers are assigned to one (1) tank, the following automatic controls shall be additionally applicable to all other automatic operations.

1). The two (2) blowers shall be programmed in a Duty and Standby configuration.

2). The Duty blower shall run for an adjustable number of hours prior to automatic alternation of the blowers. The timer shall be adjustable by the operator and initially set at 168 hours. The blowers shall also rotate after each blower stop cycle. The rotation timer shall automatically reset if the blowers rotate because of a blower cycle.

3). The blowers shall be rotated automatically by the PCS or manually by the operator. Selections shall be made available on the PCS OIT or operator workstation screen for this function.

F. Setpoints and Ranges:

1. DO Transmitter WAS-AIT-101, WAS AIT-201:
   a. DO transmitter with integral display.
   b. Refer to Section 40 70 00 for instrument calibration ranges.
   c. Low-low DO alarm adjustable between 0-3 mg/L.
   d. Low DO adjustable between 0-3 mg/L.
   e. High DO adjustable between 0-10 mg/L.
   f. High-high level alarm adjustable between 0-10 mg/L.
2. Level Transmitter WAS-LIT-101, WAS-LIT-201:
   a. Level transmitter with integral and remote display.
   b. Refer to Section 40 70 00 for instrument calibration ranges.
   c. Low level alarm adjustable between 0-10 feet.
   d. Thin Sludge Pump Run adjustable between 0-48 hours.
   e. High level alarm adjustable between 0-23 feet.
3. Operator Workstation:

a. Display range of 0-10 mg/L for DO transmitters.
b. Display range of 0-23 feet for thin sludge tank levels.

G. System Upsets and Procedures for Recovery:
1. If a high-high DO is detected, the control system shall alarm the operator via the operator workstation.
2. If a low-low DO is detected, the control system shall alarm the operator via the operator workstation.
3. If a low liquid level is detected, the control system shall alarm the operator via the operator workstation.
4. If a high liquid level is detected, the control system shall alarm the operator via the operator workstation.
5. System in Remote Automatic control mode:
a. Loss of DO signal:
(1) If the DO signal is lost or out of range, the system shall maintain the blower speed and alarm the operator via the operator workstation.
b. In the event the Duty blower becomes unavailable, fails to start, or drops off-line, the Standy blower in the starting sequence shall be automatically selected to operate as the lead blower.

3.22 THIN SLUDGE PUMPS:

A. System Components and Functions:
1. Plant Control System SPB-PLC-061.
a. Controls Thin Sludge Pumps' starting, stopping, and speed while in remote mode.
2. Thin Sludge Pumps:
a. Thin Sludge Pump No. 1 WAS-PMP-310
(1) Associated with Pump Group No. 1
b. Thin Sludge Pump No. 2 WAS-PMP-320
(1) Associated with either Pump Group No. 1 or Pump Group No. 2, dependent on position of manual valves and Operator selection at HMI.
c. Thin Sludge Pump No. 3 WAS-PMP-330
(1) Associated with Pump Group No. 2
d. Positive displacement pumps located in the Solids Processing Building Process Room, controlled by variable speed drives. Supplies sludge from the Thin Sludge Tanks normally to the Sludge Thickening System skids or alternately to the Thickened Sludge Tanks.
3. Thin Sludge Tanks:
a. Thin Sludge Tank No. 1
b. Thin Sludge Tank No. 2
c. See "Thin Sludge Holding Tanks and Sludge Blowers" sub-section for description of operation, devices, and setpoints.
4. Sludge Thickening Systems:
a. Sludge Thickening System No. 1
(1) Associated with Pump Group No. 1
b. Sludge Thickening System No. 2
(1) Associated with Pump Group No. 2
c. See "Sludge Thickening System" sub-section for detailed description of operation, devices, and setpoints.
5. Thickened Sludge Tanks:

a. Thickened Sludge Tank No. 1
b. Thickened Sludge Tank No. 2
c. See "Thickened Sludge Holding Tanks and Sludge Loadout Pumps" sub-section for description of operation, devices, and setpoints.

B. Thin Sludge Pump Flow Metering:
1. The flow of Pump Group No. 1 to Sludge Thickening System No. 1 or the Thickened Sludge Tanks shall be measured by WAS-FIT-301.
2. The flow of Pump Group No. 2 to Sludge Thickening System No. 2 or the Thickened Sludge Tanks shall be measured by WAS-FIT-302.
3. Loss of signal alarms shall be programmed.
4. The flow shall be trended, totalized, and displayed on the PCS HMI screen.

C. Thin Sludge Pump Total Solids (TS) Metering:
1. The total solids of sludge pumped from Pump Group No. 1 to Sludge Thickening System No. 1 or the Thickened Sludge Tanks shall be measured by WAS-AIT-301.
2. The total solids of sludge pumped from Pump Group No. 2 to Sludge Thickening System No. 2 or the Thickened Sludge Tanks shall be measured by WAS-AIT-302.
3. Loss of signal alarms shall be programmed.
4. Total solids shall be trended and displayed on the PCS HMI screen.

D. Thin Sludge Pumps:
1. The pumps shall be capable of being controlled locally at the associated pump VFD or remotely by the plant control system when the LOCAL/OFF/REMOTE switch is in REMOTE.
2. Flow controls for the pumps shall be based on the signal from the thin sludge pump flow meters.
3. Local Control:
a. When the pumps are in LOCAL control, starting and stopping of the pumps and the speed of the pumps shall be controlled at the associated VFD.
4. Remote Control:
a. When the pumps are in REMOTE control, starting and stopping of the pumps, and the speed of the pumps shall be controlled by the plant control system PLC, SPB-PLC-061.
b. When a run command associated with the pump is communicated to the VFD, the corresponding pump shall start and run. When a stop command associated with the pump is communicated to the VFD, the corresponding pump shall stop.
c. HMI screens shall be developed to allow the operator to select from the following modes of operation.
d. Remote Manual Control Mode:
(1) Starting and stopping of each of the pumps initiated by the operator at the PCS OIT or operator workstation.
(2) The operator shall set the speed as a percentage of full speed for each of the VFD controlled pumps.
e. Remote Automatic Control Mode:
(1) For the following Remote Automatic control modes, the HMI screen shall allow the operator to select which pump groups are currently assigned to a particular function (i.e. Sludge Thickening Mode or Thickening Bypass Mode). The allowable assignments shall be as previously defined in the System Components and Functions.

(a) A warning pop-up shall be programmed to ensure the operator has confirmed the manual valve changes for the selected mode assignment. The pop-up shall read as follows:
1). Warning: Pump mode change requires operator confirmation of manual valve positions for intended usage! Are valve positions correct (Yes) (No)?"
2). If "Yes" is selected the mode change request shall be executed. If "No" is selected the mode change request shall be ignored, and remain unchanged.

(2) Remote Automatic Control (Sludge Thickening Mode):
(a) Each Sludge Thickening control system shall start and stop their associated thin sludge pump group and adjust the speed of the pump based on the operator input from the associated control panel operator interface settings as part of the Sludge Thickening System automatic sequence.
(b) The plant control system shall monitor the start/stop and speed control signals from each Sludge Thickening System control panel and communicate the required signals to the associated VFDs over the plant control system network.

(3) Remote Automatic Control (Thickening Bypass Mode):
(a) The plant control system shall start and stop the pump based on a start command, and the speed of the pump shall be controlled using a PID algorithm to maintain a Flow Rate Setpoint. The flow rate shall be manually set by the operator at the operator workstation.
(b) The control system shall be programmed to run the pump for an adjustable number of minutes. The timer shall be adjustable by the operator from the operator workstation and initially set at 60 minutes.
(c) The measured flow rate for Pump Group No. 1 shall be based on flow meter WAS-FIT-301 and shall be utilized for flow control.
(d) The measured flow rate for Pump Group No. 2 shall be based on flow meter WAS-FIT-302 and shall be utilized for flow control.
(e) Each flow rate shall be trended totalized, and each shall be displayed on the PCS HMI screen.

(4) Thin Sludge Pump No. 2 (WAS-PMP-320) operation:
(a) The HMI screen shall allow the operator to select the pump group with which the pump is associated. The allowable assignments shall be as previously defined in the System Components and Functions.
1). A warning pop-up shall be programmed to ensure the operator has confirmed the manual valve changes for the selected blower assignment. The pop-up shall read as follows:
a). Warning: Pump assignment change requires operator confirmation of manual valve positions for intended usage! Are valve positions correct (Yes) (No)?"
b). If "Yes" is selected the assignment change request shall be executed. If "No" is selected the assignment change request shall be ignored, and remain unchanged.

(b) When two (2) pumps are assigned to one (1) pump group, the following automatic controls shall be additionally applicable to all other automatic operations.
1). The two (2) pumps shall be programmed in a Duty and Standby configuration.
2). The Duty pump shall run for an adjustable number of hours prior to automatic alternation of the pumps. The timer shall be adjustable by the operator and initially set at 168 hours. The pumps shall also rotate after each pump stop cycle. The rotation timer shall automatically reset if the pumps rotate because of a pump cycle.
3). The pumps shall be rotated automatically by the PCS or manually by the operator. Selections shall be made available on the PCS OIT or operator workstation screen for this function.

E. Setpoints and Ranges:
1. Flow Meter WAS-FIT-301, WAS-FIT-302:
a. Flow meter with integral transmitter and reverse flow detection.
b. Refer to Section 40 70 00 for instrument calibration ranges.
2. Total Solids Analyzer WAS-AIT-301, WAS-AIT-302:
a. Total solids analyzer with integral transmitter.
b. Refer to Section 40 70 00 for instrument calibration ranges.
c. Low level alarm adjustable between 0-50,000 mg/L.
d. High level alarm adjustable between 0-50,000 mg/L.
3. Operator Workstation:
a. Display range of 0-500 gpm for flow meters.
b. Display range of 0-50,000 mg/L for total solids analyzers.
c. Thickening Bypass Mode timer adjustable between 1-480 minutes.

F. System Upsets and Procedures for Recovery:
1. If a low TS is detected, the control system shall alarm the operator via the operator workstation.
2. If a high TS is detected, the control system shall alarm the operator via the operator workstation.
3. If a reverse flow is detected, the control system shall alarm the operator via the operator workstation.
4. System in either Remote Automatic control mode:
a. If a low level is detected by either thin sludge tank level transmitter while the tank is in service, all thin sludge pumps shall be called to stop pumping. The thin sludge pumps shall be allowed to run when the level rises above the thin sludge run setpoint.
b. If a low level is detected by either thin sludge tank level switch while the tank is in service, all thin sludge pumps shall be called to stop pumping. The thin sludge pumps shall be allowed to run if the level switch returns to normal state and the alarm is cleared at the operator workstation.
c. In the event the Duty pump becomes unavailable, fails to start, or drops off-line, the Standby pump in the starting sequence shall be automatically selected to operate as the lead pump.
5. System in Remote Automatic (Sludge Thickening) control mode:

a. If a high level is detected by a pump group's associated Flocculation Tank high level switch, the pump shall immediately stop. The pump shall be allowed to start and run when the high level switch is in normal state.
b. If a high level is detected by a pump group's associated Sludge Thickening Hopper high level switch, the pump shall immediately stop. The pump shall be allowed to start and run when the high level switch is in normal state.

6. System in Remote Automatic (Thickening Bypass) control mode:
   a. If a high level is detected by either thickened sludge tank level transmitter while the tank is in service, the associated pump group(s) shall be called to stop pumping. The thin sludge pumps shall be allowed to run when the level falls below Thin and Thickened Sludge Pump Enable setpoint.
   b. If a high level is detected by either thickened sludge tank level switch while the tank is in service, all thin sludge pumps shall be called to stop pumping. The thin sludge pumps shall be allowed to run if the level switch returns to normal state and the alarm is cleared at the operator workstation.
   c. Loss of flow signal:
      (1) If the flow signal is lost or out of range, the system shall maintain the pump speed and alarm the operator via the operator workstation.

3.23 SLUDGE THICKENING SYSTEM:

A. System Components and Functions:
   1. Plant Control System SPB-PLC-061.
      a. Monitors and communicates all available I/O points to and from the Sludge Thickening Systems.
   2. Sludge Thickening Systems:
      a. Sludge Thickening System No. 1
         (1) Main Control Panel STH-MCP-100
         (2) Sludge Thickening Skid:
            (a) Flocculation Tank No. 1 STH-MIX-110
               1). Flocculation Tank High Level Switch STH-LSH-110
            (b) Rotary Drum Thickener No. 2 STH-RDT-120
               1). Discharge Hopper High Level Switch STH-LSH-120
               2). Discharge Hopper Level Sensor STH-LIT-120
      b. Sludge Thickening System No. 2
         (1) Main Control Panel STH-MCP-200
         (2) Sludge Thickening Skid:
            (a) Flocculation Tank No. 2 STH-MIX-210
               1). Flocculation Tank High Level Switch STH-LSH-210
            (b) Rotary Drum Thickener No. 2 STH-RDT-220
               1). Discharge Hopper High Level Switch STH-LSH-220
               2). Discharge Hopper Level Sensor STH-LIT-220
   3. Thin Sludge Pumps:
      a. Thin Sludge Pump No. 1 WAS-PMP-310
      b. Thin Sludge Pump No. 2 WAS-PMP-320
      c. Thin Sludge Pump No. 3 WAS-PMP-330
      d. See "Thin Sludge Pumps" sub-section for description of operation, devices, and setpoints.
   4. Thickened Sludge Pumps:

a. Thickened Sludge Pump No. 1 STH-PMP-130
b. Thickened Sludge Pump No. 2 STH-PMP-230
c. See "Thickened Sludge Pumps" sub-section for description of operation, devices, and setpoints.

5. Thickened Sludge Tanks:
   a. Thickened Sludge Tank No. 1
   b. Thickened Sludge Tank No. 2
   c. See "Thickened Sludge Holding Tanks and Sludge Loadout Pumps" sub-section for description of operation, devices, and setpoints.
6. Polymer Feed Systems:
   a. Polymer Feed System No. 1 POL-SKD-100
   b. Polymer Feed System No. 2 POL-SKD-200
   c. See "Polymer Feed Systems" sub-section for description of operation, devices, and setpoints.

B. Sludge Thickening System:
1. Refer to Section 46 71 33 – Rotary Drum Thickener for description of operation, devices, and setpoints of the Sludge Thickening System.
2. The plant control system shall provide a "Sludge Thickening System Inhibit" discrete I/O point over the PCS ethernet network for each sludge thickening system. If the inhibit point is active, the associate sludge thickening system shall not be allowed to run if in automatic mode.
3. Each Sludge Thickening control system shall start and stop their associated polymer feed system and adjust the speed of the polymer feed pump based on the operator input from the associated control panel operator interface settings as part of the Sludge Thickening System automatic sequence.
4. Each Sludge Thickening control system shall start and stop their associated thin sludge pump group and adjust the speed of the pump based on the operator input from the associated control panel operator interface settings as part of the Sludge Thickening System automatic sequence.
5. Each Sludge Thickening control system shall have option to start and stop their associated thickened sludge pump. The plant control system shall adjust the speed of the pump based on the discharge hopper level.
6. HMI screens shall be developed to allow the operator to monitor each sludge thickening system and inhibit each system from running.

C. System Upsets and Procedures for Recovery:
1. If a sludge thickening system's associated thickened sludge pump failure is detected or is stopped by the PCS, the thickened sludge system will be inhibited from running. The system will be allowed to run if the pump failure or PCS interrupt is cleared and the inhibit signal is not active.
2. If a sludge thickening system's associated thin sludge pump failure is detected or is stopped by the PCS, the thickened sludge system will be inhibited from running. The system will be allowed to run if the pump failure or PCS interrupt is cleared and the inhibit signal is not active.
3. If the thickened sludge system inhibit signal is initiated for any reason, the signal must be manually changed at the operator workstation to allow the thickened sludge system to run. I.e., an inhibit may be automatically activated by the PCS, but the signal may not be automatically deactivated.

4. If a sludge thickening system failure is detected, the plant control system shall perform the following functions:
    a. Stop the associated thin sludge pump.
    b. Stop the associated thickened sludge pump.
    c. Alarm the operator via the operator workstation.

3.24 POLYMER FEED SYSTEM:

A. System Components and Functions:
1. POL-SKD-100:
    a. Polymer Feed Pump No. 1-1 POL-PMP-110.
        (1) Manufacturer provided, skid mounted polymer feeder.
    b. Polymer Feed Pump No. 1-2 POL-PMP-120.
        (1) Manufacturer provided, skid mounted polymer feeder.
    c. Polymer Activation Chamber POL-MTR-115.
        (1) Manufacturer provided, skid mounted polymer activation chamber.
2. Polymer Feed Skid No. 2 POL-SKD-200
    a. Polymer Feed Pump No. 2-1 POL-PMP-210.
        (1) Manufacturer provided, skid mounted polymer feeder.
    b. Polymer Feed Pump No. 2-2 POL-PMP-220.
        (1) Manufacturer provided, skid mounted polymer feeder.
    c. Polymer Activation Chamber POL-MTR-215.
        (1) Manufacturer provided, skid mounted polymer activation chamber.
3. Plant Control System SPB-PLC-061.
    a. Calls for the associated polymer feed system to run while in remote mode and provides feed rate for the polymer feed system based on hard-wired or communicated inputs from the sludge thickening system PLCs.
4. Sludge Thickening Systems:
    a. Sludge Thickening System No. 1
    b. Sludge Thickening System No. 2
    c. See “Sludge Thickening System” sub-section for detailed description of operation, devices, and setpoints.

B. Description of Operation:
1. Polymer Feeder:
    a. Refer to Section 46 33 33 – Polymer Feed for description of operation, devices, and setpoints of the Polymer Feed System.
    b. The polymer feeder shall be capable of being controlled locally at the polymer feed control panel or remotely by the PLC when the LOCAL/OFF/REMOTE switch is in REMOTE.
    c. Local Control:
        (1) When the polymer feeder is in LOCAL control, starting, stopping, and polymer feed rate adjustment of the feeder shall be controlled at the local control panel.
    d. Remote Control:
        (1) When the polymer feeder is in REMOTE control, starting, stopping, and polymer feed rate adjustment of the feeder shall be controlled by the Sludge Thickening System via the PCS.

(2) The Sludge Thickening System shall provide start/stop signals and speed control signals to each polymer feeder. The PCS shall relay the Sludge Thickening System control signals to the Polymer Feed System.
(3) The operator shall select which Sludge Thickening System is associated with each Polymer Feed System on the HMI. This selection shall determine which Sludge Thickening System control signals are relayed to each Polymer Feed System via the PCS.
(4) When the start/stop contact associated with the polymer feeder is closed, the polymer feeder shall start. When the start/stop contact associated with the polymer feeder is opened, the polymer feeder shall stop.
(5) Refer to System Upsets and Procedures for Recovery this Section for additional programming requirements.

e. The polymer feed system status points and alarms shall be displayed on the operator workstation and associated Sludge Thickening System control panel operator interface. Refer to the I/O list at the end of this Section and corresponding control drawings for I/O status and alarm points.

C. Setpoints and Ranges:
1. Operator Workstation:
a. Display range of 0.0 to 6.0 gal/hr for each polymer feeder.

D. System Upsets and Procedures for Recovery:
1. If a polymer feed system failure occurs, the control system shall alarm the operator via the operator workstation and the associated Sludge Thickening System control panel operator interface.

3.25 THICKENED SLUDGE PUMPS:

A. System Components and Functions:
1. Plant Control System SPB-PLC-061.
a. Controls Thickened Sludge Pumps' starting, stopping, and speed while in remote mode.
2. Thickened Sludge Pumps:
a. Thickened Sludge Pump No. 1 STH-PMP-130
(1) Associated with Sludge Thickening System No. 1
b. Thickened Sludge Pump No. 2 STH-PMP-230
(1) Associated with Sludge Thickening System No. 2
c. Progressive cavity pumps located in the Solids Processing Building Process Room, controlled by variable speed drives. Pumps sludge from the Sludge Thickening System hoppers to the Thickened Sludge Tanks.
3. Sludge Thickening Systems:
a. Sludge Thickening System No. 1
b. Sludge Thickening System No. 2
c. See "Sludge Thickening System" sub-section for detailed description of operation, devices, and setpoints.
4. Thickened Sludge Tanks:
a. Thickened Sludge Tank No. 1
b. Thickened Sludge Tank No. 2
c. See "Thickened Sludge Holding Tanks and Sludge Loadout Pumps" sub-section for description of operation, devices, and setpoints.

B. Thickened Sludge Pump Flow Metering:

1. The flow from Thickened Sludge Pump No. 1 to the Thickened Sludge Tanks shall be measured by STH-FIT-131.
2. The flow from Thickened Sludge Pump No. 2 to the Thickened Sludge Tanks shall be measured by STH-FIT-231.
3. Loss of signal alarms shall be programmed.
4. The flow shall be trended, totalized, and displayed on the PCS HMI screen.

C. Thickened Sludge Pump Total Solids (TS) Metering:
1. The total solids of sludge pumped from Thickened Sludge Pump No. 1 to the Thickened Sludge Tanks shall be measured by STH-AIT-131.
2. The total solids of sludge pumped from Thickened Sludge Pump No. 2 to the Thickened Sludge Tanks shall be measured by STH-AIT-231.
3. Loss of signal alarms shall be programmed.
4. Total solids shall be trended and displayed on the PCS HMI screen.

D. Thickened Sludge Pumps:
1. The pumps shall be capable of being controlled locally at the associated pump VFD or remotely by the plant control system when the LOCAL/OFF/REMOTE switch is in REMOTE.
2. Level controls for the pumps shall be based on the signals from the sludge thickening systems' discharge hopper level transmitters.
3. Local Control:
   a. When the pumps are in LOCAL control, starting and stopping of the pumps and the speed of the pumps shall be controlled at the associated VFD.
4. Remote Control:
   a. When the pumps are in REMOTE control, starting and stopping of the pumps, and the speed of the pumps shall be controlled by the plant control system PLC or the associated Sludge Thickening System control panel.
   b. When a run command associated with the pump is communicated to the VFD, the corresponding pump shall start and run. When a stop command associated with the pump is communicated to the VFD, the corresponding pump shall stop.
   c. HMI screens shall be developed to allow the operator to select from two modes of operation.
   d. The following I/O points will be read/write and able to be modified by the sludge thickening control system via ethernet communication.
      (1) Remote Manual Start.
      (2) Remote Auto Mode Initiate.
      (3) Pump Off.
      (4) Remote Manual Speed Control (0-100%).
   e. Remote Manual Control Mode:
      (1) Starting and stopping of each of the pumps initiated by the operator at the PCS OIT or operator workstation.
      (2) The operator shall set the speed as a percentage of full speed for each of the VFD controlled pumps.
   f. Remote Automatic Control Mode:
      (1) The plant control system PLC shall automatically start and stop pumps and adjust the speed of the pumps to maintain the thickened sludge hopper level setpoint.
      (2) The measured level for Thickened Sludge Pump No. 1 shall be based on level sensor STH-LIT-120 and shall be utilized for level control.

(3) The measured level for Thickened Sludge Pump No. 2 shall be based on level sensor STH-LIT-220 and shall be utilized for level control.
(4) The pump(s) speed shall be controlled using a PID algorithm to maintain a Level Setpoint.
(5) Sequence of Operation:
1). When the wet well level rises above the Pump Start set point, the pump shall start. The pump speed shall be modulated to maintain the level set point.
2). If the pump is operating at the associated minimum speed set point and the level reaches the Pump Stop set point, the pump shall ramp down to zero speed and shut down.
(b) Refer to System Upsets and Procedures for Recovery this Section for additional programming requirements.
g. The pump status points and alarms shall be displayed on the operator workstation. Refer to the I/O list at the end of this section and corresponding control drawings for I/O status and alarm points.

E. Setpoints and Ranges:
1. Flow Meters STH-FIT-131, STH-FIT-231:
a. Flow meters with integral transmitter and reverse flow detection.
b. Refer to Section 40 70 00 for instrument calibration ranges.
2. Total Solids Analyzers STH-AIT-131, STH-AIT-231:
a. Total solids analyzers with integral transmitter.
b. Refer to Section 40 70 00 for instrument calibration ranges.
c. Low level alarm adjustable between HOLD.
d. High level alarm adjustable between HOLD.
3. Level Indicating Transmitters STH-LIT-120, STH-LIT-220:
a. Level transmitters with integral display.
b. Refer to Section 40 70 00 for instrument calibration ranges.
4. Thickened Sludge Pump Variable Frequency Drives:
a. Ramp up time: Adjustable setpoint initially set at 10 seconds.
b. Ramp down time: Adjustable setpoint initially set at 10 seconds.
c. Minimum Speed: 70% initial.
(1) Final setpoint shall be determined during system startup.
5. Operator Workstation:
a. Hopper Level Setpoints (Adjustable over the range of the instrument.), all relative to centerline of hopper level indicating transmitter:
(1) Zero level for the level transmitters shall be at elevation 0.00’.
(2) Pump Start set point initially set at: 1.25 feet.
(3) Pump Stop set point initially set at: 0.25 feet.
(4) High-High Level Alarm initially set at: 2.00 feet.
(5) High Level Warning initially set at: 1.75 feet.
(6) Low Level Warning initially set at: 0.00 feet.
b. Minimum Speed Setpoints:
(1) Pump Operating minimum speed: Initially set at 40%.
(2) Minimum pump speed setpoints shall be tested and confirmed during pump commissioning to ensure observed positive flow at minimum level setpoint conditions.
c. Display range of 0.0-12.0% TS for total solids analyzers.

d. Flow Transmitters STH-FIT-131, STH-FIT-231.
(1) Display range of 0.0-500 gpm.
(2) Display range of 0-500,000 gals for total flow.

F. System Upsets and Procedures for Recovery:
1. If a low TS is detected, the control system shall alarm the operator via the operator workstation.
2. If a high TS is detected, the control system shall alarm the operator via the operator workstation.
3. If a reverse flow is detected, the control system shall alarm the operator via the operator workstation.
4. System in Remote Automatic control mode:
a. If a high level is detected by either thickened sludge tank level transmitter while the tank is in service, the thickened sludge pumps shall be called to stop pumping. The pumps shall be allowed to run when the level falls below the Thin and Thickened Sludge Pump Enable set point.
b. If a high level is detected by either thickened sludge tank level switch while the tank is in service, the thickened sludge pumps shall be called to stop pumping. The pumps shall be allowed to run when the level switch returns to normal state and the alarm is cleared at the operator workstation.
c. If a low level is detected by the sludge thickening system hopper level sensor, the associated thickened sludge pump shall be called to stop pumping. The thickened sludge pump shall be allowed to run if the level returns to the Pump Run set point.
d. Loss of level signal:
(1) If the level signal is lost or out of range, the system shall maintain the pump speed and alarm the operator via the operator workstation.

3.26 THICKENED SLUDGE HOLDING TANKS AND SLUDGE MIXING AIR SYSTEM:

A. System Components and Functions:
1. Plant Control System SPB-PLC-061.
a. Monitors thickened sludge tanks level and statuses of sludge mixing air systems.
2. Thickened Sludge Tanks:
a. Thickened Sludge Tank No. 1
b. Thickened Sludge Tank No. 2
c. Holds thickened sludge pumped from the sludge thickening systems or thin sludge tanks.
3. Sludge Mixing Air Systems:
a. Sludge Mixing Air Compressors
(1) SCIN-AIRC-310
(2) SCIN-AIRC-320
b. Mixing Valve Panel
(1) SCIN-LCP-101
(a) Associated with Thickened Sludge Tank No. 1
(2) SCIN-LCP-201
(a) Associated with Thickened Sludge Tank No. 1
c. See Section 46 42 57 – Large Bubble Mixing System for description of operation, devices, and setpoints.
4. Thin Sludge Tanks:
a. Thin Sludge Tank No. 1

b. Thin Sludge Tank No. 2
c. See "Thin Sludge Holding Tanks and Sludge Blowers" sub-section for description of operation, devices, and setpoints.

5. Level Switch SCIN-LSH-101
   a. Provides a high level alarm for Thickened Sludge Tank No. 1.
6. Level Switch SCIN-LSH-201
   a. Provides a high level alarm for Thickened Sludge Tank No. 2.

B. Thickened Sludge Tank Level Monitoring:
1. The sludge level of Thickened Sludge Tank No. 1 shall be measured by SCIN-LIT-101.
2. The sludge level of Thickened Sludge Tank No. 2 shall be measured by SCIN-LIT-201.
3. Loss of signal alarms shall be programmed.

C. Thickened Sludge Tanks:
1. Each thickened sludge tank shall have the option to be placed out of service by operator selection on the PCS HMI screen.
   a. A warning pop-up shall be programmed to ensure the operator has confirmed the manual valve changes for the selected tank being placed out of service. The pop-up shall read as follows:
      (1) Warning: Tank status change requires operator confirmation of manual valve positions for intended usage! Are valve positions correct (Yes) (No)?"
      (2) If "Yes" is selected the status change request shall be executed. If "No" is selected the status change request shall be ignored, and remain unchanged.

D. Sludge Mixing Air Systems:
1. Controlled by unit-mounted local control panels.
2. Sludge Mixing Air Compressors' run statuses shall be monitored on the PCS HMI screen.

E. Setpoints and Ranges:
1. Level Transmitters SCIN-LIT-101, SCIN-LIT-201:
   a. Level transmitters with integral displays.
   b. Calibrated to a range of 0-23 feet.
   c. Low level alarm adjustable between 0-23 feet.
   d. High level alarm adjustable between 0-23 feet.
   e. Thin and Thickened Sludge Pump Enable adjustable between 0-5 feet.
2. Operator Workstation:
   a. Display range of 0-23 feet for level transmitters.

F. System Upsets and Procedures for Recovery:
1. If any components of the Sludge Mixing Air System fails, the plant control system shall alarm the operator via the operator workstation.
2. If the level signal is lost or out of range, the plant control system shall alarm the operator via the operator workstation.
3. If a high liquid level is detected, the control system shall alarm the operator via the operator workstation.

3.27 SLUDGE LOADOUT PUMPS:

A. System Components and Functions:
1. Plant Control System SPB-PLC-061.
   a. Controls Sludge Loadout Pumps' starting, stopping, and speed while in remote mode.
   b. Controls Recirculation and Loadout Valves opening and closing while in remote mode.

2. Sludge Loadout Pumps:
    a. Sludge Loadout Pump No. 1 SCIN-PMP-110
        (1) Associated with Thickened Sludge Holding Tank No. 1, Recirculation Valve SCIN-VLV-112, and Loadout Valve SCIN-VLV-113
    b. Sludge Loadout Pump No. 2 SCIN-PMP-210
        (1) Associated with Thickened Sludge Holding Tank No. 2, Recirculation Valve SCIN-VLV-212, and Loadout Valve SCIN-VLV-213
    c. Progressive cavity pumps located in the Solids Processing Building Process Room, controlled by reduced voltage soft starters. Supplies sludge from the Thickened Sludge Tanks to sludge transportation vehicles at the exterior of the Solids Processing Building.
3. Recirculation Valves:
    a. Recirculation Valve SCIN-VLV-112
        (1) Associated with Sludge Loadout Pump No. 1
    b. Recirculation Valve SCIN-VLV-212
        (1) Associated with Sludge Loadout Pump No. 2
    c. Modulating plug valves located in the Solids Processing Building Process Room, controlled by SPB-PLC-061. When opened, sludge from the Thickened Sludge Tanks is recirculated by pumping.
4. Loadout Valves:
    a. Loadout Valve SCIN-VLV-113
        (1) Associated with Sludge Loadout Pump No. 1
    b. Loadout Valve SCIN-VLV-213
        (1) Associated with Sludge Loadout Pump No. 2
    c. Modulating plug valves located in the Solids Processing Building Process Room, controlled by SPB-PLC-061. When opened, sludge is pumped from the Thickened Sludge Tanks to sludge transportation vehicles at the exterior of the Solids Processing Building.
5. Thickened Sludge Tanks:
    a. Thickened Sludge Tank No. 1
    b. Thickened Sludge Tank No. 2
    c. See “Thickened Sludge Holding Tanks and Sludge Loadout Pumps” sub-section for description of operation, devices, and setpoints.

B. Sludge Loadout Pump Flow Metering:
1. The flow of Sludge Loadout Pump No. 1 to the associated external loadout location shall be measured by SCIN-FIT-111.
2. The flow of Sludge Loadout Pump No. 2 to the associated external loadout location shall be measured by SCIN-FIT-211.
3. Provide a resettable flow totalizer for each loadout pump on the PCS HMI screen. When the associated reset button is pressed, the total flow shall be saved to Historian with the beginning and end dates and times of the totalization period.
    a. A Comments screen with a text field to be populated by the Operator will initiate after the reset button. The comment shall be saved with the total flow.
4. Provide an automatic flow totalizer for each loadout pump on the PCS HMI screen that is initiated with each automatic cycle of the associated loadout pump. When the automatic cycle is stopped, total flow shall be saved to Historian with the beginning and end dates and times of the automatic cycle.

a. A Comments screen with a text field to be populated by the Operator will initiate after the automatic cycle stops. The comment shall be saved with the total flow.

5. Loss of signal alarms shall be programmed.
6. The flow shall be trended and displayed on the PCS HMI screen.

C. Sludge Loadout Pumps:

1. The pumps shall be capable of being controlled locally at the associated pump control station or remotely by the plant control system when the LOCAL/OFF/REMOTE switch is in REMOTE.
2. The LOCAL/OFF/REMOTE switch shall be located on the face of the associated RVSS enclosure.
3. Local Control:
   a. When the pumps are in LOCAL control, starting and stopping of the pumps shall be controlled at the associated interior control stations. Stopping of the pumps shall also be controlled from the exterior control stations.
4. Remote Control:
   a. When the pumps are in REMOTE control, starting and stopping of the pumps shall be controlled by the plant control system PLC.
   b. When a run command associated with the pump is communicated to the RVSS, the corresponding pump shall start and run. When a stop command associated with the pump is communicated to the RVSS, the corresponding pump shall stop.
   c. HMI screens shall be developed to allow the operator to select from two modes of operation.
   d. Remote Manual Control Mode:
      (1) Starting and stopping of each of the pumps initiated by the operator at the PCS OIT or operator workstation.
      (2) Opening and closing of the Recirculation and Loadout Valves initiated by the operator at the PCS OIT or operator workstation.
      (3) The operator shall set the valve position as a percentage of fully open for each of the valves.
   e. Remote Automatic Control Mode:
      (1) For the following Remote Automatic control modes, the HMI screen shall allow the operator to select which pumps are currently assigned to a particular function (i.e. Sludge Recirculation Mode or Sludge Loadout Mode).
      (2) If a sludge holding tank is placed out of service, the automatic control modes for the associated sludge loadout pump will not be available.
      (3) The associated Sludge Loadout Pump, Recirculation Valve, and Loadout Valve must be in Remote-Automatic mode for the automatic control mode to initiate. If any of the devices are switched out of Remote-Automatic mode during the cycle, the cycle shall end, and the pump shall be called to stop. Once the pump is proven to be stopped, the valves shall be called to close. The above cycle end procedures shall cease when all devices in Remote-Automatic mode have been proven stopped or closed.
      (4) Remote Automatic Control Mode (Sludge Recirculation Cycle):
         (a) The plant control system PLC shall automatically start and stop pumps and open and close valves according to operator adjustable timers and valve position setpoints.
         (b) Sequence of Operation:

1). When the Cycle Start button is selected on the PCS OIT, the cycle shall begin:
2). The Loadout Valve shall fully close.
3). With the Loadout Valve being proven closed, the Recirculation Valve shall open to the Recirculation Valve Open setpoint.
4). When the Recirculation Valve is proven open to the setpoint, the Sludge Loadout Pump shall start, and the Recirculation Cycle Run Timer shall start. The pump shall operate in this valve configuration until the timer has elapsed.
5). When the timer has elapsed, the pump shall stop. If the Cycle Stop button is selected at any time during the Automatic Recirculation Sequence, the pump shall stop.
6). When the pump has been proven stopped, the Recirculation Valve shall open to 100%.
7). All timers shall reset at the conclusion of each cycle.
8). Refer to System Upsets and Procedures for Recovery this Section for additional programming requirements.

(c) Scheduled Sludge Recirculation Mode:
1). The plant control system shall include an option to schedule up to two (2) Sludge Recirculation Cycles which will initiate automatically without operator manual initiation. Each scheduled time shall be capable of being enabled or disabled through the PCS OIT.
2). The schedule shall include inputs for Start Time for each Sludge Recirculation Cycle.
3). The sequence of operation shall be similar to that described above, but with automatic initiation at the Start Time in lieu of selection of the Cycle Start button through the OIT.

(5) Remote Automatic Control Mode (Sludge Loadout Cycle):
(a) The plant control system PLC shall automatically start and stop pumps and open and close valves according to operator adjustable timers, valve position setpoints, and total flow setpoints.
(b) The measured flow rate for SCIN-PMP-110 shall be based on flow meter SCIN-FIT-111.
(c) The measured flow rate for SCIN-PMP-210 shall be based on flow meter SCIN-FIT-211.
(d) The PCS HMI screen shall indicate the state of the control sequence by displaying the current Step of Steps 1-3 as listed in the Sequence of Operation.
(e) Sequence of Operation:
a). When the Cycle Start button is selected on the PCS OIT, the cycle shall begin:
2). Loadout Step 1 – Recirculation:
a). The Loadout Valve shall fully close.
b). With the Loadout Valve being proven closed, the Recirculation Valve shall open to the Recirculation Valve Recirc position setpoint.

c). When the Recirculation Valve is proven open to the Recirculation Valve Recirc position setpoint, the Sludge Loadout Pump shall start and the Loadout Step 1 – Run Timer shall start. The pump shall operate in this valve configuration until the timer has elapsed.

3). Loadout Step 2 – Loadout:
   a). After the timer has elapsed, the Loadout Valve shall open to the Loadout Valve position setpoint.
   b). When the Loadout Valve is proven open to the setpoint, the Recirculation Valve shall modulate position to the Recirculation Valve Loadout position setpoint.
   c). The pump shall run in this valve configuration until the Total Loadout Flow setpoint has been met as reported by the associated flow meter.

4). Loadout Step 3 – Cycle Stop:
   a). When the Total Loadout Flow setpoint has been reached, the pump shall stop. If the Cycle Stop button is selected at any time during the Automatic Loadout Sequence, the pump shall stop.
   b). When the pump has been proven stopped, the Loadout Valve shall close and the Recirculation Valve shall open to 100%.

5). All timers shall reset at the conclusion of each cycle.
   a). Refer to System Upsets and Procedures for Recovery this Section for additional programming requirements.

f. The pump and valve status points and alarms shall be displayed on the operator workstation. Refer to the I/O list at the end of this section and corresponding control drawings for I/O status and alarm points.

D. Setpoints and Ranges:
1. Flow Meters SCIN-FIT-111, SCIN-FIT-211:
   a. Flow meters with integral transmitter, remote display, and reverse flow detection.
   b. Calibrated to a range of 0-1,000 gpm.
2. Operator Workstation:
   a. Display range of 0-1,000 gpm for flow meters.
3. Timer Set Points:
   a. Recirculation Cycle Run Timer (adjustable) initially set at: 60 seconds.
   b. Loadout Step 1 – Run Timer (adjustable) initially set at: 30 seconds.
4. Valve Position Set Points:
   a. Recirculation Valve in Recirculation (adjustable) initially set at: 100%.
   b. Recirculation Valve in Loadout (adjustable) initially set at: 0%.
   c. Loadout Valve (adjustable) initially set at: 100%.
5. Loadout Total Flow Set Point (adjustable) initially set at: 5,000 gallons.

E. System Upsets and Procedures for Recovery:
1. System in either Remote Automatic control mode:
   a. If a low level is detected by the associated thickened sludge tank level transmitter, the automatic cycle shall end. The sludge loadout pump shall be called to stop pumping. Once the pump is proven to be stopped, the valves shall be called to close. The automatic cycle shall be allowed to start when the level rises above the thickened sludge run setpoint.

2. System in Remote Automatic (Sludge Loadout) control mode:
    a. Loss of flow signal:
        (1) If the flow signal is lost or out of range, the automatic cycle shall end. The sludge loadout pump shall be called to stop pumping. Once the pump is proven to be stopped, the valves shall be called to close. The system shall alarm the operator via the operator workstation.

3.28 PLANT SEWER PUMP STATION:

A. System Components and Functions:
1. Plant Sewer Pump No. 1: PSEW-PMP-110.
    a. Submersible pump controlled by a VFD.
2. Plant Sewer Pump No. 2: PSEW-PMP-120.
    a. Submersible pump controlled by a VFD.
3. Level Indicating Transmitter: PSEW-LIT-101.
    a. Radar level transmitter used for measuring the plant sewer wet well level.
4. Level Float Switches: Located in the plant sewer wet well.
    a. PSEW-LSH-101.
        (1) High level float switch used for pump control interlock and warning.
    b. PSEW-LSHH-101.
        (1) High-high level float switch used for pump control interlock and alarm.
    c. PSEW-LSL-101.
        (1) Low level float switch used for pump control interlock and warning.
    d. PSEW-LSLL-101.
        (1) Low-low level float switch used for pump shut-down interlock and alarm.
5. Plant Sewer Flow Transmitter: PSEW-FIT-101.
    a. Magnetic flow meter measures the pump station discharge flow to the AGS System header.
6. Plant Control System GRSC-PLC-061.
    a. Controls Plant Sewer Pumps' starting, stopping, and speed while in remote mode.

B. Description of Operation:
1. Wet Well Level:
    a. The wet well levels shall be measured by level transmitter PSEW-LIT-101.
    b. The level shall be displayed on the operator workstation and high-high, high, low, and low-low level and loss of signal alarms shall be set. The level alarms shall be based upon the measurement from the selected transmitter.
    c. If a loss of signal alarm is detected the control system shall automatically switch to the other transmitter.
    d. The levels shall be displayed in feet to the nearest tenth on the operator workstation.
    e. The levels for both transmitters shall be trended.
2. Plant Sewer Pump Station Flow:
    a. The pump station flow shall be measured by flow transmitter PSEW-FIT-101.
    b. The flow shall be displayed in gpm (gallons per minute) and MGD (million gallons per day) on the operator workstation.
    c. High flow and loss of signal alarms shall be programmed.
    d. The pump station flow shall be trended.

3. Plant Sewer Pumps:
   a. The pumps shall be capable of being controlled locally at the associated pump VFD or remotely by the plant control system when the LOCAL/OFF/REMOTE switch is in REMOTE.
   b. Level control for the pumps shall be based on the signal from the selected level transmitter.
   c. Local Control:
      (1) When the pumps are in LOCAL control, starting and stopping of the pumps and the speed of the pumps shall be controlled at the associated VFD.
   d. Remote Control:
      (1) When the pumps are in REMOTE control, starting and stopping of the pumps, and the speed of the pumps shall be controlled by the plant control system PLC.
      (2) When a run command associated with the pump is communicated to the VFD, the corresponding pump shall start and run. When a stop command associated with the pump is communicated to the VFD, the corresponding pump shall stop.
      (3) HMI screens shall be developed to allow the operator to select from two modes of operation.
      (4) Remote Manual Control Mode:
         (a) Starting and stopping of each of the pumps initiated by the operator at the operator workstation.
         (b) The operator shall set the speed as a percentage of full speed for each of the VFD controlled pumps.
      (5) Remote Automatic Control Mode:
         (a) The plant control system PLC shall automatically start and stop pumps and adjust the speed of the pumps to maintain the level set point in the wet well.
         (b) The measured flow rate shall be based on the raw water flow meter PSEW-FIT-101 and shall be utilized for conditional peak flow control.
         (c) The pumps shall be rotated in a lead/lag fashion automatically by the control system or manually by the operator. Selections shall be made available on the operator workstation screen for this function.
         (d) The pumps shall be alternated as Duty and Standby automatically by the system after an operator adjustable time period and each time a pump is stopped. The rotation timer shall automatically reset if the pumps rotate because of a pump shutdown.
         (e) The pump speed shall be controlled using a PID algorithm to maintain a Level Set Point in the wet well.
         (f) Sequence of Operation (HOLD):
            1). When the wet well level rises above the Lead Pump Start, the Lead pump shall start. The pump speed shall be modulated to maintain the level set point.
            2). If the Lead pump is operating at 100% speed and the wet well level rises above the Lag Start set point, the Lag pump shall start after a Pump Start time delay. If the level falls below the Lag Start set point prior to the time delay expiration, the timer shall be reset.

3). When the Lag pump is called to start, it shall ramp to 100% speed to match the Lead pump speed and the Lead pump and Lag pump speeds shall be modulated together to maintain the level set point.
4). If the Lead and Lag pump combination is operating at the associated minimum speed set point and the level reaches the Pump Stop (Lag) set point, the Lead Pump shall ramp down to zero speed and shut down. The pump lead/lag role shall be rotated at this time.
a). The pumps shall automatically rotate for the lead pump position after each start/stop cycle or once every 24-hour time period, whichever occurs first. The rotation time shall be operator adjustable.
5). The Lead pump shall continue to modulate to achieve the level set point.
6). The Lead pump shall operate until the following Lead pump shutdown conditions are met:
a). All other pumps are off.
b). The Lead pump is running at the associated minimum speed.
c). The wet well level reaches the Pump Stop (Lead) set point.

(g) Point Level (Float Switch) Control Mode:
1). If the wet well level rises above the high level set point (PSEW-LSH-101), the Lead Pump shall start. The Lead pump shall run until the wet well level falls below the low level set point (PSEW-LSL-101)
2). If the wet well level rises above the high-high level set point (PSEW-LSHH-101), the Lag Pump shall start. The Lead and Lag pumps shall run until the wet well level falls below the low level set point (PSEW-LSL-101).
3). The pumps shall automatically rotate for the lead pump position after each start/stop cycle or once every 24-hour time period, whichever occurs first. The rotation time shall be operator adjustable.
4). All operational pumps will operate at 100% speed.

(6) Refer to System Upsets and Procedures for Recovery this Section for additional programming requirements.

e. The pump status points and alarms shall be displayed on the operator workstation. Refer to the I/O list at the end of this section and corresponding control drawings for I/O status and alarm points.

C. Setpoints and Ranges:
1. Level Indicating Transmitter PSEW-LIT-101:
a. Level transmitter with integral display.
b. Refer to Section 40 70 00 for instrument calibration ranges.
2. Plant Sewer Pump Variable Frequency Drives:
a. Ramp up time: Adjustable setpoint initially set at 10 seconds.
b. Ramp down time: Adjustable setpoint initially set at 10 seconds.
c. Minimum Speed: 70% initial.
(1) Final setpoint shall be determined during system startup.
3. Timer Set Points:

a. Pump Start Delay (adjustable) initially set at: 15 seconds.
b. Pump Rotation time (adjustable) initially set at: 24 hours.

4. Operator Workstation:
   a. Wet Well Level Setpoints (Adjustable over the range of the instrument.):
      (1) Zero level for the level transmitters shall be at elevation 893.00' msl.
      (2) Lead Pump Start set point initially set at: 4.00 feet (897.00' msl).
      (3) Lag Pump Start set point initially set at 7.00 feet (900.00' msl).
      (4) Lead Pump Stop set point initially set at: 2.00 feet (895.00' msl).
      (5) Lag Pump Stop set point initially set at: X.XX feet (X.XX' msl).
      (6) High-High Level Alarm initially set at: 8.00 feet (901.00' msl).
      (7) High Level Warning initially set at: 6.00 feet (899.00' msl).
      (8) Low Level Warning initially set at: 1.75 feet (894.75' msl).
      (9) Low Low Level Alarm initially set at 1.25 feet (894.25' msl).
   b. Minimum Speed Setpoints:
      (1) Pump Operating minimum speed: Initially set at 70%.
      (2) Minimum pump speed setpoints shall be tested and confirmed during pump commissioning to ensure observed positive flow at minimum level setpoint conditions.
   c. Flow Transmitter: PSEW-FIT-101.
      (1) Display range of 0.0-1,500 gpm.
      (2) Display range of 0.00-2.00 MGD for total flow.

D. System Upsets and Procedures for Recovery:
   1. If a pump failure occurs the control system shall alarm the operator via the operator workstation.
   2. If the primary level signal is lost or out of range, the plant control system shall alarm the operator via the operator workstation.
   3. If the flow signal is lost or out of range, the plant control system shall alarm the operator via the operator workstation.
   4. If a low-low level is detected, the control system shall alarm the operator via the operator workstation.
   5. If a low level is detected, the control system shall alarm the operator via the operator workstation.
   6. If a high level is detected, the control system shall alarm the operator via the operator workstation.
   7. If a high-high level is detected, the control system shall alarm the operator via the operator workstation.
   8. If a reverse flow is detected, the control system shall alarm the operator via the operator workstation.
   9. System in Remote Automatic control mode:
      a. If a low level signal is detected, all plant sewer pumps shall be called to stop pumping. The pumps shall be allowed to run when the level rises above the Lead Pump Start set point.
      b. If a low-low level signal is detected, all plant sewer pumps shall be called to stop pumping. The pumps shall be allowed to run when the level rises above the Lead Pump Start set point and the alarm is cleared at the operator workstation.
      c. Loss of Level Signal:

(1) If the level signal from the selected instrument is lost or out of range, the system shall maintain the pumps at current speed and alarm the operator via the operator workstation.
(2) In the event the lead pump becomes unavailable, fails to start, or drops off-line, the next available pump in the starting sequence shall be automatically selected to operate as the lead pump. If the lag pump is unavailable, fails to start, or drops off-line the system shall alarm the operator via the operator workstation..

3.29 SOLIDS HANDINLG ODOR CONTROL:

A. System Components and Functions:
1. Odor Control Main Control Panel ODR-MCP-100
a. Manufacturer provided control panel.

B. Odor Control:
a. Refer to Section 44 31 19 – Odor Control System for description of operation of the odor control system.
b. A system inhibit shall be provided to the main control panel PLC via the PCS network. If the inhibit is active, the odor control system shall be not be allowed to run.

3.30 ELECTRICAL SYSTEMS:

A. System Components and Functions:
1. Influent Pump Station:
a. Switchboard PRE-IPS-SWB-001.
(1) Service entrance switchboard with PLC based auto-throwover system (ATS). Located in the Electrical Building of the Influent Pump Station.
2. Wastewater Treatment Plant (Administration Building):
a. Switchboard BLGR-ADM-SWB-001.
(1) Service entrance switchboard with PLC based auto-throwover system (ATS). Located in the electrical room of the Administration Building.
3. Wastewater Treatment Plant (AGS):
a. Switchboard SEC-AGS-SWB-001.
(1) Service entrance switchboard with PLC based auto-throwover system (ATS). Located in the electrical room of the AGS Blower Building.
4. Refer to I/O list and drawings for additional electrical equipment, network equipment, and associated components to be monitored.

B. Description of Operation:
1. HMI screens shall be developed to display the status points for the monitored electrical equipment including auto-throwover switchboards, electronic power meters, UPS equipment, and network equipment as applicable.
2. In general power status, voltage, current, power, and power factor readings shall be displayed on the operator workstation for all network connected power distribution equipment. Analog points shall be trended.
3. Monitored statuses and all associated alarms shall be displayed on the operator workstation for the ATS components. Analog points shall be trended.

4. Power Failure Restart Sequence:
    a. When a power failure is detected at the switchboard ATS, the run commands for all motor starters and variable frequency drives that are being controlled by the plant control system shall be cleared.
        (1) Breaker statuses and nominal voltages shall be monitored to determine power availability.
    b. During a power failure all alarms generated by VFD's, PLC's, and associated equipment due to loss of power shall be programmed to automatically clear to prevent unnecessary interruption after emergency power becomes available or normal power has been restored.
    c. Influent Pump Station power restored:
        (1) If operating prior to the power failure in automatic mode, the following equipment/systems shall be restarted by the plant control system in the order indicated. Operator adjustable time delays shall be programmed between the enabling of the equipment to operate.
            (a) Step One Loads:
                1). General Plant Loads (Not Controllable): Lights, HVAC, Compressors, receptacle loads, etc.
            (b) Step Two Loads:
                1). Existing Screening System.
            (c) Step Three Loads:
                1). Influent Pumps.
                    a). No more than one pump shall be allowed to start simultaneously upon restart.
    d. Wastewater Treatment Plant (Administration Building) power restored:
        (1) If operating prior to the power failure in automatic mode, the following equipment/systems shall be restarted by the plant control system in the order indicated. Operator adjustable time delays shall be programmed between the enabling of the equipment to operate.
            (a) When power is restored to the plant, the following equipment controlled by manufacturer supplied control panels may automatically restart.
                a). Screening Systems.
                b). Grit System.
                c). UV System.
            (b) Step One Loads:
                1). General Plant Loads (Not Controllable): Lights, HVAC, Compressors, receptacle loads, etc.
            (c) Step Two Loads:
                1). Process Water Pump Station.
            (d) Step Three Loads:
                1). Plant Sewer Pump Station.
            (e) Step Four Loads:
                1). Thickened Sludge Pumps.
                2). Sludge Blowers.
    e. Wastewater Treatment Plant (AGS) power restored:
        (1) When power is restored, the equipment controlled by the manufacturer supplied control panel may be automatically started according to the AGS system sequence of operations.

f. Restart Time delays:
(1) HMI screens shall be developed to allow the time delays described for restart of equipment to be adjusted by a Supervisor. All restart time delays shall be adjustable from 0-600 seconds.

C. Setpoints and Ranges:
1. The following power meter status points and alarms shall be displayed on the Operator Workstation:
a. Display range of 0 to 125% of main trip rating (Amps).
b. Display range of 0-530 volts.
c. Coordinate with switchboard supplier for each power parameter (kW, kW-Hrs, VA, VAR, etc.) display ranges.
d. Low voltage alarm set for 465 volts, adjustable.
e. High voltage alarm set for 505 volts, adjustable.

D. Refer to the I/O list at the end of this section for all signals to be communicated and displayed at the Operator Workstation.

E. System Upsets and Procedures for Recovery:
1. If a power failure or switchboard ATS failure occurs, the control system shall alarm the operator via the operator workstation.

3.31 FIELD QUALITY CONTROLS:

A. Field Testing:
1. As specified in Section 40 60 00 – Process Control and instrumentation General Requirements and each applicable equipment Section.
2. A testing plan shall be developed and submitted for approval prior to testing of the control system.
3. Each mode of operation shall be tested along with fault conditions for proper system response.
4. Prior to and during initial startup period Systems Integrator shall demonstrate all modes of operation and step through various operating and failure scenarios.
a. Startup and operation mode testing shall be witnessed by the Engineer.
b. Contractor shall notify the Engineer a minimum of 2 weeks prior to the specified startup testing.

B. Test Reports:
1. Submit test reports as specified in Division 01.
2. Maintain a written record of all tests showing date, personnel making tests, equipment or material tested, tests performed, and results.

3.32 TRAINING:

A. The Systems Integrator shall provide formal training for operators, maintenance and service personnel.

B. The training session shall include classroom discussion on the theory of operation of the control system as well as maintenance and service methods for the system. Topics covered shall include functionality of the system, system navigation, data management and recommended backup procedures.

C. Operator Training Sessions:
1. Prior to the startup of the new control system a training session shall be provided for all operators. The training session shall clearly explain how to utilize the new system. HMI screens for the new system shall be presented and operators shall have the opportunity to

utilize the new system in a demonstration mode and navigate all the screens. The training session shall also explain and demonstrate customized features such as report generation, alarm review and acknowledgment procedures.

2. [Two] complete training session[s] for all specified training shall be provided for the operators [, one session for each shift].
3. [Two weeks after the control system is brought on line a 4 hour refresher training sessions shall be provided. The training session shall review the operations of the system and shall answer any questions the operators have developed on this system.]
4. [Two months after the completion of the project a 4 hour refresher training session shall be provided to review the operations of the entire plant control system and answer any questions operators have developed on the system.]
5. [Eleven months after the completion of the project a 4 hour refresher training session shall be provided to review the operations of the entire plant control system and answer any questions operators have developed on the system.]

D. Maintenance and Service Personnel Training:
   1. Prior to the startup of the new control system [three] [five] days of hands on training sessions shall be provided for all maintenance and service personnel. The training session shall include the following:
      a. Clearly explain the architecture of the new system and explain how the network is configured and managed. Personnel shall be trained on network switch programming troubleshooting and available diagnostic tools.
      b. Cover all system software operation and configuration.
      c. Introduce basic PLC programming and explain methods for troubleshooting and identifying system issues.
      d. Cover system hardware and functionality.
      e. Cover database management and trending.
      f. Cover report template creation and report generation.
      g. Cover I/O database management and modifications including how points are added to the control system and managed.
      h. Cover PLC programming layout and logic associated with the plant. Programming logic shall be reviewed with the Owner and explanations shall be provided on programming methodologies and how the programs are organized and notated.
      i. Programming comments and documentation shall be reviewed with the Owner to provide a clear understanding of how the system functions.
      j. Additional topics as required to provide Owner with the ability to manage, troubleshoot, modify and maintain the plant control system.
   2. Eleven months after the completion of the project a [two] day refresher training session shall be provided to review all of the topics covered in the original training session and answer any questions personnel have developed.

E. Contractor shall record the training sessions and provide a final edited version to the Owner in electronic video file format stored on a flash drive.

END OF SECTION 40 61 96

TODD CREEK
WWTP
I/O LIST

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
PRE-IPS-GATE-ZD-001	PRE-IPS-PLC-061	PRE-IPS-GATE-001	SCREEN EFFLUENT CHANNEL SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-GATE-ZB-001	PRE-IPS-PLC-061	PRE-IPS-GATE-001	SCREEN EFFLUENT CHANNEL SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-GATE-HS-001	PRE-IPS-PLC-061	PRE-IPS-GATE-001	SCREEN EFFLUENT CHANNEL SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-YA-001	PRE-IPS-PLC-061	PRE-IPS-GATE-001	SCREEN EFFLUENT CHANNEL SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-ZSC-001	PRE-IPS-PLC-061	PRE-IPS-GATE-001	SCREEN EFFLUENT CHANNEL SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-ZI-001	PRE-IPS-PLC-061	PRE-IPS-GATE-001	SCREEN EFFLUENT CHANNEL SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y201	
PRE-IPS-GATE-ZD-002	PRE-IPS-PLC-061	PRE-IPS-GATE-002	SCREEN EFFLUENT CHANNEL SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-GATE-ZB-002	PRE-IPS-PLC-061	PRE-IPS-GATE-002	SCREEN EFFLUENT CHANNEL SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-GATE-HS-002	PRE-IPS-PLC-061	PRE-IPS-GATE-002	SCREEN EFFLUENT CHANNEL SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-YA-002	PRE-IPS-PLC-061	PRE-IPS-GATE-002	SCREEN EFFLUENT CHANNEL SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-ZSC-002	PRE-IPS-PLC-061	PRE-IPS-GATE-002	SCREEN EFFLUENT CHANNEL SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-ZI-002	PRE-IPS-PLC-061	PRE-IPS-GATE-002	SCREEN EFFLUENT CHANNEL SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y201	
PRE-IPS-GATE-ZD-101	PRE-IPS-PLC-061	PRE-IPS-GATE-101	IPS WET WELL SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	2
PRE-IPS-GATE-ZB-101	PRE-IPS-PLC-061	PRE-IPS-GATE-101	IPS WET WELL SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	2
PRE-IPS-GATE-HS-101	PRE-IPS-PLC-061	PRE-IPS-GATE-101	IPS WET WELL SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	2
PRE-IPS-GATE-YA-101	PRE-IPS-PLC-061	PRE-IPS-GATE-101	IPS WET WELL SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	2
PRE-IPS-GATE-ZSC-101	PRE-IPS-PLC-061	PRE-IPS-GATE-101	IPS WET WELL SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	2
PRE-IPS-GATE-ZI-101	PRE-IPS-PLC-061	PRE-IPS-GATE-101	IPS WET WELL SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y201	2
PRE-IPS-LIT-LI-101	PRE-IPS-PLC-061	PRE-IPS-LIT-101	IPS WET WELL	LEVEL	AI	4-20mA	0-45	FEET	2-WIRE	SYSTEM	Y202	2, 8
PRE-IPS-LSLL-LALL-101	PRE-IPS-PLC-061	PRE-IPS-LSLL-101	IPS WET WELL	LEVEL LOW-LOW	DI	N.O. CONTACT	790.25	FEET(MSL)	N/A	SYSTEM	Y202	2, 8
PRE-IPS-LSL-LAL-101	PRE-IPS-PLC-061	PRE-IPS-LSL-101	IPS WET WELL	LEVEL LOW	DI	N.O. CONTACT	790.75	FEET(MSL)	N/A	SYSTEM	Y202	2, 8
PRE-IPS-LSH-LAH-101	PRE-IPS-PLC-061	PRE-IPS-LSH-101	IPS WET WELL	LEVEL HIGH	DI	N.O. CONTACT	796.28	FEET(MSL)	N/A	SYSTEM	Y202	2, 8
PRE-IPS-LSHH-LAHH-101	PRE-IPS-PLC-061	PRE-IPS-LSHH-101	IPS WET WELL	LEVEL HIGH-HIGH	DI	N.O. CONTACT	798.75	FEET(MSL)	N/A	SYSTEM	Y202	2, 8
PRE-IPS-LWCO-HS-101	PRE-IPS-PLC-061	PRE-IPS-LWCO-101	LWCO NO. 1 IN BYPASS	IN-BYPASS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-LWCO-YA-101	PRE-IPS-PLC-061	PRE-IPS-LWCO-101	LWCO NO. 1 CUTOUT	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-LIT-LI-102	PRE-IPS-PLC-061	PRE-IPS-LIT-102	IPS WET WELL	LEVEL	AI	4-20mA	0-45	FEET	2-WIRE	SYSTEM	Y202	2, 8
PRE-IPS-LSLL-LALL-102	PRE-IPS-PLC-061	PRE-IPS-LSLL-102	IPS WET WELL	LEVEL LOW-LOW	DI	N.O. CONTACT	790.25	FEET(MSL)	N/A	SYSTEM	Y202	2, 8
PRE-IPS-LSL-LAL-102	PRE-IPS-PLC-061	PRE-IPS-LSL-102	IPS WET WELL	LEVEL LOW	DI	N.O. CONTACT	790.75	FEET(MSL)	N/A	SYSTEM	Y202	2, 8
PRE-IPS-LSH-LAH-102	PRE-IPS-PLC-061	PRE-IPS-LSH-102	IPS WET WELL	LEVEL HIGH	DI	N.O. CONTACT	796.28	FEET(MSL)	N/A	SYSTEM	Y202	2, 8
PRE-IPS-LSHH-LAHH-102	PRE-IPS-PLC-061	PRE-IPS-LSHH-102	IPS WET WELL	LEVEL HIGH-HIGH	DI	N.O. CONTACT	798.75	FEET(MSL)	N/A	SYSTEM	Y202	2, 8
PRE-IPS-LWCO-HS-102	PRE-IPS-PLC-061	PRE-IPS-LWCO-101	LWCO NO. 2 IN BYPASS	IN-BYPASS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-LWCO-YA-102	PRE-IPS-PLC-061	PRE-IPS-LWCO-101	LWCO NO. 2 CUTOUT	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
PRE-IPS-PMP-HS-110A	PRE-IPS-PLC-061	PRE-IPS-PMP-110	INFLUENT SUBMERSIBLE PUMP	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-HS-110B	PRE-IPS-PLC-061	PRE-IPS-PMP-110	INFLUENT SUBMERSIBLE PUMP	IN-LOCAL	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-HS-110C	PRE-IPS-PLC-061	PRE-IPS-PMP-110	INFLUENT SUBMERSIBLE PUMP	IN-VFD	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-HS-110D	PRE-IPS-PLC-061	PRE-IPS-PMP-110	INFLUENT SUBMERSIBLE PUMP	IN-BYPASS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-MN-110A	PRE-IPS-PLC-061	PRE-IPS-PMP-110	INFLUENT SUBMERSIBLE PUMP	VFD RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-MN-110B	PRE-IPS-PLC-061	PRE-IPS-PMP-110	INFLUENT SUBMERSIBLE PUMP	BYPASS RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-TAH-110	PRE-IPS-PLC-061	PRE-IPS-PMP-110	INFLUENT SUBMERSIBLE PUMP TEMP HIGH	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y202	
PRE-IPS-PMP-MAH-110	PRE-IPS-PLC-061	PRE-IPS-PMP-110	INFLUENT SUBMERSIBLE PUMP SEAL LEAK	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y202	
PRE-IPS-PMP-YA-110A	PRE-IPS-PLC-061	PRE-IPS-PMP-110	INFLUENT SUBMERSIBLE PUMP	VFD FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-YA-110B	PRE-IPS-PLC-061	PRE-IPS-PMP-110	INFLUENT SUBMERSIBLE PUMP	OVERLOAD	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-MD-110	PRE-IPS-PLC-061	PRE-IPS-PMP-110	INFLUENT SUBMERSIBLE PUMP	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y202	
PRE-IPS-PMP-II-110	PRE-IPS-PLC-061	PRE-IPS-PMP-110	INFLUENT SUBMERSIBLE PUMP	CURRENT	AI	COMM	N/A	N/A	N/A	N/A	Y202	
PRE-IPS-PMP-SI-110	PRE-IPS-PLC-061	PRE-IPS-PMP-110	INFLUENT SUBMERSIBLE PUMP	SPEED	AI	4-20mA	0 - 100	%	2-WIRE	FIELD	Y202	
PRE-IPS-PMP-SC-110	PRE-IPS-PLC-061	PRE-IPS-PMP-110	INFLUENT SUBMERSIBLE PUMP	SPEED CONTROL	AO	4-20mA	0 - 100	%	2-WIRE	SYSTEM	Y202	
PRE-IPS-PMP-HS-120A	PRE-IPS-PLC-061	PRE-IPS-PMP-120	INFLUENT SUBMERSIBLE PUMP	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-HS-120B	PRE-IPS-PLC-061	PRE-IPS-PMP-120	INFLUENT SUBMERSIBLE PUMP	IN-LOCAL	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-HS-120C	PRE-IPS-PLC-061	PRE-IPS-PMP-120	INFLUENT SUBMERSIBLE PUMP	IN-VFD	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-HS-120D	PRE-IPS-PLC-061	PRE-IPS-PMP-120	INFLUENT SUBMERSIBLE PUMP	IN-BYPASS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-MN-120A	PRE-IPS-PLC-061	PRE-IPS-PMP-120	INFLUENT SUBMERSIBLE PUMP	VFD RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-MN-120B	PRE-IPS-PLC-061	PRE-IPS-PMP-120	INFLUENT SUBMERSIBLE PUMP	BYPASS RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-TAH-120	PRE-IPS-PLC-061	PRE-IPS-PMP-120	INFLUENT SUBMERSIBLE PUMP TEMP HIGH	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y202	
PRE-IPS-PMP-MAH-120	PRE-IPS-PLC-061	PRE-IPS-PMP-120	INFLUENT SUBMERSIBLE PUMP SEAL LEAK	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y202	
PRE-IPS-PMP-YA-120A	PRE-IPS-PLC-061	PRE-IPS-PMP-120	INFLUENT SUBMERSIBLE PUMP	VFD FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-YA-120B	PRE-IPS-PLC-061	PRE-IPS-PMP-120	INFLUENT SUBMERSIBLE PUMP	OVERLOAD	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-MD-120	PRE-IPS-PLC-061	PRE-IPS-PMP-120	INFLUENT SUBMERSIBLE PUMP	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y202	
PRE-IPS-PMP-II-120	PRE-IPS-PLC-061	PRE-IPS-PMP-120	INFLUENT SUBMERSIBLE PUMP	CURRENT	AI	COMM	N/A	N/A	N/A	N/A	Y202	
PRE-IPS-PMP-SI-120	PRE-IPS-PLC-061	PRE-IPS-PMP-120	INFLUENT SUBMERSIBLE PUMP	SPEED	AI	4-20mA	0 - 100	%	2-WIRE	FIELD	Y202	
PRE-IPS-PMP-SC-120	PRE-IPS-PLC-061	PRE-IPS-PMP-120	INFLUENT SUBMERSIBLE PUMP	SPEED CONTROL	AO	4-20mA	0 - 100	%	2-WIRE	SYSTEM	Y202	
PRE-IPS-PMP-HS-130A	PRE-IPS-PLC-061	PRE-IPS-PMP-130	INFLUENT SUBMERSIBLE PUMP	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-HS-130B	PRE-IPS-PLC-061	PRE-IPS-PMP-130	INFLUENT SUBMERSIBLE PUMP	IN-LOCAL	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-HS-130C	PRE-IPS-PLC-061	PRE-IPS-PMP-130	INFLUENT SUBMERSIBLE PUMP	IN-VFD	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-HS-130D	PRE-IPS-PLC-061	PRE-IPS-PMP-130	INFLUENT SUBMERSIBLE PUMP	IN-BYPASS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-MN-130A	PRE-IPS-PLC-061	PRE-IPS-PMP-130	INFLUENT SUBMERSIBLE PUMP	VFD RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-MN-130B	PRE-IPS-PLC-061	PRE-IPS-PMP-130	INFLUENT SUBMERSIBLE PUMP	BYPASS RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-TAH-130	PRE-IPS-PLC-061	PRE-IPS-PMP-130	INFLUENT SUBMERSIBLE PUMP TEMP HIGH	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y202	
PRE-IPS-PMP-MAH-130	PRE-IPS-PLC-061	PRE-IPS-PMP-130	INFLUENT SUBMERSIBLE PUMP SEAL LEAK	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y202	
PRE-IPS-PMP-YA-130A	PRE-IPS-PLC-061	PRE-IPS-PMP-130	INFLUENT SUBMERSIBLE PUMP	VFD FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-YA-130B	PRE-IPS-PLC-061	PRE-IPS-PMP-130	INFLUENT SUBMERSIBLE PUMP	OVERLOAD	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-MD-130	PRE-IPS-PLC-061	PRE-IPS-PMP-130	INFLUENT SUBMERSIBLE PUMP	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y202	
PRE-IPS-PMP-II-130	PRE-IPS-PLC-061	PRE-IPS-PMP-130	INFLUENT SUBMERSIBLE PUMP	CURRENT	AI	COMM	N/A	N/A	N/A	N/A	Y202	
PRE-IPS-PMP-SI-130	PRE-IPS-PLC-061	PRE-IPS-PMP-130	INFLUENT SUBMERSIBLE PUMP	SPEED	AI	4-20mA	0 - 100	%	2-WIRE	FIELD	Y202	
PRE-IPS-PMP-SC-130	PRE-IPS-PLC-061	PRE-IPS-PMP-130	INFLUENT SUBMERSIBLE PUMP	SPEED CONTROL	AO	4-20mA	0 - 100	%	2-WIRE	SYSTEM	Y202	

TODD CREEK
WWTP
I/O LIST

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
PRE-IPS-PMP-HS-140A	PRE-IPS-PLC-061	PRE-IPS-PMP-140	INFLUENT SUBMERSIBLE PUMP	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-HS-140B	PRE-IPS-PLC-061	PRE-IPS-PMP-140	INFLUENT SUBMERSIBLE PUMP	IN-LOCAL	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-HS-140C	PRE-IPS-PLC-061	PRE-IPS-PMP-140	INFLUENT SUBMERSIBLE PUMP	IN-VFD	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-HS-140D	PRE-IPS-PLC-061	PRE-IPS-PMP-140	INFLUENT SUBMERSIBLE PUMP	IN-BYPASS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-MN-140A	PRE-IPS-PLC-061	PRE-IPS-PMP-140	INFLUENT SUBMERSIBLE PUMP	VFD RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-MN-140B	PRE-IPS-PLC-061	PRE-IPS-PMP-140	INFLUENT SUBMERSIBLE PUMP	BYPASS RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-TAH-140	PRE-IPS-PLC-061	PRE-IPS-PMP-140	INFLUENT SUBMERSIBLE PUMP TEMP HIGH	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y202	
PRE-IPS-PMP-MAH-140	PRE-IPS-PLC-061	PRE-IPS-PMP-140	INFLUENT SUBMERSIBLE PUMP SEAL LEAK	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y202	
PRE-IPS-PMP-YA-140A	PRE-IPS-PLC-061	PRE-IPS-PMP-140	INFLUENT SUBMERSIBLE PUMP	VFD FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-YA-140B	PRE-IPS-PLC-061	PRE-IPS-PMP-140	INFLUENT SUBMERSIBLE PUMP	OVERLOAD	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-MD-140	PRE-IPS-PLC-061	PRE-IPS-PMP-140	INFLUENT SUBMERSIBLE PUMP	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y202	
PRE-IPS-PMP-II-140	PRE-IPS-PLC-061	PRE-IPS-PMP-140	INFLUENT SUBMERSIBLE PUMP	CURRENT	AI	COMM	N/A	N/A	N/A	N/A	Y202	
PRE-IPS-PMP-SI-140	PRE-IPS-PLC-061	PRE-IPS-PMP-140	INFLUENT SUBMERSIBLE PUMP	SPEED	AI	4-20mA	0 - 100	%	2-WIRE	FIELD	Y202	
PRE-IPS-PMP-SC-140	PRE-IPS-PLC-061	PRE-IPS-PMP-140	INFLUENT SUBMERSIBLE PUMP	SPEED CONTROL	AO	4-20mA	0 - 100	%	2-WIRE	SYSTEM	Y202	
PRE-IPS-PMP-HS-150A	PRE-IPS-PLC-061	PRE-IPS-PMP-150	INFLUENT SUBMERSIBLE PUMP	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-HS-150B	PRE-IPS-PLC-061	PRE-IPS-PMP-150	INFLUENT SUBMERSIBLE PUMP	IN-LOCAL	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-HS-150C	PRE-IPS-PLC-061	PRE-IPS-PMP-150	INFLUENT SUBMERSIBLE PUMP	IN-VFD	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-HS-150D	PRE-IPS-PLC-061	PRE-IPS-PMP-150	INFLUENT SUBMERSIBLE PUMP	IN-BYPASS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-MN-150A	PRE-IPS-PLC-061	PRE-IPS-PMP-150	INFLUENT SUBMERSIBLE PUMP	VFD RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-MN-150B	PRE-IPS-PLC-061	PRE-IPS-PMP-150	INFLUENT SUBMERSIBLE PUMP	BYPASS RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-TAH-150	PRE-IPS-PLC-061	PRE-IPS-PMP-150	INFLUENT SUBMERSIBLE PUMP TEMP HIGH	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y202	
PRE-IPS-PMP-MAH-150	PRE-IPS-PLC-061	PRE-IPS-PMP-150	INFLUENT SUBMERSIBLE PUMP SEAL LEAK	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y202	
PRE-IPS-PMP-YA-150A	PRE-IPS-PLC-061	PRE-IPS-PMP-150	INFLUENT SUBMERSIBLE PUMP	VFD FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-YA-150B	PRE-IPS-PLC-061	PRE-IPS-PMP-150	INFLUENT SUBMERSIBLE PUMP	OVERLOAD	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y202	
PRE-IPS-PMP-MD-150	PRE-IPS-PLC-061	PRE-IPS-PMP-150	INFLUENT SUBMERSIBLE PUMP	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y202	
PRE-IPS-PMP-II-150	PRE-IPS-PLC-061	PRE-IPS-PMP-150	INFLUENT SUBMERSIBLE PUMP	CURRENT	AI	COMM	N/A	N/A	N/A	N/A	Y202	
PRE-IPS-PMP-SI-150	PRE-IPS-PLC-061	PRE-IPS-PMP-150	INFLUENT SUBMERSIBLE PUMP	SPEED	AI	4-20mA	0 - 100	%	2-WIRE	FIELD	Y202	
PRE-IPS-PMP-SC-150	PRE-IPS-PLC-061	PRE-IPS-PMP-150	INFLUENT SUBMERSIBLE PUMP	SPEED CONTROL	AO	4-20mA	0 - 100	%	2-WIRE	SYSTEM	Y202	
PRE-IPS-PIT-PI-110	PRE-IPS-PLC-061	PRE-IPS-PIT-110	INFLUENT SUBMERSIBLE PUMP	PRESSURE	AI	4-20mA	0-150	PSI	2-WIRE	SYSTEM	Y202	2, 8
PRE-IPS-PIT-PI-120	PRE-IPS-PLC-061	PRE-IPS-PIT-120	INFLUENT SUBMERSIBLE PUMP	PRESSURE	AI	4-20mA	0-150	PSI	2-WIRE	SYSTEM	Y202	2, 8
PRE-IPS-PIT-PI-130	PRE-IPS-PLC-061	PRE-IPS-PIT-130	INFLUENT SUBMERSIBLE PUMP	PRESSURE	AI	4-20mA	0-150	PSI	2-WIRE	SYSTEM	Y202	2, 8
PRE-IPS-PIT-PI-140	PRE-IPS-PLC-061	PRE-IPS-PIT-140	INFLUENT SUBMERSIBLE PUMP	PRESSURE	AI	4-20mA	0-150	PSI	2-WIRE	SYSTEM	Y202	2, 8
PRE-IPS-PIT-PI-150	PRE-IPS-PLC-061	PRE-IPS-PIT-150	INFLUENT SUBMERSIBLE PUMP	PRESSURE	AI	4-20mA	0-150	PSI	2-WIRE	SYSTEM	Y202	2, 8

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
PRE-IPS-SWB_52U1-HS-001	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 CIRCUIT BREAKER 52-U1	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A		6
PRE-IPS-SWB_52U1-YA-001A	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 CIRCUIT BREAKER 52-U1 TRIP	ALARM	DI	COMM	N/A	N/A	N/A	N/A		6
PRE-IPS-SWB_52U1-YA-001B	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 CIRCUIT BREAKER 52-U1 OPEN/CLOSE	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A		6
PRE-IPS-SWB_52U1-YN-001	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 SOURCE AVAILABLE	STATUS	DI	COMM	N/A	N/A	N/A	N/A		6
PRE-IPS-SWB_52U1-ZSC-001	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 CIRCUIT BREAKER 52-U1	CLOSED	DI	COMM	N/A	N/A	N/A	N/A		6
PRE-IPS-SWB_52U1-ZSO-001	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 CIRCUIT BREAKER 52-U1	OPEN	DI	COMM	N/A	N/A	N/A	N/A		6
PRE-IPS-SWB_52U1-EI-001AN	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 A-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
PRE-IPS-SWB_52U1-EI-001BN	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 B-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
PRE-IPS-SWB_52U1-EI-001CN	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 C-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
PRE-IPS-SWB_52U1-EI-001AB	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 A-B PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
PRE-IPS-SWB_52U1-EI-001BC	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 B-C PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
PRE-IPS-SWB_52U1-EI-001CA	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 C-A PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
PRE-IPS-SWB_52U1-II-001A	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 A LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
PRE-IPS-SWB_52U1-II-001B	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 B LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
PRE-IPS-SWB_52U1-II-001C	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 C LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
PRE-IPS-SWB_52U1-JI-001A	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 AVERAGE APPARENT	POWER	AI	COMM		KVA	N/A	N/A		4, 6
PRE-IPS-SWB_52U1-JI-001R	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 AVERAGE REAL	POWER	AI	COMM		KW	N/A	N/A		4, 6
PRE-IPS-SWB_52U1-JQ-001	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 TOTAL	ENERGY	AI	COMM		KWh	N/A	N/A		4, 6
PRE-IPS-SWB_52U1-JN-001	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1 AVERAGE	POWER FACTOR	AI	COMM		PF	N/A	N/A		4, 6
PRE-IPS-SWB_52U1-SI-001	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.1	FREQUENCY	AI	COMM		HERTZ	N/A	N/A		4, 6
PRE-IPS-SWB_52U2-HS-001	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 CIRCUIT BREAKER 52-U2	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A		6
PRE-IPS-SWB_52U2-YA-001A	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 CIRCUIT BREAKER 52-U2 TRIP	ALARM	DI	COMM	N/A	N/A	N/A	N/A		6
PRE-IPS-SWB_52U2-YA-001B	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 CIRCUIT BREAKER 52-U2 OPEN/CLOSE	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A		6
PRE-IPS-SWB_52U2-YN-001	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 SOURCE AVAILABLE	STATUS	DI	COMM	N/A	N/A	N/A	N/A		6
PRE-IPS-SWB_52U2-ZSC-001	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 CIRCUIT BREAKER 52-U2	CLOSED	DI	COMM	N/A	N/A	N/A	N/A		6
PRE-IPS-SWB_52U2-ZSO-001	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 CIRCUIT BREAKER 52-U2	OPEN	DI	COMM	N/A	N/A	N/A	N/A		6
PRE-IPS-SWB_52U2-EI-001AN	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 A-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
PRE-IPS-SWB_52U2-EI-001BN	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 B-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
PRE-IPS-SWB_52U2-EI-001CN	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 C-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
PRE-IPS-SWB_52U2-EI-001AB	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 A-B PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
PRE-IPS-SWB_52U2-EI-001BC	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 B-C PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
PRE-IPS-SWB_52U2-EI-001CA	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 C-A PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
PRE-IPS-SWB_52U2-II-001A	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 A LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
PRE-IPS-SWB_52U2-II-001B	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 B LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
PRE-IPS-SWB_52U2-II-001C	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 C LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
PRE-IPS-SWB_52U2-JI-001A	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 AVERAGE APPARENT	POWER	AI	COMM		KVA	N/A	N/A		4, 6
PRE-IPS-SWB_52U2-JI-001R	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 AVERAGE REAL	POWER	AI	COMM		KW	N/A	N/A		4, 6
PRE-IPS-SWB_52U2-JQ-001	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 TOTAL	ENERGY	AI	COMM		KWh	N/A	N/A		4, 6
PRE-IPS-SWB_52U2-JN-001	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2 AVERAGE	POWER FACTOR	AI	COMM		PF	N/A	N/A		4, 6
PRE-IPS-SWB_52U2-SI-001	PRE-IPS-PLC-061	PRE-IPS-SWB-001	UTILITY NO.2	FREQUENCY	AI	COMM		HERTZ	N/A	N/A		4, 6

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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
PRE-IPS-CTRL-TAH-001	PRE-IPS-PLC-061	PRE-IPS-CTRL-001	IPS ELECTRICAL ROOM	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-IPS-CTRL-YA-001A	PRE-IPS-PLC-061	PRE-IPS-CTRL-001	DIRTY FILTER	WARNING	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-IPS-CTRL-YA-001B	PRE-IPS-PLC-061	PRE-IPS-CTRL-001	HVAC CONTROL SYSTEM	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-IPS-UPS-JA-051	PRE-IPS-PLC-061	PRE-IPS-UPS-051	UPS SYSTEM REPLACE BATTERY	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-UPS-JAL-051	PRE-IPS-PLC-061	PRE-IPS-UPS-051	UPS SYSTEM LOW BATTERY	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-UPS-YA-051A	PRE-IPS-PLC-061	PRE-IPS-UPS-051	UPS SYSTEM	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-UPS-YN-051	PRE-IPS-PLC-061	PRE-IPS-UPS-051	UPS SYSTEM ON BATTERY	STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-UPS-ZS-051	PRE-IPS-PLC-061	PRE-IPS-UPS-051	UPS SYSTEM BYPASS	STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-NSW-YA-061A	PRE-IPS-PLC-061	PRE-IPS-NSW-061	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-NSW-YA-061B	PRE-IPS-PLC-061	PRE-IPS-NSW-061	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-NSW-YA-061C	PRE-IPS-PLC-061	PRE-IPS-NSW-061	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-NSW-TI-061	PRE-IPS-PLC-061	PRE-IPS-NSW-061	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		4, 9
PRE-IPS-NSW-YA-071A	PRE-IPS-PLC-061	PRE-IPS-NSW-071	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-NSW-YA-071B	PRE-IPS-PLC-061	PRE-IPS-NSW-071	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-NSW-YA-071C	PRE-IPS-PLC-061	PRE-IPS-NSW-071	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-NSW-TI-071	PRE-IPS-PLC-061	PRE-IPS-NSW-071	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		4, 9

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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
PRE-IPS-AIT-YA-001A	PRE-IPS-PLC-062	PRE-IPS-AIT-001	COARSE SCREENING COMBUSTIBLE GAS	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-AIT-YA-001B	PRE-IPS-PLC-062	PRE-IPS-AIT-001	COARSE SCREENING AREA GAS CONTROL PANEL	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-AE-AI-001	PRE-IPS-PLC-062	PRE-IPS-AE-001	COARSE SCREENING COMBUSTIBLE GAS	LEVEL	AI	4-20mA	0-100%	LEL	3-WIRE	FIELD	Y201	
PRE-IPS-AE-AI-003	PRE-IPS-PLC-062	PRE-IPS-AE-003	COARSE SCREENING H2S GAS	LEVEL	AI	4-20mA	0-2000	PPM	3-WIRE	FIELD	Y201	
PRE-IPS-AIT-YA-002A	PRE-IPS-PLC-062	PRE-IPS-AIT-002	COARSE SCREENING OZONE GAS	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-AIT-YA-002B	PRE-IPS-PLC-062	PRE-IPS-AIT-002	COARSE SCREENING OZONE GAS CONTROL PANEL	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-AE-AI-002	PRE-IPS-PLC-062	PRE-IPS-AE-002	COARSE SCREENING LEVEL 2 OZONE GAS	LEVEL	AI	4-20mA	0-100%	O3	3-WIRE	FIELD	Y201	
PRE-IPS-LSH-LAH-001	PRE-IPS-PLC-062	PRE-IPS-LSH-001	COARSE SCREENING INFLUENT CHANNEL	LEVEL HIGH	DI	N.O. CONTACT		FEET(MSL)	N/A	SYSTEM	Y201	8
PRE-IPS-GATE-ZD-011	PRE-IPS-PLC-062	PRE-IPS-GATE-011	SCREEN CHANNEL SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-GATE-ZB-011	PRE-IPS-PLC-062	PRE-IPS-GATE-011	SCREEN CHANNEL SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-GATE-HS-011	PRE-IPS-PLC-062	PRE-IPS-GATE-011	SCREEN CHANNEL SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-YA-011	PRE-IPS-PLC-062	PRE-IPS-GATE-011	SCREEN CHANNEL SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-ZSC-011	PRE-IPS-PLC-062	PRE-IPS-GATE-011	SCREEN CHANNEL SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-ZI-011	PRE-IPS-PLC-062	PRE-IPS-GATE-011	SCREEN CHANNEL SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y201	
PRE-IPS-GATE-ZD-012	PRE-IPS-PLC-062	PRE-IPS-GATE-012	SCREEN CHANNEL SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-GATE-ZB-012	PRE-IPS-PLC-062	PRE-IPS-GATE-012	SCREEN CHANNEL SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-GATE-HS-012	PRE-IPS-PLC-062	PRE-IPS-GATE-012	SCREEN CHANNEL SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-YA-012	PRE-IPS-PLC-062	PRE-IPS-GATE-012	SCREEN CHANNEL SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-ZSC-012	PRE-IPS-PLC-062	PRE-IPS-GATE-012	SCREEN CHANNEL SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-ZI-012	PRE-IPS-PLC-062	PRE-IPS-GATE-012	SCREEN CHANNEL SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y201	
PRE-IPS-GATE-ZD-021	PRE-IPS-PLC-062	PRE-IPS-GATE-021	SCREEN CHANNEL SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-GATE-ZB-021	PRE-IPS-PLC-062	PRE-IPS-GATE-021	SCREEN CHANNEL SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-GATE-HS-021	PRE-IPS-PLC-062	PRE-IPS-GATE-021	SCREEN CHANNEL SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-YA-021	PRE-IPS-PLC-062	PRE-IPS-GATE-021	SCREEN CHANNEL SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-ZSC-021	PRE-IPS-PLC-062	PRE-IPS-GATE-021	SCREEN CHANNEL SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-ZI-021	PRE-IPS-PLC-062	PRE-IPS-GATE-021	SCREEN CHANNEL SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y201	
PRE-IPS-GATE-ZD-022	PRE-IPS-PLC-062	PRE-IPS-GATE-022	SCREEN CHANNEL SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-GATE-ZB-022	PRE-IPS-PLC-062	PRE-IPS-GATE-022	SCREEN CHANNEL SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-GATE-HS-022	PRE-IPS-PLC-062	PRE-IPS-GATE-022	SCREEN CHANNEL SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-YA-022	PRE-IPS-PLC-062	PRE-IPS-GATE-022	SCREEN CHANNEL SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-ZSC-022	PRE-IPS-PLC-062	PRE-IPS-GATE-022	SCREEN CHANNEL SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-ZI-022	PRE-IPS-PLC-062	PRE-IPS-GATE-022	SCREEN CHANNEL SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y201	
PRE-IPS-GATE-ZD-031	PRE-IPS-PLC-062	PRE-IPS-GATE-031	SCREEN CHANNEL SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-GATE-ZB-031	PRE-IPS-PLC-062	PRE-IPS-GATE-031	SCREEN CHANNEL SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-GATE-HS-031	PRE-IPS-PLC-062	PRE-IPS-GATE-031	SCREEN CHANNEL SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-YA-031	PRE-IPS-PLC-062	PRE-IPS-GATE-031	SCREEN CHANNEL SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-ZSC-031	PRE-IPS-PLC-062	PRE-IPS-GATE-031	SCREEN CHANNEL SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
PRE-IPS-GATE-ZI-031	PRE-IPS-PLC-062	PRE-IPS-GATE-031	SCREEN CHANNEL SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y201	
PRE-IPS-GATE-ZD-032	PRE-IPS-PLC-062	PRE-IPS-GATE-032	SCREEN CHANNEL SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-GATE-ZB-032	PRE-IPS-PLC-062	PRE-IPS-GATE-032	SCREEN CHANNEL SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y201	
PRE-IPS-GATE-HS-032	PRE-IPS-PLC-062	PRE-IPS-GATE-032	SCREEN CHANNEL SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-YA-032	PRE-IPS-PLC-062	PRE-IPS-GATE-032	SCREEN CHANNEL SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-ZSC-032	PRE-IPS-PLC-062	PRE-IPS-GATE-032	SCREEN CHANNEL SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y201	
PRE-IPS-GATE-ZI-032	PRE-IPS-PLC-062	PRE-IPS-GATE-032	SCREEN CHANNEL SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y201	
PRE-IPS-MCP-YS-010	PRE-IPS-PLC-062	PRE-IPS-MCP-010	CHANNEL NO.1 SCREEN SYSTEM INHIBIT	ENABLE/DISABLE	DO	COMM	N/A	N/A	N/A	N/A	Y201	7
PRE-IPS-LSH-LAH-010	PRE-IPS-PLC-062	PRE-IPS-LSH-010	CHANNEL NO.1	LEVEL HIGH	DI	COMM		FEET(MSL)	N/A	N/A	Y201	6
PRE-IPS-SCR-HSS-010	PRE-IPS-PLC-062	PRE-IPS-SCR-010	CHANNEL NO.1 SCREEN	EMERGENCY STOP	DI	COMM	N/A	N/A	N/A	N/A	Y201	6
PRE-IPS-SCR-HS-010A	PRE-IPS-PLC-062	PRE-IPS-SCR-010	CHANNEL NO.1 SCREEN	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y201	6
PRE-IPS-SCR-HS-010B	PRE-IPS-PLC-062	PRE-IPS-SCR-010	CHANNEL NO.1 SCREEN	IN-HAND	DI	COMM	N/A	N/A	N/A	N/A	Y201	6
PRE-IPS-SCR-MN-010A	PRE-IPS-PLC-062	PRE-IPS-SCR-010	CHANNEL NO.1 SCREEN	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y201	6
PRE-IPS-SCR-YA-010	PRE-IPS-PLC-062	PRE-IPS-SCR-010	CHANNEL NO.1 SCREEN	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y201	6
PRE-IPS-SCR-TAH-010	PRE-IPS-PLC-062	PRE-IPS-SCR-010	CHANNEL NO.1 SCREEN	TEMPERATURE-HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y201	6
PRE-IPS-LE-LI-010A	PRE-IPS-PLC-062	PRE-IPS-LIT-010	CHANNEL NO.1 SCREEN UPSTREAM LEVEL	LEVEL	AI	COMM		INCHES	N/A	N/A	Y201	4,6
PRE-IPS-LE-LI-010B	PRE-IPS-PLC-062	PRE-IPS-LIT-010	CHANNEL NO.1 SCREEN DOWNSTREAM LEVEL	LEVEL	AI	COMM		INCHES	N/A	N/A	Y201	4,6
PRE-IPS-LDT-LI-010	PRE-IPS-PLC-062	PRE-IPS-MCP-010	CHANNEL NO.1 SCREEN DIFFERENTIAL LEVEL	LEVEL	AI	COMM		INCHES	N/A	N/A	Y201	4,6
PRE-IPS-MCP-YS-020	PRE-IPS-PLC-062	PRE-IPS-MCP-020	CHANNEL NO.2 SCREEN SYSTEM INHIBIT	ENABLE/DISABLE	DO	COMM	N/A	N/A	N/A	N/A	Y201	7
PRE-IPS-LSH-LAH-020	PRE-IPS-PLC-062	PRE-IPS-LSH-020	CHANNEL NO.2	LEVEL HIGH	DI	COMM		FEET(MSL)	N/A	N/A	Y201	6
PRE-IPS-SCR-HSS-020	PRE-IPS-PLC-062	PRE-IPS-SCR-020	CHANNEL NO.2 SCREEN	EMERGENCY STOP	DI	COMM	N/A	N/A	N/A	N/A	Y201	6
PRE-IPS-SCR-HS-020A	PRE-IPS-PLC-062	PRE-IPS-SCR-020	CHANNEL NO.2 SCREEN	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y201	6
PRE-IPS-SCR-HS-020B	PRE-IPS-PLC-062	PRE-IPS-SCR-020	CHANNEL NO.2 SCREEN	IN-HAND	DI	COMM	N/A	N/A	N/A	N/A	Y201	6
PRE-IPS-SCR-MN-020A	PRE-IPS-PLC-062	PRE-IPS-SCR-020	CHANNEL NO.2 SCREEN	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y201	6
PRE-IPS-SCR-YA-020	PRE-IPS-PLC-062	PRE-IPS-SCR-020	CHANNEL NO.2 SCREEN	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y201	6
PRE-IPS-SCR-TAH-020	PRE-IPS-PLC-062	PRE-IPS-SCR-020	CHANNEL NO.2 SCREEN	TEMPERATURE-HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y201	6
PRE-IPS-LE-LI-020A	PRE-IPS-PLC-062	PRE-IPS-LIT-020	CHANNEL NO.2 SCREEN UPSTREAM LEVEL	LEVEL	AI	COMM		INCHES	N/A	N/A	Y201	4,6
PRE-IPS-LE-LI-020B	PRE-IPS-PLC-062	PRE-IPS-LIT-020	CHANNEL NO.2 SCREEN DOWNSTREAM LEVEL	LEVEL	AI	COMM		INCHES	N/A	N/A	Y201	4,6
PRE-IPS-LDT-LI-020	PRE-IPS-PLC-062	PRE-IPS-MCP-020	CHANNEL NO.2 SCREEN DIFFERENTIAL LEVEL	LEVEL	AI	COMM		INCHES	N/A	N/A	Y201	4,6
PRE-ODR-MCP-PI-200A	PRE-IPS-PLC-062	PRE-ODR-MCP-200	ODOR CONTROL ENCLOSURE - OZONE	PRESSURE	AI	COMM		PSI	N/A	N/A	Y203	2, 4, 6
PRE-ODR-MCP-PI-200B	PRE-IPS-PLC-062	PRE-ODR-MCP-200	ODOR CONTROL ENCLOSURE - WATER	PRESSURE	AI	COMM		PSI	N/A	N/A	Y203	2, 4, 6
PRE-ODR-MCP-PI-200C	PRE-IPS-PLC-062	PRE-ODR-MCP-200	ODOR CONTROL ENCLOSURE - AIR	PRESSURE	AI	COMM		PSI	N/A	N/A	Y203	2, 4, 6
PRE-ODR-MCP-FAL-200	PRE-IPS-PLC-062	PRE-ODR-MCP-200	ODOR CONTROL ENCLOSURE - OZONE	FLOW LOW	DI	COMM	N/A	N/A	N/A	N/A	Y203	2, 4, 6
PRE-ODR-MCP-TAH-200	PRE-IPS-PLC-062	PRE-ODR-MCP-200	ODOR CONTROL ENCLOSURE	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y203	2, 4, 6
PRE-ODR-MCP-MN-200	PRE-IPS-PLC-062	PRE-ODR-MCP-200	ODOR CONTROL ENCLOSURE	ENABLE/DISABLE	DO	COMM	N/A	N/A	N/A	N/A	Y203	2
PRE-ODR-MCP-YA-200	PRE-IPS-PLC-062	PRE-ODR-MCP-200	ODOR CONTROL ENCLOSURE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y203	2

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
PRE-H2O2-LIT-LI-101	PRE-IPS-PLC-062	H2O2-LIT-101	HYDROGEN PEROXIDE BULK TANK	LEVEL	AI	COMM		INCHES	N/A	N/A	Y204	4, 6
PRE-H2O2-LS-LAH-101	PRE-IPS-PLC-062	H2O2-LS-101	HYDROGEN PEROXIDE BULK TANK LEAK DETECTION	LEVEL HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y204	6
PRE-H2O2-MCP-HS-100	PRE-IPS-PLC-062	H2O2-MCP-100	H2O2 SYSTEM REMOTE MODE STATUS	STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y204	6
PRE-H2O2-MCP-YA-100	PRE-IPS-PLC-062	H2O2-MCP-100	H2O2 SYSTEM COMMON FAULT	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y204	6
PRE-H2O2-FIT-FI-101	PRE-IPS-PLC-062	H2O2-MCP-100	H2O2 CHEMICAL FLOW RATE	FLOW	AI	4-20mA	0-10	GPM	N/A	SYSTEM	Y204	6
PRE-H2O2-MCP-MN-100A	PRE-IPS-PLC-062	H2O2-MCP-100	H2O2 SYSTEM REMOTE RUN COMMAND	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y204	7
PRE-H2O2-MCP-MN-100B	PRE-IPS-PLC-062	H2O2-MCP-100	H2O2 AUTO (FLOW-PACING) MODE SELECT	ENABLE/DISABLE	DO	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y204	7
PRE-H2O2-MCP-SC-100	PRE-IPS-PLC-062	H2O2-MCP-100	H2O2 PUMP SPEED	SPEED CONTROL	AO	4-20mA	0-100%	%	2-WIRE	FIELD	Y204	7
PRE-H2O2-MCP-SI-100	PRE-IPS-PLC-062	H2O2-PMP-120	H2O2 PUMP SPEED	SPEED INDICATION	AI	4-20mA	0-100%	%	2-WIRE	FIELD	Y204	6
PRE-H2O2-MCP-FC-100	PRE-IPS-PLC-062	H2O2-MCP-100	INFLUENT FLOW	FLOW	AO	4-20mA	0-5000	GPM	2-WIRE	FIELD	Y204	7
PRE-H2O2-MCP-XC-100	PRE-IPS-PLC-062	H2O2-MCP-100	HYDROGEN PEROXIDE CHEMICAL CONCENTRATION	DOSE	AO	4-20mA	0-100	PPM	N/A	FIELD	Y204	7
PRE-H2O2-PMP-MN-110	PRE-IPS-PLC-062	H2O2-PMP-110	HYDROGEN PEROXIDE FEED PUMP NO. 1	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y204	6
PRE-H2O2-PMP-YA-110	PRE-IPS-PLC-062	H2O2-PMP-110	HYDROGEN PEROXIDE FEED PUMP NO. 1	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y204	6
PRE-H2O2-PMP-MN-120	PRE-IPS-PLC-062	H2O2-PMP-120	HYDROGEN PEROXIDE FEED PUMP NO. 2	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y204	6
PRE-H2O2-PMP-YA-120	PRE-IPS-PLC-062	H2O2-PMP-120	HYDROGEN PEROXIDE FEED PUMP NO. 2	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y204	6
PRE-H2O2-LS-LAH-102	PRE-IPS-PLC-062	H2O2-LS-102	HYDROGEN PEROXIDE FEED SKID LEAK DETECTION	LEVEL HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y204	6
PRE-H2O2-PIT-PI-101	PRE-IPS-PLC-062	H2O2-PIT-101	HYDROGEN PEROXIDE PUMP DISCHARGE	PRESSURE	AI	4-20mA		PSI	2-WIRE	FIELD	Y204	4, 6
PRE-IPS-CTRL-TAH-002	PRE-IPS-PLC-062	PRE-IPS-CTRL-002	COARSE SCREENING ELECTRICAL ROOM	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-IPS-CTRL-YA-002A	PRE-IPS-PLC-062	PRE-IPS-CTRL-002	DIRTY FILTER	WARNING	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-IPS-CTRL-YA-002B	PRE-IPS-PLC-062	PRE-IPS-CTRL-002	HVAC CONTROL SYSTEM	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-IPS-CTRL-YA-002C	PRE-IPS-PLC-062	PRE-IPS-CTRL-002	VENTILATION FAILURE	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-IPS-CTRL-YA-002D	PRE-IPS-PLC-062	PRE-IPS-CTRL-002	SMOKE ALARM	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-IPS-UPS-JA-052	PRE-IPS-PLC-062	PRE-IPS-UPS-052	UPS SYSTEM REPLACE BATTERY	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-UPS-JAL-052	PRE-IPS-PLC-062	PRE-IPS-UPS-052	UPS SYSTEM LOW BATTERY	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-UPS-YA-052A	PRE-IPS-PLC-062	PRE-IPS-UPS-052	UPS SYSTEM	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-UPS-YN-052	PRE-IPS-PLC-062	PRE-IPS-UPS-052	UPS SYSTEM ON BATTERY	STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-UPS-ZS-052	PRE-IPS-PLC-062	PRE-IPS-UPS-052	UPS SYSTEM BYPASS	STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-NSW-YA-062A	PRE-IPS-PLC-062	PRE-IPS-NSW-062	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-NSW-YA-062B	PRE-IPS-PLC-062	PRE-IPS-NSW-062	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-NSW-YA-062C	PRE-IPS-PLC-062	PRE-IPS-NSW-062	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-NSW-TI-062	PRE-IPS-PLC-062	PRE-IPS-NSW-062	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		3, 9
PRE-IPS-NSW-YA-072A	PRE-IPS-PLC-062	PRE-IPS-NSW-072	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-NSW-YA-072B	PRE-IPS-PLC-062	PRE-IPS-NSW-072	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-NSW-YA-072C	PRE-IPS-PLC-062	PRE-IPS-NSW-072	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-IPS-NSW-TI-072	PRE-IPS-PLC-062	PRE-IPS-NSW-072	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		3, 9

TODD CREEK
WWTP
I/O LIST

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
PRE-GRSC-AIT-YA-001A	PRE-GRSC-PLC-061	PRE-GRSC-AIT-001	HEADWORKS COMBUSTIBLE GAS	ALARM	DI	N.O. CONTACT	10%	LEL	N/A	SYSTEM	Y301	
PRE-GRSC-AIT-YA-001B	PRE-GRSC-PLC-061	PRE-GRSC-AIT-001	HEADWORKS AREA GAS CONTROL PANEL	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-AE-AI-001	PRE-GRSC-PLC-061	PRE-GRSC-AE-001	HEADWORKS LEVEL 1 COMBUSTIBLE GAS	LEVEL	AI	4-20mA	0-100%	LEL	3-WIRE	FIELD	Y301	
PRE-GRSC-AE-AI-002	PRE-GRSC-PLC-061	PRE-GRSC-AE-002	HEADWORKS LEVEL 2 COMBUSTIBLE GAS	LEVEL	AI	4-20mA	0-100%	LEL	3-WIRE	FIELD	Y302	
PRE-GRSC-FIT-FA-001	PRE-GRSC-PLC-061	PRE-GRSC-FIT-001	INFLUENT PUMP STATION	REVERSE FLOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	8,10
PRE-GRSC-FIT-FI-001	PRE-GRSC-PLC-061	PRE-GRSC-FIT-001	INFLUENT PUMP STATION	FLOW	AI	4-20mA	0 - 15,000	GPM	4-WIRE	FIELD	Y301	8
PRE-GRSC-PIT-PI-001	PRE-GRSC-PLC-061	PRE-GRSC-PIT-001	HEADWORKS PROCESS WATER	PRESSURE	AI	4-20mA	0 - 200	PSI	2-WIRE	SYSTEM	Y601	8
PRE-GRSC-PSL-PAL-001	PRE-GRSC-PLC-061	PRE-GRSC-PSL-001	HEADWORKS PROCESS WATER	PRESSURE LOW	DI	N.O. CONTACT	40	PSIG	N/A	SYSTEM	Y302	8
PRE-GRSC-GATE-ZD-101	PRE-GRSC-PLC-061	PRE-GRSC-GATE-101	SCREEN CHANNEL SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	
PRE-GRSC-GATE-ZB-101	PRE-GRSC-PLC-061	PRE-GRSC-GATE-101	SCREEN CHANNEL SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	
PRE-GRSC-GATE-HS-101	PRE-GRSC-PLC-061	PRE-GRSC-GATE-101	SCREEN CHANNEL SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-YA-101	PRE-GRSC-PLC-061	PRE-GRSC-GATE-101	SCREEN CHANNEL SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-ZSC-101	PRE-GRSC-PLC-061	PRE-GRSC-GATE-101	SCREEN CHANNEL SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-ZI-101	PRE-GRSC-PLC-061	PRE-GRSC-GATE-101	SCREEN CHANNEL SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y301	
PRE-GRSC-GATE-ZD-102	PRE-GRSC-PLC-061	PRE-GRSC-GATE-102	SCREEN CHANNEL SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	
PRE-GRSC-GATE-ZB-102	PRE-GRSC-PLC-061	PRE-GRSC-GATE-102	SCREEN CHANNEL SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	
PRE-GRSC-GATE-HS-102	PRE-GRSC-PLC-061	PRE-GRSC-GATE-102	SCREEN CHANNEL SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-YA-102	PRE-GRSC-PLC-061	PRE-GRSC-GATE-102	SCREEN CHANNEL SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-ZSC-102	PRE-GRSC-PLC-061	PRE-GRSC-GATE-102	SCREEN CHANNEL SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-ZI-102	PRE-GRSC-PLC-061	PRE-GRSC-GATE-102	SCREEN CHANNEL SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y301	
PRE-GRSC-GATE-ZD-201	PRE-GRSC-PLC-061	PRE-GRSC-GATE-201	SCREEN CHANNEL SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	
PRE-GRSC-GATE-ZB-201	PRE-GRSC-PLC-061	PRE-GRSC-GATE-201	SCREEN CHANNEL SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	
PRE-GRSC-GATE-HS-201	PRE-GRSC-PLC-061	PRE-GRSC-GATE-201	SCREEN CHANNEL SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-YA-201	PRE-GRSC-PLC-061	PRE-GRSC-GATE-201	SCREEN CHANNEL SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-ZSC-201	PRE-GRSC-PLC-061	PRE-GRSC-GATE-201	SCREEN CHANNEL SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-ZI-201	PRE-GRSC-PLC-061	PRE-GRSC-GATE-201	SCREEN CHANNEL SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y301	
PRE-GRSC-GATE-ZD-202	PRE-GRSC-PLC-061	PRE-GRSC-GATE-202	SCREEN CHANNEL SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	
PRE-GRSC-GATE-ZB-202	PRE-GRSC-PLC-061	PRE-GRSC-GATE-202	SCREEN CHANNEL SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	
PRE-GRSC-GATE-HS-202	PRE-GRSC-PLC-061	PRE-GRSC-GATE-202	SCREEN CHANNEL SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-YA-202	PRE-GRSC-PLC-061	PRE-GRSC-GATE-202	SCREEN CHANNEL SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-ZSC-202	PRE-GRSC-PLC-061	PRE-GRSC-GATE-202	SCREEN CHANNEL SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-ZI-202	PRE-GRSC-PLC-061	PRE-GRSC-GATE-202	SCREEN CHANNEL SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y301	

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
PRE-GRSC-GATE-ZD-301	PRE-GRSC-PLC-061	PRE-GRSC-GATE-301	GRIT EFFLUENT SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	
PRE-GRSC-GATE-ZB-301	PRE-GRSC-PLC-061	PRE-GRSC-GATE-301	GRIT EFFLUENT SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	
PRE-GRSC-GATE-HS-301	PRE-GRSC-PLC-061	PRE-GRSC-GATE-301	GRIT EFFLUENT SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-YA-301	PRE-GRSC-PLC-061	PRE-GRSC-GATE-301	GRIT EFFLUENT SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-ZSC-301	PRE-GRSC-PLC-061	PRE-GRSC-GATE-301	GRIT EFFLUENT SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-ZI-301	PRE-GRSC-PLC-061	PRE-GRSC-GATE-301	GRIT EFFLUENT SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y301	
PRE-GRSC-GATE-ZD-302	PRE-GRSC-PLC-061	PRE-GRSC-GATE-302	GRIT REMOVAL SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	
PRE-GRSC-GATE-ZB-302	PRE-GRSC-PLC-061	PRE-GRSC-GATE-302	GRIT REMOVAL SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	
PRE-GRSC-GATE-HS-302	PRE-GRSC-PLC-061	PRE-GRSC-GATE-302	GRIT REMOVAL SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-YA-302	PRE-GRSC-PLC-061	PRE-GRSC-GATE-302	GRIT REMOVAL SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-ZSC-302	PRE-GRSC-PLC-061	PRE-GRSC-GATE-302	GRIT REMOVAL SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-ZI-302	PRE-GRSC-PLC-061	PRE-GRSC-GATE-302	GRIT REMOVAL SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y301	
PRE-GRSC-GATE-ZD-303	PRE-GRSC-PLC-061	PRE-GRSC-GATE-303	FUTURE GRIT SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	
PRE-GRSC-GATE-ZB-303	PRE-GRSC-PLC-061	PRE-GRSC-GATE-303	FUTURE GRIT SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	
PRE-GRSC-GATE-HS-303	PRE-GRSC-PLC-061	PRE-GRSC-GATE-303	FUTURE GRIT SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-YA-303	PRE-GRSC-PLC-061	PRE-GRSC-GATE-303	FUTURE GRIT SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-ZSC-303	PRE-GRSC-PLC-061	PRE-GRSC-GATE-303	FUTURE GRIT SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	
PRE-GRSC-GATE-ZI-303	PRE-GRSC-PLC-061	PRE-GRSC-GATE-303	FUTURE GRIT SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y301	
PRE-GRSC-GATE-ZD-304	PRE-GRSC-PLC-061	PRE-GRSC-GATE-304	DEGRITTED INFLUENT TO AGS SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	2
PRE-GRSC-GATE-ZB-304	PRE-GRSC-PLC-061	PRE-GRSC-GATE-304	DEGRITTED INFLUENT TO AGS SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	2
PRE-GRSC-GATE-HS-304	PRE-GRSC-PLC-061	PRE-GRSC-GATE-304	DEGRITTED INFLUENT TO AGS SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	2
PRE-GRSC-GATE-YA-304	PRE-GRSC-PLC-061	PRE-GRSC-GATE-304	DEGRITTED INFLUENT TO AGS SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	2
PRE-GRSC-GATE-ZSC-304	PRE-GRSC-PLC-061	PRE-GRSC-GATE-304	DEGRITTED INFLUENT TO AGS SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	2
PRE-GRSC-GATE-ZI-304	PRE-GRSC-PLC-061	PRE-GRSC-GATE-304	DEGRITTED INFLUENT TO AGS SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y301	2
PRE-GRSC-MCP-YS-100	PRE-GRSC-PLC-061	PRE-GRSC-MCP-100	CHANNEL NO.1 SCREEN SYSTEM INHIBIT	ENABLE/DISABLE	DO	COMM	N/A	N/A	N/A	N/A	Y301	7
PRE-GRSC-LSH-LAH-100	PRE-GRSC-PLC-061	PRE-GRSC-LSH-100	CHANNEL NO.1	LEVEL HIGH	DI	COMM		FEET(MSL)	N/A	N/A	Y301	6
PRE-GRSC-SCR-HSS-110	PRE-GRSC-PLC-061	PRE-GRSC-SCR-100	CHANNEL NO.1 SCREEN	EMERGENCY STOP	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-SCR-HS-110A	PRE-GRSC-PLC-061	PRE-GRSC-SCR-110	CHANNEL NO.1 SCREEN	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-SCR-HS-110B	PRE-GRSC-PLC-061	PRE-GRSC-SCR-110	CHANNEL NO.1 SCREEN	IN-HAND	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-SCR-MN-110A	PRE-GRSC-PLC-061	PRE-GRSC-SCR-110	CHANNEL NO.1 SCREEN	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-SCR-MN-110B	PRE-GRSC-PLC-061	PRE-GRSC-SCR-110	CHANNEL NO.1 SCREEN	RUN-HIGH SPEED	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-SCR-YA-110	PRE-GRSC-PLC-061	PRE-GRSC-SCR-110	CHANNEL NO.1 SCREEN	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-SCR-TAH-110	PRE-GRSC-PLC-061	PRE-GRSC-SCR-110	CHANNEL NO.1 SCREEN	TEMPERATURE-HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-SCR-MD-110	PRE-GRSC-PLC-061	PRE-GRSC-SCR-110	CHANNEL NO.1 SCREEN	START/STOP	DO	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-SCR-II-110	PRE-GRSC-PLC-061	PRE-GRSC-SCR-110	CHANNEL NO.1 SCREEN	CURRENT	AI	COMM		AMPS	N/A	N/A	Y301	6
PRE-GRSC-LE-LI-100A	PRE-GRSC-PLC-061	PRE-GRSC-LIT-100	CHANNEL NO.1 SCREEN UPSTREAM LEVEL	LEVEL	AI	COMM		INCHES	N/A	N/A	Y301	4,6
PRE-GRSC-LE-LI-100B	PRE-GRSC-PLC-061	PRE-GRSC-LIT-100	CHANNEL NO.1 SCREEN DOWNSTREAM LEVEL	LEVEL	AI	COMM		INCHES	N/A	N/A	Y301	4,6
PRE-GRSC-LDT-LI-100	PRE-GRSC-PLC-061	PRE-GRSC-MCP-100	CHANNEL NO.1 SCREEN DIFFERENTIAL LEVEL	LEVEL	AI	COMM		INCHES	N/A	N/A	Y301	4,6

TODD CREEK
WWTP
I/O LIST

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
PRE-GRSC-BR-HS-115A	PRE-GRSC-PLC-061	PRE-GRSC-BR-115	CHANNEL NO.1 BRUSH DRIVE	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-BR-HS-115B	PRE-GRSC-PLC-061	PRE-GRSC-BR-115	CHANNEL NO.1 BRUSH DRIVE	IN-HAND	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-BR-MN-115A	PRE-GRSC-PLC-061	PRE-GRSC-BR-115	CHANNEL NO.1 BRUSH DRIVE	RUN-FORWARD	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-BR-MN-115B	PRE-GRSC-PLC-061	PRE-GRSC-BR-115	CHANNEL NO.1 BRUSH DRIVE	RUN-REVERSE	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-BR-YA-115	PRE-GRSC-PLC-061	PRE-GRSC-BR-115	CHANNEL NO.1 BRUSH DRIVE	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-BR-TAH-115	PRE-GRSC-PLC-061	PRE-GRSC-BR-115	CHANNEL NO.1 BRUSH DRIVE	TEMPERATURE-HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-BR-II-115	PRE-GRSC-PLC-061	PRE-GRSC-BR-115	CHANNEL NO.1 BRUSH DRIVE	CURRENT	AI	COMM		AMPS	N/A	N/A	Y301	6
PRE-GRSC-WC-HS-120A	PRE-GRSC-PLC-061	PRE-GRSC-WC-120	CHANNEL NO.1 WASHER/COMPACTOR	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-WC-HS-120B	PRE-GRSC-PLC-061	PRE-GRSC-WC-120	CHANNEL NO.1 WASHER/COMPACTOR	IN-HAND	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-WC-MN-120A	PRE-GRSC-PLC-061	PRE-GRSC-WC-120	CHANNEL NO.1 WASHER/COMPACTOR	RUN-FORWARD	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-WC-MN-120B	PRE-GRSC-PLC-061	PRE-GRSC-WC-120	CHANNEL NO.1 WASHER/COMPACTOR	RUN-REVERSE	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-WC-YA-120	PRE-GRSC-PLC-061	PRE-GRSC-WC-120	CHANNEL NO.1 WASHER/COMPACTOR	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-WC-TAH-120	PRE-GRSC-PLC-061	PRE-GRSC-WC-120	CHANNEL NO.1 WASHER/COMPACTOR	TEMPERATURE-HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y301	6

TODD CREEK
WWTP
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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
PRE-GRSC-VLV-ZD-125	PRE-GRSC-PLC-061	PRE-GRSC-VLV-125	CHANNEL NO.1 HEATED PROCESS WATER	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	
PRE-GRSC-MCP-YS-200	PRE-GRSC-PLC-061	PRE-GRSC-MCP-200	CHANNEL NO.2 SCREEN SYSTEM INHIBIT	ENABLE/DISABLE	DO	COMM	N/A	N/A	N/A	N/A	Y301	7
PRE-GRSC-LSH-LAH-200	PRE-GRSC-PLC-061	PRE-GRSC-LSH-200	CHANNEL NO.2	LEVEL HIGH	DI	COMM		FEET(MSL)	N/A	N/A	Y301	6
PRE-GRSC-SCR-HSS-210	PRE-GRSC-PLC-061	PRE-GRSC-SCR-210	CHANNEL NO.2 SCREEN	EMERGENCY STOP	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-SCR-HS-210A	PRE-GRSC-PLC-061	PRE-GRSC-SCR-210	CHANNEL NO.2 SCREEN	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-SCR-HS-210B	PRE-GRSC-PLC-061	PRE-GRSC-SCR-210	CHANNEL NO.2 SCREEN	IN-HAND	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-SCR-MN-210A	PRE-GRSC-PLC-061	PRE-GRSC-SCR-210	CHANNEL NO.2 SCREEN	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-SCR-MN-210B	PRE-GRSC-PLC-061	PRE-GRSC-SCR-210	CHANNEL NO.2 SCREEN	RUN-HIGH SPEED	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-SCR-YA-210	PRE-GRSC-PLC-061	PRE-GRSC-SCR-210	CHANNEL NO.2 SCREEN	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-SCR-TAH-210	PRE-GRSC-PLC-061	PRE-GRSC-SCR-210	CHANNEL NO.2 SCREEN	TEMPERATURE-HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-SCR-MD-210	PRE-GRSC-PLC-061	PRE-GRSC-SCR-210	CHANNEL NO.2 SCREEN	START/STOP	DO	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-SCR-II-210	PRE-GRSC-PLC-061	PRE-GRSC-SCR-210	CHANNEL NO.2 SCREEN	CURRENT	AI	COMM		AMPS	N/A	N/A	Y301	6
PRE-GRSC-LE-LI-200A	PRE-GRSC-PLC-061	PRE-GRSC-LIT-200	CHANNEL NO.2 SCREEN UPSTREAM LEVEL	LEVEL	AI	COMM		INCHES	N/A	N/A	Y301	4,6
PRE-GRSC-LE-LI-200B	PRE-GRSC-PLC-061	PRE-GRSC-LIT-200	CHANNEL NO.2 SCREEN DOWNSTREAM LEVEL	LEVEL	AI	COMM		INCHES	N/A	N/A	Y301	4,6
PRE-GRSC-LDT-LI-200	PRE-GRSC-PLC-061	PRE-GRSC-MCP-200	CHANNEL NO.2 SCREEN DIFFERENTIAL LEVEL	LEVEL	AI	COMM		INCHES	N/A	N/A	Y301	4,6
PRE-GRSC-BR-HS-215A	PRE-GRSC-PLC-061	PRE-GRSC-BR-215	CHANNEL NO.2 BRUSH DRIVE	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-BR-HS-215B	PRE-GRSC-PLC-061	PRE-GRSC-BR-215	CHANNEL NO.2 BRUSH DRIVE	IN-HAND	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-BR-MN-215A	PRE-GRSC-PLC-061	PRE-GRSC-BR-215	CHANNEL NO.2 BRUSH DRIVE	RUN-FORWARD	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-BR-MN-215B	PRE-GRSC-PLC-061	PRE-GRSC-BR-215	CHANNEL NO.2 BRUSH DRIVE	RUN-REVERSE	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-BR-YA-215	PRE-GRSC-PLC-061	PRE-GRSC-BR-215	CHANNEL NO.2 BRUSH DRIVE	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-BR-TAH-215	PRE-GRSC-PLC-061	PRE-GRSC-BR-215	CHANNEL NO.2 BRUSH DRIVE	TEMPERATURE-HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-BR-II-215	PRE-GRSC-PLC-061	PRE-GRSC-BR-215	CHANNEL NO.2 BRUSH DRIVE	CURRENT	AI	COMM		AMPS	N/A	N/A	Y301	6
PRE-GRSC-WC-HS-220A	PRE-GRSC-PLC-061	PRE-GRSC-WC-220	CHANNEL NO.2 WASHER/COMPACTOR	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-WC-HS-220B	PRE-GRSC-PLC-061	PRE-GRSC-WC-220	CHANNEL NO.2 WASHER/COMPACTOR	IN-HAND	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-WC-MN-220A	PRE-GRSC-PLC-061	PRE-GRSC-WC-220	CHANNEL NO.2 WASHER/COMPACTOR	RUN-FORWARD	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-WC-MN-220B	PRE-GRSC-PLC-061	PRE-GRSC-WC-220	CHANNEL NO.2 WASHER/COMPACTOR	RUN-REVERSE	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-WC-YA-220	PRE-GRSC-PLC-061	PRE-GRSC-WC-220	CHANNEL NO.2 WASHER/COMPACTOR	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-WC-TAH-220	PRE-GRSC-PLC-061	PRE-GRSC-WC-220	CHANNEL NO.2 WASHER/COMPACTOR	TEMPERATURE-HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y301	6
PRE-GRSC-VLV-ZD-225	PRE-GRSC-PLC-061	PRE-GRSC-VLV-225	CHANNEL NO.2 HEATED PROCESS WATER	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y301	
PRE-GRSC-LSH-LAH-301	PRE-GRSC-PLC-061	PRE-GRSC-LSH-301	GRIT SYSTEM EFFLUENT	LEVEL HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y302	2,8
PRE-GRSC-FIT-FA-311	PRE-GRSC-PLC-061	PRE-GRSC-FIT-311	GRIT REMOVAL	REVERSE FLOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y302	8,10
PRE-GRSC-FIT-FI-311	PRE-GRSC-PLC-061	PRE-GRSC-FIT-311	GRIT REMOVAL	FLOW	AI	4-20mA	0-500	GPM	4-WIRE	FIELD	Y302	8
PRE-GRSC-PSH-PAH-312	PRE-GRSC-PLC-061	PRE-GRSC-PSH-312	GRIT REMOVAL	PRESSURE HIGH	DI	N.O. CONTACT	5	PSIG	N/A	SYSTEM	Y302	8

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
PRE-GRSC-MCP-HSS-300	PRE-GRSC-PLC-061	PRE-GRSC-MCP-300	GRIT SYSTEM	EMERGENCY STOP	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-MCP-HS-300A	PRE-GRSC-PLC-061	PRE-GRSC-MCP-300	GRIT SYSTEM IN WET MODE	STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-MCP-HS-300B	PRE-GRSC-PLC-061	PRE-GRSC-MCP-300	AUTO DRAIN	ON/OFF	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-MCP-HS-300C	PRE-GRSC-PLC-061	PRE-GRSC-MCP-300	RINSE WATER	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-MCP-HS-300D	PRE-GRSC-PLC-061	PRE-GRSC-MCP-300	GRIT WASHER/CYCLONE	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-MCP-FYH-300	PRE-GRSC-PLC-061	PRE-GRSC-MCP-300	WET WEATHER MODE	ENABLE/DISABLE	DO	COMM	N/A	N/A	N/A	N/A	Y302	7
PRE-GRSC-P-MX-310	PRE-GRSC-PLC-061	PRE-GRSC-MCP-300	GRIT SYSTEM INHIBIT	ENABLE/DISABLE	DO	COMM	N/A	N/A	N/A	N/A	Y302	7
PRE-GRSC-VLV-YA-314	PRE-GRSC-PLC-061	PRE-GRSC-VLV-314	GRIT REMOVAL PINCH VALVE	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-VLV-ZSO-314	PRE-GRSC-PLC-061	PRE-GRSC-VLV-314	GRIT REMOVAL PINCH VALVE	OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-VLV-ZSC-314	PRE-GRSC-PLC-061	PRE-GRSC-VLV-314	GRIT REMOVAL PINCH VALVE	CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-PMP-HS-310	PRE-GRSC-PLC-061	PRE-GRSC-PMP-310	GRIT PUMP	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-PMP-MN-310	PRE-GRSC-PLC-061	PRE-GRSC-PMP-310	GRIT PUMP	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-PMP-TAH-310	PRE-GRSC-PLC-061	PRE-GRSC-PMP-310	GRIT PUMP TEMPERATURE HIGH	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-PMP-YA-310	PRE-GRSC-PLC-061	PRE-GRSC-PMP-310	GRIT PUMP	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-CONV-HS-330	PRE-GRSC-PLC-061	PRE-GRSC-CONV-330	GRIT CONVEYOR	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-CONV-MN-330	PRE-GRSC-PLC-061	PRE-GRSC-CONV-330	GRIT CONVEYOR	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-CONV-TAH-330	PRE-GRSC-PLC-061	PRE-GRSC-CONV-330	GRIT CONVEYOR TEMPERATURE HIGH	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-CONV-ZAH-330	PRE-GRSC-PLC-061	PRE-GRSC-CONV-330	GRIT CONVEYOR PROXIMITY SWITCH	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-CONV-YA-330	PRE-GRSC-PLC-061	PRE-GRSC-CONV-330	GRIT CONVEYOR	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-CONV-YI-330	PRE-GRSC-PLC-061	PRE-GRSC-CONV-330	GRIT INTERMITTENT/CONTINUOUS MODE	STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y302	6
PRE-GRSC-CONV-SC-330	PRE-GRSC-PLC-061	PRE-GRSC-CONV-330	GRIT CONVEYOR	SPEED CONTROL	AO	COMM	0 - 100	%	N/A	N/A	Y302	7
SEC-PSEW-FIT-FA-101	PRE-GRSC-PLC-061	SEC-PSEW-FIT-101	PLANT SEWER HEADER	REVERSE FLOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y301	8,10
SEC-PSEW-FIT-FI-101	PRE-GRSC-PLC-061	SEC-PSEW-FIT-101	PLANT SEWER HEADER	FLOW	AI	4-20mA	0-1000	GPM	4-WIRE	FIELD	Y301	8

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
PRE-GRSC-SWB-EI-021AN	PRE-GRSC-PLC-061	PRE-GRSC-SWB-021	SWITCHBOARD A-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4
PRE-GRSC-SWB-EI-021BN	PRE-GRSC-PLC-061	PRE-GRSC-SWB-021	SWITCHBOARD B-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4
PRE-GRSC-SWB-EI-021CN	PRE-GRSC-PLC-061	PRE-GRSC-SWB-021	SWITCHBOARD C-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4
PRE-GRSC-SWB-EI-021AB	PRE-GRSC-PLC-061	PRE-GRSC-SWB-021	SWITCHBOARD A-B PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4
PRE-GRSC-SWB-EI-021BC	PRE-GRSC-PLC-061	PRE-GRSC-SWB-021	SWITCHBOARD B-C PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4
PRE-GRSC-SWB-EI-021CA	PRE-GRSC-PLC-061	PRE-GRSC-SWB-021	SWITCHBOARD C-A PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4
PRE-GRSC-SWB-II-021A	PRE-GRSC-PLC-061	PRE-GRSC-SWB-021	SWITCHBOARD A LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4
PRE-GRSC-SWB-II-021B	PRE-GRSC-PLC-061	PRE-GRSC-SWB-021	SWITCHBOARD B LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4
PRE-GRSC-SWB-II-021C	PRE-GRSC-PLC-061	PRE-GRSC-SWB-021	SWITCHBOARD C LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4
PRE-GRSC-SWB-JI-021A	PRE-GRSC-PLC-061	PRE-GRSC-SWB-021	SWITCHBOARD AVERAGE APPARENT	POWER	AI	COMM		KVA	N/A	N/A		4
PRE-GRSC-SWB-JI-021R	PRE-GRSC-PLC-061	PRE-GRSC-SWB-021	SWITCHBOARD AVERAGE REAL	POWER	AI	COMM		KW	N/A	N/A		4
PRE-GRSC-SWB-JQ-021	PRE-GRSC-PLC-061	PRE-GRSC-SWB-021	SWITCHBOARD TOTAL	ENERGY	AI	COMM		KWh	N/A	N/A		4
PRE-GRSC-SWB-JN-021	PRE-GRSC-PLC-061	PRE-GRSC-SWB-021	SWITCHBOARD AVERAGE	POWER FACTOR	AI	COMM		PF	N/A	N/A		4
PRE-GRSC-SWB-SI-021	PRE-GRSC-PLC-061	PRE-GRSC-SWB-021	SWITCHBOARD	FREQUENCY	AI	COMM		HERTZ	N/A	N/A		4
PRE-GRSC-CTRL-TAH-001	PRE-GRSC-PLC-061	PRE-GRSC-CTRL-001	HEADWORKS ELECTRICAL ROOM	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-GRSC-CTRL-YA-001A	PRE-GRSC-PLC-061	PRE-GRSC-CTRL-001	DIRTY FILTER	WARNING	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-GRSC-CTRL-YA-001B	PRE-GRSC-PLC-061	PRE-GRSC-CTRL-001	HVAC CONTROL SYSTEM	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-GRSC-CTRL-YA-001C	PRE-GRSC-PLC-061	PRE-GRSC-CTRL-001	VENTILATION FAILURE	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-GRSC-CTRL-YA-001D	PRE-GRSC-PLC-061	PRE-GRSC-CTRL-001	SMOKE ALARM	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-GRSC-UPS-JA-051	PRE-GRSC-PLC-061	PRE-GRSC-UPS-051	UPS SYSTEM REPLACE BATTERY	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-GRSC-UPS-JAL-051	PRE-GRSC-PLC-061	PRE-GRSC-UPS-051	UPS SYSTEM LOW BATTERY	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-GRSC-UPS-YA-051A	PRE-GRSC-PLC-061	PRE-GRSC-UPS-051	UPS SYSTEM	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-GRSC-UPS-YN-051	PRE-GRSC-PLC-061	PRE-GRSC-UPS-051	UPS SYSTEM ON BATTERY	STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-GRSC-UPS-ZS-051	PRE-GRSC-PLC-061	PRE-GRSC-UPS-051	UPS SYSTEM BYPASS	STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-GRSC-NSW-YA-061A	PRE-GRSC-PLC-061	PRE-GRSC-NSW-061	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-GRSC-NSW-YA-061B	PRE-GRSC-PLC-061	PRE-GRSC-NSW-061	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-GRSC-NSW-YA-061C	PRE-GRSC-PLC-061	PRE-GRSC-NSW-061	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-GRSC-NSW-TI-061	PRE-GRSC-PLC-061	PRE-GRSC-NSW-061	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		3, 9
PRE-GRSC-NSW-YA-071A	PRE-GRSC-PLC-061	PRE-GRSC-NSW-071	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-GRSC-NSW-YA-071B	PRE-GRSC-PLC-061	PRE-GRSC-NSW-071	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-GRSC-NSW-YA-071C	PRE-GRSC-PLC-061	PRE-GRSC-NSW-071	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
PRE-GRSC-NSW-TI-071	PRE-GRSC-PLC-061	PRE-GRSC-NSW-071	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		3, 9

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-VLV-ZSO-101	SEC-AGS-MCP-001	SEC-AGS-VLV-101	AGS BASIN NO. 1 INFLUENT VALVE A	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-ZSO-101	SEC-AGS-MCP-001	SEC-AGS-VLV-101	AGS BASIN NO. 1 INFLUENT VALVE A	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-HS-101	SEC-AGS-MCP-001	SEC-AGS-VLV-101	AGS BASIN NO. 1 INFLUENT VALVE A	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-ZD-101	SEC-AGS-MCP-001	SEC-AGS-VLV-101	AGS BASIN NO. 1 INFLUENT VALVE A	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y401	
SEC-AGS-VLV-ZSO-103	SEC-AGS-MCP-001	SEC-AGS-VLV-103	AGS BASIN NO. 1 INFLUENT VALVE B	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-ZSO-103	SEC-AGS-MCP-001	SEC-AGS-VLV-103	AGS BASIN NO. 1 INFLUENT VALVE B	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-HS-103	SEC-AGS-MCP-001	SEC-AGS-VLV-103	AGS BASIN NO. 1 INFLUENT VALVE B	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-ZD-103	SEC-AGS-MCP-001	SEC-AGS-VLV-103	AGS BASIN NO. 1 INFLUENT VALVE B	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y401	
SEC-AGS-VLV-HS-105	SEC-AGS-MCP-001	SEC-AGS-VLV-105	AGS BASIN NO. 1 AIR VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZSC-105	SEC-AGS-MCP-001	SEC-AGS-VLV-105	AGS BASIN NO. 1 AIR VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZI-105	SEC-AGS-MCP-001	SEC-AGS-VLV-105	AGS BASIN NO. 1 AIR VALVE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZC-105	SEC-AGS-MCP-001	SEC-AGS-VLV-105	AGS BASIN NO. 1 AIR VALVE	POSITION CONTROL	AO	4-20mA	0-100	%	2-WIRE	FIELD	Y402	2, 6
SEC-AGS-VLV-ZSO-108	SEC-AGS-MCP-001	SEC-AGS-VLV-108	AGS BASIN NO. 1 AIR VALVE	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZSO-108	SEC-AGS-MCP-001	SEC-AGS-VLV-108	AGS BASIN NO. 1 AIR VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-HS-108	SEC-AGS-MCP-001	SEC-AGS-VLV-108	AGS BASIN NO. 1 AIR VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZD-108	SEC-AGS-MCP-001	SEC-AGS-VLV-108	AGS BASIN NO. 1 AIR VALVE	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y402	
SEC-AGS-VLV-ZSO-109	SEC-AGS-MCP-001	SEC-AGS-VLV-109	AGS BASIN NO. 1 SLUDGE AIR VALVE	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZSO-109	SEC-AGS-MCP-001	SEC-AGS-VLV-109	AGS BASIN NO. 1 SLUDGE AIR VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-HS-109	SEC-AGS-MCP-001	SEC-AGS-VLV-109	AGS BASIN NO. 1 SLUDGE AIR VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZD-109	SEC-AGS-MCP-001	SEC-AGS-VLV-109	AGS BASIN NO. 1 INFLUENT VALVE B	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y401	
SEC-AGS-VLV-HS-110	SEC-AGS-MCP-001	SEC-AGS-VLV-110	AGS BASIN NO. 1 SLUDGE VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZSC-110	SEC-AGS-MCP-001	SEC-AGS-VLV-110	AGS BASIN NO. 1 SLUDGE VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZI-110	SEC-AGS-MCP-001	SEC-AGS-VLV-110	AGS BASIN NO. 1 SLUDGE VALVE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZC-110	SEC-AGS-MCP-001	SEC-AGS-VLV-110	AGS BASIN NO. 1 SLUDGE VALVE	POSITION CONTROL	AO	4-20mA	0-100	%	2-WIRE	FIELD	Y402	2, 6
SEC-AGS-VLV-HS-111	SEC-AGS-MCP-001	SEC-AGS-VLV-111	AGS BASIN NO. 1 WLC VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZSC-111	SEC-AGS-MCP-001	SEC-AGS-VLV-111	AGS BASIN NO. 1 WLC VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZI-111	SEC-AGS-MCP-001	SEC-AGS-VLV-111	AGS BASIN NO. 1 WLC VALVE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZC-111	SEC-AGS-MCP-001	SEC-AGS-VLV-111	AGS BASIN NO. 1 WLC VALVE	POSITION CONTROL	AO	4-20mA	0-100	%	2-WIRE	FIELD	Y402	2, 6
SEC-AGS-FIT-FA-101	SEC-AGS-MCP-001	SEC-AGS-FIT-101	AGS BASIN NO. 1 INFLUENT	REVERSE FLOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	6, 10
SEC-AGS-FIT-FI-101	SEC-AGS-MCP-001	SEC-AGS-FIT-101	AGS BASIN NO. 1 INFLUENT	FLOW	AI	4-20mA	0 - 15,000	GPM	4-WIRE	FIELD	Y401	2, 6

TODD CREEK
WWTP
I/O LIST

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-FIT-FI-102	SEC-AGS-MCP-001	SEC-AGS-FIT-102	AGS BASIN NO. 1 PROCESS AIR	FLOW	AI	4-20mA	0 - 15,000	SCFM	4-WIRE	FIELD	Y402	2, 6
SEC-AGS-PIT-PI-101	SEC-AGS-MCP-001	SEC-AGS-PIT-101	AGS BASIN NO. 1 SLUDGE PRESSURE TRANSMITTER	PRESSURE	AI	4-20mA	TBD	PSI	2-WIRE	SYSTEM	Y402	2, 6
SEC-AGS-LT-LI-101	SEC-AGS-MCP-001	SEC-AGS-LT-101	AGS BASIN NO. 1 LEVEL TRANSMITTER	LEVEL	AI	4-20mA	0 - 25	FEET	2-WIRE	SYSTEM	Y402	2, 6, 8
SEC-AGS-LSH-LAH-101	SEC-AGS-MCP-001	SEC-AGS-LSH-101	AGS BASIN NO. 1 LEVEL SWITCH	LEVEL HIGH	DI	N.O. CONTACT	TBD	FEET	N/A	N/A	Y402	2, 6, 8
SEC-AGS-AE-AI-111	SEC-AGS-MCP-001	SEC-AGS-AIT-110	AGS BASIN NO. 1 NH4 TRANSDUCER	NH4	AI	4-20mA	0 - 100	mg/L	4-WIRE	FIELD	Y402	2, 6
SEC-AGS-AE-TI-121	SEC-AGS-MCP-001	SEC-AGS-AIT-120	AGS BASIN NO. 1 TEMPERATURE	TEMPERATURE	AI	4-20mA	TBD	°F	4-WIRE	FIELD	Y402	2, 6
SEC-AGS-AE-AI-121	SEC-AGS-MCP-001	SEC-AGS-AIT-120	AGS BASIN NO. 1 pH TRANSDUCER	pH	AI	4-20mA	0 - 14	SU	4-WIRE	FIELD	Y402	2, 6
SEC-AGS-AE-AI-122	SEC-AGS-MCP-001	SEC-AGS-AIT-120	AGS BASIN NO. 1 D.O. TRANSDUCER	DISSOLVED OXYGEN	AI	4-20mA	0 - 10.0	mg/L	4-WIRE	FIELD	Y402	2, 6
SEC-AGS-AE-AI-123	SEC-AGS-MCP-001	SEC-AGS-AIT-120	AGS BASIN NO. 1 TSS TRANSDUCER	TSS	AI	4-20mA	0 - 50,000	mg/L	4-WIRE	FIELD	Y402	2, 6
SEC-AGS-AE-AI-124	SEC-AGS-MCP-001	SEC-AGS-AIT-120	AGS BASIN NO. 1 ORP TRANSDUCER	ORP	AI	4-20mA	-1,500 - 1,500	mV	4-WIRE	FIELD	Y402	2, 6
SEC-AGS-VLV-ZSO-201	SEC-AGS-MCP-001	SEC-AGS-VLV-201	AGS BASIN NO. 2 INFLUENT VALVE A	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-ZSO-201	SEC-AGS-MCP-001	SEC-AGS-VLV-201	AGS BASIN NO. 2 INFLUENT VALVE A	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-HS-201	SEC-AGS-MCP-001	SEC-AGS-VLV-201	AGS BASIN NO. 2 INFLUENT VALVE A	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-ZD-201	SEC-AGS-MCP-001	SEC-AGS-VLV-201	AGS BASIN NO. 2 INFLUENT VALVE A	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y401	
SEC-AGS-VLV-ZSO-203	SEC-AGS-MCP-001	SEC-AGS-VLV-203	AGS BASIN NO. 2 INFLUENT VALVE B	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-ZSO-203	SEC-AGS-MCP-001	SEC-AGS-VLV-203	AGS BASIN NO. 2 INFLUENT VALVE B	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-HS-203	SEC-AGS-MCP-001	SEC-AGS-VLV-203	AGS BASIN NO. 2 INFLUENT VALVE B	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-ZD-203	SEC-AGS-MCP-001	SEC-AGS-VLV-203	AGS BASIN NO. 2 INFLUENT VALVE B	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y401	
SEC-AGS-VLV-HS-205	SEC-AGS-MCP-001	SEC-AGS-VLV-205	AGS BASIN NO. 2 AIR VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZSC-205	SEC-AGS-MCP-001	SEC-AGS-VLV-205	AGS BASIN NO. 2 AIR VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZI-205	SEC-AGS-MCP-001	SEC-AGS-VLV-205	AGS BASIN NO. 2 AIR VALVE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZC-205	SEC-AGS-MCP-001	SEC-AGS-VLV-205	AGS BASIN NO. 2 AIR VALVE	POSITION CONTROL	AO	4-20mA	0-100	%	2-WIRE	FIELD	Y402	2, 6
SEC-AGS-VLV-ZSO-208	SEC-AGS-MCP-001	SEC-AGS-VLV-208	AGS BASIN NO. 2 AIR VALVE	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZSO-208	SEC-AGS-MCP-001	SEC-AGS-VLV-208	AGS BASIN NO. 2 AIR VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-HS-208	SEC-AGS-MCP-001	SEC-AGS-VLV-208	AGS BASIN NO. 2 AIR VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZD-208	SEC-AGS-MCP-001	SEC-AGS-VLV-208	AGS BASIN NO. 2 AIR VALVE	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y402	
SEC-AGS-VLV-ZSO-209	SEC-AGS-MCP-001	SEC-AGS-VLV-209	AGS BASIN NO. 2 SLUDGE AIR VALVE	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZSO-209	SEC-AGS-MCP-001	SEC-AGS-VLV-209	AGS BASIN NO. 2 SLUDGE AIR VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-HS-209	SEC-AGS-MCP-001	SEC-AGS-VLV-209	AGS BASIN NO. 2 SLUDGE AIR VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZD-209	SEC-AGS-MCP-001	SEC-AGS-VLV-209	AGS BASIN NO. 2 INFLUENT VALVE B	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y401	
SEC-AGS-VLV-HS-210	SEC-AGS-MCP-001	SEC-AGS-VLV-210	AGS BASIN NO. 2 SLUDGE VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZSC-210	SEC-AGS-MCP-001	SEC-AGS-VLV-210	AGS BASIN NO. 2 SLUDGE VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZI-210	SEC-AGS-MCP-001	SEC-AGS-VLV-210	AGS BASIN NO. 2 SLUDGE VALVE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZC-210	SEC-AGS-MCP-001	SEC-AGS-VLV-210	AGS BASIN NO. 2 SLUDGE VALVE	POSITION CONTROL	AO	4-20mA	0-100	%	2-WIRE	FIELD	Y402	2, 6
SEC-AGS-VLV-HS-211	SEC-AGS-MCP-001	SEC-AGS-VLV-211	AGS BASIN NO. 2 WLC VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZSC-211	SEC-AGS-MCP-001	SEC-AGS-VLV-211	AGS BASIN NO. 2 WLC VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZI-211	SEC-AGS-MCP-001	SEC-AGS-VLV-211	AGS BASIN NO. 2 WLC VALVE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y402	2, 6
SEC-AGS-VLV-ZC-211	SEC-AGS-MCP-001	SEC-AGS-VLV-211	AGS BASIN NO. 2 WLC VALVE	POSITION CONTROL	AO	4-20mA	0-100	%	2-WIRE	FIELD	Y402	2, 6

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-FIT-FA-201	SEC-AGS-MCP-001	SEC-AGS-FIT-201	AGS BASIN NO. 2 INFLUENT	REVERSE FLOW	DI	N.O. CONTACT		N/A	N/A	SYSTEM	Y401	6, 10
SEC-AGS-FIT-FI-201	SEC-AGS-MCP-001	SEC-AGS-FIT-201	AGS BASIN NO. 2 INFLUENT	FLOW	AI	4-20mA	0 - 15,000	GPM	4-WIRE	FIELD	Y401	2, 6
SEC-AGS-FIT-FI-202	SEC-AGS-MCP-001	SEC-AGS-FIT-202	AGS BASIN NO. 2 PROCESS AIR	FLOW	AI	4-20mA	0 - 15,000	SCFM	4-WIRE	FIELD	Y402	2, 6
SEC-AGS-PIT-PI-201	SEC-AGS-MCP-001	SEC-AGS-PIT-201	AGS BASIN NO. 2 SLUDGE PRESSURE TRANSMITTER	PRESSURE	AI	4-20mA	TBD	PSI	2-WIRE	SYSTEM	Y402	2, 6
SEC-AGS-LT-LI-201	SEC-AGS-MCP-001	SEC-AGS-LT-201	AGS BASIN NO. 2 LEVEL TRANSMITTER	LEVEL	AI	4-20mA	0 - 25	FEET	2-WIRE	SYSTEM	Y402	2, 6, 8
SEC-AGS-LSH-LAH-201	SEC-AGS-MCP-001	SEC-AGS-LSH-201	AGS BASIN NO. 2 LEVEL SWITCH	LEVEL HIGH	DI	N.O. CONTACT	TBD	FEET	N/A	N/A	Y402	2, 6, 8
SEC-AGS-AE-AI-211	SEC-AGS-MCP-001	SEC-AGS-AIT-210	AGS BASIN NO. 2 NH4 TRANSDUCER	NH4	AI	4-20mA	0 - 100	mg/L	4-WIRE	FIELD	Y402	2, 6
SEC-AGS-AE-TI-221	SEC-AGS-MCP-001	SEC-AGS-AIT-220	AGS BASIN NO. 2 TEMPERATURE	TEMPERATURE	AI	4-20mA	TBD	°F	4-WIRE	FIELD	Y402	2, 6
SEC-AGS-AE-AI-221	SEC-AGS-MCP-001	SEC-AGS-AIT-220	AGS BASIN NO. 2 pH TRANSDUCER	pH	AI	4-20mA	0 - 14	SU	4-WIRE	FIELD	Y402	2, 6
SEC-AGS-AE-AI-222	SEC-AGS-MCP-001	SEC-AGS-AIT-220	AGS BASIN NO. 2 D.O. TRANSDUCER	DISSOLVED OXYGEN	AI	4-20mA	0 - 10.0	mg/L	4-WIRE	FIELD	Y402	2, 6
SEC-AGS-AE-AI-223	SEC-AGS-MCP-001	SEC-AGS-AIT-220	AGS BASIN NO. 2 TSS TRANSDUCER	TSS	AI	4-20mA	0 - 50,000	mg/L	4-WIRE	FIELD	Y402	2, 6
SEC-AGS-AE-AI-224	SEC-AGS-MCP-001	SEC-AGS-AIT-220	AGS BASIN NO. 2 ORP TRANSDUCER	ORP	AI	4-20mA	-1,500 - 1,500	mV	4-WIRE	FIELD	Y402	2, 6
SEC-AGS-VLV-ZSO-301	SEC-AGS-MCP-001	SEC-AGS-VLV-301	AGS BASIN NO. 3 INFLUENT VALVE A	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-ZSO-301	SEC-AGS-MCP-001	SEC-AGS-VLV-301	AGS BASIN NO. 3 INFLUENT VALVE A	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-HS-301	SEC-AGS-MCP-001	SEC-AGS-VLV-301	AGS BASIN NO. 3 INFLUENT VALVE A	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-ZD-301	SEC-AGS-MCP-001	SEC-AGS-VLV-301	AGS BASIN NO. 3 INFLUENT VALVE A	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y401	
SEC-AGS-VLV-ZSO-303	SEC-AGS-MCP-001	SEC-AGS-VLV-303	AGS BASIN NO. 3 INFLUENT VALVE B	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-ZSO-303	SEC-AGS-MCP-001	SEC-AGS-VLV-303	AGS BASIN NO. 3 INFLUENT VALVE B	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-HS-303	SEC-AGS-MCP-001	SEC-AGS-VLV-303	AGS BASIN NO. 3 INFLUENT VALVE B	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-ZD-303	SEC-AGS-MCP-001	SEC-AGS-VLV-303	AGS BASIN NO. 3 INFLUENT VALVE B	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y401	
SEC-AGS-VLV-HS-305	SEC-AGS-MCP-001	SEC-AGS-VLV-305	AGS BASIN NO. 3 AIR VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZSC-305	SEC-AGS-MCP-001	SEC-AGS-VLV-305	AGS BASIN NO. 3 AIR VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZI-305	SEC-AGS-MCP-001	SEC-AGS-VLV-305	AGS BASIN NO. 3 AIR VALVE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZC-305	SEC-AGS-MCP-001	SEC-AGS-VLV-305	AGS BASIN NO. 3 AIR VALVE	POSITION CONTROL	AO	4-20mA	0-100	%	2-WIRE	FIELD	Y403	2, 6
SEC-AGS-VLV-ZSO-308	SEC-AGS-MCP-001	SEC-AGS-VLV-308	AGS BASIN NO. 3 AIR VALVE	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZSO-308	SEC-AGS-MCP-001	SEC-AGS-VLV-308	AGS BASIN NO. 3 AIR VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-HS-308	SEC-AGS-MCP-001	SEC-AGS-VLV-308	AGS BASIN NO. 3 AIR VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZD-308	SEC-AGS-MCP-001	SEC-AGS-VLV-308	AGS BASIN NO. 3 AIR VALVE	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y403	
SEC-AGS-VLV-ZSO-309	SEC-AGS-MCP-001	SEC-AGS-VLV-309	AGS BASIN NO. 3 SLUDGE AIR VALVE	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZSO-309	SEC-AGS-MCP-001	SEC-AGS-VLV-309	AGS BASIN NO. 3 SLUDGE AIR VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-HS-309	SEC-AGS-MCP-001	SEC-AGS-VLV-309	AGS BASIN NO. 3 SLUDGE AIR VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZD-309	SEC-AGS-MCP-001	SEC-AGS-VLV-309	AGS BASIN NO. 3 INFLUENT VALVE B	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y403	
SEC-AGS-VLV-HS-310	SEC-AGS-MCP-001	SEC-AGS-VLV-310	AGS BASIN NO. 3 SLUDGE VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZSC-310	SEC-AGS-MCP-001	SEC-AGS-VLV-310	AGS BASIN NO. 3 SLUDGE VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZI-310	SEC-AGS-MCP-001	SEC-AGS-VLV-310	AGS BASIN NO. 3 SLUDGE VALVE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZC-310	SEC-AGS-MCP-001	SEC-AGS-VLV-310	AGS BASIN NO. 3 SLUDGE VALVE	POSITION CONTROL	AO	4-20mA	0-100	%	2-WIRE	FIELD	Y403	2, 6

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-VLV-HS-311	SEC-AGS-MCP-001	SEC-AGS-VLV-311	AGS BASIN NO. 3 WLC VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZSC-311	SEC-AGS-MCP-001	SEC-AGS-VLV-311	AGS BASIN NO. 3 WLC VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZI-311	SEC-AGS-MCP-001	SEC-AGS-VLV-311	AGS BASIN NO. 3 WLC VALVE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZC-311	SEC-AGS-MCP-001	SEC-AGS-VLV-311	AGS BASIN NO. 3 WLC VALVE	POSITION CONTROL	AO	4-20mA	0-100	%	2-WIRE	FIELD	Y403	2, 6
SEC-AGS-FIT-FA-301	SEC-AGS-MCP-001	SEC-AGS-FIT-301	AGS BASIN NO. 3 INFLUENT	REVERSE FLOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	6, 10
SEC-AGS-FIT-FI-301	SEC-AGS-MCP-001	SEC-AGS-FIT-301	AGS BASIN NO. 3 INFLUENT	FLOW	AI	4-20mA	0 - 15,000	GPM	4-WIRE	FIELD	Y401	2, 6
SEC-AGS-FIT-FI-302	SEC-AGS-MCP-001	SEC-AGS-FIT-302	AGS BASIN NO. 3 PROCESS AIR	FLOW	AI	4-20mA	0 - 15,000	SCFM	4-WIRE	FIELD	Y403	2, 6
SEC-AGS-PIT-PI-301	SEC-AGS-MCP-001	SEC-AGS-PIT-301	AGS BASIN NO. 3 SLUDGE PRESSURE TRANSMITTER	PRESSURE	AI	4-20mA	TBD	PSI	2-WIRE	SYSTEM	Y403	2, 6
SEC-AGS-LT-LI-301	SEC-AGS-MCP-001	SEC-AGS-LT-301	AGS BASIN NO. 3 LEVEL TRANSMITTER	LEVEL	AI	4-20mA	0 - 25	FEET	2-WIRE	SYSTEM	Y403	2, 6, 8
SEC-AGS-LSH-LAH-301	SEC-AGS-MCP-001	SEC-AGS-LSH-301	AGS BASIN NO. 3 LEVEL SWITCH	LEVEL HIGH	DI	N.O. CONTACT	TBD	FEET	N/A	N/A	Y403	2, 6, 8
SEC-AGS-AE-AI-311	SEC-AGS-MCP-001	SEC-AGS-AIT-310	AGS BASIN NO. 3 NH4 TRANSDUCER	NH4	AI	4-20mA	0 - 100	mg/L	4-WIRE	FIELD	Y403	2, 6
SEC-AGS-AE-TI-321	SEC-AGS-MCP-001	SEC-AGS-AIT-320	AGS BASIN NO. 3 TEMPERATURE	TEMPERATURE	AI	4-20mA	TBD	°F	4-WIRE	FIELD	Y403	2, 6
SEC-AGS-AE-AI-321	SEC-AGS-MCP-001	SEC-AGS-AIT-320	AGS BASIN NO. 3 pH TRANSDUCER	pH	AI	4-20mA	0 - 14	SU	4-WIRE	FIELD	Y403	2, 6
SEC-AGS-AE-AI-322	SEC-AGS-MCP-001	SEC-AGS-AIT-320	AGS BASIN NO. 3 D.O. TRANSDUCER	DISSOLVED OXYGEN	AI	4-20mA	0 - 10.0	mg/L	4-WIRE	FIELD	Y403	2, 6
SEC-AGS-AE-AI-323	SEC-AGS-MCP-001	SEC-AGS-AIT-320	AGS BASIN NO. 3 TSS TRANSDUCER	TSS	AI	4-20mA	0 - 50,000	mg/L	4-WIRE	FIELD	Y403	2, 6
SEC-AGS-AE-AI-324	SEC-AGS-MCP-001	SEC-AGS-AIT-320	AGS BASIN NO. 3 ORP TRANSDUCER	ORP	AI	4-20mA	-1,500 - 1,500	mV	4-WIRE	FIELD	Y403	2, 6
SEC-AGS-VLV-ZSO-401	SEC-AGS-MCP-001	SEC-AGS-VLV-401	AGS BASIN NO. 4 INFLUENT VALVE A	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-ZSO-401	SEC-AGS-MCP-001	SEC-AGS-VLV-401	AGS BASIN NO. 4 INFLUENT VALVE A	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-HS-401	SEC-AGS-MCP-001	SEC-AGS-VLV-401	AGS BASIN NO. 4 INFLUENT VALVE A	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-ZD-401	SEC-AGS-MCP-001	SEC-AGS-VLV-401	AGS BASIN NO. 4 INFLUENT VALVE A	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y401	
SEC-AGS-VLV-ZSO-403	SEC-AGS-MCP-001	SEC-AGS-VLV-403	AGS BASIN NO. 4 INFLUENT VALVE B	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-ZSO-403	SEC-AGS-MCP-001	SEC-AGS-VLV-403	AGS BASIN NO. 4 INFLUENT VALVE B	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-HS-403	SEC-AGS-MCP-001	SEC-AGS-VLV-403	AGS BASIN NO. 4 INFLUENT VALVE B	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y401	2, 6
SEC-AGS-VLV-ZD-403	SEC-AGS-MCP-001	SEC-AGS-VLV-403	AGS BASIN NO. 4 INFLUENT VALVE B	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y401	
SEC-AGS-VLV-HS-405	SEC-AGS-MCP-001	SEC-AGS-VLV-405	AGS BASIN NO. 4 AIR VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZSC-405	SEC-AGS-MCP-001	SEC-AGS-VLV-405	AGS BASIN NO. 4 AIR VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZI-405	SEC-AGS-MCP-001	SEC-AGS-VLV-405	AGS BASIN NO. 4 AIR VALVE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZC-405	SEC-AGS-MCP-001	SEC-AGS-VLV-405	AGS BASIN NO. 4 AIR VALVE	POSITION CONTROL	AO	4-20mA	0-100	%	2-WIRE	FIELD	Y403	2, 6
SEC-AGS-VLV-ZSO-408	SEC-AGS-MCP-001	SEC-AGS-VLV-408	AGS BASIN NO. 4 AIR VALVE	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZSO-408	SEC-AGS-MCP-001	SEC-AGS-VLV-408	AGS BASIN NO. 4 AIR VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-HS-408	SEC-AGS-MCP-001	SEC-AGS-VLV-408	AGS BASIN NO. 4 AIR VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZD-408	SEC-AGS-MCP-001	SEC-AGS-VLV-408	AGS BASIN NO. 4 AIR VALVE	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y403	
SEC-AGS-VLV-ZSO-409	SEC-AGS-MCP-001	SEC-AGS-VLV-409	AGS BASIN NO. 4 SLUDGE AIR VALVE	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZSO-409	SEC-AGS-MCP-001	SEC-AGS-VLV-409	AGS BASIN NO. 4 SLUDGE AIR VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-HS-409	SEC-AGS-MCP-001	SEC-AGS-VLV-409	AGS BASIN NO. 4 SLUDGE AIR VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZD-409	SEC-AGS-MCP-001	SEC-AGS-VLV-409	AGS BASIN NO. 4 INFLUENT VALVE B	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y403	

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-VLV-HS-410	SEC-AGS-MCP-001	SEC-AGS-VLV-410	AGS BASIN NO. 4 SLUDGE VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZSC-410	SEC-AGS-MCP-001	SEC-AGS-VLV-410	AGS BASIN NO. 4 SLUDGE VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZI-410	SEC-AGS-MCP-001	SEC-AGS-VLV-410	AGS BASIN NO. 4 SLUDGE VALVE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZC-410	SEC-AGS-MCP-001	SEC-AGS-VLV-410	AGS BASIN NO. 4 SLUDGE VALVE	POSITION CONTROL	AO	4-20mA	0-100	%	2-WIRE	FIELD	Y403	2, 6
SEC-AGS-VLV-HS-411	SEC-AGS-MCP-001	SEC-AGS-VLV-411	AGS BASIN NO. 4 WLC VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZSC-411	SEC-AGS-MCP-001	SEC-AGS-VLV-411	AGS BASIN NO. 4 WLC VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZI-411	SEC-AGS-MCP-001	SEC-AGS-VLV-411	AGS BASIN NO. 4 WLC VALVE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y403	2, 6
SEC-AGS-VLV-ZC-411	SEC-AGS-MCP-001	SEC-AGS-VLV-411	AGS BASIN NO. 4 WLC VALVE	POSITION CONTROL	AO	4-20mA	0-100	%	2-WIRE	FIELD	Y403	2, 6
SEC-AGS-FIT-FA-401	SEC-AGS-MCP-001	SEC-AGS-FIT-401	AGS BASIN NO. 4 INFLUENT	REVERSE FLOW	DI	N.O. CONTACT		N/A	N/A	SYSTEM	Y401	6, 10
SEC-AGS-FIT-FI-401	SEC-AGS-MCP-001	SEC-AGS-FIT-401	AGS BASIN NO. 4 INFLUENT	FLOW	AI	4-20mA	0 - 15,000	GPM	4-WIRE	FIELD	Y401	2, 6
SEC-AGS-FIT-FI-402	SEC-AGS-MCP-001	SEC-AGS-FIT-402	AGS BASIN NO. 4 PROCESS AIR	FLOW	AI	4-20mA	0 - 15,000	SCFM	4-WIRE	FIELD	Y403	2, 6
SEC-AGS-PIT-PI-401	SEC-AGS-MCP-001	SEC-AGS-PIT-401	AGS BASIN NO. 4 SLUDGE PRESSURE TRANSMITTER	PRESSURE	AI	4-20mA	TBD	PSI	2-WIRE	SYSTEM	Y403	2, 6
SEC-AGS-LT-LI-401	SEC-AGS-MCP-001	SEC-AGS-LT-401	AGS BASIN NO. 4 LEVEL TRANSMITTER	LEVEL	AI	4-20mA	0 - 25	FEET	2-WIRE	SYSTEM	Y403	2, 6, 8
SEC-AGS-LSH-LAH-401	SEC-AGS-MCP-001	SEC-AGS-LSH-401	AGS BASIN NO. 4 LEVEL SWITCH	LEVEL HIGH	DI	N.O. CONTACT	TBD	FEET	N/A	N/A	Y403	2, 6, 8
SEC-AGS-AE-AI-411	SEC-AGS-MCP-001	SEC-AGS-AIT-410	AGS BASIN NO. 4 NH4 TRANSDUCER	NH4	AI	4-20mA	0 - 100	mg/L	4-WIRE	FIELD	Y403	2, 6
SEC-AGS-AE-TI-421	SEC-AGS-MCP-001	SEC-AGS-AIT-420	AGS BASIN NO. 4 TEMPERATURE	TEMPERATURE	AI	4-20mA	TBD	°F	4-WIRE	FIELD	Y403	2, 6
SEC-AGS-AE-AI-421	SEC-AGS-MCP-001	SEC-AGS-AIT-420	AGS BASIN NO. 4 pH TRANSDUCER	pH	AI	4-20mA	0 - 14	SU	4-WIRE	FIELD	Y403	2, 6
SEC-AGS-AE-AI-422	SEC-AGS-MCP-001	SEC-AGS-AIT-420	AGS BASIN NO. 4 D.O. TRANSDUCER	DISSOLVED OXYGEN	AI	4-20mA	0 - 10.0	mg/L	4-WIRE	FIELD	Y403	2, 6
SEC-AGS-AE-AI-423	SEC-AGS-MCP-001	SEC-AGS-AIT-420	AGS BASIN NO. 4 TSS TRANSDUCER	TSS	AI	4-20mA	0 - 50,000	mg/L	4-WIRE	FIELD	Y403	2, 6
SEC-AGS-AE-AI-424	SEC-AGS-MCP-001	SEC-AGS-AIT-420	AGS BASIN NO. 4 ORP TRANSDUCER	ORP	AI	4-20mA	-1,500 - 1,500	mV	4-WIRE	FIELD	Y403	2, 6
SEC-AGS-FIT-FA-601	SEC-AGS-MCP-001	SEC-AGS-FIT-601	SUPERNATANT INFLUENT HEADER	REVERSE FLOW	DI	N.O. CONTACT		N/A	N/A	SYSTEM	Y405	6, 10
SEC-AGS-FIT-FI-601	SEC-AGS-MCP-001	SEC-AGS-FIT-601	SUPERNATANT INFLUENT HEADER	FLOW	AI	4-20mA	0 - 1,200	GPM	4-WIRE	FIELD	Y405	2, 6
SEC-AGS-AIT-AI-701	SEC-AGS-MCP-001	SEC-AGS-AIT-701	SLUDGE PUMPING	TSS	AI	4-20mA	0 - 50,000	mg/L	4-WIRE	FIELD	Y405	2, 6
SEC-AGS-FIT-FA-701	SEC-AGS-MCP-001	SEC-AGS-FIT-701	SLUDGE PUMPING	REVERSE FLOW	DI	N.O. CONTACT		N/A	N/A	SYSTEM	Y405	6, 10
SEC-AGS-FIT-FI-701	SEC-AGS-MCP-001	SEC-AGS-FIT-701	SLUDGE PUMPING	FLOW	AI	4-20mA	0 - 500	GPM	4-WIRE	FIELD	Y405	2, 6
SEC-AGS-LT-LI-510	SEC-AGS-MCP-001	SEC-AGS-LT-510	SLUDGE BUFFER TANK NO. 1	LEVEL	AI	4-20mA	0 - 25	FEET	2-WIRE	SYSTEM	Y405	2, 6, 8
SEC-AGS-LSH-LAH-510	SEC-AGS-MCP-001	SEC-AGS-LSH-510	SLUDGE BUFFER TANK NO. 1	LEVEL HIGH	DI	N.O. CONTACT	TBD	FEET	N/A	SYSTEM	Y405	2, 6, 8
SEC-AGS-LSL-LAL-510	SEC-AGS-MCP-001	SEC-AGS-LSL-510	SLUDGE BUFFER TANK NO. 1	LEVEL LOW	DI	N.O. CONTACT	TBD	FEET	N/A	SYSTEM	Y405	2, 6, 8
SEC-AGS-LSLL-LALL-510	SEC-AGS-MCP-001	SEC-AGS-LSLL-510	SLUDGE BUFFER TANK NO. 1	LEVEL LOW-LOW	DI	N.O. CONTACT	TBD	FEET	N/A	SYSTEM	Y405	2, 6, 8
SEC-AGS-VLV-ZSO-511	SEC-AGS-MCP-001	SEC-AGS-VLV-511	SLUDGE BUFFER TANK NO. 1 INFLUENT VALVE	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	2, 6
SEC-AGS-VLV-ZSO-511	SEC-AGS-MCP-001	SEC-AGS-VLV-511	SLUDGE BUFFER TANK NO. 1 INFLUENT VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	2, 6
SEC-AGS-VLV-HS-511	SEC-AGS-MCP-001	SEC-AGS-VLV-511	SLUDGE BUFFER TANK NO. 1 INFLUENT VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	2, 6
SEC-AGS-VLV-ZD-511	SEC-AGS-MCP-001	SEC-AGS-VLV-511	SLUDGE BUFFER TANK NO. 1 INFLUENT VALVE	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y405	6
SEC-AGS-LT-LI-520	SEC-AGS-MCP-001	SEC-AGS-LT-520	SLUDGE BUFFER TANK NO. 2	LEVEL	AI	4-20mA	0 - 25	FEET	2-WIRE	SYSTEM	Y405	2, 6, 8
SEC-AGS-LSH-LAH-520	SEC-AGS-MCP-001	SEC-AGS-LSH-520	SLUDGE BUFFER TANK NO. 2	LEVEL HIGH	DI	N.O. CONTACT	TBD	FEET	N/A	SYSTEM	Y405	2, 6, 8
SEC-AGS-LSL-LAL-520	SEC-AGS-MCP-001	SEC-AGS-LSL-520	SLUDGE BUFFER TANK NO. 2	LEVEL LOW	DI	N.O. CONTACT	TBD	FEET	N/A	SYSTEM	Y405	2, 6, 8
SEC-AGS-LSLL-LALL-520	SEC-AGS-MCP-001	SEC-AGS-LSLL-520	SLUDGE BUFFER TANK NO. 2	LEVEL LOW-LOW	DI	N.O. CONTACT	TBD	FEET	N/A	SYSTEM	Y405	2, 6, 8

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-VLV-ZSO-521	SEC-AGS-MCP-001	SEC-AGS-VLV-521	SLUDGE BUFFER TANK NO. 2 INFLUENT VALVE	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	2, 6
SEC-AGS-VLV-ZSO-521	SEC-AGS-MCP-001	SEC-AGS-VLV-521	SLUDGE BUFFER TANK NO. 2 INFLUENT VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	2, 6
SEC-AGS-VLV-HS-521	SEC-AGS-MCP-001	SEC-AGS-VLV-521	SLUDGE BUFFER TANK NO. 2 INFLUENT VALVE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	2, 6
SEC-AGS-VLV-ZD-521	SEC-AGS-MCP-001	SEC-AGS-VLV-521	SLUDGE BUFFER TANK NO. 2 INFLUENT VALVE	OPEN/CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y405	6
SEC-AGS-PMP-MD-610	SEC-AGS-MCP-001	SEC-AGS-PMP-610	SUPERNATANT PUMP NO. 1	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y405	6
SEC-AGS-PMP-HS-610A	SEC-AGS-MCP-001	SEC-AGS-PMP-610	SUPERNATANT PUMP NO. 1	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-MN-610	SEC-AGS-MCP-001	SEC-AGS-PMP-610	SUPERNATANT PUMP NO. 1	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-YA-610	SEC-AGS-MCP-001	SEC-AGS-PMP-610	SUPERNATANT PUMP NO. 1	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-SC-610	SEC-AGS-MCP-001	SEC-AGS-PMP-610	SUPERNATANT PUMP NO. 1	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y405	6
SEC-AGS-PMP-SI-610	SEC-AGS-MCP-001	SEC-AGS-PMP-610	SUPERNATANT PUMP NO. 1	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y405	6
SEC-AGS-PMP-MD-620	SEC-AGS-MCP-001	SEC-AGS-PMP-620	SUPERNATANT PUMP NO. 2	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y405	6
SEC-AGS-PMP-HS-620A	SEC-AGS-MCP-001	SEC-AGS-PMP-620	SUPERNATANT PUMP NO. 2	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-MN-620	SEC-AGS-MCP-001	SEC-AGS-PMP-620	SUPERNATANT PUMP NO. 2	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-YA-620	SEC-AGS-MCP-001	SEC-AGS-PMP-620	SUPERNATANT PUMP NO. 2	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-SC-620	SEC-AGS-MCP-001	SEC-AGS-PMP-620	SUPERNATANT PUMP NO. 2	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y405	6
SEC-AGS-PMP-SI-620	SEC-AGS-MCP-001	SEC-AGS-PMP-620	SUPERNATANT PUMP NO. 2	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y405	6
SEC-AGS-PMP-MD-630	SEC-AGS-MCP-001	SEC-AGS-PMP-630	SUPERNATANT PUMP NO. 3	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y405	6
SEC-AGS-PMP-HS-630A	SEC-AGS-MCP-001	SEC-AGS-PMP-630	SUPERNATANT PUMP NO. 3	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-MN-630	SEC-AGS-MCP-001	SEC-AGS-PMP-630	SUPERNATANT PUMP NO. 3	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-YA-630	SEC-AGS-MCP-001	SEC-AGS-PMP-630	SUPERNATANT PUMP NO. 3	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-SC-630	SEC-AGS-MCP-001	SEC-AGS-PMP-630	SUPERNATANT PUMP NO. 3	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y405	6
SEC-AGS-PMP-SI-630	SEC-AGS-MCP-001	SEC-AGS-PMP-630	SUPERNATANT PUMP NO. 3	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y405	6
SEC-AGS-PMP-MD-710	SEC-AGS-MCP-001	SEC-AGS-PMP-710	SLUDGE PUMP NO. 1	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y405	6
SEC-AGS-PMP-HS-710A	SEC-AGS-MCP-001	SEC-AGS-PMP-710	SLUDGE PUMP NO. 1	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-MN-710	SEC-AGS-MCP-001	SEC-AGS-PMP-710	SLUDGE PUMP NO. 1	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-YA-710	SEC-AGS-MCP-001	SEC-AGS-PMP-710	SLUDGE PUMP NO. 1	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-SC-710	SEC-AGS-MCP-001	SEC-AGS-PMP-710	SLUDGE PUMP NO. 1	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y405	6
SEC-AGS-PMP-SI-710	SEC-AGS-MCP-001	SEC-AGS-PMP-710	SLUDGE PUMP NO. 1	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y405	6
SEC-AGS-PMP-MD-720	SEC-AGS-MCP-001	SEC-AGS-PMP-720	SLUDGE PUMP NO. 2	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y405	6
SEC-AGS-PMP-HS-720A	SEC-AGS-MCP-001	SEC-AGS-PMP-720	SLUDGE PUMP NO. 2	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-MN-720	SEC-AGS-MCP-001	SEC-AGS-PMP-720	SLUDGE PUMP NO. 2	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-YA-720	SEC-AGS-MCP-001	SEC-AGS-PMP-720	SLUDGE PUMP NO. 2	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-SC-720	SEC-AGS-MCP-001	SEC-AGS-PMP-720	SLUDGE PUMP NO. 2	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y405	6
SEC-AGS-PMP-SI-720	SEC-AGS-MCP-001	SEC-AGS-PMP-720	SLUDGE PUMP NO. 2	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y405	6
SEC-AGS-PMP-MD-730	SEC-AGS-MCP-001	SEC-AGS-PMP-730	SLUDGE PUMP NO. 3	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y405	6
SEC-AGS-PMP-HS-730A	SEC-AGS-MCP-001	SEC-AGS-PMP-730	SLUDGE PUMP NO. 3	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-MN-730	SEC-AGS-MCP-001	SEC-AGS-PMP-730	SLUDGE PUMP NO. 3	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-YA-730	SEC-AGS-MCP-001	SEC-AGS-PMP-730	SLUDGE PUMP NO. 3	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y405	6
SEC-AGS-PMP-SC-730	SEC-AGS-MCP-001	SEC-AGS-PMP-730	SLUDGE PUMP NO. 3	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y405	6
SEC-AGS-PMP-SI-730	SEC-AGS-MCP-001	SEC-AGS-PMP-730	SLUDGE PUMP NO. 3	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y405	6

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-LSH-LAH-801	SEC-AGS-MCP-001	SEC-AGS-LSH-801	WLC TANK	LEVEL HIGH	DI	N.O. CONTACT	TBD	FEET(MSL)	2-WIRE	SYSTEM	Y406	2, 6, 8
SEC-AGS-LSLL-LALL-801	SEC-AGS-MCP-001	SEC-AGS-LSLL-801	WLC TANK	LEVEL LOW-LOW	DI	N.O. CONTACT	TBD	FEET(MSL)	2-WIRE	SYSTEM	Y406	6
SEC-AGS-LSL-LAL-801	SEC-AGS-MCP-001	SEC-AGS-LSL-801	WLC TANK	LEVEL LOW	DI	N.O. CONTACT	TBD	FEET(MSL)	2-WIRE	SYSTEM	Y406	6
SEC-AGS-LSHH-LAHH-801	SEC-AGS-MCP-001	SEC-AGS-LSHH-801	WLC TANK	LEVEL HIGH-HIGH	DI	N.O. CONTACT	TBD	FEET(MSL)	2-WIRE	SYSTEM	Y406	2, 6, 8
SEC-AGS-LT-LI-801	SEC-AGS-MCP-001	SEC-AGS-LT-801	WLC TANK	LEVEL	AI	4-20mA	0 - 25	FEET	2-WIRE	SYSTEM	Y406	2, 6, 8
SEC-AGS-FIT-FA-801	SEC-AGS-MCP-001	SEC-AGS-FIT-801	WLC RETURN	REVERSE FLOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y406	6, 10
SEC-AGS-FIT-FI-801	SEC-AGS-MCP-001	SEC-AGS-FIT-801	WLC RETURN	FLOW	AI	4-20mA	0 - 5,000	GPM	4-WIRE	FIELD	Y406	2, 6
SEC-AGS-PMP-MD-810	SEC-AGS-MCP-001	SEC-AGS-PMP-810	WLC PUMP NO. 1	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y406	6
SEC-AGS-PMP-HS-810A	SEC-AGS-MCP-001	SEC-AGS-PMP-810	WLC PUMP NO. 1	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y406	6
SEC-AGS-PMP-MN-810	SEC-AGS-MCP-001	SEC-AGS-PMP-810	WLC PUMP NO. 1	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y406	6
SEC-AGS-PMP-YA-810	SEC-AGS-MCP-001	SEC-AGS-PMP-810	WLC PUMP NO. 1	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y406	6
SEC-AGS-PMP-SC-810	SEC-AGS-MCP-001	SEC-AGS-PMP-810	WLC PUMP NO. 1	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y406	6
SEC-AGS-PMP-SI-810	SEC-AGS-MCP-001	SEC-AGS-PMP-810	WLC PUMP NO. 1	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y406	6
SEC-AGS-PMP-MD-820	SEC-AGS-MCP-001	SEC-AGS-PMP-820	WLC PUMP NO. 2	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y406	6
SEC-AGS-PMP-HS-820A	SEC-AGS-MCP-001	SEC-AGS-PMP-820	WLC PUMP NO. 2	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y406	6
SEC-AGS-PMP-MN-820	SEC-AGS-MCP-001	SEC-AGS-PMP-820	WLC PUMP NO. 2	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y406	6
SEC-AGS-PMP-YA-820	SEC-AGS-MCP-001	SEC-AGS-PMP-820	WLC PUMP NO. 2	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y406	6
SEC-AGS-PMP-SC-820	SEC-AGS-MCP-001	SEC-AGS-PMP-820	WLC PUMP NO. 2	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y406	6
SEC-AGS-PMP-SI-820	SEC-AGS-MCP-001	SEC-AGS-PMP-820	WLC PUMP NO. 2	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y406	6
SEC-AGS-PIT-PI-901	SEC-AGS-MCP-001	SEC-AGS-PIT-901	AERATION HEADER	PRESSURE	DI	4-20mA	TBD	PSI	N/A	N/A	Y408	2, 6
SEC-AGS-BLOW-MD-910	SEC-AGS-MCP-001	SEC-AGS-BLOW-910	AERATION BLOWER NO. 1	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y407	6
SEC-AGS-BLOW-MN-910	SEC-AGS-MCP-001	SEC-AGS-BLOW-910	AERATION BLOWER NO. 1	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	6
SEC-AGS-BLOW-HS-910A	SEC-AGS-MCP-001	SEC-AGS-BLOW-910	AERATION BLOWER NO. 1	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	6
SEC-AGS-BLOW-YA-910	SEC-AGS-MCP-001	SEC-AGS-BLOW-910	AERATION BLOWER NO. 1	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	6
SEC-AGS-BLOW-SC-910	SEC-AGS-MCP-001	SEC-AGS-BLOW-910	AERATION BLOWER NO. 1	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y407	6
SEC-AGS-BLOW-SI-910	SEC-AGS-MCP-001	SEC-AGS-BLOW-910	AERATION BLOWER NO. 1	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y407	6
SEC-AGS-BLOW-MD-920	SEC-AGS-MCP-001	SEC-AGS-BLOW-920	AERATION BLOWER NO. 2	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y407	6
SEC-AGS-BLOW-MN-920	SEC-AGS-MCP-001	SEC-AGS-BLOW-920	AERATION BLOWER NO. 2	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	6
SEC-AGS-BLOW-HS-920A	SEC-AGS-MCP-001	SEC-AGS-BLOW-920	AERATION BLOWER NO. 2	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	6
SEC-AGS-BLOW-YA-920	SEC-AGS-MCP-001	SEC-AGS-BLOW-920	AERATION BLOWER NO. 2	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	6
SEC-AGS-BLOW-SC-920	SEC-AGS-MCP-001	SEC-AGS-BLOW-920	AERATION BLOWER NO. 2	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y407	6
SEC-AGS-BLOW-SI-920	SEC-AGS-MCP-001	SEC-AGS-BLOW-920	AERATION BLOWER NO. 2	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y407	6
SEC-AGS-BLOW-MD-930	SEC-AGS-MCP-001	SEC-AGS-BLOW-930	AERATION BLOWER NO. 3	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y407	6
SEC-AGS-BLOW-MN-930	SEC-AGS-MCP-001	SEC-AGS-BLOW-930	AERATION BLOWER NO. 3	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	6
SEC-AGS-BLOW-HS-930A	SEC-AGS-MCP-001	SEC-AGS-BLOW-930	AERATION BLOWER NO. 3	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	6
SEC-AGS-BLOW-YA-930	SEC-AGS-MCP-001	SEC-AGS-BLOW-930	AERATION BLOWER NO. 3	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	6
SEC-AGS-BLOW-SC-930	SEC-AGS-MCP-001	SEC-AGS-BLOW-930	AERATION BLOWER NO. 3	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y407	6
SEC-AGS-BLOW-SI-930	SEC-AGS-MCP-001	SEC-AGS-BLOW-930	AERATION BLOWER NO. 3	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y407	6

TODD CREEK
WWTP
I/O LIST

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-BLOW-MD-940	SEC-AGS-MCP-001	SEC-AGS-BLOW-940	AERATION BLOWER NO. 4	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y408	6
SEC-AGS-BLOW-MN-940	SEC-AGS-MCP-001	SEC-AGS-BLOW-940	AERATION BLOWER NO. 4	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y408	6
SEC-AGS-BLOW-HS-940A	SEC-AGS-MCP-001	SEC-AGS-BLOW-940	AERATION BLOWER NO. 4	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y408	6
SEC-AGS-BLOW-YA-940	SEC-AGS-MCP-001	SEC-AGS-BLOW-940	AERATION BLOWER NO. 4	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y408	6
SEC-AGS-BLOW-SC-940	SEC-AGS-MCP-001	SEC-AGS-BLOW-940	AERATION BLOWER NO. 4	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y408	6
SEC-AGS-BLOW-SI-940	SEC-AGS-MCP-001	SEC-AGS-BLOW-940	AERATION BLOWER NO. 4	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y408	6
SEC-AGS-BLOW-MD-950	SEC-AGS-MCP-001	SEC-AGS-BLOW-950	AERATION BLOWER NO. 5	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y408	6
SEC-AGS-BLOW-MN-950	SEC-AGS-MCP-001	SEC-AGS-BLOW-950	AERATION BLOWER NO. 5	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y408	6
SEC-AGS-BLOW-HS-950A	SEC-AGS-MCP-001	SEC-AGS-BLOW-950	AERATION BLOWER NO. 5	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y408	6
SEC-AGS-BLOW-YA-950	SEC-AGS-MCP-001	SEC-AGS-BLOW-950	AERATION BLOWER NO. 5	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y408	6
SEC-AGS-BLOW-SC-950	SEC-AGS-MCP-001	SEC-AGS-BLOW-950	AERATION BLOWER NO. 5	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y408	6
SEC-AGS-BLOW-SI-950	SEC-AGS-MCP-001	SEC-AGS-BLOW-950	AERATION BLOWER NO. 5	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y408	6
DIS-UV-AIT-AI-021	SEC-AGS-MCP-001	DIS-UV-AIT-020	TOTAL PHOSPHATE	PHOSPHOROUS	AI	COMM	TBD	mg/L PO_4-P	4-WIRE	FIELD	Y601	7

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-AIT-AI-001	SEC-AGS-MCP-061	SEC-AGS-AIT-001	AGS INFLUENT	TSS	AI	4-20mA	0 - 50,000	mg/L	4-WIRE	FIELD	Y401	2
SEC-AGS-VLV-ZSO-101	SEC-AGS-PLC-061	SEC-AGS-VLV-101	AGS BASIN NO. 1 INFLUENT VALVE A	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-ZSO-101	SEC-AGS-PLC-061	SEC-AGS-VLV-101	AGS BASIN NO. 1 INFLUENT VALVE A	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-HS-101	SEC-AGS-PLC-061	SEC-AGS-VLV-101	AGS BASIN NO. 1 INFLUENT VALVE A	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-ZSO-103	SEC-AGS-PLC-061	SEC-AGS-VLV-103	AGS BASIN NO. 1 INFLUENT VALVE B	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-ZSO-103	SEC-AGS-PLC-061	SEC-AGS-VLV-103	AGS BASIN NO. 1 INFLUENT VALVE B	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-HS-103	SEC-AGS-PLC-061	SEC-AGS-VLV-103	AGS BASIN NO. 1 INFLUENT VALVE B	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-HS-105	SEC-AGS-PLC-061	SEC-AGS-VLV-105	AGS BASIN NO. 1 AIR VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZSC-105	SEC-AGS-PLC-061	SEC-AGS-VLV-105	AGS BASIN NO. 1 AIR VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZI-105	SEC-AGS-PLC-061	SEC-AGS-VLV-105	AGS BASIN NO. 1 AIR VALVE	POSITION	AI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZSO-108	SEC-AGS-MCP-001	SEC-AGS-VLV-108	AGS BASIN NO. 1 AIR VALVE	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZSO-108	SEC-AGS-MCP-001	SEC-AGS-VLV-108	AGS BASIN NO. 1 AIR VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-HS-108	SEC-AGS-MCP-001	SEC-AGS-VLV-108	AGS BASIN NO. 1 AIR VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZSO-109	SEC-AGS-PLC-061	SEC-AGS-VLV-109	AGS BASIN NO. 1 SLUDGE AIR VALVE	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZSO-109	SEC-AGS-PLC-061	SEC-AGS-VLV-109	AGS BASIN NO. 1 SLUDGE AIR VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-HS-109	SEC-AGS-PLC-061	SEC-AGS-VLV-109	AGS BASIN NO. 1 SLUDGE AIR VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-HS-110	SEC-AGS-PLC-061	SEC-AGS-VLV-110	AGS BASIN NO. 1 SLUDGE VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZSC-110	SEC-AGS-PLC-061	SEC-AGS-VLV-110	AGS BASIN NO. 1 SLUDGE VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZI-110	SEC-AGS-PLC-061	SEC-AGS-VLV-110	AGS BASIN NO. 1 SLUDGE VALVE	POSITION	AI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-HS-111	SEC-AGS-PLC-061	SEC-AGS-VLV-111	AGS BASIN NO. 1 WLC VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZSC-111	SEC-AGS-PLC-061	SEC-AGS-VLV-111	AGS BASIN NO. 1 WLC VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZI-111	SEC-AGS-PLC-061	SEC-AGS-VLV-111	AGS BASIN NO. 1 WLC VALVE	POSITION	AI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-FIT-FA-101	SEC-AGS-PLC-061	SEC-AGS-FIT-101	AGS BASIN NO. 1 INFLUENT	REVERSE FLOW	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-FIT-FI-101	SEC-AGS-PLC-061	SEC-AGS-FIT-101	AGS BASIN NO. 1 INFLUENT	FLOW	AI	COMM	0 - 15,000	GPM	N/A	N/A	Y401	6
SEC-AGS-FIT-FI-102	SEC-AGS-PLC-061	SEC-AGS-FIT-102	AGS BASIN NO. 1 PROCESS AIR	FLOW	AI	COMM	0 - 15,000	SCFM	N/A	N/A	Y402	6
SEC-AGS-PIT-PI-101	SEC-AGS-PLC-061	SEC-AGS-PIT-101	AGS BASIN NO. 1 SLUDGE PRESSURE TRANSMITTER	PRESSURE	AI	COMM	TBD	PSI	N/A	N/A	Y402	6
SEC-AGS-LT-LI-101	SEC-AGS-PLC-061	SEC-AGS-LT-101	AGS BASIN NO. 1 LEVEL TRANSMITTER	LEVEL	AI	COMM	0 - 25	FEET	N/A	N/A	Y402	6
SEC-AGS-LSH-LAH-101	SEC-AGS-PLC-061	SEC-AGS-LSH-101	AGS BASIN NO. 1 LEVEL SWITCH	LEVEL HIGH	DI	COMM	TBD	FEET	N/A	N/A	Y402	6
SEC-AGS-AE-AI-111	SEC-AGS-PLC-061	SEC-AGS-AIT-110	AGS BASIN NO. 1 NH4 TRANSDUCER	NH4	AI	COMM	0 - 100	mg/L	N/A	N/A	Y402	6
SEC-AGS-AE-TI-121	SEC-AGS-PLC-061	SEC-AGS-AIT-120	AGS BASIN NO. 1 TEMPERATURE	TEMPERATURE	AI	COMM	TBD	°F	N/A	N/A	Y402	6
SEC-AGS-AE-AI-121	SEC-AGS-PLC-061	SEC-AGS-AIT-120	AGS BASIN NO. 1 pH TRANSDUCER	pH	AI	COMM	0 - 14	SU	N/A	N/A	Y402	6
SEC-AGS-AE-AI-122	SEC-AGS-PLC-061	SEC-AGS-AIT-120	AGS BASIN NO. 1 D.O. TRANSDUCER	DISSOLVED OXYGEN	AI	COMM	0 - 10.0	mg/L	N/A	N/A	Y402	6
SEC-AGS-AE-AI-123	SEC-AGS-PLC-061	SEC-AGS-AIT-120	AGS BASIN NO. 1 TSS TRANSDUCER	TSS	AI	COMM	0 - 50,000	mg/L	N/A	N/A	Y402	6
SEC-AGS-AE-AI-124	SEC-AGS-PLC-061	SEC-AGS-AIT-120	AGS BASIN NO. 1 ORP TRANSDUCER	ORP	AI	COMM	-1,500 - 1,500	mV	N/A	N/A	Y402	6

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-VLV-ZSO-201	SEC-AGS-PLC-061	SEC-AGS-VLV-201	AGS BASIN NO. 2 INFLUENT VALVE A	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-ZSO-201	SEC-AGS-PLC-061	SEC-AGS-VLV-201	AGS BASIN NO. 2 INFLUENT VALVE A	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-HS-201	SEC-AGS-PLC-061	SEC-AGS-VLV-201	AGS BASIN NO. 2 INFLUENT VALVE A	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-ZSO-203	SEC-AGS-PLC-061	SEC-AGS-VLV-203	AGS BASIN NO. 2 INFLUENT VALVE B	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-ZSO-203	SEC-AGS-PLC-061	SEC-AGS-VLV-203	AGS BASIN NO. 2 INFLUENT VALVE B	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-HS-203	SEC-AGS-PLC-061	SEC-AGS-VLV-203	AGS BASIN NO. 2 INFLUENT VALVE B	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-HS-205	SEC-AGS-PLC-061	SEC-AGS-VLV-205	AGS BASIN NO. 2 AIR VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZSC-205	SEC-AGS-PLC-061	SEC-AGS-VLV-205	AGS BASIN NO. 2 AIR VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZI-205	SEC-AGS-PLC-061	SEC-AGS-VLV-205	AGS BASIN NO. 2 AIR VALVE	POSITION	AI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZSO-208	SEC-AGS-MCP-001	SEC-AGS-VLV-208	AGS BASIN NO. 2 AIR VALVE	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZSO-208	SEC-AGS-MCP-001	SEC-AGS-VLV-208	AGS BASIN NO. 2 AIR VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-HS-208	SEC-AGS-MCP-001	SEC-AGS-VLV-208	AGS BASIN NO. 2 AIR VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZSO-209	SEC-AGS-PLC-061	SEC-AGS-VLV-209	AGS BASIN NO. 2 SLUDGE AIR VALVE	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZSO-209	SEC-AGS-PLC-061	SEC-AGS-VLV-209	AGS BASIN NO. 2 SLUDGE AIR VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-HS-209	SEC-AGS-PLC-061	SEC-AGS-VLV-209	AGS BASIN NO. 2 SLUDGE AIR VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-HS-210	SEC-AGS-PLC-061	SEC-AGS-VLV-210	AGS BASIN NO. 2 SLUDGE VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZSC-210	SEC-AGS-PLC-061	SEC-AGS-VLV-210	AGS BASIN NO. 2 SLUDGE VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZI-210	SEC-AGS-PLC-061	SEC-AGS-VLV-210	AGS BASIN NO. 2 SLUDGE VALVE	POSITION	AI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-HS-211	SEC-AGS-PLC-061	SEC-AGS-VLV-211	AGS BASIN NO. 2 WLC VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZSC-211	SEC-AGS-PLC-061	SEC-AGS-VLV-211	AGS BASIN NO. 2 WLC VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-VLV-ZI-211	SEC-AGS-PLC-061	SEC-AGS-VLV-211	AGS BASIN NO. 2 WLC VALVE	POSITION	AI	COMM	N/A	N/A	N/A	N/A	Y402	6
SEC-AGS-FIT-FA-201	SEC-AGS-PLC-061	SEC-AGS-FIT-201	AGS BASIN NO. 2 INFLUENT	REVERSE FLOW	DI	COMM		N/A	N/A	N/A	Y401	6
SEC-AGS-FIT-FI-201	SEC-AGS-PLC-061	SEC-AGS-FIT-201	AGS BASIN NO. 2 INFLUENT	FLOW	AI	COMM	0 - 15,000	GPM	N/A	N/A	Y401	6
SEC-AGS-FIT-FI-202	SEC-AGS-PLC-061	SEC-AGS-FIT-202	AGS BASIN NO. 2 PROCESS AIR	FLOW	AI	COMM	0 - 15,000	SCFM	N/A	N/A	Y402	6
SEC-AGS-PIT-PI-201	SEC-AGS-PLC-061	SEC-AGS-PIT-201	AGS BASIN NO. 2 SLUDGE PRESSURE TRANSMITTER	PRESSURE	AI	COMM	TBD	PSI	N/A	N/A	Y402	6
SEC-AGS-LT-LI-201	SEC-AGS-PLC-061	SEC-AGS-LT-201	AGS BASIN NO. 2 LEVEL TRANSMITTER	LEVEL	AI	COMM	0 - 25	FEET	N/A	N/A	Y402	6
SEC-AGS-LSH-LAH-201	SEC-AGS-PLC-061	SEC-AGS-LSH-201	AGS BASIN NO. 2 LEVEL SWITCH	LEVEL HIGH	DI	COMM	TBD	FEET	N/A	N/A	Y402	6
SEC-AGS-AE-AI-211	SEC-AGS-PLC-061	SEC-AGS-AIT-210	AGS BASIN NO. 2 NH4 TRANSDUCER	NH4	AI	COMM	0 - 100	mg/L	N/A	N/A	Y402	6
SEC-AGS-AE-TI-221	SEC-AGS-PLC-061	SEC-AGS-AIT-220	AGS BASIN NO. 2 TEMPERATURE	TEMPERATURE	AI	COMM	TBD	°F	N/A	N/A	Y402	6
SEC-AGS-AE-AI-221	SEC-AGS-PLC-061	SEC-AGS-AIT-220	AGS BASIN NO. 2 pH TRANSDUCER	pH	AI	COMM	0 - 14	SU	N/A	N/A	Y402	6
SEC-AGS-AE-AI-222	SEC-AGS-PLC-061	SEC-AGS-AIT-220	AGS BASIN NO. 2 D.O. TRANSDUCER	DISSOLVED OXYGEN	AI	COMM	0 - 10.0	mg/L	N/A	N/A	Y402	6
SEC-AGS-AE-AI-223	SEC-AGS-PLC-061	SEC-AGS-AIT-220	AGS BASIN NO. 2 TSS TRANSDUCER	TSS	AI	COMM	0 - 50,000	mg/L	N/A	N/A	Y402	6
SEC-AGS-AE-AI-224	SEC-AGS-PLC-061	SEC-AGS-AIT-220	AGS BASIN NO. 2 ORP TRANSDUCER	ORP	AI	COMM	-1,500 - 1,500	mV	N/A	N/A	Y402	6

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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-VLV-ZSO-301	SEC-AGS-PLC-061	SEC-AGS-VLV-301	AGS BASIN NO. 3 INFLUENT VALVE A	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-ZSO-301	SEC-AGS-PLC-061	SEC-AGS-VLV-301	AGS BASIN NO. 3 INFLUENT VALVE A	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-HS-301	SEC-AGS-PLC-061	SEC-AGS-VLV-301	AGS BASIN NO. 3 INFLUENT VALVE A	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-ZSO-303	SEC-AGS-PLC-061	SEC-AGS-VLV-303	AGS BASIN NO. 3 INFLUENT VALVE B	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-ZSO-303	SEC-AGS-PLC-061	SEC-AGS-VLV-303	AGS BASIN NO. 3 INFLUENT VALVE B	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-HS-303	SEC-AGS-PLC-061	SEC-AGS-VLV-303	AGS BASIN NO. 3 INFLUENT VALVE B	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-HS-305	SEC-AGS-PLC-061	SEC-AGS-VLV-305	AGS BASIN NO. 3 AIR VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZSC-305	SEC-AGS-PLC-061	SEC-AGS-VLV-305	AGS BASIN NO. 3 AIR VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZI-305	SEC-AGS-PLC-061	SEC-AGS-VLV-305	AGS BASIN NO. 3 AIR VALVE	POSITION	AI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZSO-308	SEC-AGS-MCP-001	SEC-AGS-VLV-308	AGS BASIN NO. 3 AIR VALVE	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZSO-308	SEC-AGS-MCP-001	SEC-AGS-VLV-308	AGS BASIN NO. 3 AIR VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-HS-308	SEC-AGS-MCP-001	SEC-AGS-VLV-308	AGS BASIN NO. 3 AIR VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZSO-309	SEC-AGS-PLC-061	SEC-AGS-VLV-309	AGS BASIN NO. 3 SLUDGE AIR VALVE	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZSO-309	SEC-AGS-PLC-061	SEC-AGS-VLV-309	AGS BASIN NO. 3 SLUDGE AIR VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-HS-309	SEC-AGS-PLC-061	SEC-AGS-VLV-309	AGS BASIN NO. 3 SLUDGE AIR VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-HS-310	SEC-AGS-PLC-061	SEC-AGS-VLV-310	AGS BASIN NO. 3 SLUDGE VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZSC-310	SEC-AGS-PLC-061	SEC-AGS-VLV-310	AGS BASIN NO. 3 SLUDGE VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZI-310	SEC-AGS-PLC-061	SEC-AGS-VLV-310	AGS BASIN NO. 3 SLUDGE VALVE	POSITION	AI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-HS-311	SEC-AGS-PLC-061	SEC-AGS-VLV-311	AGS BASIN NO. 3 WLC VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZSC-311	SEC-AGS-PLC-061	SEC-AGS-VLV-311	AGS BASIN NO. 3 WLC VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZI-311	SEC-AGS-PLC-061	SEC-AGS-VLV-311	AGS BASIN NO. 3 WLC VALVE	POSITION	AI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-FIT-FA-301	SEC-AGS-PLC-061	SEC-AGS-FIT-301	AGS BASIN NO. 3 INFLUENT	REVERSE FLOW	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-FIT-FI-301	SEC-AGS-PLC-061	SEC-AGS-FIT-301	AGS BASIN NO. 3 INFLUENT	FLOW	AI	COMM	0 - 15,000	GPM	N/A	N/A	Y401	6
SEC-AGS-FIT-FI-302	SEC-AGS-PLC-061	SEC-AGS-FIT-302	AGS BASIN NO. 3 PROCESS AIR	FLOW	AI	COMM	0 - 15,000	SCFM	N/A	N/A	Y403	6
SEC-AGS-PIT-PI-301	SEC-AGS-PLC-061	SEC-AGS-PIT-301	AGS BASIN NO. 3 SLUDGE PRESSURE TRANSMITTER	PRESSURE	AI	COMM	TBD	PSI	N/A	N/A	Y403	6
SEC-AGS-LT-LI-301	SEC-AGS-PLC-061	SEC-AGS-LT-301	AGS BASIN NO. 3 LEVEL TRANSMITTER	LEVEL	AI	COMM	0 - 25	FEET	N/A	N/A	Y403	6
SEC-AGS-LSH-LAH-301	SEC-AGS-PLC-061	SEC-AGS-LSH-301	AGS BASIN NO. 3 LEVEL SWITCH	LEVEL HIGH	DI	COMM	TBD	FEET	N/A	N/A	Y403	6
SEC-AGS-AE-AI-311	SEC-AGS-PLC-061	SEC-AGS-AIT-310	AGS BASIN NO. 3 NH4 TRANSDUCER	NH4	AI	COMM	0 - 100	mg/L	N/A	N/A	Y403	6
SEC-AGS-AE-TI-321	SEC-AGS-PLC-061	SEC-AGS-AIT-320	AGS BASIN NO. 3 TEMPERATURE	TEMPERATURE	AI	COMM	TBD	°F	N/A	N/A	Y403	6
SEC-AGS-AE-AI-321	SEC-AGS-PLC-061	SEC-AGS-AIT-320	AGS BASIN NO. 3 pH TRANSDUCER	pH	AI	COMM	0 - 14	SU	N/A	N/A	Y403	6
SEC-AGS-AE-AI-322	SEC-AGS-PLC-061	SEC-AGS-AIT-320	AGS BASIN NO. 3 D.O. TRANSDUCER	DISSOLVED OXYGEN	AI	COMM	0 - 10.0	mg/L	N/A	N/A	Y403	6
SEC-AGS-AE-AI-323	SEC-AGS-PLC-061	SEC-AGS-AIT-320	AGS BASIN NO. 3 TSS TRANSDUCER	TSS	AI	COMM	0 - 50,000	mg/L	N/A	N/A	Y403	6
SEC-AGS-AE-AI-324	SEC-AGS-PLC-061	SEC-AGS-AIT-320	AGS BASIN NO. 3 ORP TRANSDUCER	ORP	AI	COMM	-1,500 - 1,500	mV	N/A	N/A	Y403	6

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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-VLV-ZSO-401	SEC-AGS-PLC-061	SEC-AGS-VLV-401	AGS BASIN NO. 4 INFLUENT VALVE A	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-ZSO-401	SEC-AGS-PLC-061	SEC-AGS-VLV-401	AGS BASIN NO. 4 INFLUENT VALVE A	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-HS-401	SEC-AGS-PLC-061	SEC-AGS-VLV-401	AGS BASIN NO. 4 INFLUENT VALVE A	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-ZSO-403	SEC-AGS-PLC-061	SEC-AGS-VLV-403	AGS BASIN NO. 4 INFLUENT VALVE B	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-ZSO-403	SEC-AGS-PLC-061	SEC-AGS-VLV-403	AGS BASIN NO. 4 INFLUENT VALVE B	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-HS-403	SEC-AGS-PLC-061	SEC-AGS-VLV-403	AGS BASIN NO. 4 INFLUENT VALVE B	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y401	6
SEC-AGS-VLV-HS-405	SEC-AGS-PLC-061	SEC-AGS-VLV-405	AGS BASIN NO. 4 AIR VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZSC-405	SEC-AGS-PLC-061	SEC-AGS-VLV-405	AGS BASIN NO. 4 AIR VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZI-405	SEC-AGS-PLC-061	SEC-AGS-VLV-405	AGS BASIN NO. 4 AIR VALVE	POSITION	AI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZSO-408	SEC-AGS-MCP-001	SEC-AGS-VLV-408	AGS BASIN NO. 4 AIR VALVE	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZSO-408	SEC-AGS-MCP-001	SEC-AGS-VLV-408	AGS BASIN NO. 4 AIR VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-HS-408	SEC-AGS-MCP-001	SEC-AGS-VLV-408	AGS BASIN NO. 4 AIR VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZSO-409	SEC-AGS-PLC-061	SEC-AGS-VLV-409	AGS BASIN NO. 4 SLUDGE AIR VALVE	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZSO-409	SEC-AGS-PLC-061	SEC-AGS-VLV-409	AGS BASIN NO. 4 SLUDGE AIR VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-HS-409	SEC-AGS-PLC-061	SEC-AGS-VLV-409	AGS BASIN NO. 4 SLUDGE AIR VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-HS-410	SEC-AGS-PLC-061	SEC-AGS-VLV-410	AGS BASIN NO. 4 SLUDGE VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZSC-410	SEC-AGS-PLC-061	SEC-AGS-VLV-410	AGS BASIN NO. 4 SLUDGE VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZI-410	SEC-AGS-PLC-061	SEC-AGS-VLV-410	AGS BASIN NO. 4 SLUDGE VALVE	POSITION	AI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-HS-411	SEC-AGS-PLC-061	SEC-AGS-VLV-411	AGS BASIN NO. 4 WLC VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZSC-411	SEC-AGS-PLC-061	SEC-AGS-VLV-411	AGS BASIN NO. 4 WLC VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-VLV-ZI-411	SEC-AGS-PLC-061	SEC-AGS-VLV-411	AGS BASIN NO. 4 WLC VALVE	POSITION	AI	COMM	N/A	N/A	N/A	N/A	Y403	6
SEC-AGS-FIT-FA-401	SEC-AGS-PLC-061	SEC-AGS-FIT-401	AGS BASIN NO. 4 INFLUENT	REVERSE FLOW	DI	COMM		N/A	N/A	N/A	Y401	6
SEC-AGS-FIT-FI-401	SEC-AGS-PLC-061	SEC-AGS-FIT-401	AGS BASIN NO. 4 INFLUENT	FLOW	AI	COMM	0 - 15,000	GPM	N/A	N/A	Y401	6
SEC-AGS-FIT-FI-402	SEC-AGS-PLC-061	SEC-AGS-FIT-402	AGS BASIN NO. 4 PROCESS AIR	FLOW	AI	COMM	0 - 15,000	SCFM	N/A	N/A	Y403	6
SEC-AGS-PIT-PI-401	SEC-AGS-PLC-061	SEC-AGS-PIT-401	AGS BASIN NO. 4 SLUDGE PRESSURE TRANSMITTER	PRESSURE	AI	COMM	TBD	PSI	N/A	N/A	Y403	6
SEC-AGS-LT-LI-401	SEC-AGS-PLC-061	SEC-AGS-LT-401	AGS BASIN NO. 4 LEVEL TRANSMITTER	LEVEL	AI	COMM	0 - 25	FEET	N/A	N/A	Y403	6
SEC-AGS-LSH-LAH-401	SEC-AGS-PLC-061	SEC-AGS-LSH-401	AGS BASIN NO. 4 LEVEL SWITCH	LEVEL HIGH	DI	COMM	TBD	FEET	N/A	N/A	Y403	6
SEC-AGS-AE-AI-411	SEC-AGS-PLC-061	SEC-AGS-AIT-410	AGS BASIN NO. 4 NH4 TRANSDUCER	NH4	AI	COMM	0 - 100	mg/L	N/A	N/A	Y403	6
SEC-AGS-AE-TI-421	SEC-AGS-PLC-061	SEC-AGS-AIT-420	AGS BASIN NO. 4 TEMPERATURE	TEMPERATURE	AI	COMM	TBD	°F	N/A	N/A	Y403	6
SEC-AGS-AE-AI-421	SEC-AGS-PLC-061	SEC-AGS-AIT-420	AGS BASIN NO. 4 pH TRANSDUCER	pH	AI	COMM	0 - 14	SU	N/A	N/A	Y403	6
SEC-AGS-AE-AI-422	SEC-AGS-PLC-061	SEC-AGS-AIT-420	AGS BASIN NO. 4 D.O. TRANSDUCER	DISSOLVED OXYGEN	AI	COMM	0 - 10.0	mg/L	N/A	N/A	Y403	6
SEC-AGS-AE-AI-423	SEC-AGS-PLC-061	SEC-AGS-AIT-420	AGS BASIN NO. 4 TSS TRANSDUCER	TSS	AI	COMM	0 - 50,000	mg/L	N/A	N/A	Y403	6
SEC-AGS-AE-AI-424	SEC-AGS-PLC-061	SEC-AGS-AIT-420	AGS BASIN NO. 4 ORP TRANSDUCER	ORP	AI	COMM	-1,500 - 1,500	mV	N/A	N/A	Y403	6

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-FIT-FA-601	SEC-AGS-PLC-061	SEC-AGS-FIT-601	SUPERNATANT INFLUENT HEADER	REVERSE FLOW	DI	COMM		N/A	N/A	N/A	Y405	6
SEC-AGS-FIT-FI-601	SEC-AGS-PLC-061	SEC-AGS-FIT-601	SUPERNATANT INFLUENT HEADER	FLOW	AI	COMM	0 - 1,200	GPM	N/A	N/A	Y405	6
SEC-AGS-AIT-AI-701	SEC-AGS-PLC-061	SEC-AGS-AIT-701	SLUDGE PUMPING	TSS	AI	COMM	0 - 50,000	mg/L	N/A	N/A	Y405	6
SEC-AGS-FIT-FA-701	SEC-AGS-PLC-061	SEC-AGS-FIT-701	SLUDGE PUMPING	REVERSE FLOW	DI	COMM		N/A	N/A	N/A	Y405	6
SEC-AGS-FIT-FI-701	SEC-AGS-PLC-061	SEC-AGS-FIT-701	SLUDGE PUMPING	FLOW	AI	COMM	0 - 500	GPM	N/A	N/A	Y405	6
SEC-AGS-LT-LI-510	SEC-AGS-PLC-061	SEC-AGS-LT-510	SLUDGE BUFFER TANK NO. 1	LEVEL	AI	COMM	0 - 25	FEET	N/A	N/A	Y405	6
SEC-AGS-LSH-LAH-510	SEC-AGS-PLC-061	SEC-AGS-LSH-510	SLUDGE BUFFER TANK NO. 1	LEVEL HIGH	DI	COMM	TBD	FEET	N/A	N/A	Y405	6
SEC-AGS-LSL-LAL-510	SEC-AGS-PLC-061	SEC-AGS-LSL-510	SLUDGE BUFFER TANK NO. 1	LEVEL LOW	DI	COMM	TBD	FEET	N/A	N/A	Y405	6
SEC-AGS-LSLL-LALL-510	SEC-AGS-PLC-061	SEC-AGS-LSLL-510	SLUDGE BUFFER TANK NO. 1	LEVEL LOW-LOW	DI	COMM	TBD	FEET	N/A	N/A	Y405	6
SEC-AGS-VLV-ZSO-511	SEC-AGS-PLC-061	SEC-AGS-VLV-511	SLUDGE BUFFER TANK NO. 1 INFLUENT VALVE	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y405	6
SEC-AGS-VLV-ZSO-511	SEC-AGS-PLC-061	SEC-AGS-VLV-511	SLUDGE BUFFER TANK NO. 1 INFLUENT VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y405	6
SEC-AGS-VLV-HS-511	SEC-AGS-PLC-061	SEC-AGS-VLV-511	SLUDGE BUFFER TANK NO. 1 INFLUENT VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y405	6
SEC-AGS-LT-LI-520	SEC-AGS-PLC-061	SEC-AGS-LT-520	SLUDGE BUFFER TANK NO. 2	LEVEL	AI	COMM	0 - 25	FEET	N/A	N/A	Y405	6
SEC-AGS-LSH-LAH-520	SEC-AGS-PLC-061	SEC-AGS-LSH-520	SLUDGE BUFFER TANK NO. 2	LEVEL HIGH	DI	COMM	TBD	FEET	N/A	N/A	Y405	6
SEC-AGS-LSL-LAL-520	SEC-AGS-PLC-061	SEC-AGS-LSL-520	SLUDGE BUFFER TANK NO. 2	LEVEL LOW	DI	COMM	TBD	FEET	N/A	N/A	Y405	6
SEC-AGS-LSLL-LALL-520	SEC-AGS-PLC-061	SEC-AGS-LSLL-520	SLUDGE BUFFER TANK NO. 2	LEVEL LOW-LOW	DI	COMM	TBD	FEET	N/A	N/A	Y405	6
SEC-AGS-VLV-ZSO-521	SEC-AGS-PLC-061	SEC-AGS-VLV-521	SLUDGE BUFFER TANK NO. 2 INFLUENT VALVE	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y405	6
SEC-AGS-VLV-ZSO-521	SEC-AGS-PLC-061	SEC-AGS-VLV-521	SLUDGE BUFFER TANK NO. 2 INFLUENT VALVE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y405	6
SEC-AGS-VLV-HS-521	SEC-AGS-PLC-061	SEC-AGS-VLV-521	SLUDGE BUFFER TANK NO. 2 INFLUENT VALVE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y405	6
SEC-AGS-PMP-HS-610A	SEC-AGS-PLC-061	SEC-AGS-PMP-610	SUPERNATANT PUMP NO. 1	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-HS-610B	SEC-AGS-PLC-061	SEC-AGS-PMP-610	SUPERNATANT PUMP NO. 1	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-MN-610	SEC-AGS-PLC-061	SEC-AGS-PMP-610	SUPERNATANT PUMP NO. 1	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-TAH-610	SEC-AGS-PLC-061	SEC-AGS-PMP-610	SUPERNATANT PUMP NO. 1	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-YA-610	SEC-AGS-PLC-061	SEC-AGS-PMP-610	SUPERNATANT PUMP NO. 1	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-SI-610	SEC-AGS-PLC-061	SEC-AGS-PMP-610	SUPERNATANT PUMP NO. 1	SPEED	AI	COMM	0-100	%	N/A	N/A	Y405	
SEC-AGS-PMP-II-610	SEC-AGS-PLC-061	SEC-AGS-PMP-610	SUPERNATANT PUMP NO. 1	CURRENT	AI	COMM		AMPS	N/A	N/A	Y405	4
SEC-AGS-PMP-HS-620A	SEC-AGS-PLC-061	SEC-AGS-PMP-620	SUPERNATANT PUMP NO. 2	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-HS-620B	SEC-AGS-PLC-061	SEC-AGS-PMP-620	SUPERNATANT PUMP NO. 2	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-MN-620	SEC-AGS-PLC-061	SEC-AGS-PMP-620	SUPERNATANT PUMP NO. 2	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-TAH-620	SEC-AGS-PLC-061	SEC-AGS-PMP-620	SUPERNATANT PUMP NO. 2	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-YA-620	SEC-AGS-PLC-061	SEC-AGS-PMP-620	SUPERNATANT PUMP NO. 2	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-SI-620	SEC-AGS-PLC-061	SEC-AGS-PMP-620	SUPERNATANT PUMP NO. 2	SPEED	AI	COMM	0-100	%	N/A	N/A	Y405	
SEC-AGS-PMP-II-620	SEC-AGS-PLC-061	SEC-AGS-PMP-620	SUPERNATANT PUMP NO. 2	CURRENT	AI	COMM		AMPS	N/A	N/A	Y405	4

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-PMP-HS-630A	SEC-AGS-PLC-061	SEC-AGS-PMP-630	SUPERNATANT PUMP NO. 3	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-HS-630B	SEC-AGS-PLC-061	SEC-AGS-PMP-630	SUPERNATANT PUMP NO. 3	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-MN-630	SEC-AGS-PLC-061	SEC-AGS-PMP-630	SUPERNATANT PUMP NO. 3	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-TAH-630	SEC-AGS-PLC-061	SEC-AGS-PMP-630	SUPERNATANT PUMP NO. 3	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-YA-630	SEC-AGS-PLC-061	SEC-AGS-PMP-630	SUPERNATANT PUMP NO. 3	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-SI-630	SEC-AGS-PLC-061	SEC-AGS-PMP-630	SUPERNATANT PUMP NO. 3	SPEED	AI	COMM	0-100	%	N/A	N/A	Y405	
SEC-AGS-PMP-II-630	SEC-AGS-PLC-061	SEC-AGS-PMP-630	SUPERNATANT PUMP NO. 3	CURRENT	AI	COMM		AMPS	N/A	N/A	Y405	4
SEC-AGS-PMP-HS-710A	SEC-AGS-PLC-061	SEC-AGS-PMP-710	SLUDGE PUMP NO. 1	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-HS-710B	SEC-AGS-PLC-061	SEC-AGS-PMP-710	SLUDGE PUMP NO. 1	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-MN-710	SEC-AGS-PLC-061	SEC-AGS-PMP-710	SLUDGE PUMP NO. 1	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-TAH-710	SEC-AGS-PLC-061	SEC-AGS-PMP-710	SLUDGE PUMP NO. 1	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-YA-710	SEC-AGS-PLC-061	SEC-AGS-PMP-710	SLUDGE PUMP NO. 1	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-SI-710	SEC-AGS-PLC-061	SEC-AGS-PMP-710	SLUDGE PUMP NO. 1	SPEED	AI	COMM	0-100	%	N/A	N/A	Y405	
SEC-AGS-PMP-II-710	SEC-AGS-PLC-061	SEC-AGS-PMP-710	SLUDGE PUMP NO. 1	CURRENT	AI	COMM		AMPS	N/A	N/A	Y405	4
SEC-AGS-PMP-HS-720A	SEC-AGS-PLC-061	SEC-AGS-PMP-720	SLUDGE PUMP NO. 2	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-HS-720B	SEC-AGS-PLC-061	SEC-AGS-PMP-720	SLUDGE PUMP NO. 2	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-MN-720	SEC-AGS-PLC-061	SEC-AGS-PMP-720	SLUDGE PUMP NO. 2	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-TAH-720	SEC-AGS-PLC-061	SEC-AGS-PMP-720	SLUDGE PUMP NO. 2	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-YA-720	SEC-AGS-PLC-061	SEC-AGS-PMP-720	SLUDGE PUMP NO. 2	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-SI-720	SEC-AGS-PLC-061	SEC-AGS-PMP-720	SLUDGE PUMP NO. 2	SPEED	AI	COMM	0-100	%	N/A	N/A	Y405	
SEC-AGS-PMP-II-720	SEC-AGS-PLC-061	SEC-AGS-PMP-720	SLUDGE PUMP NO. 2	CURRENT	AI	COMM		AMPS	N/A	N/A	Y405	4
SEC-AGS-PMP-HS-730A	SEC-AGS-PLC-061	SEC-AGS-PMP-730	SLUDGE PUMP NO. 3	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-HS-730B	SEC-AGS-PLC-061	SEC-AGS-PMP-730	SLUDGE PUMP NO. 3	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-MN-730	SEC-AGS-PLC-061	SEC-AGS-PMP-730	SLUDGE PUMP NO. 3	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-TAH-730	SEC-AGS-PLC-061	SEC-AGS-PMP-730	SLUDGE PUMP NO. 3	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-YA-730	SEC-AGS-PLC-061	SEC-AGS-PMP-730	SLUDGE PUMP NO. 3	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y405	
SEC-AGS-PMP-SI-730	SEC-AGS-PLC-061	SEC-AGS-PMP-730	SLUDGE PUMP NO. 3	SPEED	AI	COMM	0-100	%	N/A	N/A	Y405	
SEC-AGS-PMP-II-730	SEC-AGS-PLC-061	SEC-AGS-PMP-730	SLUDGE PUMP NO. 3	CURRENT	AI	COMM		AMPS	N/A	N/A	Y405	4
SEC-AGS-LSH-LAH-801	SEC-AGS-PLC-061	SEC-AGS-LSH-801	WLC TANK	LEVEL HIGH	DI	COMM		FEET(MSL)	N/A	N/A	Y406	6
SEC-AGS-LSLL-LALL-801	SEC-AGS-PLC-061	SEC-AGS-LSLL-801	WLC TANK	LEVEL LOW-LOW	DI	COMM		FEET(MSL)	N/A	N/A	Y406	6
SEC-AGS-LSL-LAL-801	SEC-AGS-PLC-061	SEC-AGS-LSL-801	WLC TANK	LEVEL LOW	DI	COMM		FEET(MSL)	N/A	N/A	Y406	6
SEC-AGS-LSHH-LAHH-801	SEC-AGS-PLC-061	SEC-AGS-LSHH-801	WLC TANK	LEVEL HIGH-HIGH	DI	COMM		FEET(MSL)	N/A	N/A	Y406	6
SEC-AGS-LT-LI-801	SEC-AGS-PLC-061	SEC-AGS-LT-801	WLC TANK	LEVEL	AI	COMM		FEET	N/A	N/A	Y406	6
SEC-AGS-LWCO-HS-801	SEC-AGS-PLC-061	SEC-AGS-LWCO-801	LWCO IN BYPASS	IN-BYPASS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y406	
SEC-AGS-LWCO-YA-801	SEC-AGS-PLC-061	SEC-AGS-LWCO-801	LWCO CUTOUT	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y406	
SEC-AGS-FIT-FA-801	SEC-AGS-PLC-061	SEC-AGS-FIT-801	WLC RETURN	REVERSE FLOW	DI	COMM		N/A	N/A	N/A	Y406	6
SEC-AGS-FIT-FI-801	SEC-AGS-PLC-061	SEC-AGS-FIT-801	WLC RETURN	FLOW	AI	COMM		GPM	N/A	N/A	Y406	6

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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-PMP-HS-810A	SEC-AGS-PLC-061	SEC-AGS-PMP-810	WLC PUMP NO. 1	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y406	
SEC-AGS-PMP-HS-810B	SEC-AGS-PLC-061	SEC-AGS-PMP-810	WLC PUMP NO. 1	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y406	
SEC-AGS-PMP-MN-810	SEC-AGS-PLC-061	SEC-AGS-PMP-810	WLC PUMP NO. 1	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y406	
SEC-AGS-PMP-TAH-810	SEC-AGS-PLC-061	SEC-AGS-PMP-810	WLC PUMP NO. 1	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y406	
SEC-AGS-PMP-YA-810	SEC-AGS-PLC-061	SEC-AGS-PMP-810	WLC PUMP NO. 1	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y406	
SEC-AGS-PMP-SI-810	SEC-AGS-PLC-061	SEC-AGS-PMP-810	WLC PUMP NO. 1	SPEED	AI	COMM	0-100	%	N/A	N/A	Y406	
SEC-AGS-PMP-II-810	SEC-AGS-PLC-061	SEC-AGS-PMP-810	WLC PUMP NO. 1	CURRENT	AI	COMM		AMPS	N/A	N/A	Y406	4
SEC-AGS-PMP-HS-820A	SEC-AGS-PLC-061	SEC-AGS-PMP-820	WLC PUMP NO. 2	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y406	
SEC-AGS-PMP-HS-820B	SEC-AGS-PLC-061	SEC-AGS-PMP-820	WLC PUMP NO. 2	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y406	
SEC-AGS-PMP-MN-820	SEC-AGS-PLC-061	SEC-AGS-PMP-820	WLC PUMP NO. 2	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y406	
SEC-AGS-PMP-TAH-820	SEC-AGS-PLC-061	SEC-AGS-PMP-820	WLC PUMP NO. 2	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y406	
SEC-AGS-PMP-YA-820	SEC-AGS-PLC-061	SEC-AGS-PMP-820	WLC PUMP NO. 2	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y406	
SEC-AGS-PMP-SI-820	SEC-AGS-PLC-061	SEC-AGS-PMP-820	WLC PUMP NO. 2	SPEED	AI	COMM	0-100	%	N/A	N/A	Y406	
SEC-AGS-PMP-II-820	SEC-AGS-PLC-061	SEC-AGS-PMP-820	WLC PUMP NO. 2	CURRENT	AI	COMM		AMPS	N/A	N/A	Y406	4
SEC-AGS-PIT-PI-901	SEC-AGS-PLC-061	SEC-AGS-PIT-901	AERATION HEADER	PRESSURE	DI	COMM			N/A	N/A	Y408	6
SEC-AGS-PDS-PDAH-912	SEC-AGS-PLC-061	SEC-AGS-PDS-912	INLET FILTER NO. 1	DIFFERENTIAL PRESSURE	DI	N.O. CONTACT	N/A	N/A	2-WIRE	SYSTEM	Y407	
SEC-AGS-PDS-PDAH-922	SEC-AGS-PLC-061	SEC-AGS-PDS-922	INLET FILTER NO. 2	DIFFERENTIAL PRESSURE	DI	N.O. CONTACT	N/A	N/A	2-WIRE	SYSTEM	Y407	
SEC-AGS-PDS-PDAH-932	SEC-AGS-PLC-061	SEC-AGS-PDS-932	INLET FILTER NO. 3	DIFFERENTIAL PRESSURE	DI	N.O. CONTACT	N/A	N/A	2-WIRE	SYSTEM	Y407	
SEC-AGS-PDS-PDAH-942	SEC-AGS-PLC-061	SEC-AGS-PDS-942	INLET FILTER NO. 4	DIFFERENTIAL PRESSURE	DI	N.O. CONTACT	N/A	N/A	2-WIRE	SYSTEM	Y408	
SEC-AGS-PDS-PDAH-952	SEC-AGS-PLC-061	SEC-AGS-PDS-952	INLET FILTER NO. 5	DIFFERENTIAL PRESSURE	DI	N.O. CONTACT	N/A	N/A	2-WIRE	SYSTEM	Y408	
SEC-AGS-BLOW-MN-910	SEC-AGS-PLC-061	SEC-AGS-BLOW-910	AERATION BLOWER NO. 1	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y407	
SEC-AGS-BLOW-HS-910A	SEC-AGS-PLC-061	SEC-AGS-BLOW-910	AERATION BLOWER NO. 1	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y407	
SEC-AGS-BLOW-HS-910B	SEC-AGS-PLC-061	SEC-AGS-BLOW-910	AERATION BLOWER NO. 1	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y407	
SEC-AGS-BLOW-TAH-910	SEC-AGS-PLC-061	SEC-AGS-BLOW-910	AERATION BLOWER NO. 1	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	
SEC-AGS-BLOW-PDAH-911	SEC-AGS-PLC-061	SEC-AGS-BLOW-910	AERATION BLOWER NO. 1	DIFFERENTIAL PRESSURE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	
SEC-AGS-BLOW-TAH-911	SEC-AGS-PLC-061	SEC-AGS-BLOW-910	AERATION BLOWER NO. 1	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	
SEC-AGS-BLOW-YA-910	SEC-AGS-PLC-061	SEC-AGS-BLOW-910	AERATION BLOWER NO. 1	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y407	
SEC-AGS-BLOW-SI-910	SEC-AGS-PLC-061	SEC-AGS-BLOW-910	AERATION BLOWER NO. 1	SPEED	AI	COMM	0-100	%	2-WIRE	N/A	Y407	
SEC-AGS-BLOW-II-910	SEC-AGS-PLC-061	SEC-AGS-BLOW-910	AERATION BLOWER NO. 1	CURRENT	AI	COMM		AMPS	N/A	N/A	Y407	4
SEC-AGS-BLOW-MN-920	SEC-AGS-PLC-061	SEC-AGS-BLOW-920	AERATION BLOWER NO. 2	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y407	
SEC-AGS-BLOW-HS-920A	SEC-AGS-PLC-061	SEC-AGS-BLOW-920	AERATION BLOWER NO. 2	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y407	
SEC-AGS-BLOW-HS-920B	SEC-AGS-PLC-061	SEC-AGS-BLOW-920	AERATION BLOWER NO. 2	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y407	
SEC-AGS-BLOW-TAH-920	SEC-AGS-PLC-061	SEC-AGS-BLOW-920	AERATION BLOWER NO. 2	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	
SEC-AGS-BLOW-PDAH-921	SEC-AGS-PLC-061	SEC-AGS-BLOW-920	AERATION BLOWER NO. 2	DIFFERENTIAL PRESSURE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	
SEC-AGS-BLOW-TAH-921	SEC-AGS-PLC-061	SEC-AGS-BLOW-920	AERATION BLOWER NO. 2	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	
SEC-AGS-BLOW-YA-920	SEC-AGS-PLC-061	SEC-AGS-BLOW-920	AERATION BLOWER NO. 2	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y407	
SEC-AGS-BLOW-SI-920	SEC-AGS-PLC-061	SEC-AGS-BLOW-920	AERATION BLOWER NO. 2	SPEED	AI	COMM	0-100	%	2-WIRE	N/A	Y407	
SEC-AGS-BLOW-II-920	SEC-AGS-PLC-061	SEC-AGS-BLOW-920	AERATION BLOWER NO. 2	CURRENT	AI	COMM		AMPS	N/A	N/A	Y407	4

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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-BLOW-MN-930	SEC-AGS-PLC-061	SEC-AGS-BLOW-930	AERATION BLOWER NO. 3	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y407	
SEC-AGS-BLOW-HS-930A	SEC-AGS-PLC-061	SEC-AGS-BLOW-930	AERATION BLOWER NO. 3	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y407	
SEC-AGS-BLOW-HS-930B	SEC-AGS-PLC-061	SEC-AGS-BLOW-930	AERATION BLOWER NO. 3	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y407	
SEC-AGS-BLOW-TAH-930	SEC-AGS-PLC-061	SEC-AGS-BLOW-930	AERATION BLOWER NO. 3	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	
SEC-AGS-BLOW-PDAH-931	SEC-AGS-PLC-061	SEC-AGS-BLOW-930	AERATION BLOWER NO. 3	DIFFERENTIAL PRESSURE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	
SEC-AGS-BLOW-TAH-931	SEC-AGS-PLC-061	SEC-AGS-BLOW-930	AERATION BLOWER NO. 3	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y407	
SEC-AGS-BLOW-YA-930	SEC-AGS-PLC-061	SEC-AGS-BLOW-930	AERATION BLOWER NO. 3	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y407	
SEC-AGS-BLOW-SI-930	SEC-AGS-PLC-061	SEC-AGS-BLOW-930	AERATION BLOWER NO. 3	SPEED	AI	COMM	0-100	%	2-WIRE	N/A	Y407	
SEC-AGS-BLOW-II-930	SEC-AGS-PLC-061	SEC-AGS-BLOW-930	AERATION BLOWER NO. 3	CURRENT	AI	COMM		AMPS	N/A	N/A	Y407	4
SEC-AGS-BLOW-MN-940	SEC-AGS-PLC-061	SEC-AGS-BLOW-940	AERATION BLOWER NO. 4	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y408	
SEC-AGS-BLOW-HS-940A	SEC-AGS-PLC-061	SEC-AGS-BLOW-940	AERATION BLOWER NO. 4	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y408	
SEC-AGS-BLOW-HS-940B	SEC-AGS-PLC-061	SEC-AGS-BLOW-940	AERATION BLOWER NO. 4	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y408	
SEC-AGS-BLOW-TAH-940	SEC-AGS-PLC-061	SEC-AGS-BLOW-940	AERATION BLOWER NO. 4	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y408	
SEC-AGS-BLOW-PDAH-941	SEC-AGS-PLC-061	SEC-AGS-BLOW-940	AERATION BLOWER NO. 4	DIFFERENTIAL PRESSURE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y408	
SEC-AGS-BLOW-TAH-941	SEC-AGS-PLC-061	SEC-AGS-BLOW-940	AERATION BLOWER NO. 4	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y408	
SEC-AGS-BLOW-YA-940	SEC-AGS-PLC-061	SEC-AGS-BLOW-940	AERATION BLOWER NO. 4	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y408	
SEC-AGS-BLOW-SI-940	SEC-AGS-PLC-061	SEC-AGS-BLOW-940	AERATION BLOWER NO. 4	SPEED	AI	COMM	0-100	%	2-WIRE	N/A	Y408	
SEC-AGS-BLOW-II-940	SEC-AGS-PLC-061	SEC-AGS-BLOW-940	AERATION BLOWER NO. 4	CURRENT	AI	COMM		AMPS	N/A	N/A	Y408	4
SEC-AGS-BLOW-MN-950	SEC-AGS-PLC-061	SEC-AGS-BLOW-950	AERATION BLOWER NO. 5	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y408	
SEC-AGS-BLOW-HS-950A	SEC-AGS-PLC-061	SEC-AGS-BLOW-950	AERATION BLOWER NO. 5	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y408	
SEC-AGS-BLOW-HS-950B	SEC-AGS-PLC-061	SEC-AGS-BLOW-950	AERATION BLOWER NO. 5	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y408	
SEC-AGS-BLOW-TAH-950	SEC-AGS-PLC-061	SEC-AGS-BLOW-950	AERATION BLOWER NO. 5	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y408	
SEC-AGS-BLOW-PDAH-951	SEC-AGS-PLC-061	SEC-AGS-BLOW-950	AERATION BLOWER NO. 5	DIFFERENTIAL PRESSURE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y408	
SEC-AGS-BLOW-TAH-951	SEC-AGS-PLC-061	SEC-AGS-BLOW-950	AERATION BLOWER NO. 5	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y408	
SEC-AGS-BLOW-YA-950	SEC-AGS-PLC-061	SEC-AGS-BLOW-950	AERATION BLOWER NO. 5	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y408	
SEC-AGS-BLOW-SI-950	SEC-AGS-PLC-061	SEC-AGS-BLOW-950	AERATION BLOWER NO. 5	SPEED	AI	COMM	0-100	%	2-WIRE	N/A	Y408	
SEC-AGS-BLOW-II-950	SEC-AGS-PLC-061	SEC-AGS-BLOW-950	AERATION BLOWER NO. 5	CURRENT	AI	COMM		AMPS	N/A	N/A	Y408	4
SEC-AGS-CTRL-TAH-001	SEC-AGS-PLC-061	SEC-AGS-CTRL-001	AGS ELECTRICAL ROOM	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
SEC-AGS-CTRL-YA-001A	SEC-AGS-PLC-061	SEC-AGS-CTRL-001	DIRTY FILTER	WARNING	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
SEC-AGS-CTRL-YA-001B	SEC-AGS-PLC-061	SEC-AGS-CTRL-001	HVAC CONTROL SYSTEM	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
SEC-AGS-CTRL-YA-001C	SEC-AGS-PLC-061	SEC-AGS-CTRL-001	VENTILATION FAILURE	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
SEC-AGS-CTRL-YA-001D	SEC-AGS-PLC-061	SEC-AGS-CTRL-001	SMOKE ALARM	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		

TODD CREEK
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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-SWB_52U1-HS-001	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 CIRCUIT BREAKER 52-U1	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A		6
SEC-AGS-SWB_52U1-YA-001A	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 CIRCUIT BREAKER 52-U1 TRIP	ALARM	DI	COMM	N/A	N/A	N/A	N/A		6
SEC-AGS-SWB_52U1-YA-001B	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 CIRCUIT BREAKER 52-U1 OPEN/CLOSE	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A		6
SEC-AGS-SWB_52U1-YN-001	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 SOURCE AVAILABLE	STATUS	DI	COMM	N/A	N/A	N/A	N/A		6
SEC-AGS-SWB_52U1-ZSC-001	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 CIRCUIT BREAKER 52-U1	CLOSED	DI	COMM	N/A	N/A	N/A	N/A		6
SEC-AGS-SWB_52U1-ZSO-001	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 CIRCUIT BREAKER 52-U1	OPEN	DI	COMM	N/A	N/A	N/A	N/A		6
SEC-AGS-SWB_52U1-EI-001AN	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 A-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SEC-AGS-SWB_52U1-EI-001BN	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 B-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SEC-AGS-SWB_52U1-EI-001CN	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 C-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SEC-AGS-SWB_52U1-EI-001AB	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 A-B PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SEC-AGS-SWB_52U1-EI-001BC	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 B-C PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SEC-AGS-SWB_52U1-EI-001CA	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 C-A PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SEC-AGS-SWB_52U1-II-001A	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 A LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
SEC-AGS-SWB_52U1-II-001B	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 B LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
SEC-AGS-SWB_52U1-II-001C	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 C LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
SEC-AGS-SWB_52U1-JI-001A	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 AVERAGE APPARENT	POWER	AI	COMM		KVA	N/A	N/A		4, 6
SEC-AGS-SWB_52U1-JI-001R	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 AVERAGE REAL	POWER	AI	COMM		KW	N/A	N/A		4, 6
SEC-AGS-SWB_52U1-JQ-001	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 TOTAL	ENERGY	AI	COMM		KWh	N/A	N/A		4, 6
SEC-AGS-SWB_52U1-JN-001	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1 AVERAGE	POWER FACTOR	AI	COMM		PF	N/A	N/A		4, 6
SEC-AGS-SWB_52U1-SI-001	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.1	FREQUENCY	AI	COMM		HERTZ	N/A	N/A		4, 6
SEC-AGS-SWB_52U2-HS-001	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 CIRCUIT BREAKER 52-U2	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A		6
SEC-AGS-SWB_52U2-YA-001A	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 CIRCUIT BREAKER 52-U2 TRIP	ALARM	DI	COMM	N/A	N/A	N/A	N/A		6
SEC-AGS-SWB_52U2-YA-001B	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 CIRCUIT BREAKER 52-U2 OPEN/CLOSE	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A		6
SEC-AGS-SWB_52U2-YN-001	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 SOURCE AVAILABLE	STATUS	DI	COMM	N/A	N/A	N/A	N/A		6
SEC-AGS-SWB_52U2-ZSC-001	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 CIRCUIT BREAKER 52-U2	CLOSED	DI	COMM	N/A	N/A	N/A	N/A		6
SEC-AGS-SWB_52U2-ZSO-001	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 CIRCUIT BREAKER 52-U2	OPEN	DI	COMM	N/A	N/A	N/A	N/A		6
SEC-AGS-SWB_52U2-EI-001AN	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 A-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SEC-AGS-SWB_52U2-EI-001BN	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 B-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SEC-AGS-SWB_52U2-EI-001CN	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 C-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SEC-AGS-SWB_52U2-EI-001AB	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 A-B PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SEC-AGS-SWB_52U2-EI-001BC	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 B-C PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SEC-AGS-SWB_52U2-EI-001CA	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 C-A PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SEC-AGS-SWB_52U2-II-001A	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 A LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
SEC-AGS-SWB_52U2-II-001B	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 B LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
SEC-AGS-SWB_52U2-II-001C	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 C LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
SEC-AGS-SWB_52U2-JI-001A	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 AVERAGE APPARENT	POWER	AI	COMM		KVA	N/A	N/A		4, 6
SEC-AGS-SWB_52U2-JI-001R	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 AVERAGE REAL	POWER	AI	COMM		KW	N/A	N/A		4, 6
SEC-AGS-SWB_52U2-JQ-001	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 TOTAL	ENERGY	AI	COMM		KWh	N/A	N/A		4, 6
SEC-AGS-SWB_52U2-JN-001	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2 AVERAGE	POWER FACTOR	AI	COMM		PF	N/A	N/A		4, 6
SEC-AGS-SWB_52U2-SI-001	SEC-AGS-PLC-061	SEC-AGS-SWB-001	UTILITY NO.2	FREQUENCY	AI	COMM		HERTZ	N/A	N/A		4, 6

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-AGS-UPS-JA-051	SEC-AGS-PLC-061	SEC-AGS-UPS-051	UPS SYSTEM REPLACE BATTERY	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SEC-AGS-UPS-JAL-051	SEC-AGS-PLC-061	SEC-AGS-UPS-051	UPS SYSTEM LOW BATTERY	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SEC-AGS-UPS-YA-051A	SEC-AGS-PLC-061	SEC-AGS-UPS-051	UPS SYSTEM	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
SEC-AGS-UPS-YN-051	SEC-AGS-PLC-061	SEC-AGS-UPS-051	UPS SYSTEM ON BATTERY	STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
SEC-AGS-UPS-ZS-051	SEC-AGS-PLC-061	SEC-AGS-UPS-051	UPS SYSTEM BYPASS	STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
SEC-AGS-NSW-YA-061A	SEC-AGS-PLC-061	SEC-AGS-NSW-061	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SEC-AGS-NSW-YA-061B	SEC-AGS-PLC-061	SEC-AGS-NSW-061	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SEC-AGS-NSW-YA-061C	SEC-AGS-PLC-061	SEC-AGS-NSW-061	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SEC-AGS-NSW-TI-061	SEC-AGS-PLC-061	SEC-AGS-NSW-061	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		4, 9
SEC-AGS-NSW-YA-062A	SEC-AGS-PLC-061	SEC-AGS-NSW-062	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SEC-AGS-NSW-YA-062B	SEC-AGS-PLC-061	SEC-AGS-NSW-062	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SEC-AGS-NSW-YA-062C	SEC-AGS-PLC-061	SEC-AGS-NSW-062	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SEC-AGS-NSW-TI-062	SEC-AGS-PLC-061	SEC-AGS-NSW-062	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		4, 9
SEC-AGS-NSW-YA-071A	SEC-AGS-PLC-061	SEC-AGS-NSW-071	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SEC-AGS-NSW-YA-071B	SEC-AGS-PLC-061	SEC-AGS-NSW-071	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SEC-AGS-NSW-YA-071C	SEC-AGS-PLC-061	SEC-AGS-NSW-071	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SEC-AGS-NSW-TI-071	SEC-AGS-PLC-061	SEC-AGS-NSW-071	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		4, 9

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
DIS-UV-AIT-AI-021	DIS-UV-PLC-061	DIS-UV-AIT-020	TOTAL PHOSPHATE	LEVEL	AI	4-20mA			4-WIRE	FIELD	Y601	
DIS-UV-PMP-YA-021	DIS-UV-PLC-061	DIS-UV-PMP-021	TP SAMPLE PUMP	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
DIS-UV-MCP-AAL-001	DIS-UV-PLC-061	DIS-UV-MCP-001	LOW UV DOSE	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-MCP-AALL-001	DIS-UV-PLC-061	DIS-UV-MCP-001	LOW-LOW UV DOSE	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-MCP-QAL-001	DIS-UV-PLC-061	DIS-UV-MCP-001	NOT ENOUGH CHANNELS OPERATIONAL	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-MCP-FAL-001	DIS-UV-PLC-061	DIS-UV-MCP-001	LOW FLOW	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-MCP-FAH-001	DIS-UV-PLC-061	DIS-UV-MCP-001	HIGH FLOW	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-MCP-YAL-001	DIS-UV-PLC-061	DIS-UV-MCP-001	UV SYSTEM COMMON MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-MCP-YAM-001	DIS-UV-PLC-061	DIS-UV-MCP-001	UV SYSTEM COMMON MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-MCP-YAH-001	DIS-UV-PLC-061	DIS-UV-MCP-001	UV SYSTEM COMMON CRITICAL	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-MCP-MX-001	DIS-UV-PLC-061	DIS-UV-MCP-001	UV SYSTEM INHIBIT	ENABLE/DISABLE	DO	COMM	N/A	N/A	N/A	N/A	Y601	6, 7
DIS-UV-MCP-KI-001	DIS-UV-PLC-061	DIS-UV-MCP-001	SYSTEM RETENTION	TIME	AI	COMM		SECONDS	N/A	N/A	Y601	4, 6
DIS-UV-MCP-AI-001	DIS-UV-PLC-061	DIS-UV-MCP-001	CALCULATED SYSTEM UV	DOSE	AI	COMM		mWs/cm^2	N/A	N/A	Y601	4, 6
DIS-UV-MCP-RI-001	DIS-UV-PLC-061	DIS-UV-MCP-001	CALCULATED AVERAGE UV	INTENSITY	AI	COMM		mW/cm^2	N/A	N/A	Y601	4, 6
DIS-UV-LSL-LAL-101	DIS-UV-PLC-061	DIS-UV-LSL-101	CHANNEL 1 LOW LEVEL	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LSL-LAL-201	DIS-UV-PLC-061	DIS-UV-LSL-201	CHANNEL 2 LOW LEVEL	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-AIT-AIL-010	DIS-UV-PLC-061	DIS-UV-AIT-010	UV TRANSMITTANCE	LEVEL-LOW	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-AIT-AI-010	DIS-UV-PLC-061	DIS-UV-AIT-010	UV TRANSMITTANCE	LEVEL	AI	COMM	0-100	%	4-WIRE	FIELD	Y601	6
DIS-UV-GATE-HS-101	DIS-UV-PLC-061	DIS-UV-GATE-101	CHANNEL 1 WEIR GATE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-GATE-ZSO-101	DIS-UV-PLC-061	DIS-UV-GATE-101	CHANNEL 1 WEIR GATE	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-GATE-ZSC-101	DIS-UV-PLC-061	DIS-UV-GATE-101	CHANNEL 1 WEIR GATE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-GATE-HS-201	DIS-UV-PLC-061	DIS-UV-GATE-201	CHANNEL 2 WEIR GATE	IN-REMOTE	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-GATE-ZSO-201	DIS-UV-PLC-061	DIS-UV-GATE-201	CHANNEL 2 WEIR GATE	POSITION-OPEN	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-GATE-ZSC-201	DIS-UV-PLC-061	DIS-UV-GATE-201	CHANNEL 2 WEIR GATE	POSITION-CLOSED	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-HCP-YA-110	DIS-UV-PLC-061	DIS-UV-HCP-110	HYDRAULIC SYSTEM CENTER	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-HCP-HS-110A	DIS-UV-PLC-061	DIS-UV-HCP-110	CHANNEL 1 BANK A WIPER	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-HCP-YN-110A	DIS-UV-PLC-061	DIS-UV-HCP-110	CHANNEL 1 BANK A WIPER	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-HCP-YA-110A	DIS-UV-PLC-061	DIS-UV-HCP-110	CHANNEL 1 BANK A WIPER	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-HCP-HS-110B	DIS-UV-PLC-061	DIS-UV-HCP-110	CHANNEL 1 BANK B WIPER	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-HCP-YN-110B	DIS-UV-PLC-061	DIS-UV-HCP-110	CHANNEL 1 BANK B WIPER	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-HCP-YA-110B	DIS-UV-PLC-061	DIS-UV-HCP-110	CHANNEL 1 BANK B WIPER	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-HCP-YA-210	DIS-UV-PLC-061	DIS-UV-HCP-210	HYDRAULIC SYSTEM CENTER	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-HCP-HS-210A	DIS-UV-PLC-061	DIS-UV-HCP-210	CHANNEL 2 BANK A WIPER	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-HCP-YN-210A	DIS-UV-PLC-061	DIS-UV-HCP-210	CHANNEL 2 BANK A WIPER	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-HCP-YA-210A	DIS-UV-PLC-061	DIS-UV-HCP-210	CHANNEL 2 BANK A WIPER	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-HCP-HS-210B	DIS-UV-PLC-061	DIS-UV-HCP-210	CHANNEL 2 BANK B WIPER	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-HCP-YN-210B	DIS-UV-PLC-061	DIS-UV-HCP-210	CHANNEL 2 BANK B WIPER	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-HCP-YA-210B	DIS-UV-PLC-061	DIS-UV-HCP-210	CHANNEL 2 BANK B WIPER	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6

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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
DIS-UV-LCP-HS-110A	DIS-UV-PLC-061	DIS-UV-LCP-110A	CHANNEL 1 BANK A	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LCP-YN-110A	DIS-UV-PLC-061	DIS-UV-LCP-110A	CHANNEL 1 BANK A	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LCP-YA-110A	DIS-UV-PLC-061	DIS-UV-LCP-110A	CHANNEL 1 BANK A	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LCP-XA-110A	DIS-UV-PLC-061	DIS-UV-LCP-110A	CHANNEL 1 BANK A COMMUNICATION	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LCP-JI-110A	DIS-UV-PLC-061	DIS-UV-LCP-110A	CHANNEL 1 BANK A	POWER	AI	COMM	0-100	%	N/A	N/A	Y601	6
DIS-UV-LCP-AI-110A	DIS-UV-PLC-061	DIS-UV-LCP-110A	CHANNEL 1 BANK A UV	INTENSITY	AI	COMM		mW/cm^2	N/A	N/A	Y601	4, 6
DIS-UV-LCP-KQ-110A	DIS-UV-PLC-061	DIS-UV-LCP-110A	CHANNEL 1 BANK A	RUN TIME	AI	COMM		HOURS	N/A	N/A	Y601	4, 6
DIS-UV-LCP-HS-110B	DIS-UV-PLC-061	DIS-UV-LCP-110B	CHANNEL 1 BANK B	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LCP-YN-110B	DIS-UV-PLC-061	DIS-UV-LCP-110B	CHANNEL 1 BANK B	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LCP-YA-110B	DIS-UV-PLC-061	DIS-UV-LCP-110B	CHANNEL 1 BANK B	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LCP-XA-110B	DIS-UV-PLC-061	DIS-UV-LCP-110B	CHANNEL 1 BANK B COMMUNICATION	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LCP-JI-110B	DIS-UV-PLC-061	DIS-UV-LCP-110B	CHANNEL 1 BANK B	POWER	AI	COMM	0-100	%	N/A	N/A	Y601	6
DIS-UV-LCP-AI-110B	DIS-UV-PLC-061	DIS-UV-LCP-110B	CHANNEL 1 BANK B UV	INTENSITY	AI	COMM		mW/cm^2	N/A	N/A	Y601	4, 6
DIS-UV-LCP-KQ-110B	DIS-UV-PLC-061	DIS-UV-LCP-110B	CHANNEL 1 BANK B	RUN TIME	AI	COMM		HOURS	N/A	N/A	Y601	4, 6
DIS-UV-LCP-HS-210A	DIS-UV-PLC-061	DIS-UV-LCP-210A	CHANNEL 2 BANK A	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LCP-YN-210A	DIS-UV-PLC-061	DIS-UV-LCP-210A	CHANNEL 2 BANK A	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LCP-YA-210A	DIS-UV-PLC-061	DIS-UV-LCP-210A	CHANNEL 2 BANK A	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LCP-XA-210A	DIS-UV-PLC-061	DIS-UV-LCP-210A	CHANNEL 2 BANK A COMMUNICATION	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LCP-JI-210A	DIS-UV-PLC-061	DIS-UV-LCP-210A	CHANNEL 2 BANK A	POWER	AI	COMM	0-100	%	N/A	N/A	Y601	6
DIS-UV-LCP-AI-210A	DIS-UV-PLC-061	DIS-UV-LCP-210A	CHANNEL 2 BANK A UV	INTENSITY	AI	COMM		mW/cm^2	N/A	N/A	Y601	4, 6
DIS-UV-LCP-KQ-210A	DIS-UV-PLC-061	DIS-UV-LCP-210A	CHANNEL 2 BANK A	RUN TIME	AI	COMM		HOURS	N/A	N/A	Y601	4, 6
DIS-UV-LCP-HS-210B	DIS-UV-PLC-061	DIS-UV-LCP-210B	CHANNEL 2 BANK B	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LCP-YN-210B	DIS-UV-PLC-061	DIS-UV-LCP-210B	CHANNEL 2 BANK B	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LCP-YA-210B	DIS-UV-PLC-061	DIS-UV-LCP-210B	CHANNEL 2 BANK B	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LCP-XA-210B	DIS-UV-PLC-061	DIS-UV-LCP-210B	CHANNEL 2 BANK B COMMUNICATION	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y601	6
DIS-UV-LCP-JI-210B	DIS-UV-PLC-061	DIS-UV-LCP-210B	CHANNEL 2 BANK B	POWER	AI	COMM	0-100	%	N/A	N/A	Y601	6
DIS-UV-LCP-AI-210B	DIS-UV-PLC-061	DIS-UV-LCP-210B	CHANNEL 2 BANK B UV	INTENSITY	AI	COMM		mW/cm^2	N/A	N/A	Y601	4, 6
DIS-UV-LCP-KQ-210B	DIS-UV-PLC-061	DIS-UV-LCP-210B	CHANNEL 2 BANK B	RUN TIME	AI	COMM		HOURS	N/A	N/A	Y601	4, 6

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
DIS-UV-FIT-FI-301	DIS-UV-PLC-061	DIS-UV-FIT-301	PLANT EFFLUENT	FLOW	AI	4-20mA		GPM	2-WIRE	SYSTEM	Y601	2
DIS-UV-GATE-ZD-001	DIS-UV-PLC-061	DIS-UV-GATE-001	PROCESS WATER SLIDE GATE	OPEN	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y601	
DIS-UV-GATE-ZB-001	DIS-UV-PLC-061	DIS-UV-GATE-001	PROCESS WATER SLIDE GATE	CLOSE	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y601	
DIS-UV-GATE-HS-001	DIS-UV-PLC-061	DIS-UV-GATE-001	PROCESS WATER SLIDE GATE	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y601	
DIS-UV-GATE-YA-001	DIS-UV-PLC-061	DIS-UV-GATE-001	PROCESS WATER SLIDE GATE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y601	
DIS-UV-GATE-ZSC-001	DIS-UV-PLC-061	DIS-UV-GATE-001	PROCESS WATER SLIDE GATE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y601	
DIS-UV-GATE-ZI-001	DIS-UV-PLC-061	DIS-UV-GATE-001	PROCESS WATER SLIDE GATE	POSITION	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y601	
DIS-PW-LSH-LAH-101	DIS-UV-PLC-061	DIS-PW-LSH-101	PROCESS WATER PS WET WELL	LEVEL HIGH	DI	N.O. CONTACT		FEET(MSL)	N/A	SYSTEM	Y601	
DIS-PW-LSL-LAL-101	DIS-UV-PLC-061	DIS-PW-LSL-101	PROCESS WATER PS WET WELL	LEVEL LOW	DI	N.O. CONTACT		FEET(MSL)	N/A	SYSTEM	Y601	
DIS-PW-PIT-PI-101	DIS-UV-PLC-061	DIS-PW-PIT-101	PROCESS WATER PUMPS	PRESSURE	AI	4-20mA		PSI	2-WIRE	SYSTEM	Y601	
DIS-PW-FIT-FI-101	DIS-UV-PLC-061	DIS-PW-FIT-101	PROCESS WATER PUMPS	FLOW	AI	4-20mA		GPM	4-WIRE	FIELD	Y601	
DIS-PW-PIT-PI-103	DIS-UV-PLC-061	DIS-PW-PIT-103	PROCESS WATER TANK	PRESSURE	AI	4-20mA		PSI	2-WIRE	SYSTEM	Y601	
DIS-PW-PMP-MD-110	DIS-UV-PLC-061	DIS-PW-PMP-110	PROCESS WATER PUMP NO. 1	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y601	
DIS-PW-PMP-HS-110A	DIS-UV-PLC-061	DIS-PW-PMP-110	PROCESS WATER PUMP NO. 1	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y601	
DIS-PW-PMP-HS-110B	DIS-UV-PLC-061	DIS-PW-PMP-110	PROCESS WATER PUMP NO. 1	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y601	
DIS-PW-PMP-MN-110	DIS-UV-PLC-061	DIS-PW-PMP-110	PROCESS WATER PUMP NO. 1	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y601	
DIS-PW-PMP-TAH-110	DIS-UV-PLC-061	DIS-PW-PMP-110	PROCESS WATER PUMP NO. 1	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y601	
DIS-PW-PMP-YA-110	DIS-UV-PLC-061	DIS-PW-PMP-110	PROCESS WATER PUMP NO. 1	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y601	
DIS-PW-PMP-SC-110	DIS-UV-PLC-061	DIS-PW-PMP-110	PROCESS WATER PUMP NO. 1	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y601	
DIS-PW-PMP-SI-110	DIS-UV-PLC-061	DIS-PW-PMP-110	PROCESS WATER PUMP NO. 1	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y601	
DIS-PW-PMP-II-110	DIS-UV-PLC-061	DIS-PW-PMP-110	PROCESS WATER PUMP NO. 1	CURRENT	AI	COMM		AMPS	N/A	N/A	Y601	4
DIS-PW-PMP-MD-120	DIS-UV-PLC-061	DIS-PW-PMP-120	PROCESS WATER PUMP NO. 2	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y601	
DIS-PW-PMP-HS-120A	DIS-UV-PLC-061	DIS-PW-PMP-120	PROCESS WATER PUMP NO. 2	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y601	
DIS-PW-PMP-HS-120B	DIS-UV-PLC-061	DIS-PW-PMP-120	PROCESS WATER PUMP NO. 2	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y601	
DIS-PW-PMP-MN-120	DIS-UV-PLC-061	DIS-PW-PMP-120	PROCESS WATER PUMP NO. 2	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y601	
DIS-PW-PMP-TAH-120	DIS-UV-PLC-061	DIS-PW-PMP-120	PROCESS WATER PUMP NO. 2	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y601	
DIS-PW-PMP-YA-120	DIS-UV-PLC-061	DIS-PW-PMP-120	PROCESS WATER PUMP NO. 2	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y601	
DIS-PW-PMP-SC-120	DIS-UV-PLC-061	DIS-PW-PMP-120	PROCESS WATER PUMP NO. 2	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y601	
DIS-PW-PMP-SI-120	DIS-UV-PLC-061	DIS-PW-PMP-120	PROCESS WATER PUMP NO. 2	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y601	
DIS-PW-PMP-II-120	DIS-UV-PLC-061	DIS-PW-PMP-120	PROCESS WATER PUMP NO. 2	CURRENT	AI	COMM		AMPS	N/A	N/A	Y601	4
DIS-PW-PMP-MD-130	DIS-UV-PLC-061	DIS-PW-PMP-130	PROCESS WATER PUMP NO. 3	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y601	
DIS-PW-PMP-HS-130A	DIS-UV-PLC-061	DIS-PW-PMP-130	PROCESS WATER PUMP NO. 3	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y601	
DIS-PW-PMP-HS-130B	DIS-UV-PLC-061	DIS-PW-PMP-130	PROCESS WATER PUMP NO. 3	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y601	
DIS-PW-PMP-MN-130	DIS-UV-PLC-061	DIS-PW-PMP-130	PROCESS WATER PUMP NO. 3	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y601	
DIS-PW-PMP-TAH-130	DIS-UV-PLC-061	DIS-PW-PMP-130	PROCESS WATER PUMP NO. 3	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y601	
DIS-PW-PMP-YA-130	DIS-UV-PLC-061	DIS-PW-PMP-130	PROCESS WATER PUMP NO. 3	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y601	
DIS-PW-PMP-SC-130	DIS-UV-PLC-061	DIS-PW-PMP-130	PROCESS WATER PUMP NO. 3	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y601	
DIS-PW-PMP-SI-130	DIS-UV-PLC-061	DIS-PW-PMP-130	PROCESS WATER PUMP NO. 3	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y601	
DIS-PW-PMP-II-130	DIS-UV-PLC-061	DIS-PW-PMP-130	PROCESS WATER PUMP NO. 3	CURRENT	AI	COMM		AMPS	N/A	N/A	Y601	4

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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SEC-PSEW-LSHH-LAHH-101	PRE-GRSC-PLC-061	SEC-PSEW-LSHH-101	PLANT SEWER PS WET WELL	LEVEL HIGH-HIGH	DI	N.O. CONTACT	901	FEET(MSL)	2-WIRE	SYSTEM	Y801	2,8
SEC-PSEW-LSH-LAH-101	PRE-GRSC-PLC-061	SEC-PSEW-LSH-101	PLANT SEWER PS WET WELL	LEVEL HIGH	DI	N.O. CONTACT	899	FEET(MSL)	2-WIRE	SYSTEM	Y801	2,8
SEC-PSEW-LSL-LAL-101	PRE-GRSC-PLC-061	SEC-PSEW-LSL-101	PLANT SEWER PS WET WELL	LEVEL LOW	DI	N.O. CONTACT	894.75	FEET(MSL)	2-WIRE	SYSTEM	Y801	2,8
SEC-PSEW-LSLL-LALL-101	PRE-GRSC-PLC-061	SEC-PSEW-LSLL-101	PLANT SEWER PS WET WELL	LEVEL LOW-LOW	DI	N.O. CONTACT	894.25	FEET(MSL)	2-WIRE	SYSTEM	Y801	2,8
SEC-PSEW-LWCO-HS-101	PRE-GRSC-PLC-061	SEC-PSEW-LWCO-101	LWCO IN BYPASS	IN-BYPASS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y801	
SEC-PSEW-LWCO-YA-101	PRE-GRSC-PLC-061	SEC-PSEW-LWCO-101	LWCO CUTOUT	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y801	
SEC-PSEW-LIT-LI-101	PRE-GRSC-PLC-061	SEC-PSEW-LIT-101	PLANT SEWER PS WET WELL	LEVEL	AI	4-20mA	0-15	FEET	2-WIRE	SYSTEM	Y801	2,8
SEC-PSEW-PMP-MD-110	PRE-GRSC-PLC-061	SEC-PSEW-PMP-110	PLANT SEWER PUMP NO. 1	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y801	
SEC-PSEW-PMP-HS-110A	PRE-GRSC-PLC-061	SEC-PSEW-PMP-110	PLANT SEWER PUMP NO. 1	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y801	
SEC-PSEW-PMP-HS-110B	PRE-GRSC-PLC-061	SEC-PSEW-PMP-110	PLANT SEWER PUMP NO. 1	IN-LOCAL	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y801	
SEC-PSEW-PMP-MN-110	PRE-GRSC-PLC-061	SEC-PSEW-PMP-110	PLANT SEWER PUMP NO. 1	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y801	
SEC-PSEW-PMP-TAH-110	PRE-GRSC-PLC-061	SEC-PSEW-PMP-110	PLANT SEWER PUMP NO. 1	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y801	
SEC-PSEW-PMP-MAH-110	PRE-GRSC-PLC-061	SEC-PSEW-PMP-110	PLANT SEWER PUMP NO. 1	LEAK	DI	COMM	N/A	N/A	N/A	N/A	Y801	
SEC-PSEW-PMP-YA-110	PRE-GRSC-PLC-061	SEC-PSEW-PMP-110	PLANT SEWER PUMP NO. 1	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y801	
SEC-PSEW-PMP-SC-110	PRE-GRSC-PLC-061	SEC-PSEW-PMP-110	PLANT SEWER PUMP NO. 1	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y801	
SEC-PSEW-PMP-SI-110	PRE-GRSC-PLC-061	SEC-PSEW-PMP-110	PLANT SEWER PUMP NO. 1	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y801	
SEC-PSEW-PMP-II-110	PRE-GRSC-PLC-061	SEC-PSEW-PMP-110	PLANT SEWER PUMP NO. 1	CURRENT	AI	COMM		AMPS	N/A	N/A	Y801	
SEC-PSEW-PMP-MD-120	PRE-GRSC-PLC-061	SEC-PSEW-PMP-120	PLANT SEWER PUMP NO. 2	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y801	
SEC-PSEW-PMP-HS-120A	PRE-GRSC-PLC-061	SEC-PSEW-PMP-120	PLANT SEWER PUMP NO. 2	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y801	
SEC-PSEW-PMP-HS-120B	PRE-GRSC-PLC-061	SEC-PSEW-PMP-120	PLANT SEWER PUMP NO. 2	IN-LOCAL	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y801	
SEC-PSEW-PMP-MN-120	PRE-GRSC-PLC-061	SEC-PSEW-PMP-120	PLANT SEWER PUMP NO. 2	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y801	
SEC-PSEW-PMP-TAH-120	PRE-GRSC-PLC-061	SEC-PSEW-PMP-120	PLANT SEWER PUMP NO. 2	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y801	
SEC-PSEW-PMP-MAH-120	PRE-GRSC-PLC-061	SEC-PSEW-PMP-120	PLANT SEWER PUMP NO. 2	LEAK	DI	COMM	N/A	N/A	N/A	N/A	Y801	
SEC-PSEW-PMP-YA-120	PRE-GRSC-PLC-061	SEC-PSEW-PMP-120	PLANT SEWER PUMP NO. 2	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y801	
SEC-PSEW-PMP-SC-120	PRE-GRSC-PLC-061	SEC-PSEW-PMP-120	PLANT SEWER PUMP NO. 2	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y801	
SEC-PSEW-PMP-SI-120	PRE-GRSC-PLC-061	SEC-PSEW-PMP-120	PLANT SEWER PUMP NO. 2	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y801	
SEC-PSEW-PMP-II-120	PRE-GRSC-PLC-061	SEC-PSEW-PMP-120	PLANT SEWER PUMP NO. 2	CURRENT	AI	COMM		AMPS	N/A	N/A	Y801	

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
DIS-UV-PNL-EI-021AN	DIS-UV-PLC-061	DIS-UV-PNL-061	PANEL PQM A-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
DIS-UV-PNL-EI-021BN	DIS-UV-PLC-061	DIS-UV-PNL-061	PANEL PQM B-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
DIS-UV-PNL-EI-021CN	DIS-UV-PLC-061	DIS-UV-PNL-061	PANEL PQM C-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
DIS-UV-PNL-EI-021AB	DIS-UV-PLC-061	DIS-UV-PNL-061	PANEL PQM A-B LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
DIS-UV-PNL-EI-021BC	DIS-UV-PLC-061	DIS-UV-PNL-061	PANEL PQM B-C LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
DIS-UV-PNL-EI-021CA	DIS-UV-PLC-061	DIS-UV-PNL-061	PANEL PQM C-A LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
DIS-UV-PNL-II-021A	DIS-UV-PLC-061	DIS-UV-PNL-061	PANEL PQM A LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
DIS-UV-PNL-II-021B	DIS-UV-PLC-061	DIS-UV-PNL-061	PANEL PQM B LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
DIS-UV-PNL-II-021C	DIS-UV-PLC-061	DIS-UV-PNL-061	PANEL PQM C LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
DIS-UV-PNL-JI-021A	DIS-UV-PLC-061	DIS-UV-PNL-061	PANEL PQM AVERAGE APPARENT	POWER	AI	COMM		KVA	N/A	N/A		4, 6
DIS-UV-PNL-JI-021R	DIS-UV-PLC-061	DIS-UV-PNL-061	PANEL PQM AVERAGE REAL	POWER	AI	COMM		KW	N/A	N/A		4, 6
DIS-UV-PNL-JQ-021	DIS-UV-PLC-061	DIS-UV-PNL-061	PANEL PQM TOTAL	ENERGY	AI	COMM		KWh	N/A	N/A		4, 6
DIS-UV-PNL-JN-021	DIS-UV-PLC-061	DIS-UV-PNL-061	PANEL PQM AVERAGE	POWER FACTOR	AI	COMM		PF	N/A	N/A		4, 6
DIS-UV-PNL-SI-021	DIS-UV-PLC-061	DIS-UV-PNL-061	PANEL PQM	FREQUENCY	AI	COMM		FREQUENCY	N/A	N/A		4, 6
DIS-UV-UPS-JA-050	DIS-UV-PLC-061	DIS-UV-UPS-050	UPS SYSTEM REPLACE BATTERY	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
DIS-UV-UPS-JAL-050	DIS-UV-PLC-061	DIS-UV-UPS-050	UPS SYSTEM LOW BATTERY	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
DIS-UV-UPS-YS-050A	DIS-UV-PLC-061	DIS-UV-UPS-050	UPS SYSTEM	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
DIS-UV-UPS-YN-050	DIS-UV-PLC-061	DIS-UV-UPS-050	UPS SYSTEM ON BATTERY	STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
DIS-UV-UPS-ZS-050	DIS-UV-PLC-061	DIS-UV-UPS-050	UPS SYSTEM BYPASS	STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
DIS-UV-NSW-YA-061A	DIS-UV-PLC-061	DIS-UV-NSW-061	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
DIS-UV-NSW-YA-061B	DIS-UV-PLC-061	DIS-UV-NSW-061	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
DIS-UV-NSW-YA-061C	DIS-UV-PLC-061	DIS-UV-NSW-061	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
DIS-UV-NSW-TI-061	DIS-UV-PLC-061	DIS-UV-NSW-061	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		4, 9
DIS-UV-NSW-YA-071A	DIS-UV-PLC-061	DIS-UV-NSW-071	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
DIS-UV-NSW-YA-071B	DIS-UV-PLC-061	DIS-UV-NSW-071	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
DIS-UV-NSW-YA-071C	DIS-UV-PLC-061	DIS-UV-NSW-071	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
DIS-UV-NSW-TI-071	DIS-UV-PLC-061	DIS-UV-NSW-071	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		4, 9

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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SOL-SPB-PIT-PI-001	SOL-SPB-PLC-061	SOL-SPB-PIT-001	SOLIDS PROCESSING PROCESS WATER	PRESSURE	AI	4-20mA	0 - 200	PSI	2-WIRE	SYSTEM	Y601	
SOL-SPB-PSL-PAL-001	SOL-SPB-PLC-061	SOL-SPB-PSL-001	SOLIDS PROCESSING PROCESS WATER	PRESSURE LOW	DI	N.O. CONTACT	40	PSIG	N/A	SYSTEM	Y302	
SOL-WAS-LSL-LAL-101	SOL-SPB-PLC-061	SOL-WAS-LSL-101	THIN SLUDGE TANK NO. 1	LEVEL LOW	DI	N.O. CONTACT	911	FEET(MSL)	N/A	SYSTEM	Y702	2, 8
SOL-WAS-LSH-LAH-101	SOL-SPB-PLC-061	SOL-WAS-LSH-101	THIN SLUDGE TANK NO. 1	LEVEL HIGH	DI	N.O. CONTACT	931	FEET(MSL)	N/A	SYSTEM	Y702	2, 8
SOL-WAS-LIT-LI-101	SOL-SPB-PLC-061	SOL-WAS-LIT-101	THIN SLUDGE TANK NO. 1	LEVEL	AI	4-20mA	0-25	FEET	2-WIRE	SYSTEM	Y702	2, 8
SOL-WAS-AIT-AI-101	SOL-SPB-PLC-061	SOL-WAS-AIT-101	THIN SLUDGE TANK NO. 1	DISSOLVED OXYGEN	AI	4-20mA	0 - 10	mg/L	2-WIRE	FIELD	Y702	2
SOL-WAS-LSL-LAL-201	SOL-SPB-PLC-061	SOL-WAS-LSL-201	THIN SLUDGE TANK NO. 2	LEVEL LOW	DI	N.O. CONTACT	911	FEET(MSL)	N/A	SYSTEM	Y702	2, 8
SOL-WAS-LSH-LAH-201	SOL-SPB-PLC-061	SOL-WAS-LSH-201	THIN SLUDGE TANK NO. 2	LEVEL HIGH	DI	N.O. CONTACT	931	FEET(MSL)	N/A	SYSTEM	Y702	2, 8
SOL-WAS-LIT-LI-201	SOL-SPB-PLC-061	SOL-WAS-LIT-201	THIN SLUDGE TANK NO. 2	LEVEL	AI	4-20mA	0-25	FEET	2-WIRE	SYSTEM	Y702	2, 8
SOL-WAS-AIT-AI-201	SOL-SPB-PLC-061	SOL-WAS-AIT-201	THIN SLUDGE TANK NO. 2	DISSOLVED OXYGEN	AI	4-20mA	0 - 10	mg/L	2-WIRE	FIELD	Y702	2
SOL-WAS-PMP-MD-310	SOL-SPB-PLC-061	SOL-WAS-PMP-310	THIN SLUDGE PUMP NO. 1	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y702	
SOL-WAS-PMP-HS-310A	SOL-SPB-PLC-061	SOL-WAS-PMP-310	THIN SLUDGE PUMP NO. 1	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-PMP-HS-310B	SOL-SPB-PLC-061	SOL-WAS-PMP-310	THIN SLUDGE PUMP NO. 1	IN-LOCAL	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-PMP-MN-310	SOL-SPB-PLC-061	SOL-WAS-PMP-310	THIN SLUDGE PUMP NO. 1	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-PMP-TAH-310A	SOL-SPB-PLC-061	SOL-WAS-PMP-310	THIN SLUDGE PUMP NO. 1 MOTOR	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y702	
SOL-WAS-PMP-TAH-310B	SOL-SPB-PLC-061	SOL-WAS-PMP-310	THIN SLUDGE PUMP NO. 1 STATOR	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y702	
SOL-WAS-PMP-YA-310	SOL-SPB-PLC-061	SOL-WAS-PMP-310	THIN SLUDGE PUMP NO. 1	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-PMP-SC-310	SOL-SPB-PLC-061	SOL-WAS-PMP-310	THIN SLUDGE PUMP NO. 1	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y702	
SOL-WAS-PMP-SI-310	SOL-SPB-PLC-061	SOL-WAS-PMP-310	THIN SLUDGE PUMP NO. 1	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y702	
SOL-WAS-PMP-II-310	SOL-SPB-PLC-061	SOL-WAS-PMP-310	THIN SLUDGE PUMP NO. 1	CURRENT	AI	COMM	N/A	AMPS	N/A	N/A	Y702	
SOL-WAS-PSL-PAL-310	SOL-SPB-PLC-061	SOL-WAS-PSL-310A	THIN SLUDGE PUMP NO. 1	PRESSURE LOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-PSH-PAH-310	SOL-SPB-PLC-061	SOL-WAS-PSH-310B	THIN SLUDGE PUMP NO. 1	PRESSURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-VLV-ZSO-311	SOL-SPB-PLC-061	SOL-WAS-VLV-311	TS PUMP NO. 1 SUCTION VALVE	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-VLV-ZSO-311	SOL-SPB-PLC-061	SOL-WAS-VLV-311	TS PUMP NO. 1 SUCTION VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-VLV-YA-311A	SOL-SPB-PLC-061	SOL-WAS-VLV-311	TS PUMP NO. 1 SUCTION VALVE FAILED TO OPEN	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-VLV-YA-311B	SOL-SPB-PLC-061	SOL-WAS-VLV-311	TS PUMP NO. 1 SUCTION VALVE FAILED TO CLOSE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	

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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SOL-WAS-PMP-MD-320	SOL-SPB-PLC-061	SOL-WAS-PMP-320	THIN SLUDGE PUMP NO. 2	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y702	
SOL-WAS-PMP-HS-320A	SOL-SPB-PLC-061	SOL-WAS-PMP-320	THIN SLUDGE PUMP NO. 2	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-PMP-HS-320B	SOL-SPB-PLC-061	SOL-WAS-PMP-320	THIN SLUDGE PUMP NO. 2	IN-LOCAL	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-PMP-MN-320	SOL-SPB-PLC-061	SOL-WAS-PMP-320	THIN SLUDGE PUMP NO. 2	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-PMP-TAH-320A	SOL-SPB-PLC-061	SOL-WAS-PMP-320	THIN SLUDGE PUMP NO. 2 MOTOR	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y702	
SOL-WAS-PMP-TAH-320B	SOL-SPB-PLC-061	SOL-WAS-PMP-320	THIN SLUDGE PUMP NO. 2 STATOR	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y702	
SOL-WAS-PMP-YA-320	SOL-SPB-PLC-061	SOL-WAS-PMP-320	THIN SLUDGE PUMP NO. 2	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-PMP-SC-320	SOL-SPB-PLC-061	SOL-WAS-PMP-320	THIN SLUDGE PUMP NO. 2	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y702	
SOL-WAS-PMP-SI-320	SOL-SPB-PLC-061	SOL-WAS-PMP-320	THIN SLUDGE PUMP NO. 2	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y702	
SOL-WAS-PMP-II-320	SOL-SPB-PLC-061	SOL-WAS-PMP-320	THIN SLUDGE PUMP NO. 2	CURRENT	AI	COMM	N/A	AMPS	N/A	N/A	Y702	
SOL-WAS-PSL-PAL-320	SOL-SPB-PLC-061	SOL-WAS-PSL-320A	THIN SLUDGE PUMP NO. 2	PRESSURE LOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-PSH-PAH-320	SOL-SPB-PLC-061	SOL-WAS-PSH-320B	THIN SLUDGE PUMP NO. 2	PRESSURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-VLV-ZSO-321	SOL-SPB-PLC-061	SOL-WAS-VLV-321	TS PUMP NO. 2 SUCTION VALVE	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-VLV-ZSO-321	SOL-SPB-PLC-061	SOL-WAS-VLV-321	TS PUMP NO. 2 SUCTION VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-VLV-YA-321A	SOL-SPB-PLC-061	SOL-WAS-VLV-321	TS PUMP NO. 2 SUCTION VALVE FAILED TO OPEN	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-VLV-YA-321B	SOL-SPB-PLC-061	SOL-WAS-VLV-321	TS PUMP NO. 2 SUCTION VALVE FAILED TO CLOSE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-PMP-MD-330	SOL-SPB-PLC-061	SOL-WAS-PMP-330	THIN SLUDGE PUMP NO. 3	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y702	
SOL-WAS-PMP-HS-330A	SOL-SPB-PLC-061	SOL-WAS-PMP-330	THIN SLUDGE PUMP NO. 3	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-PMP-HS-330B	SOL-SPB-PLC-061	SOL-WAS-PMP-330	THIN SLUDGE PUMP NO. 3	IN-LOCAL	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-PMP-MN-330	SOL-SPB-PLC-061	SOL-WAS-PMP-330	THIN SLUDGE PUMP NO. 3	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-PMP-TAH-330A	SOL-SPB-PLC-061	SOL-WAS-PMP-330	THIN SLUDGE PUMP NO. 3 MOTOR	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y702	
SOL-WAS-PMP-TAH-330B	SOL-SPB-PLC-061	SOL-WAS-PMP-330	THIN SLUDGE PUMP NO. 3 STATOR	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y702	
SOL-WAS-PMP-YA-330	SOL-SPB-PLC-061	SOL-WAS-PMP-330	THIN SLUDGE PUMP NO. 3	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-PMP-SC-330	SOL-SPB-PLC-061	SOL-WAS-PMP-330	THIN SLUDGE PUMP NO. 3	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y702	
SOL-WAS-PMP-SI-330	SOL-SPB-PLC-061	SOL-WAS-PMP-330	THIN SLUDGE PUMP NO. 3	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y702	
SOL-WAS-PMP-II-330	SOL-SPB-PLC-061	SOL-WAS-PMP-330	THIN SLUDGE PUMP NO. 3	CURRENT	AI	COMM	N/A	AMPS	N/A	N/A	Y702	
SOL-WAS-PSL-PAL-330	SOL-SPB-PLC-061	SOL-WAS-PSL-330A	THIN SLUDGE PUMP NO. 3	PRESSURE LOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-PSH-PAH-330	SOL-SPB-PLC-061	SOL-WAS-PSH-330B	THIN SLUDGE PUMP NO. 3	PRESSURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-VLV-ZSO-331	SOL-SPB-PLC-061	SOL-WAS-VLV-331	TS PUMP NO. 3 SUCTION VALVE	POSITION-OPEN	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-VLV-ZSO-331	SOL-SPB-PLC-061	SOL-WAS-VLV-331	TS PUMP NO. 3 SUCTION VALVE	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-VLV-YA-331A	SOL-SPB-PLC-061	SOL-WAS-VLV-331	TS PUMP NO. 3 SUCTION VALVE FAILED TO OPEN	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-VLV-YA-331B	SOL-SPB-PLC-061	SOL-WAS-VLV-331	TS PUMP NO. 3 SUCTION VALVE FAILED TO CLOSE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	
SOL-WAS-AIT-AI-301	SOL-SPB-PLC-061	SOL-WAS-AIT-301	THIN SLUDGE PUMPING	TS	AI	4-20mA	0-5	%	4-WIRE	FIELD	Y702	
SOL-WAS-FIT-FI-301	SOL-SPB-PLC-061	SOL-WAS-FIT-301	THIN SLUDGE PUMPING	FLOW	AI	4-20mA	0-600	GPM	4-WIRE	FIELD	Y702	
SOL-WAS-FIT-FA-301	SOL-SPB-PLC-061	SOL-WAS-FIT-301	THIN SLUDGE PUMPING	REVERSE FLOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	10
SOL-WAS-AIT-AI-302	SOL-SPB-PLC-061	SOL-WAS-AIT-302	THIN SLUDGE PUMPING	TS	AI	4-20mA	0-5	%	4-WIRE	FIELD	Y702	
SOL-WAS-FIT-FI-302	SOL-SPB-PLC-061	SOL-WAS-FIT-302	THIN SLUDGE PUMPING	FLOW	AI	4-20mA	0-600	GPM	4-WIRE	FIELD	Y702	
SOL-WAS-FIT-FA-302	SOL-SPB-PLC-061	SOL-WAS-FIT-302	THIN SLUDGE PUMPING	REVERSE FLOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y702	10

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SOL-STH-FIT-FI-131	SOL-SPB-PLC-061	SOL-STH-FIT-131	THICKENED SLUDGE PUMPING	FLOW	AI	4-20mA	0-200	GPM	4-WIRE	FIELD	Y703	
SOL-STH-FIT-FA-131	SOL-SPB-PLC-061	SOL-STH-FIT-131	THICKENED SLUDGE PUMPING	REVERSE FLOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y703	10
SOL-STH-AIT-AI-131	SOL-SPB-PLC-061	SOL-STH-AIT-131	THICKENED SLUDGE PUMPING	TS	AI	4-20mA	0-5	%	4-WIRE	FIELD	Y703	
SOL-STH-FIT-FI-231	SOL-SPB-PLC-061	SOL-STH-FIT-231	THICKENED SLUDGE PUMPING	FLOW	AI	4-20mA	0-200	GPM	4-WIRE	FIELD	Y703	
SOL-STH-FIT-FA-231	SOL-SPB-PLC-061	SOL-STH-FIT-231	THICKENED SLUDGE PUMPING	REVERSE FLOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y703	10
SOL-STH-AIT-AI-231	SOL-SPB-PLC-061	SOL-STH-AIT-231	THICKENED SLUDGE PUMPING	TS	AI	4-20mA	0-5	%	4-WIRE	FIELD	Y703	
SOL-STH-PMP-MD-130	SOL-SPB-PLC-061	SOL-STH-PMP-130	THICKENED SLUDGE PUMP NO. 1	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y703	
SOL-STH-PMP-HS-130A	SOL-SPB-PLC-061	SOL-STH-PMP-130	THICKENED SLUDGE PUMP NO. 1	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y703	
SOL-STH-PMP-HS-130B	SOL-SPB-PLC-061	SOL-STH-PMP-130	THICKENED SLUDGE PUMP NO. 1	IN-LOCAL	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y703	
SOL-STH-PMP-MN-130	SOL-SPB-PLC-061	SOL-STH-PMP-130	THICKENED SLUDGE PUMP NO. 1	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y703	
SOL-STH-PMP-TAH-130A	SOL-SPB-PLC-061	SOL-STH-PMP-130	THICKENED SLUDGE PUMP NO. 1 STATOR	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y703	
SOL-STH-PMP-TAH-130B	SOL-SPB-PLC-061	SOL-STH-PMP-130	THICKENED SLUDGE PUMP NO. 1 MOTOR	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y703	
SOL-STH-PMP-YA-130	SOL-SPB-PLC-061	SOL-STH-PMP-130	THICKENED SLUDGE PUMP NO. 1	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y703	
SOL-STH-PMP-SC-130	SOL-SPB-PLC-061	SOL-STH-PMP-130	THICKENED SLUDGE PUMP NO. 1	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y703	
SOL-STH-PMP-SI-130	SOL-SPB-PLC-061	SOL-STH-PMP-130	THICKENED SLUDGE PUMP NO. 1	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y703	
SOL-STH-PMP-II-130	SOL-SPB-PLC-061	SOL-STH-PMP-130	THICKENED SLUDGE PUMP NO. 1	CURRENT	AI	COMM	N/A	AMPS	N/A	N/A	Y703	
SOL-STH-PMP-PAH-130	SOL-SPB-PLC-061	SOL-STH-PMP-130	THICKENED SLUDGE PUMP NO. 1	PRESSURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y703	
SOL-STH-PMP-MD-230	SOL-SPB-PLC-061	SOL-STH-PMP-230	THICKENED SLUDGE PUMP NO. 2	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y703	
SOL-STH-PMP-HS-230A	SOL-SPB-PLC-061	SOL-STH-PMP-230	THICKENED SLUDGE PUMP NO. 2	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y703	
SOL-STH-PMP-HS-230B	SOL-SPB-PLC-061	SOL-STH-PMP-230	THICKENED SLUDGE PUMP NO. 2	IN-LOCAL	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y703	
SOL-STH-PMP-MN-230	SOL-SPB-PLC-061	SOL-STH-PMP-230	THICKENED SLUDGE PUMP NO. 2	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y703	
SOL-STH-PMP-TAH-230A	SOL-SPB-PLC-061	SOL-STH-PMP-230	THICKENED SLUDGE PUMP NO. 2 STATOR	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y703	
SOL-STH-PMP-TAH-230B	SOL-SPB-PLC-061	SOL-STH-PMP-230	THICKENED SLUDGE PUMP NO. 2 MOTOR	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y703	
SOL-STH-PMP-YA-230	SOL-SPB-PLC-061	SOL-STH-PMP-230	THICKENED SLUDGE PUMP NO. 2	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y703	
SOL-STH-PMP-SC-230	SOL-SPB-PLC-061	SOL-STH-PMP-230	THICKENED SLUDGE PUMP NO. 2	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y703	
SOL-STH-PMP-SI-230	SOL-SPB-PLC-061	SOL-STH-PMP-230	THICKENED SLUDGE PUMP NO. 2	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y703	
SOL-STH-PMP-II-230	SOL-SPB-PLC-061	SOL-STH-PMP-230	THICKENED SLUDGE PUMP NO. 2	CURRENT	AI	COMM	N/A	AMPS	N/A	N/A	Y703	
SOL-STH-PMP-PAH-230	SOL-SPB-PLC-061	SOL-STH-PMP-230	THICKENED SLUDGE PUMP NO. 2	PRESSURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y703	

TODD CREEK
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I/O LIST

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SOL-STH-MIX-HS-110	SOL-SPB-PLC-061	SOL-STH-MCP-100	FLOCCULATION TANK NO. 1 (STH-MIX-110)	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-MIX-MN-110	SOL-SPB-PLC-061	SOL-STH-MCP-100	FLOCCULATION TANK NO. 1 (STH-MIX-110)	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-MIX-YA-110	SOL-SPB-PLC-061	SOL-STH-MCP-100	FLOCCULATION TANK NO. 1 (STH-MIX-110)	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-MIX-SI-110	SOL-SPB-PLC-061	SOL-STH-MCP-100	FLOCCULATION TANK NO. 1 (STH-MIX-110)	SPEED	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-LSH-LAH-110	SOL-SPB-PLC-061	SOL-STH-MCP-100	FLOCCULATION TANK NO. 1 (STH-MIX-110)	LEVEL HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-RDT-HS-120	SOL-SPB-PLC-061	SOL-STH-MCP-100	ROTARY THICKENER NO. 1 (STH-RDT-120)	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-RDT-MN-120	SOL-SPB-PLC-061	SOL-STH-MCP-100	ROTARY THICKENER NO. 1 (STH-RDT-120)	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-RDT-YA-120	SOL-SPB-PLC-061	SOL-STH-MCP-100	ROTARY THICKENER NO. 1 (STH-RDT-120)	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-RDT-SI-120	SOL-SPB-PLC-061	SOL-STH-MCP-100	ROTARY THICKENER NO. 1 (STH-RDT-120)	SPEED	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-SSL-SAL-120	SOL-SPB-PLC-061	SOL-STH-MCP-100	ROTARY THICKENER NO. 1 (STH-RDT-120)	SPEED-LOW	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-LSH-LAH-120	SOL-SPB-PLC-061	SOL-STH-MCP-100	DISCHARGE HOPPER NO. 1	LEVEL	AI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-LIT-LI-120	SOL-SPB-PLC-061	SOL-STH-MCP-100	DISCHARGE HOPPER NO. 1	LEVEL HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-PSL-PAL-120	SOL-SPB-PLC-061	SOL-STH-MCP-100	WASH WATER	PRESSURE LOW	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-HS-ES-120	SOL-SPB-PLC-061	SOL-STH-MCP-100	SLUDGE THICKENING SYSTEM NO. 1	EMERGENCY STOP	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-MCP-MN-100	SOL-SPB-PLC-061	SOL-STH-MCP-100	SLUDGE THICKENING SYSTEM NO. 1 RUNNING IN-AUTO	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-MCP-YA-100	SOL-SPB-PLC-061	SOL-STH-MCP-100	SLUDGE THICKENING SYSTEM NO. 1	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-MCP-MN-100	SOL-SPB-PLC-061	SOL-STH-MCP-100	SLUDGE THICKENING SYSTEM NO. 1 INHIBIT	ENABLE/DISABLE	DO	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-MIX-HS-210	SOL-SPB-PLC-061	SOL-STH-MCP-200	FLOCCULATION TANK NO. 2 (STH-MIX-210)	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-MIX-MN-210	SOL-SPB-PLC-061	SOL-STH-MCP-200	FLOCCULATION TANK NO. 2 (STH-MIX-210)	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-MIX-YA-210	SOL-SPB-PLC-061	SOL-STH-MCP-200	FLOCCULATION TANK NO. 2 (STH-MIX-210)	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-MIX-SI-210	SOL-SPB-PLC-061	SOL-STH-MCP-200	FLOCCULATION TANK NO. 2 (STH-MIX-210)	SPEED	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-LSH-LAH-210	SOL-SPB-PLC-061	SOL-STH-MCP-200	FLOCCULATION TANK NO. 2 (STH-MIX-210)	LEVEL HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-RDT-HS-220	SOL-SPB-PLC-061	SOL-STH-MCP-200	ROTARY THICKENER NO. 2 (STH-RDT-220)	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-RDT-MN-220	SOL-SPB-PLC-061	SOL-STH-MCP-200	ROTARY THICKENER NO. 2 (STH-RDT-220)	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-RDT-YA-220	SOL-SPB-PLC-061	SOL-STH-MCP-200	ROTARY THICKENER NO. 2 (STH-RDT-220)	ALARM	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-RDT-SI-220	SOL-SPB-PLC-061	SOL-STH-MCP-200	ROTARY THICKENER NO. 2 (STH-RDT-220)	SPEED	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-SSL-SAL-220	SOL-SPB-PLC-061	SOL-STH-MCP-200	ROTARY THICKENER NO. 2 (STH-RDT-220)	SPEED-LOW	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-LSH-LAH-220	SOL-SPB-PLC-061	SOL-STH-MCP-200	DISCHARGE HOPPER NO. 2	LEVEL	AI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-LIT-LI-220	SOL-SPB-PLC-061	SOL-STH-MCP-200	DISCHARGE HOPPER NO. 2	LEVEL HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-PSL-PAL-220	SOL-SPB-PLC-061	SOL-STH-MCP-200	WASH WATER	PRESSURE LOW	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-HS-ES-220	SOL-SPB-PLC-061	SOL-STH-MCP-200	SLUDGE THICKENING SYSTEM NO. 2	EMERGENCY STOP	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-MCP-MN-200	SOL-SPB-PLC-061	SOL-STH-MCP-200	SLUDGE THICKENING SYSTEM NO. 2	RUN STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-MCP-YA-200	SOL-SPB-PLC-061	SOL-STH-MCP-200	SLUDGE THICKENING SYSTEM NO. 2	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-STH-MCP-MN-200	SOL-SPB-PLC-061	SOL-STH-MCP-200	SLUDGE THICKENING SYSTEM NO. 2 INHIBIT	ENABLE/DISABLE	DO	COMM	N/A	N/A	N/A	N/A	Y703	6
SOL-SCIN-LSH-LAH-101	SOL-SPB-PLC-061	SOL-SCIN-LSH-101	THICKENED SLUDGE TANK NO. 1	LEVEL HIGH	DI	N.O. CONTACT	931	FEET(MSL)	N/A	SYSTEM	Y704	2, 8
SOL-SCIN-LIT-LI-101	SOL-SPB-PLC-061	SOL-SCIN-LIT-101	THICKENED SLUDGE TANK NO. 1	LEVEL	AI	4-20mA	0-25	FEET	2-WIRE	SYSTEM	Y704	2, 8
SOL-SCIN-FIT-FI-111	SOL-SPB-PLC-061	SOL-SCIN-FIT-111	THICKENED SLUDGE TANK NO. 1	FLOW	AI	4-20mA	0-200	GPM	4-WIRE	FIELD	Y704	
SOL-SCIN-FIT-FA-111	SOL-SPB-PLC-061	SOL-SCIN-FIT-111	THICKENED SLUDGE TANK NO. 1	REVERSE FLOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	10
SOL-SCIN-LSH-LAH-201	SOL-SPB-PLC-061	SOL-SCIN-LSH-201	THICKENED SLUDGE TANK NO. 2	LEVEL HIGH	DI	N.O. CONTACT	931	FEET(MSL)	N/A	SYSTEM	Y704	2, 8
SOL-SCIN-LIT-LI-201	SOL-SPB-PLC-061	SOL-SCIN-LIT-201	THICKENED SLUDGE TANK NO. 2	LEVEL	AI	4-20mA	0-25	FEET	2-WIRE	SYSTEM	Y704	2, 8

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SOL-SCIN-FIT-FI-211	SOL-SPB-PLC-061	SOL-SCIN-FIT-211	THICKENED SLUDGE TANK NO. 2	FLOW	AI	4-20mA	0-200	GPM	4-WIRE	FIELD	Y704	
SOL-SCIN-FIT-FA-211	SOL-SPB-PLC-061	SOL-SCIN-FIT-211	THICKENED SLUDGE TANK NO. 2	REVERSE FLOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	10
SOL-SCIN-PMP-MD-110	SOL-SPB-PLC-061	SOL-SCIN-PMP-110	SLUDGE LOADOUT PUMP NO. 1	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y704	
SOL-SCIN-PMP-MN-110A	SOL-SPB-PLC-061	SOL-SCIN-PMP-110	SLUDGE LOADOUT PUMP NO. 1	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-PAL-110	SOL-SPB-PLC-061	SOL-SCIN-PMP-110	SLUDGE LOADOUT PUMP NO. 1	PRESSURE LOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-PAH-110	SOL-SPB-PLC-061	SOL-SCIN-PMP-110	SLUDGE LOADOUT PUMP NO. 1	PRESSURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-HS-110A	SOL-SPB-PLC-061	SOL-SCIN-PMP-110	SLUDGE LOADOUT PUMP NO. 1	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-HS-110B	SOL-SPB-PLC-061	SOL-SCIN-PMP-110	SLUDGE LOADOUT PUMP NO. 1	IN-LOCAL	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-HS-110C	SOL-SPB-PLC-061	SOL-SCIN-PMP-110	SLUDGE LOADOUT PUMP NO. 1	STOP	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-ES-110	SOL-SPB-PLC-061	SOL-SCIN-PMP-110	SLUDGE LOADOUT PUMP NO. 1	EMERGENCY STOP	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-TAH-110A	SOL-SPB-PLC-061	SOL-SCIN-PMP-110	SLUDGE LOADOUT PUMP NO. 1 STATOR	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-TAH-110B	SOL-SPB-PLC-061	SOL-SCIN-PMP-110	SLUDGE LOADOUT PUMP NO. 1 MOTOR	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-YA-110	SOL-SPB-PLC-061	SOL-SCIN-PMP-110	SLUDGE LOADOUT PUMP NO. 1	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-VLV-HS-112	SOL-SPB-PLC-061	SOL-SCIN-VLV-112	SLUDGE RECIRCULATION VALVE NO. 1	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-VLV-YA-112	SOL-SPB-PLC-061	SOL-SCIN-VLV-112	SLUDGE RECIRCULATION VALVE NO. 1	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-VLV-ZSC-112	SOL-SPB-PLC-061	SOL-SCIN-VLV-112	SLUDGE RECIRCULATION VALVE NO. 1	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-VLV-ZC-112	SOL-SPB-PLC-061	SOL-SCIN-VLV-112	SLUDGE RECIRCULATION VALVE NO. 1	POSITION CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y704	
SOL-SCIN-VLV-ZI-112	SOL-SPB-PLC-061	SOL-SCIN-VLV-112	SLUDGE RECIRCULATION VALVE NO. 1	POSITION	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y704	
SOL-SCIN-VLV-HS-113	SOL-SPB-PLC-061	SOL-SCIN-VLV-113	SLUDGE LOADOUT VALVE NO. 1	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-VLV-YA-113	SOL-SPB-PLC-061	SOL-SCIN-VLV-113	SLUDGE LOADOUT VALVE NO. 1	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-VLV-ZSC-113	SOL-SPB-PLC-061	SOL-SCIN-VLV-113	SLUDGE LOADOUT VALVE NO. 1	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-VLV-ZC-113	SOL-SPB-PLC-061	SOL-SCIN-VLV-113	SLUDGE LOADOUT VALVE NO. 1	POSITION CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y704	
SOL-SCIN-VLV-ZI-113	SOL-SPB-PLC-061	SOL-SCIN-VLV-113	SLUDGE LOADOUT VALVE NO. 1	POSITION	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y704	
SOL-SCIN-PMP-MD-210	SOL-SPB-PLC-061	SOL-SCIN-PMP-210	SLUDGE LOADOUT PUMP NO. 2	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y704	
SOL-SCIN-PMP-MN-210A	SOL-SPB-PLC-061	SOL-SCIN-PMP-210	SLUDGE LOADOUT PUMP NO. 2	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-PAL-210	SOL-SPB-PLC-061	SOL-SCIN-PMP-210	SLUDGE LOADOUT PUMP NO. 2	PRESSURE LOW	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-PAH-210	SOL-SPB-PLC-061	SOL-SCIN-PMP-210	SLUDGE LOADOUT PUMP NO. 2	PRESSURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-HS-210A	SOL-SPB-PLC-061	SOL-SCIN-PMP-210	SLUDGE LOADOUT PUMP NO. 2	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-HS-210B	SOL-SPB-PLC-061	SOL-SCIN-PMP-210	SLUDGE LOADOUT PUMP NO. 2	IN-LOCAL	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-HS-210C	SOL-SPB-PLC-061	SOL-SCIN-PMP-210	SLUDGE LOADOUT PUMP NO. 2	STOP	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-ES-210	SOL-SPB-PLC-061	SOL-SCIN-PMP-210	SLUDGE LOADOUT PUMP NO. 2	EMERGENCY STOP	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-TAH-210A	SOL-SPB-PLC-061	SOL-SCIN-PMP-210	SLUDGE LOADOUT PUMP NO. 2 STATOR	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-TAH-210B	SOL-SPB-PLC-061	SOL-SCIN-PMP-210	SLUDGE LOADOUT PUMP NO. 2 MOTOR	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-PMP-YA-210	SOL-SPB-PLC-061	SOL-SCIN-PMP-210	SLUDGE LOADOUT PUMP NO. 2	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SOL-SCIN-VLV-HS-212	SOL-SPB-PLC-061	SOL-SCIN-VLV-212	SLUDGE RECIRCULATION VALVE NO. 2	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-VLV-YA-212	SOL-SPB-PLC-061	SOL-SCIN-VLV-212	SLUDGE RECIRCULATION VALVE NO. 2	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-VLV-ZSC-212	SOL-SPB-PLC-061	SOL-SCIN-VLV-212	SLUDGE RECIRCULATION VALVE NO. 2	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-VLV-ZC-212	SOL-SPB-PLC-061	SOL-SCIN-VLV-212	SLUDGE RECIRCULATION VALVE NO. 2	POSITION CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y704	
SOL-SCIN-VLV-ZI-212	SOL-SPB-PLC-061	SOL-SCIN-VLV-212	SLUDGE RECIRCULATION VALVE NO. 2	POSITION	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y704	
SOL-SCIN-VLV-HS-213	SOL-SPB-PLC-061	SOL-SCIN-VLV-213	SLUDGE LOADOUT VALVE NO. 2	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-VLV-YA-213	SOL-SPB-PLC-061	SOL-SCIN-VLV-213	SLUDGE LOADOUT VALVE NO. 2	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-VLV-ZSC-213	SOL-SPB-PLC-061	SOL-SCIN-VLV-213	SLUDGE LOADOUT VALVE NO. 2	POSITION-CLOSED	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	
SOL-SCIN-VLV-ZC-213	SOL-SPB-PLC-061	SOL-SCIN-VLV-213	SLUDGE LOADOUT VALVE NO. 2	POSITION CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y704	
SOL-SCIN-VLV-ZI-213	SOL-SPB-PLC-061	SOL-SCIN-VLV-213	SLUDGE LOADOUT VALVE NO. 2	POSITION	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y704	
SOL-SCIN-LCP-YA-101	SOL-SPB-PLC-061	SOL-SCIN-LCP-101	MIXING VALVE PANEL NO. 1	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	2
SOL-SCIN-LCP-YA-201	SOL-SPB-PLC-061	SOL-SCIN-LCP-201	MIXING VALVE PANEL NO. 2	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y704	2
SOL-WAS-BLOW-MD-410	SOL-SPB-PLC-061	SOL-WAS-BLOW-410	SLUDGE BLOWER NO. 1	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y705	
SOL-WAS-BLOW-MN-410	SOL-SPB-PLC-061	SOL-WAS-BLOW-410	SLUDGE BLOWER NO. 1	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-HS-410A	SOL-SPB-PLC-061	SOL-WAS-BLOW-410	SLUDGE BLOWER NO. 1	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-HS-410B	SOL-SPB-PLC-061	SOL-WAS-BLOW-410	SLUDGE BLOWER NO. 1	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y705	
SOL-WAS-BLOW-TAH-410	SOL-SPB-PLC-061	SOL-WAS-BLOW-410	SLUDGE BLOWER NO. 1	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-PDAH-411	SOL-SPB-PLC-061	SOL-WAS-BLOW-410	SLUDGE BLOWER NO. 1	DIFFERENTIAL PRESSURE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-TAH-411	SOL-SPB-PLC-061	SOL-WAS-BLOW-410	SLUDGE BLOWER NO. 1	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-YA-410	SOL-SPB-PLC-061	SOL-WAS-BLOW-410	SLUDGE BLOWER NO. 1	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-SC-410	SOL-SPB-PLC-061	SOL-WAS-BLOW-410	SLUDGE BLOWER NO. 1	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y705	
SOL-WAS-BLOW-SI-410	SOL-SPB-PLC-061	SOL-WAS-BLOW-410	SLUDGE BLOWER NO. 1	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y705	
SOL-WAS-BLOW-II-410	SOL-SPB-PLC-061	SOL-WAS-BLOW-410	SLUDGE BLOWER NO. 1	CURRENT	AI	COMM		AMPS	N/A	N/A	Y705	

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SOL-WAS-BLOW-MD-420	SOL-SPB-PLC-061	SOL-WAS-BLOW-420	SLUDGE BLOWER NO. 2	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y705	
SOL-WAS-BLOW-MN-420	SOL-SPB-PLC-061	SOL-WAS-BLOW-420	SLUDGE BLOWER NO. 2	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-HS-420A	SOL-SPB-PLC-061	SOL-WAS-BLOW-420	SLUDGE BLOWER NO. 2	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-HS-420B	SOL-SPB-PLC-061	SOL-WAS-BLOW-420	SLUDGE BLOWER NO. 2	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y705	
SOL-WAS-BLOW-TAH-420	SOL-SPB-PLC-061	SOL-WAS-BLOW-420	SLUDGE BLOWER NO. 2	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-PDAH-421	SOL-SPB-PLC-061	SOL-WAS-BLOW-420	SLUDGE BLOWER NO. 2	DIFFERENTIAL PRESSURE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-TAH-421	SOL-SPB-PLC-061	SOL-WAS-BLOW-420	SLUDGE BLOWER NO. 2	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-YA-420	SOL-SPB-PLC-061	SOL-WAS-BLOW-420	SLUDGE BLOWER NO. 2	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-SC-420	SOL-SPB-PLC-061	SOL-WAS-BLOW-420	SLUDGE BLOWER NO. 2	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y705	
SOL-WAS-BLOW-SI-420	SOL-SPB-PLC-061	SOL-WAS-BLOW-420	SLUDGE BLOWER NO. 2	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y705	
SOL-WAS-BLOW-II-420	SOL-SPB-PLC-061	SOL-WAS-BLOW-420	SLUDGE BLOWER NO. 2	CURRENT	AI	COMM		AMPS	N/A	N/A	Y705	
SOL-WAS-BLOW-MD-430	SOL-SPB-PLC-061	SOL-WAS-BLOW-430	SLUDGE BLOWER NO. 3	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y705	
SOL-WAS-BLOW-MN-430	SOL-SPB-PLC-061	SOL-WAS-BLOW-430	SLUDGE BLOWER NO. 3	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-HS-430A	SOL-SPB-PLC-061	SOL-WAS-BLOW-430	SLUDGE BLOWER NO. 3	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-HS-430B	SOL-SPB-PLC-061	SOL-WAS-BLOW-430	SLUDGE BLOWER NO. 3	IN-LOCAL	DI	COMM	N/A	N/A	N/A	N/A	Y705	
SOL-WAS-BLOW-TAH-430	SOL-SPB-PLC-061	SOL-WAS-BLOW-430	SLUDGE BLOWER NO. 3	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-PDAH-431	SOL-SPB-PLC-061	SOL-WAS-BLOW-430	SLUDGE BLOWER NO. 3	DIFFERENTIAL PRESSURE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-TAH-431	SOL-SPB-PLC-061	SOL-WAS-BLOW-430	SLUDGE BLOWER NO. 3	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-YA-430	SOL-SPB-PLC-061	SOL-WAS-BLOW-430	SLUDGE BLOWER NO. 3	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y705	
SOL-WAS-BLOW-SC-430	SOL-SPB-PLC-061	SOL-WAS-BLOW-430	SLUDGE BLOWER NO. 3	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	SYSTEM	Y705	
SOL-WAS-BLOW-SI-430	SOL-SPB-PLC-061	SOL-WAS-BLOW-430	SLUDGE BLOWER NO. 3	SPEED	AI	4-20mA	0-100	%	2-WIRE	FIELD	Y705	
SOL-WAS-BLOW-II-430	SOL-SPB-PLC-061	SOL-WAS-BLOW-430	SLUDGE BLOWER NO. 3	CURRENT	AI	COMM		AMPS	N/A	N/A	Y705	
SOL-WAS-PDS-PDAH-401	SOL-SPB-PLC-061	SOL-WAS-PDS-401	INTAKE FILTER	DIFFERENTIAL PRESSURE	DI	N.O. CONTACT		PSIG	N/A	SYSTEM	Y705	
SOL-SCIN-AIRC-MN-310	SOL-SPB-PLC-061	SOL-SCIN-AIRC-310	SLUDGE MIXING AIR COMPRESSOR NO. 1	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y706	2
SOL-SCIN-AIRC-YA-310A	SOL-SPB-PLC-061	SOL-SCIN-AIRC-310	SLUDGE MIXING AIR COMPRESSOR NO. 1	WARNING	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y706	2
SOL-SCIN-AIRC-YA-310B	SOL-SPB-PLC-061	SOL-SCIN-AIRC-310	SLUDGE MIXING AIR COMPRESSOR NO. 1	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y706	2

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SOL-SCIN-AIRC-MN-320	SOL-SPB-PLC-061	SOL-SCIN-AIRC-320	SLUDGE MIXING AIR COMPRESSOR NO. 2	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y706	2
SOL-SCIN-AIRC-YA-320A	SOL-SPB-PLC-061	SOL-SCIN-AIRC-320	SLUDGE MIXING AIR COMPRESSOR NO. 2	WARNING	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y706	2
SOL-SCIN-AIRC-YA-320B	SOL-SPB-PLC-061	SOL-SCIN-AIRC-320	SLUDGE MIXING AIR COMPRESSOR NO. 2	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y706	2
SOL-POL-PMP-MD-110	SOL-SPB-PLC-061	SOL-POL-PMP-110	POLYMER FEED SKID NO. 1, PUMP NO. 1	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y707	
SOL-POL-PMP-MD-120	SOL-SPB-PLC-061	SOL-POL-PMP-120	POLYMER FEED SKID NO. 1, PUMP NO. 2	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y707	
SOL-POL-PMP-MN-110	SOL-SPB-PLC-061	SOL-POL-PMP-110	POLYMER FEED SKID NO. 1, PUMP NO. 1	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y707	
SOL-POL-PMP-MN-120	SOL-SPB-PLC-061	SOL-POL-PMP-120	POLYMER FEED SKID NO. 1, PUMP NO. 2	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y707	
SOL-POL-LCP-HS-100	SOL-SPB-PLC-061	SOL-POL-LCP-100	POLYMER FEED SKID NO. 1	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y707	
SOL-POL-LCP-YA-100	SOL-SPB-PLC-061	SOL-POL-LCP-100	POLYMER FEED SKID NO. 1	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y707	
SOL-POL-PMP-SC-110	SOL-SPB-PLC-061	SOL-POL-PMP-110	POLYMER FEED PUMP NO. 1-1	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	FIELD	Y707	
SOL-POL-PMP-SI-110	SOL-SPB-PLC-061	SOL-POL-PMP-110	POLYMER FEED PUMP NO. 1-1	SPEED	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y707	
SOL-POL-PMP-SC-120	SOL-SPB-PLC-061	SOL-POL-PMP-120	POLYMER FEED PUMP NO. 1-2	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	FIELD	Y707	
SOL-POL-PMP-SI-120	SOL-SPB-PLC-061	SOL-POL-PMP-120	POLYMER FEED PUMP NO. 1-2	SPEED	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y707	
SOL-POL-LIT-LI-101	SOL-SPB-PLC-061	SOL-POL-LIT-101	POLYMER TOTE	LEVEL	AI	4-20mA		FEET	2-WIRE	SYSTEM	Y707	
SOL-POL-PMP-MD-210	SOL-SPB-PLC-061	SOL-POL-PMP-210	POLYMER FEED SKID NO. 2, PUMP NO. 1	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y707	
SOL-POL-PMP-MD-220	SOL-SPB-PLC-061	SOL-POL-PMP-220	POLYMER FEED SKID NO. 2, PUMP NO. 2	START/STOP	DO	N.O. CONTACT	N/A	N/A	N/A	FIELD	Y707	
SOL-POL-PMP-MN-210	SOL-SPB-PLC-061	SOL-POL-PMP-210	POLYMER FEED SKID NO. 2, PUMP NO. 1	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y707	
SOL-POL-PMP-MN-220	SOL-SPB-PLC-061	SOL-POL-PMP-220	POLYMER FEED SKID NO. 2, PUMP NO. 2	RUN STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y707	
SOL-POL-LCP-HS-200	SOL-SPB-PLC-061	SOL-POL-LCP-200	POLYMER FEED SKID NO. 2	IN-REMOTE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y707	
SOL-POL-LCP-YA-200	SOL-SPB-PLC-061	SOL-POL-LCP-200	POLYMER FEED SKID NO. 2	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y707	
SOL-POL-PMP-SC-210	SOL-SPB-PLC-061	SOL-POL-PMP-210	POLYMER FEED PUMP NO. 2-1	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	FIELD	Y707	
SOL-POL-PMP-SI-210	SOL-SPB-PLC-061	SOL-POL-PMP-210	POLYMER FEED PUMP NO. 2-1	SPEED	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y707	
SOL-POL-PMP-SC-220	SOL-SPB-PLC-061	SOL-POL-PMP-220	POLYMER FEED PUMP NO. 2-2	SPEED CONTROL	AO	4-20mA	0-100	%	2-WIRE	FIELD	Y707	
SOL-POL-PMP-SI-220	SOL-SPB-PLC-061	SOL-POL-PMP-220	POLYMER FEED PUMP NO. 2-2	SPEED	AI	4-20mA	0-100	%	2-WIRE	SYSTEM	Y707	
SOL-POL-LIT-LI-201	SOL-SPB-PLC-061	SOL-POL-LIT-201	POLYMER TOTE	LEVEL	AI	4-20mA		FEET	2-WIRE	SYSTEM	Y707	

TODD CREEK
WWTP
I/O LIST

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SOL-ODR-MCP-PI-100A	SOL-SPB-PLC-061	SOL-ODR-MCP-100	ODOR CONTROL ENCLOSURE - OZONE	PRESSURE	AI	COMM		PSI	N/A	N/A	Y802	2, 4, 6
SOL-ODR-MCP-PI-100B	SOL-SPB-PLC-061	SOL-ODR-MCP-100	ODOR CONTROL ENCLOSURE - WATER	PRESSURE	AI	COMM		PSI	N/A	N/A	Y802	2, 4, 6
SOL-ODR-MCP-PI-100C	SOL-SPB-PLC-061	SOL-ODR-MCP-100	ODOR CONTROL ENCLOSURE - AIR	PRESSURE	AI	COMM		PSI	N/A	N/A	Y802	2, 4, 6
SOL-ODR-MCP-FAL-100	SOL-SPB-PLC-061	SOL-ODR-MCP-100	ODOR CONTROL ENCLOSURE - OZONE	FLOW LOW	DI	COMM	N/A	N/A	N/A	N/A	Y802	2, 4, 6
SOL-ODR-MCP-TAH-100	SOL-SPB-PLC-061	SOL-ODR-MCP-100	ODOR CONTROL ENCLOSURE	TEMPERATURE HIGH	DI	COMM	N/A	N/A	N/A	N/A	Y802	2, 4, 6
SOL-ODR-MCP-MN-100	SOL-SPB-PLC-061	SOL-ODR-MCP-100	ODOR CONTROL ENCLOSURE	ENABLE/DISABLE	DO	COMM	N/A	N/A	N/A	N/A	Y802	2
SOL-ODR-MCP-YA-100	SOL-SPB-PLC-061	SOL-ODR-MCP-100	ODOR CONTROL ENCLOSURE	FAIL STATUS	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM	Y802	2
SOL-SPB-FS-YA-001	SOL-SPB-PLC-061	SOL-SPB-FS-001	EMERGENCY EYEWASH/SHOWER	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
SOL-SPB-FACP-YA-001A	SOL-SPB-PLC-061	SOL-SPB-FACP-071	SPB FIRE ALARM CONTROL UNIT	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		10
SOL-SPB-FACP-YA-001B	SOL-SPB-PLC-061	SOL-SPB-FACP-071	SPB FIRE ALARM CONTROL UNIT	TROUBLE	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		10
SOL-SPB-FACP-YA-001C	SOL-SPB-PLC-061	SOL-SPB-FACP-071	SPB FIRE ALARM CONTROL UNIT	SUPERVISORY	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		10
PRE-SPB-CTRL-TAH-001	SOL-SPB-PLC-061	PRE-SPB-CTRL-001	SPB ELECTRICAL ROOM	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-SPB-CTRL-YA-001A	SOL-SPB-PLC-061	PRE-SPB-CTRL-001	DIRTY FILTER	WARNING	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-SPB-CTRL-YA-001B	SOL-SPB-PLC-061	PRE-SPB-CTRL-001	HVAC CONTROL SYSTEM	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-SPB-CTRL-YA-001C	SOL-SPB-PLC-061	PRE-SPB-CTRL-001	VENTILATION FAILURE	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
PRE-SPB-CTRL-YA-001D	SOL-SPB-PLC-061	PRE-SPB-CTRL-001	SMOKE ALARM	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
SOL-SPB-SWB-EI-021AN	SOL-SPB-PLC-061	SOL-SPB-SWB-021	SWITCHBOARD A-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SOL-SPB-SWB-EI-021BN	SOL-SPB-PLC-061	SOL-SPB-SWB-021	SWITCHBOARD B-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SOL-SPB-SWB-EI-021CN	SOL-SPB-PLC-061	SOL-SPB-SWB-021	SWITCHBOARD C-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SOL-SPB-SWB-EI-021AB	SOL-SPB-PLC-061	SOL-SPB-SWB-021	SWITCHBOARD A-B PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SOL-SPB-SWB-EI-021BC	SOL-SPB-PLC-061	SOL-SPB-SWB-021	SWITCHBOARD B-C PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SOL-SPB-SWB-EI-021CA	SOL-SPB-PLC-061	SOL-SPB-SWB-021	SWITCHBOARD C-A PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
SOL-SPB-SWB-II-021A	SOL-SPB-PLC-061	SOL-SPB-SWB-021	SWITCHBOARD A LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
SOL-SPB-SWB-II-021B	SOL-SPB-PLC-061	SOL-SPB-SWB-021	SWITCHBOARD B LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
SOL-SPB-SWB-II-021C	SOL-SPB-PLC-061	SOL-SPB-SWB-021	SWITCHBOARD C LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
SOL-SPB-SWB-JI-021A	SOL-SPB-PLC-061	SOL-SPB-SWB-021	SWITCHBOARD AVERAGE APPARENT	POWER	AI	COMM		KVA	N/A	N/A		4, 6
SOL-SPB-SWB-JI-021R	SOL-SPB-PLC-061	SOL-SPB-SWB-021	SWITCHBOARD AVERAGE REAL	POWER	AI	COMM		KW	N/A	N/A		4, 6
SOL-SPB-SWB-JQ-021	SOL-SPB-PLC-061	SOL-SPB-SWB-021	SWITCHBOARD TOTAL	ENERGY	AI	COMM		KWh	N/A	N/A		4, 6
SOL-SPB-SWB-JN-021	SOL-SPB-PLC-061	SOL-SPB-SWB-021	SWITCHBOARD AVERAGE	POWER FACTOR	AI	COMM		PF	N/A	N/A		4, 6
SOL-SPB-SWB-SI-021	SOL-SPB-PLC-061	SOL-SPB-SWB-021	SWITCHBOARD	FREQUENCY	AI	COMM		HERTZ	N/A	N/A		4, 6

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
SOL-SPB-UPS-JA-051	SOL-SPB-PLC-061	SOL-SPB-UPS-051	UPS SYSTEM REPLACE BATTERY	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SOL-SPB-UPS-JAL-051	SOL-SPB-PLC-061	SOL-SPB-UPS-051	UPS SYSTEM LOW BATTERY	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SOL-SPB-UPS-YA-051A	SOL-SPB-PLC-061	SOL-SPB-UPS-051	UPS SYSTEM	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
SOL-SPB-UPS-YN-051	SOL-SPB-PLC-061	SOL-SPB-UPS-051	UPS SYSTEM ON BATTERY	STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
SOL-SPB-UPS-ZS-051	SOL-SPB-PLC-061	SOL-SPB-UPS-051	UPS SYSTEM BYPASS	STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
SOL-SPB-NSW-YA-061A	SOL-SPB-PLC-061	SOL-SPB-NSW-061	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SOL-SPB-NSW-YA-061B	SOL-SPB-PLC-061	SOL-SPB-NSW-061	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SOL-SPB-NSW-YA-061C	SOL-SPB-PLC-061	SOL-SPB-NSW-061	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SOL-SPB-NSW-TI-061	SOL-SPB-PLC-061	SOL-SPB-NSW-061	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		4, 9
SOL-SPB-NSW-YA-062A	SOL-SPB-PLC-061	SOL-SPB-NSW-062	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SOL-SPB-NSW-YA-062B	SOL-SPB-PLC-061	SOL-SPB-NSW-062	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SOL-SPB-NSW-YA-062C	SOL-SPB-PLC-061	SOL-SPB-NSW-062	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SOL-SPB-NSW-TI-062	SOL-SPB-PLC-061	SOL-SPB-NSW-062	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		4, 9
SOL-SPB-NSW-YA-071A	SOL-SPB-PLC-061	SOL-SPB-NSW-071	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SOL-SPB-NSW-YA-071B	SOL-SPB-PLC-061	SOL-SPB-NSW-071	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SOL-SPB-NSW-YA-071C	SOL-SPB-PLC-061	SOL-SPB-NSW-071	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
SOL-SPB-NSW-TI-071	SOL-SPB-PLC-061	SOL-SPB-NSW-071	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		4, 9

TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
BLGR-ADM-FS-YA-001	BLGR-ADM-PLC-061	BLGR-ADM-FS-001	EMERGENCY EYEWASH/SHOWER	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
BLGR-ADM-CTRL-TAH-001	BLGR-ADM-PLC-061	BLGR-ADM-CTRL-001	ADMIN ELECTRICAL ROOM	TEMPERATURE HIGH	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
BLGR-ADM-CTRL-YA-001A	BLGR-ADM-PLC-061	BLGR-ADM-CTRL-001	DIRTY FILTER	WARNING	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
BLGR-ADM-CTRL-YA-001B	BLGR-ADM-PLC-061	BLGR-ADM-CTRL-001	HVAC CONTROL SYSTEM	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
BLGR-ADM-CTRL-YA-001D	BLGR-ADM-PLC-061	BLGR-ADM-CTRL-001	SMOKE ALARM	ALARM	DI	N.O. CONTACT	N/A	N/A	N/A	SYSTEM		
BLGR-ADM-SWB_52U1-HS-001	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 CIRCUIT BREAKER 52-U1	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A		6
BLGR-ADM-SWB_52U1-YA-001A	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 CIRCUIT BREAKER 52-U1 TRIP	ALARM	DI	COMM	N/A	N/A	N/A	N/A		6
BLGR-ADM-SWB_52U1-YA-001B	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 CIRCUIT BREAKER 52-U1 OPEN/CLOSE	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A		6
BLGR-ADM-SWB_52U1-YN-001	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 SOURCE AVAILABLE	STATUS	DI	COMM	N/A	N/A	N/A	N/A		6
BLGR-ADM-SWB_52U1-ZSC-001	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 CIRCUIT BREAKER 52-U1	CLOSED	DI	COMM	N/A	N/A	N/A	N/A		6
BLGR-ADM-SWB_52U1-ZSO-001	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 CIRCUIT BREAKER 52-U1	OPEN	DI	COMM	N/A	N/A	N/A	N/A		6
BLGR-ADM-SWB_52U1-EI-001AN	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 A-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U1-EI-001BN	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 B-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U1-EI-001CN	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 C-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U1-EI-001AB	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 A-B PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U1-EI-001BC	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 B-C PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U1-EI-001CA	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 C-A PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U1-II-001A	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 A LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U1-II-001B	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 B LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U1-II-001C	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 C LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U1-JI-001A	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 AVERAGE APPARENT	POWER	AI	COMM		KVA	N/A	N/A		4, 6
BLGR-ADM-SWB_52U1-JI-001R	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 AVERAGE REAL	POWER	AI	COMM		KW	N/A	N/A		4, 6
BLGR-ADM-SWB_52U1-JQ-001	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 TOTAL	ENERGY	AI	COMM		KWh	N/A	N/A		4, 6
BLGR-ADM-SWB_52U1-JN-001	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1 AVERAGE	POWER FACTOR	AI	COMM		PF	N/A	N/A		4, 6
BLGR-ADM-SWB_52U1-SI-001	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.1	FREQUENCY	AI	COMM		HERTZ	N/A	N/A		4, 6
BLGR-ADM-SWB_52U2-HS-001	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 CIRCUIT BREAKER 52-U2	IN-AUTO	DI	COMM	N/A	N/A	N/A	N/A		6
BLGR-ADM-SWB_52U2-YA-001A	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 CIRCUIT BREAKER 52-U2 TRIP	ALARM	DI	COMM	N/A	N/A	N/A	N/A		6
BLGR-ADM-SWB_52U2-YA-001B	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 CIRCUIT BREAKER 52-U2 OPEN/CLOSE	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A		6
BLGR-ADM-SWB_52U2-YN-001	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 SOURCE AVAILABLE	STATUS	DI	COMM	N/A	N/A	N/A	N/A		6
BLGR-ADM-SWB_52U2-ZSC-001	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 CIRCUIT BREAKER 52-U2	CLOSED	DI	COMM	N/A	N/A	N/A	N/A		6
BLGR-ADM-SWB_52U2-ZSO-001	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 CIRCUIT BREAKER 52-U2	OPEN	DI	COMM	N/A	N/A	N/A	N/A		6
BLGR-ADM-SWB_52U2-EI-001AN	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 A-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U2-EI-001BN	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 B-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U2-EI-001CN	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 C-N LINE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U2-EI-001AB	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 A-B PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U2-EI-001BC	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 B-C PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U2-EI-001CA	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 C-A PHASE	VOLTAGE	AI	COMM		VOLTS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U2-II-001A	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 A LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U2-II-001B	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 B LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6
BLGR-ADM-SWB_52U2-II-001C	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 C LINE	CURRENT	AI	COMM		AMPS	N/A	N/A		4, 6

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TAG NUMBER	ASSOCIATED EQUIPMENT / PLC	FIELD DEVICE	DESCRIPTION	FUNCTION	TYPE	OUTPUT/INPUT (NORMAL STATE)	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER (SEE NOTE 1)	DRAWING	SPECIAL NOTES
BLGR-ADM-SWB_52U2-JI-001A	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 AVERAGE APPARENT	POWER	AI	COMM		KVA	N/A	N/A		4, 6
BLGR-ADM-SWB_52U2-JI-001R	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 AVERAGE REAL	POWER	AI	COMM		KW	N/A	N/A		4, 6
BLGR-ADM-SWB_52U2-JQ-001	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 TOTAL	ENERGY	AI	COMM		KWh	N/A	N/A		4, 6
BLGR-ADM-SWB_52U2-JN-001	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2 AVERAGE	POWER FACTOR	AI	COMM		PF	N/A	N/A		4, 6
BLGR-ADM-SWB_52U2-SI-001	BLGR-ADM-PLC-061	BLGR-ADM-SWB-001	UTILITY NO.2	FREQUENCY	AI	COMM		HERTZ	N/A	N/A		4, 6
BLGR-ADM-UPS-JA-051	BLGR-ADM-PLC-061	BLGR-ADM-UPS-051	UPS SYSTEM REPLACE BATTERY	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
BLGR-ADM-UPS-JAL-051	BLGR-ADM-PLC-061	BLGR-ADM-UPS-051	UPS SYSTEM LOW BATTERY	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
BLGR-ADM-UPS-YA-051A	BLGR-ADM-PLC-061	BLGR-ADM-UPS-051	UPS SYSTEM	FAIL STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
BLGR-ADM-UPS-YN-051	BLGR-ADM-PLC-061	BLGR-ADM-UPS-051	UPS SYSTEM ON BATTERY	STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
BLGR-ADM-UPS-ZS-051	BLGR-ADM-PLC-061	BLGR-ADM-UPS-051	UPS SYSTEM BYPASS	STATUS	DI	COMM	N/A	N/A	N/A	N/A		9
BLGR-ADM-NSW-YA-061A	BLGR-ADM-PLC-061	BLGR-ADM-NSW-061	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
BLGR-ADM-NSW-YA-061B	BLGR-ADM-PLC-061	BLGR-ADM-NSW-061	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
BLGR-ADM-NSW-YA-061C	BLGR-ADM-PLC-061	BLGR-ADM-NSW-061	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
BLGR-ADM-NSW-TI-061	BLGR-ADM-PLC-061	BLGR-ADM-NSW-061	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		4, 9
BLGR-ADM-NSW-YA-062A	BLGR-ADM-PLC-061	BLGR-ADM-NSW-062	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
BLGR-ADM-NSW-YA-062B	BLGR-ADM-PLC-061	BLGR-ADM-NSW-062	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
BLGR-ADM-NSW-YA-062C	BLGR-ADM-PLC-061	BLGR-ADM-NSW-062	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
BLGR-ADM-NSW-TI-062	BLGR-ADM-PLC-061	BLGR-ADM-NSW-062	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		4, 9
BLGR-ADM-NSW-YA-071A	BLGR-ADM-PLC-061	BLGR-ADM-NSW-071	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
BLGR-ADM-NSW-YA-071A	BLGR-ADM-PLC-061	BLGR-ADM-NSW-071	COMMUNICATION FAULT	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
BLGR-ADM-NSW-YA-071B	BLGR-ADM-PLC-061	BLGR-ADM-NSW-071	MINOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
BLGR-ADM-NSW-YA-071C	BLGR-ADM-PLC-061	BLGR-ADM-NSW-071	MAJOR	ALARM	DI	COMM	N/A	N/A	N/A	N/A		9
BLGR-ADM-NSW-TI-071	BLGR-ADM-PLC-061	BLGR-ADM-NSW-071	SWITCH	TEMPERATURE	AI	COMM		°F	N/A	N/A		4, 9

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NOTES:

1. "SYSTEM" - POWER FROM ASSOCIATED PANEL. "FIELD" - POWER FROM OTHER SOURCE INDICATED ELSEWHERE.

2. PROVIDE SURGE PROTECTION DEVICE (SPD) FOR I/O POINT.

3. PROVIDE TEMPERATURE SWITCH INSTALLED IN THE PLC CABINET. SEE SPECIFICATIONS FOR REQUIREMENTS.

4. RANGE SHALL BE COORDINATED WITH THE EQUIPMENT SUPPLIER.

5. PROVIDE 120VAC POWER SOURCE FROM PLC PANEL FOR INSTRUMENT.

6. INDICATED POINTS SHALL BE CONSUMED BY THE PLANT CONTROL SYSTEM FROM THE MANUFACTURER SUPPLIED PLC.

7. INDICATED POINTS SHALL BE CONSUMED BY THE MANUFACTURER SUPPLIED PLC FROM THE PLANT CONTROL SYSTEM.

8. PROVIDE INTRINSICALLY SAFE BARRIER FOR I/O POINT.

9. WHERE ETHERNET/IP COMMUNICIATIONS IS NOT AVAILABLE, COMMS TO PCS SHALL BE UTILIZE SIMPLE NETWORK MANAGEMENT PROTOCOL (SNMP). UTILIZE SNMP TO OPC GATEWAY SOFTWARE AS REQUIRED.

10. PROVIDE AN INTERPOSING RELAY TO CONSUME THE INDICATED I/O POINT. SUPPLY VOLTAGE SHALL BE 24VDC SOURCED FROM THE ASSOCIATED PCS PLC CABINET.

SECTION 40 62 00 – COMPUTER SYSTEM HARDWARE AND ANCILLARIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section specifies computers and associated peripherals required for digital process control. This Section includes the following:
   1. Servers.
   2. Mobile Workstations (Laptops).
   3. Thin Client Terminals.
   4. Network Attached Storage.
   5. KVM Switches and Consoles.
   6. Printers.

1.03 RELATED REQUIREMENTS:

A. Section 26 33 53 – Static Uninterruptible Power Supply.
B. Section 40 61 96 – Process Control Software Programming and Reports.
C. Section 40 66 00 – Network and Communications Equipment.
D. Section 40 67 00 – Process Control Panels and Hardware.
E. Section 40 68 00 – Process Control Software.

1.04 REFERENCE STANDARDS:

A. The seller shall furnish Equipment which conforms in all respects to applicable industry standards and sound engineering practice.
B. Design, fabricate, assemble, install and test Equipment to conform to the applicable standards specified herein.
C. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
D. Code of Federal Regulations (CFR):
   1. Title 47 CFR, Part 15 – Radio Frequency Devices.
E. Institute of Electrical and Electronics Engineers (IEEE):
   1. IEEE C37.90.1 - Surge Withstand Capability Test.
F. National Fire Protection Association (NFPA):
   1. NFPA 70 - National Electrical Code (NEC).
G. Underwriters Laboratories (UL):
   1. UL 1449 - Safety for Surge Protective Devices.
H. Instrument Society of America (ISA).
I. National Electrical Safety Code (NESC).

1.05 SUBMITTALS:

A. Submit as specified in Division 1.
B. Product Data: Submit for each type of product specified and include the following as minimum:
   1. Device list and bills of material.
   2. Data sheets for all hardware and software.
   3. Description of operation for control Equipment.

C. Shop Drawings: Provide the following as minimum:
   1. Drawings of operator interface touch screen enclosures and mounting system.
D. Closeout Submittals: Final documentation shall include the following as minimum:
   1. Information listed above.
   2. Commissioning test reports.
   3. Operation and maintenance manuals.
E. Maintenance Material Submittals:
   1. Spare Parts:
      a. Toner Cartridges: Provide one complete set of high-yield toner replacement cartridges for each laser printer supplied.
      b. Paper: Provide two reams (1000 sheets) of 8-1/2" x 11", 24lb, multi-purpose printing paper
   2. Software:
      a. Original electronic installation files on solid state drive or flash media containing all software provided. Associated licenses and license documentation shall be included.

1.06 QUALITY ASSURANCE:

A. All Equipment and Material furnished shall have an acceptable history of satisfactory reliable service in similar use for a period of at least six months.
B. Equivalent newly developed Equipment with less than two years actual service will be considered from established manufacturers if it has been adequately tested, meets the requirements of this Contract, and is approved by Engineer. Such Equipment shall be noted in the proposal for review.
C. All equipment shall be installed according to the respective NFPA 70 requirements.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. Computers and peripherals shall be packaged and shipped to the project site to avoid damage.
B. All equipment shall be stored according to the manufacturer's instructions and in a conditioned space to avoid condensation, dust, and other environmental contaminants.

1.08 PROJECT SITE CONDITIONS:

A. Do not store or install computers, peripherals, and other equipment specified herein until designated installation spaces are enclosed, weather tight, and free of contaminants.
B. Final or temporary HVAC systems shall be in place and operational to maintain the ambient temperatures and humidity conditions at occupancy levels prior to installation and shall be maintained for the remainder of the construction period.

1.09 WARRANTY:

A. Servers, Workstations, Laptops, and other computer equipment shall be provided with a minimum 3-year manufacturer's warranty. Warranty shall include 24x7 manufacturer's support and include next business day onsite service.
B. All other peripherals shall be provided with a minimum one-year warranty period.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Servers:
   1. Stratus Technologies.

B. PC Workstations and Mobile Workstations (Laptops):
   1. Hewlett-Packard Company (HP).
   2. Engineer-approved equal.
C. Thin Client Terminals:
   1. Allen-Bradley, Rockwell Automation, Inc.
   2. Engineer-approved equal.
D. Network Attached Storage:
   1. Synology Inc.
   2. Engineer-approved equal.
E. KVM Switches and Consoles:
   1. Hewlett-Packard Company (HP).
   2. Engineer-approved equal.
F. Multi-Function Laser Printers:
   1. Hewlett-Packard (HP).

2.02 PERFORMANCE AND DESIGN CRITERIA:

A. Contractor shall provide computer equipment and peripherals which meets the functional requirements of this PART 2.
B. The equipment shall be fully functional and compatible with the software and hardware as specified in Division 40.
C. Any device that does not meet IEEE C37.90.1 shall have a surge protection device that passes IEEE C37.90.1 and UL 1449.
D. Any device emitting an RF signal must meet CFR Title 47 CFR, Part 15.

2.03 PC WORKSTATIONS:

A. The processor shall be a 8 Core i7 11th generation series or AMD equivalent processor rated up to 4.9 GHz or greater. Processor shall have a minimum of 16.0 MBytes of cache.
B. Provide 16.0 Gigabytes (minimum), of Non-ECC DDR4 RAM designed to operate on a front side bus (FSB) speed of 1333 Mhz (2666 MT/s) or greater.
C. Provide at least three full-sized expansion slots.
D. Provide a minimum of 300-watt power supply.
E. Provide with standard keyboard.
F. Provide a wireless three-button, scroll wheel, optical mouse with “nano” USB receiver and mouse pad with each computer.
G. Graphics Card:
   1. Dedicated processor with a minimum of 4.0 GBytes of on-board GDDR5 or GDDR6 RAM.
   2. Shall support digital resolutions up to 3840 x 2160 at 60Hz or greater.
   3. The card shall have support a minimum of four displays and have the necessary DP and HDMI output ports.
   4. The graphics card shall be PCI Express 3.0 compliant.
H. Storage Drives:
   1. Provide a hard drive controller capable of supporting at least two SATA drives (up to 6.0Gbit/s minimum).
   2. Provide one internal SATA III type hard drive to meet the following requirements:
      a. Solid-state drive (SSD) with a minimum capacity of 512 GB.
      b. Sequential read up to 550MB/sec and Sequential write up to 520MB/sec.
      c. 2.5-inch or M.2 PCIe form factor.

I. Audio:
   1. The system shall include an integrated audio card supporting analog 2-channel and digital 5.1-channel outputs.
   2. 3.5mm audio output jack.
   3. Shall include a 3.5mm stereo or mono microphone input.

J. External ports shall include the following as minimum:
   1. Six (6) USB 3.0 ports. A minimum of two USB port shall be accessible on the front of the system chassis.

K. Provide an all-in-one flash card reader supporting a minimum of SD, CF, MMC, Memory Stick, and XD flash cards. Interface shall be mounted on the front of the system chassis.

L. Provide Ethernet 10/100/1000 gigabit Base-T network interface card with a single-shield RJ-45 connector.

M. Operating System and Software:
   1. Provide Microsoft Windows 11 Professional Edition for each PC workstation.
      a. The Operating System shall have the latest service packs and patches required for proper operation of the workstation and control software. Provide the OS license documentation as part of the workstation package.
      b. The PC shall have a clean install of the operating system and essential hardware drivers and software only. Non-essential applications, such as manufacturer provided trial software and utilities, shall not be loaded on the system.
   2. Provide a copy of the latest version of Microsoft Office (including Microsoft Word, Excel, and Access) for each PC workstation.
   3. The operating system shall include integrated firewall, virus, spyware, and malicious software protection.
   4. Provide and install the latest edition of Adobe Acrobat Professional.
   5. All software shall be licensed to the Owner. Coordinate with the Owner for specific contact information.

2.04 SERVERS:

A. Servers for the plant control system as specified below. Servers dedicated to the biological treatment system shall be as specified in the associated equipment specification section.

B. The host servers shall be fault tolerant (ft), Stratus Server 6910 series. Servers shall be included with a minimum of 5 year warranty and "Total Assurance" support with active remote fault notification.

C. The servers shall be rack mounted and provided with sliding rack rails.
   1. The processor shall be a 10-core Intel Xeon or equivalent AMD processor rated at 2.2 GHz or greater. The processor shall have a minimum of 15 Mbytes of Cache.
   2. Provide 128 Gigabytes (minimum) of registered ECC, DDR4 RAM (RDIMMS) designed to operate on a front side bus (FSB) speed of 1333 MHz (2666 MT/s) or greater.
   3. Provide at least four spare PCIe adapter slots for future expansion.
   4. Provide a minimum of two fully rated power supplies for redundant operation.
   5. Provide with a minimum dual on-board 10/100/1000 Base-T network interface card per CRU. The dual NIC card shall be configurable to serve as a primary and secondary fail-over.
   6. Hot-swappable components shall include CPU, I/O modules, and storage drives.

D. The graphics card shall be integrated with a minimum of 16 MB of video memory.

E. Disk Drives:
   1. Provide a system capable of supporting at least eight small form factor hot-swappable SAS hard drives per CRU. Support bandwidth of 12.0 Gb/s (SAS-3).

2. Total system storage capacity shall be a minimum of 2.4TB.
3. Provide a minimum of eight (8) hot swappable hard drives to meet the following requirements:
   a. Formatted capacity of 300GB or greater.
   b. Rotational speed of 15,000 rpm or greater.
   c. An average seek time of 3.5 msec or faster.
   d. Cache size of 256MB or greater.
   e. The hard drives shall be configured as a RAID 5.

F. Operating System and Software:
1. Provide Microsoft Windows Server 2019 with Hyper-V virtualization as required. Provide and install the latest service packs and patches available that are compatible with the control system software.
2. Configure the Operating System to allow all control software full access to communication ports as required.
3. The Owner shall provide the necessary Remote Desktop Services (RDS) client access licenses (CAL's) and Microsoft Office application licenses for each server. Integrator shall coordinate with the Owner's IT for specific license counts required.
4. All software provided shall be licensed to the Owner. Coordinate with the Owner for specific contact information.

2.05 THIN CLIENT TERMINALS:

A. Provide industrial grade thin client terminals, optimized for ACP ThinManager.
B. The processor shall be a 4-core AMD Ryzen or equivalent processor rated at 2.0Ghz or greater.
C. Provide 4.0 Gigabytes (minimum) of DDR4 RAM designed to operate on a front side bus (FSB) speed of 1333 MHz (2666 MT/s) or greater.
D. Support M.2 and 2.5" HDD/SSD storage devices.
E. Minimum of one full size mPCIe socket.
F. Graphics processor shall be Radeon Vega 8 or equivalent multi-display type supporting up to four monitors. Provide resolutions up to 4096 x 2160 at 60Hz or greater.
G. External ports shall include the following as minimum:
1. 4- DisplayPort 1.3/DP+ ports.
2. 2- Gb LAN ports.
3. 2- USB 3.2 Gen 2 ports.
4. 2- USB 2.0 ports.
5. 2- RS-232/422/485 COM ports.

H. Enclosure shall be aluminum or steel with fanned cooling. Operational temperature range of 0-50°C.
I. Designed to operate on an ACP ThinManager 13 or greater operating system.
J. Powered from 12Vdc. Provide required power supply adapter.
K. Provide standard keyboard and optical mouse.
L. Shall support up to 6 monitors as minimum. Workstation monitors and large displays shall be as specified this section.
M. Provide panel mount touch screen displays when required for control panels. Coordinate with Section 40 67 00.
N. Rockwell 6200 Versaview 5200 non-display series or equal.

2.06 WORKSTATION MONITORS:

A. Provide 24-inch widescreen (16:9) LCD displays as minimum. Quantity shall be as indicated.
B. LCD monitor shall be LED backlit.

C. Contrast Ratio of 1,000:1 (typical) as minimum.
D. Brightness of 250 nits (cd/m2), minimum.
E. Pixel pitch of 0.275 mm, maximum.
F. Minimum response time of 5ms with an average of 8ms.
G. Viewing angle (horizontal and vertical) of 170 degrees minimum.
H. Support resolution of 1980 x 1080 at 60 hertz, minimum.
I. Monitors shall include VESA mounting capabilities.
J. Shall include DisplayPort and HDMI inputs. Provide the required interconnecting cables between graphic card and monitor.
K. Shall include a minimum of 2- USB 3.2 Gen2 Type B and a minimum of 2 USB-C ports (1-upstream and 1-downstream) ports.

2.07 LARGE DISPLAY MONITORS (UHDTV):

A. Provide 65-inch widescreen (16:9) LCD HDTV monitors. Quantity shall be as indicated.
B. HDTV monitor shall be LED backlit.
C. Static Contrast Ratio of 5,000:1 minimum.
D. Brightness of 1000 nits (cd/m2), minimum.
E. Pixel pitch of 0.5 mm, maximum.
F. Response time of 5ms, maximum.
G. Viewing angle (horizontal and vertical) of 140 degrees minimum.
H. Support resolutions of 3840 x 2160 (2160p / 4K) at 60 hertz refresh rate, minimum.
I. Video inputs shall include the following as minimum:
    1. 3 – HDMI.
    2. 2 – USB 2.0 or greater.
    3. 1 – Coaxial F-type female.
    4. 1 – RJ-45 LAN port.
J. Monitors shall include VESA wall mounting capabilities.
K. Provide required interconnecting cables and video extension hardware between the graphic card and UHDTV monitors. Video extension hardware shall support full resolution specified.
L. Provide articulating wall mounting hardware or suspended ceiling mounting for each monitor as indicated. Mounting hardware shall be VESA compatible and rated to support the HDTV supplied. Coordinate overall dimensions of supplied display with the available mounting space shown on the Contract Drawings.

2.08 BADGE SCANNERS:

A. Each Engineering Workstation and Thin Client shall be provided with an RFID badge scanner. The badge scanner shall be configured to allow the operators to log onto the workstation or thin client by swiping their Owner-provided RFID. User verification shall come from the SCADA Active Directory. Badge scanners shall be manufactured by Lenel S2, without exception. Coordinate with security system hardware provider.

2.09 NETWORK ATTACHED STORAGE:

A. Provide rack mounted network attached storage (NAS) devices for connection to the plant control system network. The NAS devices shall be used for routine server backups and centralized file sharing:
B. NAS shall have a minimum AMD Ryzen 4-core 2.2 GHz processor with 16.0 GB DDR4 onboard system memory. 4 SO-DIMM slots with memory expandable to 32GB or greater.
C. Each storage controller shall have a minimum of six drive bays and be compatible with 2.5" and 3.5" SATA(II)/SATA(III) drives.

D. Screwless drive bay design with hot-swappable support.
E. Supported RAID types shall include RAID 0 and RAID 1.
F. Unit shall be provided with six (6) 10-TByte SATA drives. Drives shall be Seagate Ironwolf NAS series or equivalent.
G. NAS shall include a minimum of two gigabit Ethernet (RJ-45) ports with failover and link aggregation support.
H. Additional external ports shall include the following as minimum:
    1. Two (2) – USB 3.2 Gen 1.
    2. One (1) – eSATA.
    3. One (1) – VGA/Console.
I. Provide the required interconnection cables, power supplies, and rack mount rails.
J. Backup Software:
    1. Provide the necessary backup management software and install on appropriate server(s) for use with the NAS devices.

2.10 CONSOLE KVM SWITCH:

A. Integrated KVM and console shall provide control of multiple servers from a single keyboard, monitor, and touchpad.
B. Console shall provide 8-port KVM switch, 19” LCD, keyboard, and touchpad in a single 1U rack mountable chassis.
C. Support USB keyboard and mouse connections as required.
D. Support video resolutions up to 1280 x 1024.
E. Indicators for power and selected CPU.
F. CPU selection via face mounted pushbuttons or switches.
G. Shall include an external USB port for sharing a USB peripheral among all ports on the KVM switch.
H. Provide all required cables for complete installation.
I. Provide HPE Advanced KVM with LCD8500 rackmount console kit or engineer-approved equal.

2.11 MULTI-FUNCTION LASER PRINTER (COLOR):

A. Provide a multi-function laser printer (copy/scan/fax/print) as required.
B. General Requirements:
    1. The multi-function printer shall utilize color laser technology with copy and print speeds of 28 pages per minute (ppm) minimum.
    2. Support resolutions of 3600 dots per inch (dpi).
    3. Paper size capability of standard letter format 8 1/2" x 11" and standard legal format of 8 1/2" x 14".
    4. 512MB of internal RAM as minimum.
    5. Shall be capable of automatic duplex handling in all modes.
    6. Include Automatic Document Feeder with a 50 page capacity, minimum.
    7. Programming shall be accomplished by integral touchscreen display or PC software interface.
C. Fax Capabilities:
    1. 33.6kbps modem.
    2. Include a minimum of 100 Auto Dial and Memory locations.
    3. Minimum of 500-page fax memory.
    4. Support all standard faxing functions.

D. Scan Capabilities:
   1. Support B/W and Color scanning.
   2. Optical Scan Resolution of 600 dpi.
   3. Input color scan bit depth of 48-bit.
E. Interfaces shall include the following as minimum:
   1. Ethernet 10/100/1000 Base-TX. Provided with integral RJ-45 connector.
   2. USB 2.0 minimum.
   3. Wireless 802.11 b/g/n/2.4/5Ghz.
F. Each printer shall be provided with the required power supply and associated cables for network and PC connectivity.
G. Provide HP Color LaserJet Pro MFP M479fdw or Engineer-approved equal.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Verify site conditions are suitable for installation of equipment. The area for installation shall be fully enclosed, weather tight, and free of contaminants.
B. Final or temporary HVAC systems shall be in place and operational to maintain the ambient temperatures and humidity conditions at occupancy levels prior to installation and shall be maintained for the remainder of the construction period.

3.02 INSTALLATION:

A. Operator Workstations:
   1. Mount Workstations on desktop, shelf, or floor surface as indicated and specified.
   2. Provide all necessary hardware and interconnecting cables to install Equipment where specified.
   3. Install all software and drivers as required to configure the PC Workstation. Verify that all associated peripherals are functioning properly.
   4. All cabling shall be neatly routed and tie wrapped.
   5. Configure all network interfaces and Ethernet configuration settings as required for network printers and shared server file space.
B. Servers:
   1. Mount Servers in equipment racks as indicated and specified.
   2. Provide and install server rack rails and other mounting hardware as required for proper installation.
   3. Configure Servers and setup all network interfaces.
   4. Setup the network domain, add users, and configure privileges as required by the Owner. Coordinate with Owner IT department as necessary.
   5. Setup a common shared folder on the server drives and provide workstation mapping as required for a general use file storage area for the PCS and reporting software.
   6. Install the necessary HMI system software, backup software, and other third-party software as required for the plant control system.
C. Thin Client Terminals:
   1. Desk Mounted:
      a. Mount client chassis below desktop with stainless steel hardware. If desk mounted, coordinate with Owner for preferred location. Monitors, keyboard, and mouse shall be located on the desktop.
   2. Panel Mounted:
      a. Coordinate with Section 40 67 00 – Process Control Panels and Hardware.

b. Install touchscreen in door of panel.
c. Coordinate with panel supplier for mounting of touchscreen and thin client terminal.

D. Network Attached Storage (NAS):
1. Mount the NAS units in the network rack and make the necessary Ethernet connections to the associated network switch.
2. After all servers are operational and properly configured provide a complete partition image backup of the server drives for permanent storage.
3. Program the installed backup software to perform routine bi-weekly, weekly, and monthly backups of the servers to the network attached storage.
4. Coordinate with Owner's IT Department for preferred backup intervals and content.

E. Printers:
1. Install the printers at designated location. Coordinate with Owner's representative for final location of printer when not indicated or specified.
2. Provide all necessary hardware and interconnecting cables to install Equipment where indicated.
3. Install laser toner cartridges and perform printer startup and configuration per manufacturer instructions.
4. Adjust paper delivery and storage shelves for smooth operation.
5. Printers shall be connected to the Ethernet network and shared within the network domain as required.
6. Install the required network printer drivers on all servers, workstations, and laptops.

F. Equipment Asset Tags:
1. Provide and affix asset tags to all of the supplied computer hardware and other equipment specified in this Section. Asset tag shall be as specified or indicated.

3.03 ADJUSTING AND CLEANING:

A. All cables for peripheral and network connections shall be adjusted and neatly secured with tie wraps, hook-and-loop straps, or the like.
B. Prior to final acceptance all computers, servers, network racks and associated equipment shall be wiped clean and free from dust.
C. If equipment interiors have been exposed to dust and other contaminates the Contractor shall provide the necessary interior cleaning of equipment. Use precaution and proper cleaning methods to avoid damage of equipment.

3.04 TRAINING:

A. The training session shall be of sufficient content and duration to provide a basic understanding of the hardware/software in general and specific instruction on the Site-specific implementation.
B. Training for equipment specified in this section shall be a minimum of 4 hours in duration. The training sessions shall be coordinated with Owner and Engineer.
A. Additional training shall be provided as specified in Section 40 61 96 – Process Control Software Programming and Reports.
B. Training shall conform to the requirements of Section 01664 – Training.

END OF SECTION 40 62 00

SECTION 40 66 00 – PROCESS CONTROL NETWORKS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section specifies network infrastructure, wireless equipment, and ancillaries for Process Control System (PCS) networks and Supervisory Control and Data Acquisition (SCADA) systems. This Section includes the following:
   1. Fiber Optic Cabling and Accessories.
   2. UTP Cabling and Accessories.
   3. Equipment Racks and Accessories.
   4. Ethernet switches.
   5. Industrial Media Converters.

1.03 RELATED REQUIREMENTS:

A. Section 26 05 26 – Grounding and Bonding for Electrical Systems.
B. Section 26 05 33 – Raceways, Boxes, and Supports for Electrical Systems.
C. Section 26 05 43 – Underground Duct Banks and Manholes.
D. Section 26 05 53 – Identification for Electrical Systems.
E. Section 26 24 19 – Motor Control Centers.
F. Section 26 43 13 – Surge Protection Devices for Low-Voltage Electrical Power Equipment.
G. Section 40 62 00 – Computer System Hardware and Ancillaries.
H. Section 40 67 00 – Process Control Panels and Hardware.

1.04 REFERENCE STANDARDS:

A. Furnish equipment which conforms in all respects to applicable industry standards and sound engineer practice.
B. Furnish equipment which is FCC type accepted for the frequency band in which the equipment is to be applied.
C. Design, fabricate, assemble, and test equipment so as to conform with the latest revision of all applicable codes and standards including, but not necessarily limited to, the following.
D. Electronic Components Industry Association (ECIA):
   1. EIA/ECA-310-E – Cabinets, Racks, Panels, and Associated Equipment.
E. Insulated Cable Engineer's Association (ICEA).
   1. ICEA S-83-596 – Fiber Optic Premises Distribution Cable.
   2. ICEA S-104-696 – Indoor-Outdoor Optical Fiber Cable.
F. Institute of Electrical and Electronic Engineers (IEEE):
   1. IEEE 802.1 – Local and Metropolitan Area Networks.
   2. IEEE 802.3 – Ethernet.
   3. IEEE 802.11 – Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications.
   4. IEEE 1613 – Environmental and Testing Requirements for Communications Networking Devices in Electric Power Substations.
G. National Electrical Manufacturer's Association (NEMA):
   1. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).
H. National Fire Protection Association (NFPA):
   1. NFPA 70 – National Electrical Code.

2. NFPA 262 – Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

I. Telecommunications Industry Association (TIA):
1. TIA-222-G – Structural Standards for Antenna Supporting Structures and Antennas.
2. TIA-232-F – Interface Between Data Terminal Equipment and Data Circuit – Terminating Equipment Employing Serial Binary Data Interchange.
3. TIA-329.1-D – Communications Antennas Base Station Antennas.
4. TIA-485-A – Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems.
5. TIA-455-21A – FOTP 21 Mating Durability of Fiber-Optic Interconnecting Devices.
6. TIA-492AAAA-B – 62.5-µm Core Diameter/125-µm Cladding Diameter Class Ia Graded-Index Multi-mode Optical Fibers.
7. TIA-492AAAB-A – 50-µm Core Diameter/125-µm Cladding Diameter Class Ia Graded-Index Multi-mode Optical Fibers.
8. TIA-492AAAC-B – 850-nm Laser- Optimized 50-µm Core Diameter/125-µm Cladding Diameter Class Ia Graded-Index Multi-mode Optical Fibers.
9. TIA-526-7 – Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant, Adoption of IEC 61280-4-2 Edition 2: Fibre-Optic Communications Subsystem Test Procedures – Part 4-2: Installed Cable Plant Single-Mode Attenuation and Optical Return Loss Measurement.
10. TIA-526-14-B – Optical Power Loss Measurements of Installed Multi-mode Fiber Cable Plant.
11. TIA-568.0-E – Generic Telecommunications Cabling for Customer Premises.
12. TIA-568.1-E – Commercial Building Telecommunications Infrastructure Standard.
13. TIA-568.2-D – Balanced Twisted Pair Cabling and Components Standard.
14. TIA-568.3-D – Optical Fiber Cabling Components Standard.
15. TIA-598-D – Optical Fiber Cable Color Coding.
16. TIA-607-D – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.

J. Telcordia Technologies Standards:
1. GR-20 – Generic Requirements for Optical Fiber and Optical Fiber Cable.
2. GR-409 – Generic Requirements for Indoor Fiber Optic Cable.

K. Underwriter's Laboratories, Inc. (UL):
1. UL 44 – Thermoset-Insulated Wires and Cables.
2. UL 50 – Electrical Cabinets and Boxes.
3. UL 444 – Communications Cables.
4. UL 467 – Grounding and Bonding Equipment.
5. UL 514C – Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers.
6. UL 969 – Marking and Labeling Systems.
7. UL 1581 – Electrical Wires, Cables, and Flexible Cords.
8. UL 1651 – Optical Fiber Cable.
9. UL 1666 – Flame Propagation Height of Electrical and Optical Fiber Cables Installed in Vertical Shafts.
10. UL 1685 – Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables.
11. UL 1863 – Communication Circuit Accessories.
12. UL 60950-1 – Information Technology Equipment - Safety - Part 1: General Requirements.

1.05 SUBMITTALS:

A. Submit as specified in Division 01.

B. Product Data: Submit for each type of product specified and included the following as minimum:
   1. Data sheets for each cable type and equipment type specified.
   2. Cable manufacturer's approval of pulling compounds.
   3. Cable manufacturer's installation requirements such as maximum pulling tensions, sidewall pressures, minimum bending radii, reel dimensions, etc.
   4. Other ancillary equipment and materials to be used.
   5. Description of cable identification tags and attachment methods which will be used.

C. Qualification Statements:
   1. Installer’s qualifications.
   2. Certifications:
      a. Submit certifications for personnel responsible for configuring and commissioning the managed network switches, servers, VLANs, VPNs, firewall appliances, routers, and other network security components.

D. Shop Drawings: Provide the following as minimum:
   1. Drawings indicating equipment rack layout and cable management plan.

E. Special Procedure Submittals:
   1. Test Plan:
      a. Provide a complete and detailed test plan for the fiber optic and UTP cabling system including a complete list of test equipment.
      b. Provide a complete and detailed test plan for the completed radio network including a complete list of test equipment.
      c. Include procedures for certification, validation, and testing.

F. Test and Evaluation Reports:
   1. Factory test reports.
   2. Field test reports.

G. Closeout Submittals: Final documentation shall include the following as minimum:
   1. Operation and Maintenance Manuals including the following:
      a. Preventive maintenance plan and schedule.
      b. Copies of all approved Shop Drawings.
      c. Copies of all approved Product Data.
      d. Copies of all approved Test Reports.
      e. Spare parts and supply list.
      f. Warranty Information.
      g. Contractor Information.

H. Maintenance Material Submittals:
   1. Spare Parts:
      a. Ethernet Switches: Provide one spare of each type of switch used.
      b. Fiber and UTP patch cables: Provide spares as specified herein.
      c. Fuses: Provide two of each type used.
   2. Software:
      a. If software is not embedded, compile original software on flash media or SSD associated with the supplied network hardware and submit.

1.06 QUALITY ASSURANCE:

A. Materials and Equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall be the manufacturer’s latest standard design that

has been in satisfactory use for at least 1 year prior to Bid opening. Each major component of the equipment shall have the manufacturer's name and type identified on the equipment. All products supplied shall be specifically designed and manufactured for use with plant communications systems. All items of the same class of equipment shall be the products of a single manufacturer unless indicated otherwise.

B. Factory Tests:
   1. Quality Control Test Protocol: The manufacturer shall conduct tests according to industry standard requirements. These tests shall be performed routinely on sample sizes sufficient to verify quality and continuity or as specified.
   2. The end-to-end attenuation of each reel of fiber optic cable supplied shall be tested. All of the fibers per reel shall be tested. The results shall be recorded and provided with the cable when shipped. A copy of these test reports shall be submitted to Engineer.

C. Fiber Optic Cable Site Tests:
   1. Upon delivery of the fiber optic cable to the specified location, the Contractor shall perform acceptance testing.
   2. Perform optical fiber end to end attenuation tests using an optical light meter and manufacturer's recommended test procedures.
   3. Perform tests in accordance with TIA-526-14-B, Method B for horizontal, multi-mode optical fiber.
   4. Perform tests in accordance with ANSI/TIA-526-7 OFSTP-7 for single-mode optical fiber.
   5. Copies of the tests showing the attenuation results for each fiber shall be submitted to the Owner and Engineer no later than 5 days after acceptance of the cable.
   6. Any visible damage to the cable construction should be brought to the Engineer's attention immediately.
   7. Refer to PART 3 – EXECUTION for additional site testing requirements.

D. Installer Qualifications:
   1. Cabling:
      a. Prior to installation, submit data of installer's experience and qualifications.
      b. Installers shall be a Building Industry Consulting Service International (BICSI) Registered Cabling Installation Technician or have experience which shall include projects of similar complexity. Include names and locations of projects successfully completed using optical fiber and copper communications cabling systems.
      c. Include written certification from users that systems have performed satisfactorily for not less than 18 months.
      d. Include specific experience in installing and testing structured communications distribution systems using managed Ethernet switches, optical fiber, and Category 6 cabling systems.
   2. Industrial Control System (ICS) Security Professional Certifications:
      a. The installer responsible for configuration and commissioning of network switches, firewalls, servers, VLANs, wireless access points, and other network communication devices shall hold a current Cisco Certified Network Professional (CCNP) Enterprise certification or hold other approved networking certifications.
      b. To be considered equivalent, the certification must cover topics including, but not limited to, routing & switching, WAN solutions, wireless networks, remote access, and network security. The certificate of the qualified technician shall be submitted as required this Section.

c. Configuration of the network indicated for this Contract shall comply with the specifications herein and industry best practices for ICS network security and reliability.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. Network hardware and associated equipment shall be packaged and shipped to the project site to avoid damage.

B. All network appliances shall be stored according to the manufacturer's instructions and in a conditioned space to avoid condensation, dust, and other environmental contaminants.

1.08 PROJECT SITE CONDITIONS:

A. Do not store or install the network equipment specified herein until designated installation spaces are enclosed, weather tight, and free of contaminants.

B. Final or temporary HVAC systems shall be in place and operational to maintain the ambient temperatures and humidity conditions at occupancy levels prior to installation and shall be maintained for the remainder of the construction period.

1.09 WARRANTY:

A. Ethernet switches, routers, and other similar network appliances shall be provided with a minimum 5-year manufacturer's warranty.

B. All other equipment shall be provided with a minimum one-year warranty period.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Fiber-Optic Cables:
1. AFL.
2. Avaya Inc.
3. Belden Inc.
4. Berk-Tek, Nexans.
5. Draka Cableteq USA Corporation, Prysmian Group.
6. Corning Optical Communications.
7. CommScope Inc.
8. General Cable Technologies Corporation.
9. Mohawk, Belden Inc.
10. Optical Cable Corporation.
11. Superior Essex Inc.

B. Fiber-Optic Cable Connectors, Duplex Jumpers, Patch Panels and Accessories:
1. AFL.
2. Avaya Inc.
3. Corning Optical Communications.
4. DINSpace.
5. Hirshmann, Belden Inc.
6. Ortronics, Legrand.
7. Panduit.

C. UTP Cables, Patch Panels, Connectors and Accessories:
1. Belden.
2. Berk-Tek, Nexans.
3. Leviton.

4. Mohawk, Belden.
5. Ortronics, Legrand.
6. Panduit.
7. Siemon.

D. Equipment Racks:
1. Black Box Corporation.
2. B-Line, Eaton.
3. Hoffman, nVent.
4. Lowell Manufacturing Company.
5. Middle Atlantic Products, Legrand.
6. Panduit.
7. Rittal, Inc.
8. Engineer-approved equal.

E. Ethernet Switches:
1. Allen-Bradley, Rockwell Automation.

F. Industrial Media Converters:
1. Advantech Co., Ltd.
2. Black Box Corporation.
3. Hirschmann, Belden Inc.
4. Moxa Inc.
5. GarrettCom, Inc.
6. N-Tron Series, Red Lion Controls, Inc.

G. Cable Accessories:
1. Tape:
a. Minnesota Mining and Manufacturing (3M).
2. Cable Ties:
a. AMP, TE Connectivity Ltd.
b. IDEAL Industries, Inc.
c. Minnesota Mining and Manufacturing (3M).
d. Panduit.
e. Thomas and Betts Corporation, ABB Group.
3. Cable Supports:
a. O-Z Gedney, Emerson Electric Co.

2.02 FIBER-OPTIC CABLE:

A. General:
1. Surface printing on cable shall show manufacturer's name, jacket types, number of conductors, numbered footage markers, and words "Fiber-Optic Cable" or "Optic Cable". The markings shall be in contrasting color to cable jacket.
2. Cable operating temperature range (long term and storage) shall be from -40°C to +70°C (-40°F to +158°F).
3. Standard factory tests shall be performed on all cable.
4. Cable shall meet the following requirements:
a. Shall contain multi-mode fibers in numbers indicated.
b. Shall consist of 900 µm tight buffered optical fibers, stranded together with aramid yarn strength members and contained in a PVC outer jacket.
c. All cable elements shall be stranded together to maintain flexibility. Stiff central elements such as wire or dielectrics epoxy glass rods shall not be permitted.

Aramid yarn strength member elements shall be precision tensioned and uniformly distributed around the fibers.

d. Jacket shall be PVC and rated for indoor and outdoor installation. Jacket shall be fungus-resistant, UV inhibited, flame retardant, and contain a rip cord for easy removal. Tape separators are not allowed.

5. Cable shall meet the flame test requirements of UL 1666 and UL 1651.
   a. Indoor cable shall be certified to be in conformance with all applicable requirements of UL OFNR riser rated cable.
6. Cable shall meet the applicable requirements of ICEA S-83-596, ICEA S-104-696, TIA-492AAAA (OM1), TIA-492AAAB (OM2), TIA-492AAAC (OM3).

B. Optical Fiber Cabling: Multi-mode (FIB1):
1. Each fiber shall have a tight buffer 900 µm, color coded, mechanically strippable, acrylate protective coating.
2. The entire fiber length per reel shall be unspliced and subjected to a tensile proof stress test equivalent to 100 kpsi for 1.0 second dwell time.
3. Optical Fiber Parameters: The following specifications represent minimum values.
   a. Shall be multi-mode graded index with 50/125/900 µm fiber/cladding/buffer diameters. Must be OM3 quality or better.
4. Fiber attenuation and bandwidth:

Optical Wavelength (nm):	850	1300
Maximum Attenuation (dB/km):	3.5	1.0
50/125 µm – OM3 Minimum Bandwidth (MHz-km):	1500	500

C. Optical Fiber Cabling: Single-mode (FIB2):
1. Fiber cable shall be loose tube, gel free water-blocking design for outdoor underground duct installation. Cable shall have an overall polyethylene strippable jacket with individually color-coded fibers.
2. The entire fiber length per reel shall be unspliced.
3. Optical Fiber Parameters: The following specifications represent minimum values.
   a. Shall be single-mode graded index with 9/125/900µm fiber/cladding/buffer diameters. Cable shall be rated to OS2 standards.
4. Fiber attenuation and bandwidth:

Optical Wavelength (nm):	1310	1550
Outside Plant Maximum Attenuation (dB/km):	0.5	0.5

5. Cable shall be water-blocked per water penetration requirements of GR-20-CORE or equivalent. Water-blocking of pathway alone will not be considered sufficient for adequate protection against water-ingress in the fiber optic cable.
6. Cable shall meet the applicable requirements of ICEA S-87-640, ICEA S-104-696 and TIA-492CAAC (OS2).

2.03 FIBER-OPTIC DUPLEX JUMPER/PATCH CORD:

A. Two-fiber cable with zipcord cable design, riser - rated (UL listed type OFNR).
B. Fiber shall be 50/125 µm, multi-mode, graded index, OM3 quality or 9/125 µm, single mode, graded index, OS2 as applicable.
C. Factory installed LC type connectors on each end of each fiber for patch through cables and connection to panel mounted Ethernet switches as required.
D. Factory installed LC type connectors on one end and SC type connectors on other end when required for changing connector types.

E. Minimum length of 3 feet. Provide longer jumpers as required.
F. Provide patch cords as indicated plus 20% spare of each type.

2.04 FIBER-OPTIC PATCH PANELS:

A. Shall be a complete system of components by a single manufacturer, and shall provide termination, splice storage, routing, radius limiting, cable fastening, storage, and cross connection.
B. Shall be capable of terminating number of fibers indicated plus 25% spare capacity.
C. Shall be equipped with strain-relief and routing guides for incoming cables to ensure minimum bend radius is not exceeded.
D. Patch panels shall be provided with adapter plates loaded with LC connectors that utilize zirconia ceramic alignment sleeves. Connectors shall be provided with dust covers.
E. Epoxyless crimp style LC connectors compatible with 50/125 multi-mode or 9/125 single-mode fiber as applicable and shall have maximum attenuation of .3 dB at 1300 nm with less than a 0.2 dB change after 500 mating cycles.
    1. Patch panels for the 9/125 single-mode fiber may alternately utilize cassette style patch modules/panels with LC adapter plate and factory terminated and tested 1-meter pigtails and duplex LC connectors suitable for fusion splicing. AFL Poli-MOD or equal.
    2. Pigtails shall be provided with 250 µm jacket and heat shrink splice protector.
F. Shall be provided with labeling space, panel directory and warning labels.
G. Panel Mounted:
    1. Single compartment enclosure or modular design with fiber optic adaptors mounted in the side or face of unit.
    2. Shall be DIN or back-panel mounted in enclosures or control panels as indicated.
    3. Coordinate size of patch panel with control panel manufacturer.
H. Rack Mounted:
    1. Designed for installation within a 19-inch equipment rack.
    2. Slide out tray to provide front access to fiber optic cables.
    3. Cable management rings to provide bending radius control for patch cords.

2.05 UNSHIELDED TWISTED PAIR (UTP) CABLE:

A. Provide four each individually twisted pair, 23-24 AWG conductors, 100 ohm, NFPA 70 CMP rated with PVC jacket for indoor applications and NFPA 70 CMR/CMX rated for outdoor applications.
B. Individual pairs shall be constructed to contain a minimum of two twists per foot per each pair.
C. Overall diameter of four pair cable shall not exceed 0.25 inches.
D. Ultimate breaking strength shall be minimum 90 pounds.
E. Shall withstand a bend radius of one inch minimum at a temperature of -20°C or lower without jacket or insulation cracking.
F. Shielded Cable (CAT6-S)
    1. Provide overall shielded category 6 cable for outdoor application and where indicated.
    2. Cable shall include an aluminum foil shield with tinned copper drain wire.
    3. Shall meet all other specifications and requirements for UTP cable as specified herein.
G. Conductors shall be color coded and polarized in accordance with TIA-568-C.2.
    1. Category 6 UTP shall meet or exceed the standards set forth in TIA-568-C.2.
        a. Insertion Loss (IL) / Attenuation (Maximum): 32.8 dB/100 m @ 250 MHz.
        b. NEXT (Minimum): 38.3 dB/100 m @ 250 MHz.
        c. PSNEXT (Minimum): 36.3 dB/100 m @ 250 MHz.
        d. ELFEXT (Minimum): 19.8 dB/100 m @ 250 MHz.

e. PSELFEXT (Minimum): 16.8 dB/100 m @ 250 MHz.
f. Propagation Delay (Maximum): 536 ns/100 m @ 250 MHz.
g. Velocity of Propagation (Minimum): 62.1% @ 250 MHz.
h. Propagation Delay Skew (Maximum): 45 ns/100 m @ 250 MHz.
i. Return Loss (Minimum): 17.3 dB/100 m @ 250 MHz.

H. Cable shall meet the applicable testing requirements of UL 444, UL 1581, UL 1666, UL 1685, and NFPA 262.
I. Cable jackets shall be color coded according to the following standard:
1. Plant Control System Network – Orange.
2. Business/Enterprise Network – Blue.
3. Access Control (All types) – White.
4. Security Audio/Visual Applications – Yellow.

2.06 UTP JUMPER/PATCH CORD:

A. Patch cords shall consist of factory assembled, 4 pair, 100 ohm UTP, Category 6 cables and equivalent eight-position, RJ-45 wiring connectors at each end.
B. Cables shall be wired with straight through pinning and shall be label verified.
C. Cable jacket shall be factory marked indicating organization and performance level.
D. Cable assemblies shall be designed with strain relief at each connector.
E. Cables shall be terminated according to type T568B configuration as defined by TIA-568-C.1.
F. Minimum length of 2 feet. Provide longer jumpers as required.
G. Provide patch cords as indicated plus 25% spare.
H. Cable shall comply with the applicable requirements of UL 444, UL 1685, UL 1863, and ANSI/TIA-568-C.2.
I. Cable jackets shall be color coded according to the following standard:
1. Plant Control System Network – Orange.
2. Business/Enterprise Network – Blue.
3. Access Control (All types) – White.
4. Audio/Visual Applications – Yellow.

2.07 COMMUNICATIONS JACK/CONNECTOR ASSEMBLIES:

A. Copper jack/connectors shall comply with FCC Part 68.5, and TIA-568-C.2.
B. Shall be UL 1863 and UL 44 listed, non-keyed, 4 pair, constructed of high impact rated thermoplastic housing and shall be third party verified and shall comply with TIA-568-C.2 Category 6 requirements.
C. Shall meet or exceed Category 6 requirements.
D. Shall be terminated using a 110 style PC board connector, color coded for both T568A and T568B wiring.
E. Shall be wired T568B.
F. Shall comply with TIA-455-21A for 500 mating cycles.
G. Cover plates shall comply with UL 514C, and TIA-568-C.2; flush design constructed of 302 stainless steel material.
H. Stenciled lettering for voice and data circuits shall be provided using thermal ink transfer process.
I. Cover plates shall accept 4 Category 6 data jacks, or 4 RJ-45 telephone jacks, or a combination thereof.
J. Provide blank filler plates as required.

2.08 UTP PATCH PANELS:

A. Shall be a complete system of components by a single manufacturer, and shall provide termination, cable fastening, storage, and cross connection.
B. Utilize 110-style punch-down terminations on back of panel with individual retention caps. RJ-45 ports on front of unit.
C. Rear of panel shall have incoming cable strain relief and routing guides.
D. Shall meet or exceed TIA-568-C.2-1 Category 6 requirements. Each port shall be factory tested.
E. Wired to T568B configuration.
F. Shall be capable of terminating number of cables as indicated plus 25% spare capacity.
G. Shall be provided with labeling space, panel directory and warning labels.
H. Designed for installation within a 19-inch equipment rack.

2.09 EQUIPMENT RACKS:

A. Floor Mounted:
   1. Provide floor mounted enclosed style equipment racks unless indicated otherwise. 19-inch (483 mm) standard designed complying with EIA/ECA-310-E.
   2. Shall be a minimum of 42U of mounting units and shall be a minimum of 29-inches wide by 36-inches deep.
   3. Load rated for a minimum of 1500 pounds.
   4. Lockable perforated front door with reversible hinges.
   5. Lockable, perforated, split rear door.
   6. Removable solid side panels.
   7. Louvered top panel with ventilation fans. Fans shall be provided with cord and plug and provide a minimum of 500 cfm of air flow. Provide plug and cord type thermostat controls with integral receptacle for fan plug connections.
   8. Leveling feet.
   9. Square hole mounting angles. Provide the required cage nuts and bolts with a minimum of 25% spare.
   10. Black powder coat finish.
   11. Provide a vertical plug strip with NEMA 5-20R receptacles, 12-inches (300 mm) o.c. for the full height of the rack for each supplying circuit. Provide additional strips if required to accommodate all installed equipment plus 20% spare.
   12. Provide a grounding kit for each rack.
   13. Provide horizontal cable managers below each patch panel and Ethernet switch.
   14. Provide vertical D-rings or vertical cable troughs along each side for management of vertical routed cables.
   15. Provide sliding shelves for monitors, keyboards, and other non-rack mountable equipment.
   16. Provide all shelves, drawers, and accessories required for mounting and supporting equipment within the rack.
B. Wall Mounted:
   1. Wall mounted pivot style equipment rack only where indicated. 19-inch standard designed complying with EIA/ECA-310-E.
   2. Shall be a minimum of 18U of mounting units and shall be a minimum of 26-inches wide by 26-inches deep. Coordinate final depth requirements to coordinate with equipment supplied.
   3. Load rated for a minimum of 200 pounds.
   4. Swing open center section for front and rear access.

5. Lockable front door and center section with reversible hinges for right or left-hand swing.
6. Passive thermal management with mounting options for optional fan kit.
7. Adjustable wide-face rackrail with minimum 4" setback to accommodate cable managers. Provide required cage nuts and bolts with a minimum of 25% spare.
8. Rack shall include conduit knockouts on the top and bottom of the back pan with 12" x 12" (minimum) opening on backpan for cable entry.
9. Black powder coat finish.
10. Provide a vertical plug strip with NEMA 5-20R receptacles, 12-inches (300 mm) o.c. for the full height of the rack for each supplying circuit. Provide additional strips if required to accommodate all installed equipment plus 20% spare.
11. Provide a grounding kit for each rack.
12. Provide horizontal cable managers below each patch panel and Ethernet switch.
13. Provide vertical D-rings or vertical cable troughs along each side for management of vertical routed cables.
14. Provide sliding shelves for non-rack mountable equipment.
15. Provide all accessories required for mounting and supporting equipment within the rack.

2.10 RACK MOUNTED MANAGED ETHERNET SWITCHES:

A. Rack mounted managed (Layer 3) Ethernet switches shall be a modular multi-gigabit design supporting the specified and indicated configurations.
B. Rackmount chassis for installation in a 19-inch equipment rack.
C. Operating temperature 0°C to 60°C minimum.
D. Ethernet switch shall accept Small form-factor pluggable (SFP) media modules.
   1. Provide with uplink ports for connection to the fiber backbone with additional fiber ports as indicated. Uplink ports shall be available in 10-gigabit or 1-gigabit modules.
      a. 10-gigabit SFPs shall be provided.
   2. Provide with single-mode SFPs with LC type connectors.
E. Provide with the required quantity of 10/100/1000 Base-T RJ-45 ports.
F. Provide IEEE 802.3af/at Power-over-Ethernet (PoE+) ports for network switches when indicated to support IP cameras and any other PoE powered devices indicated. Final quantity and loading of the PoE switches determined by supplying subcontractor based on the equipment supplied. Switches shall include a minimum of 4 PoE+ ports.
G. Shall provide half and full duplex operation.
H. Provide with redundant 120Vac, 60-hertz power supplies and cord and plug connection.
I. Provide with redundant fan module for switch chassis if required to meet industrial environment ratings.
J. LED indicators for system status, each power supply status, fault.
K. LED indicators for each port indicating link, activity, full/half duplex mode and speed.
L. Provide with a basic set of I/O parameters available via the EtherNet/IP protocol for device management and remote monitoring.
   1. When EtherNet/IP protocols are not available from specific manufacturer's, SNMP protocols shall be used in conjunction with an SNMP OPC server to collect the required I/O points for the plant control system.
M. Comply with IEEE 802.1Q, 802.1D, 802.1X, 802.3, 802.3U, 802.3X, 802.3Z, 802.3ab, 802.3ae.
N. Capable of operating in a mesh network with rapid spanning tree protocol and manufacturer's proprietary equivalent.
O. Shall support the following protocols or functions as minimum: SNMPv3, IGMP, DHCP, RMON, RSTP, HTTP, HTTPS, Telnet, QoS, and VLAN.

P. Shall be UL listed and FCC approved. Unit shall be rated for continuous operation under the environmental temperature, humidity, and vibrating conditions encountered at the installed location.
Q. Provide all required management and monitoring software.
R. Provide Allen-Bradley Stratix 5800 series industrial switch or Engineer-approved equal.

2.11 PANEL MOUNT MANAGED ETHERNET SWITCHES:

A. Panel mounted managed (Layer 2 minimum) Ethernet switches shall be 10/100/1000 Mbps autosensing and operate using the Store and Forward Method.
B. Compact Industrial DIN rail mounted design.
C. Convection cooled with no fans and designed for an industrial environment.
D. Operating temperature 0°C to 60°C minimum.
E. Ethernet switch shall be modular in design and accept Small form-factor pluggable (SFP) media modules.
F. Provide with a minimum of two SFP or integral gigabit LX ports for connection to the fiber backbone when indicated. Provide with single-mode LC type connectors.
G. Provide with the indicated number of 10/100/1000 Base-T RJ-45 ports.
    1. Port count shall include 20% spare with a minimum of two.
H. Provide with IEEE 802.3af/at Power-over-Ethernet (PoE+) ports when required for the application.
I. Shall provide half and full duplex operation.
J. Input power 24Vdc with terminal blocks for connection.
K. LED indicators for system status, each power supply status, fault.
L. LED indicators for each port indicating link, activity, full/half duplex mode and speed.
M. Provide with a basic set of I/O parameters available via the EtherNet/IP protocol for device management and remote monitoring.
    1. When EtherNet/IP protocols are not available from specific manufacturer's, SNMP protocols shall be used in conjunction with an SNMP OPC server to collect the required I/O points for the plant control system.
N. Comply with IEEE 802.1Q, 802.1D, 802.3, 802.3U, 802.3X, 802.3Z, and 802.3ab.
O. Capable of operating in a mesh network with rapid spanning tree protocol.
P. Shall support the following protocols or functions as minimum: SNMPv3, IGMP, DHCP, RMON, RSTP, HTTP, HTTPS, Telnet, and VLAN.
Q. Shall be UL listed and FCC approved. Unit shall be rated for continuous operation under the environmental temperature, humidity, and vibrating conditions encountered at the installed location.
R. Provide all required management and monitoring software.
S. Provide Allen-Bradley 5200 series industrial switch or Engineer-approved equal.

2.12 INDUSTRIAL MEDIA CONVERTER:

A. Provide only when indicated for media conversion of copper to direct fiber connections for specific use case.
B. DIN rail mounted 10/100Base-TX to 100Base-FX media converter.
C. Shall be autosensing.
D. Support full and half duplex operation and operate using the Store and Forward Method.
E. Equipped with one RJ-45 10/100Base-TX port and dual LC or SC-type 100Base-FX ports.
    1. Provide LC to SC fiber jumpers when required to mat with alternate form factors.
F. LED indicators for power, link status and activity.
G. Shall comply with IEEE 802.3 and 802.3U.

H. Environmental Specifications:
   1. Operating Temperature: -20° to 60°C.
   2. Ambient Relative Humidity: 5%-95% (non-condensing)

I. Powered from 120Vac or 24Vdc power supply. Provide DIN rail mounted power supply sized for the unit if required.

2.13 ACCESSORIES:

A. Cable Supports:
   1. Cable supports for cables in vertical conduit risers or vertical tray, with considerable weight of cables shall be O. Z. Gedney Type "R" wedging plug type or approved equal.

B. Cable Ties:
   1. Shall be hook-and-loop (Velcro type) to meet EIA/TIA standards.

C. Cable Identification Tags:
   1. Designed to provide a permanent wire and cable identification system.
   2. Show complete cable number including colors.
   3. Cable numbers shall be machine printed, legible, and permanent.
   4. Character size for cable numbers shall be a minimum of 1/8 inch.
   5. Material shall be nonmetallic and impervious to moisture.
   6. Be securely attached to cables and accessible for inspection.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Verify site conditions are suitable for installation of equipment. The area for network equipment installation shall be fully enclosed, weather tight, and free of contaminants.

B. Final or temporary HVAC systems shall be in place and operational to maintain the ambient temperatures and humidity conditions at occupancy levels prior to installation and shall be maintained for the remainder of the construction period.

C. Verify that all labels and nameplates meet UL 969 standards.

D. Any applicable equipment shall meet UL 60950-1.

3.02 INSTALLATION:

A. General:
   1. Cabling, connector assemblies, and associated hardware shall be installed in accordance with TIA 568 C.1, TIA 568 C.2, TIA-568-C.3, TIA 569 C, NFPA 70, and UL standards as applicable.
   2. Equipment Asset Tags:
      a. Provide and affix asset tags for all supplied network hardware. Asset tag shall be as specified or indicated.

B. Cable:
   1. General Requirements:
      a. Metal raceway bases, covers, and dividers shall be bonded and grounded in accordance with TIA-607-B and UL 467.
      b. Install cable in raceway as indicated.
      c. Do not subject cable to pulling tensions or sidewall pressures in excess of manufacturer's recommendations.
      d. Contractor shall use a load rated swivel, rated to assure compliance with cable pulling tension as published by the cable manufacturer.

e. Attach pulling grips around the cable diameter. Sufficient slack should be provided to cut off several meters of cable after it is in place.
f. Do not subject cable to bending radius less than those recommended by the cable manufacturer.
g. Support cables at connections or termination points such that any strain on cable will not be transmitted to the connection or termination.
h. Install cable supports in vertical runs of conduit, at boxes and at terminations in equipment, and as required to meet intermediate support requirements of National Electrical Code (NEC).
i. All pulling compounds shall be approved by cable manufacturer as being compatible with cable materials.
j. Follow the cable numbering scheme indicated and attach a cable identification tag to each cable at all termination or end points.

2. Fiber Optic Cable:
   a. Contractor shall exercise due caution during installation of the fiber-optic cable to prevent damage to glass fibers. Follow manufacturer's recommendations for maximum cable lengths.
   b. Fiber optic cable shall not be spliced.
   c. Install cables in conduit and underground duct bank as indicated and specified.
   d. Install pull boxes as required.
   e. All pull boxes and termination cabinets shall be clearly identified as containing fiber-optic cable.
   f. Coil a minimum of 20 feet of excess fiber optic cable at each pull box or handhole.
   g. There shall be a minimum of 10 feet of excess fiber-optic cable remaining at all terminations for the purpose of making connections, splices or tests.
   h. Cable Bends:
      (1) Make gradual bends of cable, where necessary.
      (2) Do not allow cable to be sharply bent or kinked at any time.
      (3) Maximum bending radius of 20x the cable diameter.
   i. Cable Pulling:
      (1) Do not exceed manufacturer's recommended pulling tension.
      (2) Tension shall be monitored at all times with a dynamometer or with a pulling wheel.
   j. Cable identification tags shall be installed at each pull box.
   k. Label cable at each termination points with unique number for each cable segment.
   l. Cable Ties: Dress cables neatly with cable ties using low to moderate pressure.
   m. Testing Cables: Testing shall be performed in accordance with TIA-568-C.0.
      (1) Clean all connections and adapters at each optical test point prior to taking measurements, as per TIA-526-7-A (single-mode) or TIA-526-14-B (multi-mode).
      (2) The recommended test method for multi-mode shall be TIA-526-14-B single-jumper method (Method B.)
      (3) The recommended test method for single-mode shall be TIA-526-7-A, single-jumper method (Method A.1)
   n. Cable Slack:
      (1) Leave extra slack on cables, neatly coiled-up in patch panel box.
      (2) Leave a minimum of 10 feet of cable slack at each fiber patch panel.
   o. Do not install cables taut.

3. UTP Cable:
    a. Communications cabling and pathways with copper media shall be installed in accordance with the following criteria to avoid potential electromagnetic interference between power and communications equipment.
        (1) The interference ceiling shall not exceed 3.0 volts per meter measured over the usable bandwidth of the communications cabling.
        (2) Pathways shall be installed in accordance with the following minimum clearance distances of 4 feet from motors, generators, frequency converters, transformers, or uninterruptible power system, 12 inches from power conduits and cable systems, 5 inches from fluorescent or high frequency lighting system fixtures.
    b. Screw terminals shall not be used.
    c. Use an approved insulation displacement connection (IDC) tool kit for copper cable terminations.
    d. Do not untwist Category 6 UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.
    e. Provide service loop on each end of the cable, 10 feet at the equipment rack and 12 inches at the jack.
    f. Do not exceed 25 pounds pull tension for four pair copper cables.
    g. Do not chafe or damage outer jacket materials.
    h. Do not over cinch cables, or crush cables with staples.
    i. UTP cable bend radii shall not be less than four times the cable diameter.
4. Cable Connections and Terminations:
    a. Contractor shall provide a qualified technician to make all connections and terminations cable as specified.
    b. All cable connections and terminations shall be made according to manufacturer's instructions.
    c. Make only in terminal boxes, equipment or other accepted enclosures and not in conduit or cable tray.
    d. Install all connectors with manufacturer's approved tooling.
    e. Cable identification markers shall be installed at each connection.

C. Equipment Racks:
1. Equipment racks shall be installed at location indicated. Verify proper clearances and adequate access prior to installation.
2. Install grounding kit and bond to building ground system.
3. Install cable management accessories and supports as specified.
4. Securely install equipment in racks as indicated. When required monitor and keyboard shelves shall be mounted at a convenient operating height.
5. Utilize manufacturer’s recommended fasteners for all connections.

D. Fiber Optic Patch Panels:
1. Install rack mounted patch panels in equipment racks.
2. Install panel mounted enclosures in NEMA rated enclosure or control panels as specified and indicated. For panels installed in equipment manufacturer’s control panels coordinate with supplier for required panel space and location.
3. Arrange with proper clearances from other equipment and material to obtain accessibility for operation and maintenance.
4. Install adaptor plates and connectors in accordance with manufacturer’s recommendations.
5. Utilize panel spools for slack management of individual fibers.

6. Mount plumb and level.
7. Complete panel directory and labeling.

E. UTP Patch Panels:
1. Install in equipment racks.
2. Punch down cables as specified.
3. Install cable strain relief and routing guides.
4. Wire to T568B configuration.
5. Complete port labeling.

F. Ethernet Switches:
1. Install Ethernet switches in equipment rack or control panels and make connections as indicated.
2. Arrange with proper clearances from other equipment and material to obtain accessibility for operation and maintenance.
3. Program managed switches for proper operations.
   a. Rapid spanning tree, or network switch manufacturer equivalent protocol, shall be implemented for redundancy in a loop connected system.
   b. Program switch fault contacts to alert operators of switch problems or errors.
4. Where management software is not embedded, install on the server or designated laptop to allow the Owner to monitor and configure the Ethernet switches.

G. Industrial Media Converters:
1. Mount the industrial media converters where indicated.
2. Configure media converters per manufacturer instructions.

3.03 FIELD QUALITY CONTROL:

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. System Tests:
1. Perform communications cabling inspection, verification, and performance tests in accordance with TIA-568-C.0, TIA-568-C.1, TIA-568-B.2 and TIA-568-C.3.
2. Inspect all cabling terminations to confirm color code for tip and ring pin assignments and inspect cabling connections to confirm compliance with TIA-568-C.2.
3. Perform optical fiber end to end attenuation tests using an optical light meter and manufacturer's recommended test procedures.
   a. Perform tests in accordance with TIA-526-7-A Method A.1 for single-mode optical fiber and TIA-526-14-B, Method B for horizontal, multi-mode optical fiber.
   b. Perform verification acceptance test on each fiber after installation of the cable.
   c. Any excessive losses due to installation, connectors, etc., shall be identified and corrected by the Contractor and tested with no additional charge.
4. Category 6 Links: Perform UTP link tests in accordance with TIA-568-C.2.
   a. Tests shall include wire map, length, attenuation, NEXT, and propagation delay.
5. After acceptance of communication cable system, all additional components (including Ethernet switches and jumpers) shall be installed and operation of the complete system tested.
6. Copies of the test shall be submitted to the Engineer for acceptance of the communication system.

3.04 ADJUSTING AND CLEANING:

A. All network cables shall be adjusted and neatly secured with tie wraps, hook-and-loop straps, or the like.

B. Prior to final acceptance all network equipment shall be wiped clean and free from dust.

3.05 TRAINING:

A. Provide a minimum of 4 hours of training at the customer's facility for operations, maintenance, and service personnel of the installed network and system equipment.
   1. The training session shall include classroom discussion on the theory of operation of the equipment, as well as maintenance and service methods for the purchased equipment.
   2. Topics covered shall include hardware layout and functions, programming and configuration, diagnostic indicators, faults, diagnostic tools, troubleshooting, and preventive maintenance.
   3. Hands-on training shall be provided on equipment.
   4. Documentation shall be provided which shall include actual hard copies of manuals for the equipment supplied for this project.

B. Contractor shall record the training sessions and provide a final edited version to the Owner in electronic video file format.

C. Training shall conform to the requirements of Section 01664 – Training.

END OF SECTION 40 66 00

SECTION 40 67 00 – PROCESS CONTROL PANELS AND HARDWARE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes requirements for control panels including, but not limited to, the following:
   1. Equipment manufacturer supplied control panels.
   2. PLC Cabinets.
   3. HVAC equipment control panels.
   4. Network and Security Enclosures.

1.03 RELATED REQUIREMENTS:

A. Section 26 33 53 – Static Uninterruptible Power Supply.
B. Section 40 60 00 – Process Control and Instrumentation - General Requirements.
C. Section 40 61 96 – Process Control System Programming and Reports.
D. Section 40 66 00 – Network and Communications Equipment.
E. Section 40 68 00 – Process Control Software.
F. Section 40 70 00 – Instrumentation for Process Systems.

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
B. Institute of Electrical and Electronic Engineers (IEEE):
   1. IEEE C37.90.1 – Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus.
   2. IEEE C62.11 – Metal Oxide Surge Arresters for AC Power Circuits.
   3. IEEE C62.33 – Test Specifications for Varistor Surge-Protective Devices.
   4. IEEE C62.36 – Surge Protectors Used in Low-Voltage Data, Communications, and Signaling Circuits
   5. IEEE C62.41.1 – Surge Environment in Low-Voltage (1000 Volts and less) AC Power Circuits.
   6. IEEE C62.41.2 – Characterization of Surges in Low-Voltage (1000 Volts and less) AC Power Circuits.
   7. IEEE C62.45 – Surge Testing on Equipment Connected to Low Voltage (1000 Volts and less) AC Power Circuits.
   8. IEEE C62.62 – Test Specification for Surge Protective Devices (SPDs) for Use on the Load Side of the Service Equipment in Low Voltage (1000 Volts and less) AC Power Circuits.
   9. IEEE 802.1 – Local and Metropolitan Area Networks.
   10. IEEE 802.3 – Ethernet.
C. National Fire Protection Association (NFPA):
   1. NFPA 70 – National Electrical Code (NEC).
   2. NFPA 79 – Electrical Standard for Industrial Machinery.
D. National Electrical Manufacturers Association (NEMA):
   1. NEMA 250 – Enclosures for Electrical Equipment (1,000V maximum).
   2. NEMA ICS 1 – Industrial Control and Systems - General Requirements.

3. NEMA ICS 2 – Industrial Control and Systems - Controllers, Contactors, and Overload Relays Rated 600 Volts.
4. NEMA ICS 4 – Application Guideline for Terminal Blocks.
5. NEMA ICS 5 – Industrial Control and Systems - Control Circuit and Pilot Devices.
6. NEMA ICS 6 – Industrial Control and Systems - Enclosures.
7. NEMA ICS 7 – Adjustable Speed Drives.

E. Underwriters Laboratories (UL):
1. UL 50 – Enclosures for Electrical Equipment.
2. UL 489 – Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.
3. UL 508 – Industrial Control Equipment.
4. UL 508A – Industrial Control Panels.
5. UL 698A – Industrial Control Panels Relating to Hazardous (Classified) Locations.
6. UL 869A – Service Equipment.
7. UL 1077 - Supplementary Protectors for Use in Electrical Equipment
8. UL 1449 – Surge Protective Devices.

1.05 SUBMITTALS:

A. Submit as specified in Division 1.
B. Manufacturer with prime responsibility shall assume responsibility for all Compliance Submittals.
C. Product Data: Submit the following for each type of product specified and included as minimum:
1. Data sheets for all control panel components furnished.
D. Qualification Statements:
1. Fabricator's qualifications.
E. Shop Drawings: Provide the following as minimum:
1. Fabrication drawings, front elevation, wiring diagrams, and bills of material for control panels.
2. Electrical connection diagrams showing termination locations for all field wiring. External connection diagrams shall indicate cable number and wire color for field cables terminated at the panel.
3. Engraving schedule and physical dimensions for nameplates.
4. Provide heat dissipation calculations for all panels containing programmable logic controllers. Include calculation for ventilation fans if required.
F. Special Procedure Submittals:
1. Test Plan:
a. Provide a complete and detailed test plan for the supplied control panels.
b. Include procedures for certification, validation, and testing.
2. Syllabus for Owner training.
G. Test and Evaluation Reports:
1. Factory test reports.
2. Field test reports.
H. Closeout Submittals: Final documentation shall include the following as minimum:
1. Operation and Maintenance Manuals including the following:
a. Operation and maintenance manuals for all components furnished.
b. Certified "As-Built"/"As-Installed" drawings.
c. Copies of all approved Product Data.
d. Copies of all approved Test Reports.

e. Spare parts and supply list.
f. Warranty Information.
g. Contractor Information.
h. Training Materials. Includes final edited training videos.

I. Maintenance Material Submittals:
1. Spare Parts:
a. Two spare LED indicating lamps for each type and color used.
b. Two spare indicating light assemblies.
c. Ten spare control fuses of each voltage and current rating used.
d. One aerosol cans of manufacturer's touch-up paint for each color used. Color shall match the original factory applied color.
e. PLC spare parts listed below are for plant control system PLC Cabinets only. Vendor supplied PLC spare parts shall be as specified in the associated equipment Section.
(1) Provide at least one spare for each piece of PLC Equipment provided, including but not limited to:
(a) Processor.
(b) PLC chassis.
(c) Power supply.
(d) Communications interface module.
(e) Provide spare I/O cards in quantities corresponding to 10% (rounded up) of the total quantity of each type of card provided. At least one (1) spare shall be provided for each type of I/O card.
(2) Provide ten (10) spare fuses of each type used including those used in power supplies, processor and all I/O cards.
(3) Ethernet Switches: Provide one (1) spare of each type of switch used.
2. Software:
a. Soft copy of PLC and OIT programs including programming comments.
b. Where external applications are required and not embedded within the equipment, provide original software on USB, SD, or other flash drive media containing all configuration files and applications associated with managed Ethernet switches, and similar configurable devices.
c. Organize and submit all software copies with individually labeled items.

1.06 QUALITY ASSURANCE:

A. Materials and Equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall be the manufacturer's latest standard design that has been in satisfactory use for at least 1 year prior to Bid opening.
B. Fabricator Qualifications:
1. Prior to assembly and installation, submit data of fabricator's experience and qualifications.
2. Fabrication shall be by a manufacturer or a particular division of a manufacturing firm specializing in control panel construction.
3. Shall have experience in control panel fabrication.
4. Panel shall be fabricated in a UL listed panel shop.
C. Factory Tests:
1. The manufacturer shall conduct tests according to industry standard requirements.
2. Perform factory tests on all control panels and components and subassemblies to assure that all devices and systems are in proper working order before delivery to jobsite.

3. Test all power, control, and communication systems for proper operation.
4. Simulate actual system operation.
5. Submit test reports as specified in Division 1.

D. All control panels and associated equipment shall conform to the requirements of NEMA ICS and UL 508A standards.

1.07 DELIVERY, STORAGE, AND HANDLING:

A. Control panels and associate equipment shall be packaged and shipped to the project site in such a manner as to avoid damage.
B. All control panels shall be stored according to the manufacturer's instructions and in a conditioned space to avoid condensation, dust, and other environmental contaminants.

1.08 PROJECT SITE CONDITIONS:

A. Do not store or install the control panel equipment specified herein until designated installation spaces are suitable for intended service.
B. For indoor control panels final or temporary HVAC systems shall be in place and operational to maintain the ambient temperatures and humidity conditions at occupancy levels prior to energizing panel and shall be maintained for the remainder of the construction period.

1.09 WARRANTY:

A. Surge Protective Devices shall be provided with a minimum 5-year manufacturer's warranty.
B. Ethernet switches shall be provided with a minimum 5-year manufacturer's warranty.
C. All other equipment shall be provided with a minimum one-year warranty period.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Enclosures:
   1. B-Line, Eaton.
   2. Hoffman, Pentair PLC.
   3. Wiegmann, Hubbell, Inc.
   4. Milbank Manufacturing Company.
   5. Rittal, Inc.
   6. Saginaw Control & Engineering.
B. Classified Area Enclosures:
   1. Appleton, Emerson Electric Company.
   2. Killark, Hubbell, Inc.
C. Thermal Management Components:
   1. Finder Relay's Inc.
   2. Hoffman, Pentair PLC.
   3. Noren Products, Inc.
   4. Pfannenberg.
   5. Rittal, Inc.
   6. Saginaw Control & Engineering.
D. Motor Starters, Circuit Breakers, and Transformers:
   1. ABB.
   2. Acme Electric, Hubbell, Inc.
   3. Allen-Bradley, Rockwell Automation, Inc.
   4. Eaton.

5. Phoenix Contact.
6. Square D, Schneider Electric.

E. Variable Frequency Drives:
1. ABB.
2. Allen-Bradley, Rockwell Automation.
3. Eaton.
4. Danfoss.
5. Schneider Electric.
6. Yaskawa America, Inc.

F. Surge Protective Devices:
1. Advanced Protection Technologies, Inc.
2. Citel, Inc.
3. ASCO/EDCO, Vertiv Co.
4. Ferraz Shawmut, Mersen.
5. MCG Surge Protection, Inc.
6. MTL Instruments, Eaton.
7. Phoenix Contact.
8. Square-D, Schneider Electric.

G. Terminal Blocks:
1. Allen-Bradley, Rockwell Automation, Inc.
2. Buchanan, Tyco Electronics Corporation.
3. Phoenix Contact.
4. Square-D, Schneider Electric.
5. Weidmuller.

H. Push Buttons, Selector Switches and Pilot Lights:
1. Allen-Bradley, Rockwell Automation, Inc.
2. Eaton.
3. IDEC Corporation.
4. Killark, Hubbell, Inc.
5. Square-D, Schneider Electric.

I. Control and Timing Relays:
1. Allen-Bradley, Rockwell Automation, Inc.
2. Eaton.
3. Finder Relay’s Inc.
4. IDEC Corporation.
5. Phoenix Contact.
6. Potter & Brumfield, Tyco Electronics Corporation.
7. Square-D, Schneider Electric.
8. Turck, Inc.

J. Intrinsically Safe Barriers:
1. MTL Instruments, Eaton.
2. Pepperl+Fuchs.
3. Square-D, Schneider Electric.
4. Turck, Inc.

K. DC Power Supplies:
1. Allen-Bradley, Rockwell Automation, Inc.
2. Phoenix Contact.
3. PULS.
4. SolaHD, Emerson Electric Company.

L. Uninterruptible Power Supplies (UPS):
   1. Refer to Section 26 33 53 – Static Uninterruptible Power Supply.
M. Receptacles:
   1. Cooper Industries, Eaton.
   2. Hubbell, Inc.
   3. Leviton Manufacturing Co., Inc.
   4. Phoenix Contact.
N. Interior Illumination:
   1. Acuity Brands, Inc.
   2. Finder Relay's Inc.
   3. Hoffman, Pentair Inc.
   4. Hubbell, Inc.
   5. Stego, Inc.
O. Fiber-Optic Cable Connectors, Duplex Jumpers, Patch Panels and Accessories:
   1. Refer to Section 40 66 00 – Network and Communications Equipment.
P. Ethernet Switches:
   1. Refer to Section 40 66 00 – Network and Communications Equipment.
Q. Industrial Media Converters:
   1. Refer to Section 40 66 00 – Network and Communications Equipment.
R. Programmable Logic Controllers (PLC):
   1. Allen-Bradley, Rockwell Automation.
S. Distributed I/O Modules:
   1. Allen-Bradley, Rockwell Automation.
T. Operator Interface Terminal (OIT):
   1. Allen-Bradley, Rockwell Automation.
U. Wiring Duct:
   1. Panduit Corporation, H-Type.
   2. Thomas and Betts Corporation, ABB Group.
V. Wire Markers:
   1. Brady Worldwide, Inc.
   2. Panduit Corporation.
   3. Thomas and Betts Corporation, ABB Group.
W. Wire Terminals and Connectors:
   1. Refer to Section 26 05 19 – Low Voltage Electrical Conductors and Cables.

2.02 ENCLOSURES:

A. Totally enclosed panel with gasketed doors, continuous hinge, and three point latching mechanism with lockable handle.
B. Sized to house all equipment and devices required, provide sufficient space for conduit entry, and provide sufficient heat dissipation for the installed components.
C. Unless specified or indicated otherwise provide the following NEMA 250 approved enclosure type(s):
   1. NEMA Type 4X aluminum, 304 stainless steel or 316 stainless steel enclosures for the following areas:
      a. Outdoor and process area locations.
   2. NEMA Type 4X fiberglass enclosures with 316 stainless steel latches for the following areas:
      a. When specified for chemical feed and chemical compatibility.
   3. NEMA Type 12 painted steel enclosures for the following areas:

a. Indoor conditioned spaces.

4. NEMA Type 3R painted steel ventilated enclosures for the following areas:
   a. Plant entrance security network enclosure.

D. Unless specified or indicated otherwise provide the following enclosure design:
   1. Wall Mount Design:
      a. Provide for enclosures with a vertical dimension less than 50-inches.
      b. Formed and welded construction, minimum 14-gauge.
      c. Interior 12-gage minimum steel mounting panel(s).
      d. Provide mounting tabs and required hardware for installation of enclosures.
   2. Free Standing and Floor Mount Design:
      a. Provide for enclosures with vertical dimensions of 50-inches or greater.
      b. Formed and welded construction, minimum 12-gauge for single door enclosures. For multi-door enclosures provide a 10-gauge back.
      c. Interior 10 or 12-gage steel mounting panel(s).
      d. Provide door mounted folding shelf for support of instruments and test equipment. Shelf shall be mounted on the interior of the door. For multi-door enclosures provide a shelf for each pair of doors.
      e. Provide with lifting eyes.

E. Provide lockable design.

F. Painted enclosures shall have a light gray polyester powder coat finish on the exterior with a white polyester powder coat finish on the interior.

G. Accessories:
   1. Provide data pocket mounted on the interior of the panel for storage of wiring diagrams.
   2. Provide vapor action corrosion inhibitor emitters for each panel. Emitters shall be provided as a minimum based upon twice the calculated volume of the enclosure.
   3. Provide a door stop kit designed to secure the door in the 90-degree open position.

H. Shall comply with UL 50, UL 508A, and NEMA ICS 6 standards.

2.03 THERMAL MANAGEMENT:

A. Electric Heaters:
   1. Provide a forced air panel heater for each exterior mounted control panel.
   2. Heater shall be sized to maintain an interior panel temperature of 40°F.
   3. Integral thermostat adjustable from 0°F to 100°F.
   4. Rigid metal housing.
   5. Motor shall be thermally protected.
   6. Ball bearing fan shall run continuously to distribute heat throughout panel.
   7. Powered from 120Vac.
   8. Provide all required mounting brackets for complete installation in the panel.

B. Ventilation Fans (For control panels installed in conditioned spaces only):
   1. Provide as required to maintain panel temperature below component ratings.
      a. Heat gain calculations shall be provided for enclosures containing VFDs and motor controlling equipment.
   2. Provide for the following panels:
      a. NEMA 12 panels with PLCs installed. Electrical rooms only.
   3. Provide a compact 6-inch fan with rigid metal housing with finger guard. Motor shall be thermally protected and bearings shall be permanently lubricated ball bearings and design for a minimum of 50,000 hours of continuous operation. Impeller shall be polycarbonate. Powered from 120Vac.

4. Provide 14-gage steel louver for the intake and exhaust openings. Louver finish shall match the finish on the panel. Provide an aluminum filter and gasket for each louver.
5. Provide all required mounting brackets for complete installation in the panel.
6. Temperature Control Switches:
    a. Provide two temperature control switches for each panel, one for control of the exhaust fan, and one for the high temperature alarm as indicated.
    b. The temperature control switches shall have an adjustable range of 30°F to 140°F.
    c. The temperature switch contact shall close on temperature rise and be rated 15A at 120Vac.
    d. Designed for DIN rail mounting.
    e. The high temperature alarm switch shall be set at 100°F and the fan switch shall be set at 85°F.

C. Closed-Loop Air Conditioning System:
1. Provide a closed-loop mechanical refrigeration air conditioning system for the following panels:
    a. Control Panels Containing VFDs located outdoor or in unconditioned indoor process areas.
2. The air conditioning system shall be selected to maintain the NEMA rating of the enclosure. The construction material shall match the associated panel.
3. The system shall be capable of maintaining a temperature of 85°F inside the enclosure under the following conditions:
    a. All equipment in the panel operating.
    b. Continuous exposure to sunlight.
    c. Exterior ambient air temperature of 104°F.
4. The compressor and condenser shall be located outside the control panel enclosure.
5. Provisions shall be made to remove condensate from the control panel and to protect all devices within the enclosure from condensate.
6. Manufacturer shall submit sizing calculations for each panel listed above.

D. Temperature Transmitters:
1. Provide a temperature transmitter for room ambient air measurement for the following panels:
    a. PCS Control Panels in Electrical Rooms.
2. Shall be connected to the panel PLC and provided for remote temperature monitoring.
3. Provide loop powered temperature transmitter for monitoring of air temperature.
4. Spring loaded platinum RTD sensing element.
5. Provide compact stainless steel sensing element when used for ambient air sensing applications.
6. Provide 4-20mA analog signal proportional to temperature.
7. Provide DIN rail mounted housing for mounting within control panel.

2.04 CLASSIFIED AREA ENCLOSURES:

A. NEMA Type 7 enclosure suitable for installation in a Class 1 Division 1, Group D area.
B. Cast copper-free aluminum enclosure with stainless steel hinges and O-ring gasket.
C. Stainless steel cover bolts.
D. Stainless steel mounting tabs.
E. Aluminum interior mounting panel.
F. Sized to house all equipment and devices required, provide sufficient space for conduit entry, and provide sufficient heat dissipation for the installed components.

G. Provide vapor action corrosion inhibitor emitters for each panel. Emitters shall be provided as a minimum based upon twice the calculated volume of the enclosure.
H. Shall comply with UL 50, UL 508A, and NEMA ICS 6 standards.

2.05 NAMEPLATES:
A. Fabricate from laminated phenolic sheeting with black core and satin finish melamine overlay.
B. Colors shall white with black letters.
C. Thickness: 1/16 inch nominal.
D. Bevel edges to expose black core on perimeter.
E. Engraved legend through overlay to expose core.
F. Attach to panels with industrial grade double-faced tape.
G. Refer to Section 26 05 53 – Identifications for Electrical Systems for additional labeling requirements.

2.06 CIRCUIT BREAKERS:
A. 480Vac:
1. Protective devices shall be molded case circuit breakers with thermal-magnetic trip units and inverse time and instantaneous tripping characteristics.
2. Circuit breakers shall be operated by a toggle-type handle and shall have a quick-make, quick-break over-center switching mechanism that is mechanically trip-free. Automatic tripping of the breaker shall be clearly indicated by the handle position.
3. Circuit breakers shall have a minimum symmetrical interrupting capacity of 18,000 AIC. Higher ratings when indicated or required to comply with short-circuit coordination study.
4. Main circuit breakers shall be provided with a door interlocked remote operator kit suitable for installation in provided enclosure. The main disconnect shall be lockable in the off position.
5. Number of poles and ampere rating as required.
B. 120/240Vac and 24Vdc:
1. Provide for main disconnecting means for panel and for power distribution within the panel as indicated.
2. Rated for 120/240Vac and 24Vdc as indicated.
3. Thermal-magnetic trip units.
4. Trip rating and curve as recommended by manufacturer of equipment being protected.
5. DIN rail mounted on the inside of the control panel in a readily accessible location.
6. Toggle-type handle with a quick-make, quick-break over-center switching mechanism that is mechanically trip-free.
7. Minimum symmetrical interrupting capacity of 10,000 AIC.
C. Main and branch circuit breakers shall be UL 489 listed. Supplementary protectors for electronic equipment within control panel shall be UL 489 or UL 1077 listed.

2.07 MOTOR STARTERS:
A. Provide full-voltage reversing or non-reversing starters as required.
B. General:
1. Each starter sized according to horsepower rating of motor.
2. Auxiliary contacts as required.
3. Selector switches, push buttons and indicating lights for motor starters as indicated, specified and required.
4. Comply with NEMA ICS 2.

C. Full-Voltage Reversing or Non-Reversing Starters:
   1. Equipped with a motor circuit protector (MCP).
      a. Toggle-type operating handle shall clearly indicate when the MCP is "ON," "OFF," or "TRIPPED".
      b. Molded-case, manually-operated, 3-pole.
      c. The MCP shall provide adjustable magnetic protection and be provided with pin insert to limit magnetic adjustable protection to a maximum of 1700% of motor nameplate full load current to comply with NEC requirements.
      d. Equipped with a push-to-test button.
      e. Shall include transient override feature for inrush current.
   2. Minimum starter size NEMA Size 1.
   3. Solid-State Overload Relay:
      a. Provide with solid-state, self-powered overload relay sized for and adjusted to full load current of motor being protected.
      b. Selectable Trip Class. Trip Class shall be selected as recommended by the motor manufacturer to protect the motor.
      c. Provide a minimum [4][5]:1 adjustment range matched to NEMA contactor sizes 00-6.
      d. Overload relay shall provide phase loss protection.
      e. Selectable Manual/Auto-Manual reset.
      f. Relay shall have a visible trip indication with remote push button reset.

2.08 VARIABLE FREQUENCY DRIVES (VFD):

A. General Requirements:
   1. VFD shall be microprocessor based and utilize Pulse Width Modulation (PWM) for speed control of an induction motor.
   2. The VFD shall utilize Insulated Gate Bipolar Transistors (IGBT's).
   3. The VFD shall be sized to operate the connected motor.
   4. The VFD shall be capable of producing a variable AC voltage/frequency output to provide continuous operation of a standard induction motor over a 5-100% speed range.
   5. As a commissioning and troubleshooting feature, the VFD power circuit shall be capable of operating without a motor connected to the VFD output.
   6. VFD rated for variable torque loads shall be capable of a momentary overload of 110% for one minute.
   7. VFD rated for constant torque loads shall be capable of a momentary overload of 150% for one minute.
   8. Comply with NEMA ICS 7.
B. Input Harmonics:
   1. Provide with input 5% line reactor and EMI/RFI filter.
C. Input Protection:
   1. Provide with an input circuit breaker.
      a. Shall be provided with an external handle that clearly indicates when the circuit breaker is "ON", "OFF", or "TRIPPED" and be lockable in the "OFF" position.
      b. Molded-case, manually-operated, 3-pole.
      c. Provide instantaneous and thermal magnetic short circuit protection.
D. Motor Compatibility:
   1. Motor life expectancy shall not be compromised in any way by operation with the VFD system. The VFD shall provide motor overload protection in any operating condition.

2. The VFD output waveform shall be suitable for operating a squirrel cage induction motor without derating or requiring additional service factor.
3. The system design shall not have any inherent output harmonic resonance in the operating speed range.
4. The VFD output shall produce no electrically-induced, pulsating torque to the output shaft of the mechanical system eliminating the possibility of exciting a resonance caused by VFD induced torque pulsations.
5. The VFD shall protect the motor from high-voltage dv/dt stress which would cause insulation breakdown of an "inverter ready" motor. If the VFD requires an output filter to meet this requirement, it shall be provided.
6. As a minimum, an output filter shall be provided for motor lead lengths longer than 100 feet.

E. VFD System Efficiency: Guaranteed minimum total VFD system efficiency shall be a minimum 96% at 100% speed.

F. System Input Power Factor: VFD system shall maintain a 95% minimum power factor from 30% to 100% of rated speed.

G. Speed Regulation: VFD speed regulation shall be ±0.5% without encoder or tachometer feedback.

H. Sound Level: Maximum allowable audible noise from the VFD system will be 80 dB(A) at a distance of one meter (3.3 ft) at any speed or load condition. VFD systems with audible noise in excess of this limit shall be provided with sufficient noise abatement treatment to reduce the sound pressure level below 80 dB(A).

I. Availability and Reliability:
1. Firing Signals: All internal firing signals and other communications (which link operational controls with power components such as status and diagnostic signals) shall meet noise immunity and safety requirements as defined by applicable IEEE Standards.
2. Power Sag Ride-Through: The VFD system shall be capable of continuous operation with a 20% voltage sag on the input power line.
3. "Catch-A-Spinning-Load" Capability: The VFD system shall be able to catch and take control of a spinning load if started while rotating equipment is already spinning. Appropriate safeguards shall be included in this operation to prevent damaging torque(s), voltages or currents from impacting any of the equipment. The user shall have the option of employing this feature or disabling it.
4. Auto-Restart Capability: The VFD system shall be capable of automatically restarting in the event of a power failure or drive trip. The VFD system shall provide the user with the choice of automatically restarting or not. The user shall be able to selectively apply this feature to some [but not necessarily all] conditions as determined by the user to be appropriate for the specific application.
5. Ground Fault Withstand: In the event of a ground fault, the VFD shall annunciate the ground fault condition and trip offline to clear the fault. The cause of the shutdown shall be logged to the fault history and be available at the keypad.

J. Physical Requirements:
1. Environmental Requirements: The VFD system shall be capable of continuous operation in an average ambient temperature between 0°C and 40°C at an elevation up to 3300 feet (1000 meters) above MSL without derating. The VFD system shall also be simultaneously suitable for continuous operation in a maximum humidity between 0 and 95% noncondensing.
2. The VFD system shall be air-cooled.

K. Protective Features and Circuits:

1. The controller shall include the following alarms and protective features:
   a. Static instantaneous over-current and over-voltage trip.
   b. Under-voltage and power loss protection.
   c. Over-temperature protection.
   d. Electronic motor inverse time overload protection.
   e. When power is restored after a complete power outage, the VFD shall be capable of catching the motor while it is still spinning and restoring it to proper operating speed without the use of an encoder.
2. The VFD system shall be protected from damage due to the following, without requiring an output contactor:
   a. Single-phase fault or three-phase short circuit on VFD system output terminals.
   b. Loss of input power due to opening of VFD input disconnect device or utility power failure during VFD operation.
   c. Loss of one (1) phase of input power.
   d. Motor regeneration due to backspin or loss of VFD input power.
3. The VFD shall be able to withstand the following fault conditions without damage to the power circuit components:
   a. Failure to connect a motor to the VFD output.
   b. VFD output open circuit that may occur during operation.
4. The VFD shall include a customer selectable automatic restart feature. When enabled, the VFD shall automatically attempt to restart after a trip condition resulting from over-current, over-voltage, under-voltage, or over-temperature.
5. The VFD system shall have the user selectable option of programming up to three speed avoidance bands. This gives the user the ability to block out and prevent operation at any undesirable speed, such as one that may be coincident with a mechanical resonance condition.

L. Diagnostics and Fault Recording:
1. The control logic section shall be fully digital and not require analog adjustment pots or fixed selector resistors.
2. Fault log data shall be stored in nonvolatile memory.
3. The VFD shall include a comprehensive microprocessor based digital diagnostic system which monitors its own control functions and displays faults and operating conditions.
4. A "FAULT LOG" shall record, store, and display upon demand, a minimum of the last four fault events.

M. Interfaces:
1. Keypad and Display:
   a. A unit mounted keypad with integral digital LCD display shall be furnished, capable of controlling the VFD and setting drive parameters. The display shall present all diagnostic message and parameter values in standard engineering units when accessed, without the use of codes. The keypad shall allow the operator to enter exact numerical settings in standard engineering units. A plain English user menu (rather than codes) shall be provided in software as a guide to parameter setting.
   b. As a minimum, the following parameters shall be available for display:
      (1) Speed demand in percent.
      (2) Output current in amperes.
      (3) Output Frequency in hertz.
      (4) Output voltage.
      (5) Total 3-phase kW output.

(6) Kilowatt hour meter.
(7) Elapsed time running meter.
(8) Run status.
(9) Fault status.

c. Drive parameters shall be factory set in non-volatile memory and re-settable in the field through the keypad. Password security shall be available to protect drive parameters from unauthorized personnel.

d. The keypad module shall contain a "self-test" software program that can be activated to verify proper keypad operations.

N. Hard-Wired I/O and Control Devices:

1. The VFD shall include programmable I/O for application specific configuration. The drive shall be configurable to operate in a local and remote mode. The drive shall provide for the following programmable input/output points to be associated with the control functions:

a. Digital Inputs:
(1) Provide a minimum of 6 fully programmable inputs configured, as indicated.

b. Digital Outputs:
(1) Form C Relay. Dry Contact rated a minimum of 2 Amps at 120Vac:
(2) Provide a minimum of 2 fully programmable outputs configured, as indicated.

c. Analog Input:
(1) One 4-20 mA isolated input to control drive output (motor speed) when indicated.

d. Analog Output:
(1) One 4-20 mA isolated output signal representing drive speed and scaled 0 100%.

O. Communication and Protocols:

1. The VFD shall be capable of direct communication to a laptop or computer workstation for serial link setup of parameters, fault diagnostics, trending and diagnostic log downloading.

2. The VFD shall be provided with an Ethernet communication card capable of communicating on a Ethernet/IP network when specified or indicated for the associated control panel.

a. All control functions including start/stop and speed control shall be available via the network.

b. VFD status and I/O shall be available via the network.

3. Provide a complete list of available control and indication points including the required documentation for network configuration.

P. Printed Circuit Boards: All printed circuit boards shall be new. They shall be conformably coated for moisture and chemical resistance, in addition to any dielectric coating properties.

2.09 CONTROL POWER TRANSFORMERS:

A. Rated 480-120/240 Vac, 1-phase, 3-wire, 60 hertz.
B. Varnish impregnated core and coil.
C. 55°C rise with a 105°C insulation system.
D. Finger safe terminal blocks.
E. Transformers 3kVA and above shall be mounted on the exterior of the panel.

1. The transformer enclosure shall match the rating of the associated control panel.

2.10 SURGE PROTECTIVE DEVICES:

A. 480V Surge Suppressors:
1. Provide for 480Vac distribution system within panel.
2. UL 1449 (3rd Edition) listed.
3. Shall meet Type 2 SPD criteria with the following minimum protection characteristics:
   a. I_n: 20kA (per mode)
   b. SCCR: 100kAIC (minimum)
   c. MCOV: 550V
   d. UL Voltage Protection Rating:
      (1) L-L: 1800V
      (2) L-N, L-G, N-G: 900V
4. Designed for 480Vac, three-phase operation.
5. Minimum surge current capacity (I_{max}) of 40 kA per mode (8/20µs).
6. Response time of less than 25 nanoseconds.
7. Equipped with an LED status indicator for verification that unit is functioning.
8. NEMA 1 enclosure designed for back panel or DIN rail mounting within a control panel.
9. Minimum five year warranty.
10. Provide SPDT contacts for remote indication. Contacts rated 0.5A at 120Vac minimum.

B. 120/240V Surge Suppressors:
1. Provide for 120V/240Vac distribution system within panel to protect electronic components from transient voltage surges.
2. UL 1449 listed.
3. Shall meet Type 2 SPD criteria with the following minimum protection characteristics:
   a. I_n: 20kA (per mode)
   b. SCCR: 100kAIC (minimum)
   c. MCOV: 150V (L-G), 270 (L-L).
   d. UL Voltage Protection Rating:
      (1) L-L: 1000V
      (2) L-N, L-G, N-G: 600V
4. Designed for 120/240Vac, single-phase operation.
5. EMI/RFI filtering.
6. Peak clamping voltage of 320 volts line to neutral and 350 volts line to ground with Category B waveform.
7. Minimum surge current capacity of 10 kA per mode (8/20µs).
8. Response time of less than 25 nanoseconds.
9. Equipped with an LED status indicator for verification that unit is functioning.
10. NEMA 1 enclosure designed for back panel or DIN rail mounting within a control panel.
11. Minimum five year warranty.
12. Provide SPDT contacts for remote indication. Contacts rated 0.5A at 120Vac minimum.

C. Panel I/O Surge Suppressors:
1. Provide DIN rail mounted terminal block type transient voltage surge suppressors for all inputs and outputs that are wired to devices located outside of the building envelope.
2. Finger safe screw type terminals.
3. Replaceable surge modules.
4. Three-stage surge protection.
5. Provisions for labeling terminal block numbers.
6. Minimum five year warranty.
7. Analog and 24Vdc Signal Surge Protection:
   a. Series surge suppressor.

b. Minimum surge current capacity of 10 kA per mode (8/20µs).
c. Minimum lightning surge current capacity of 500A per path (10/350µs).
d. Maximum let thru voltage line to ground of 45 Vdc.
e. Maximum let thru voltage line to line of 90 Vdc.
f. Response time of less than 5 nanoseconds.
g. Maximum series resistance of 10 ohms.
h. Minimum continuous current rating of 300 mA.

8. 120Vac Discrete Signal Surge Protection:
   a. Series surge suppressor.
   b. Minimum surge current capacity of 4 kA per mode (8/20µs).
   c. Minimum lightning surge current capacity of 2.5 kA per path (10/350µs).
   d. Maximum let thru voltage line to ground 380 Vac.
   e. Maximum let thru voltage line to line of 600 Vac.
   f. Minimum continuous current rating of 10A.
   g. Continuous current rating shall be increased for individual suppressor blocks when the load exceeds the minimum rating.
   h. Response time of less than 25 nanoseconds.

D. Shall be designed to pass the appropriate IEEE testing standards included below:
1. IEEE C62.11.
2. IEEE C62.33.
3. IEEE C62.36.
4. IEEE C62.45.
5. IEEE C62.62.

2.11 TERMINAL BLOCKS:

A. 600V, sectional type polyamide blocks.
B. Rated a minimum of 24A. Provide higher Amp rated blocks as required.
C. Spring-cage connection type.
D. Finger safe.
E. Slide in vinyl marking strip for terminal identification.
F. DIN rail mounted.
G. Terminal blocks shall comply with NEMA ICS 4.

2.12 SWITCH ACTION FUSE BLOCKS:

A. Rated 600V.
B. Spring-cage connection type.
C. Finger safe.
D. DIN Rail mounted.

2.13 PUSH BUTTONS AND SELECTOR SWITCHES:

A. Heavy duty, 30 mm units with contacts rated 10A continuous at 120Vac.
B. NEMA 4X rated when installed in NEMA 12 or 4X enclosures.
C. Provide the number of contacts and contact development as indicated.
D. Operator colors shall comply with UL 508A and NFPA 79.
1. Start or On push buttons shall have green or black operators.
2. Stop or Off push buttons shall have black operators.
E. Emergency Stop push buttons shall have red mushroom head operators with a yellow base.
F. Provide hermetically sealed units when installed within a classified area.
1. Suitable for installation in a Class I, Division 1 and 2, Group D area.

G. Push Buttons and Selector Switches shall conform to NEMA ICS 5.

2.14 PILOT LIGHTS:

A. Heavy duty, 30 mm units.
B. NEMA 4X rated when installed in NEMA 12 or 4X enclosures.
C. NEMA 4X and suitable for installation in a Class I, Division 1 and 2, Group D area when installed in NEMA 7 enclosures.
D. 120Vac or 24Vdc cluster LED type.
E. Green lights shall indicate “Equipment On”,“Running”, or “Valve Open”.
F. Red lights shall indicate “Equipment Off”, “Stopped”, or “Valve Closed”.
G. Amber lights shall indicate “Equipment Failure” or “Alarm”.
H. Push-to-test type.
I. Pilot lights shall conform to NEMA ICS 5.

2.15 CONTROL RELAYS:

A. Plug-in type relay with neon coil energization indicator.
B. Coil voltage: 120Vac or 24Vdc as required.
C. Contacts rated 10 Amps at 120Vac.
D. Number of contacts as required.
   1. Provide one spare N.O. and one spare N.C. contact (minimum).
   2. Additional spare contacts when indicated.
E. Provide DIN rail mounted relay socket with screw type terminations.
F. Control relays shall conform to NEMA ICS 5.

2.16 TIME DELAY RELAYS:

A. Plug-in type digital based electronic timing relay with coil energization indicator.
B. Coil voltage: 120Vac or 24Vdc as required.
C. Contacts rated 10 Amps at 120Vac.
D. Timing range as indicated with a minimum setting accuracy of ±2% and repeat accuracy of ±0.1%.
E. The selection of timing range settings via DIP switches. The time delay within the range shall be set utilizing an adjustment dial.
F. Number of contacts as required.
   1. Provide one spare N.O. and one spare N.C. contact (minimum).
   2. Additional spare contacts when indicated.
G. Provide DIN rail mounted relay socket with screw type terminations.
H. Time delay relays shall conform to NEMA ICS 5.

2.17 INTRINSICALLY SAFE BARRIERS:

A. Intrinsically Safe Barrier Relays:
   1. Supply voltage 120Vac.
   2. Approved intrinsically safe for Class 1, Division 1, Group D areas.
   3. Accept a dry contact input.
   4. Two SPDT relay outputs rated 5A at 120Vac.
   5. LED indication of relay state.
B. Intrinsically Safe Barrier Transmitters:
   1. 24Vdc regulated power supply input.
   2. 2 wire, 4-20mA transmitter type.
   3. 4-20mA safe area output.

4. Approved intrinsically safe for Class 1, Division 1, Group D areas.

2.18 DC POWER SUPPLIES:

A. Provide industrial rated primary switched 24Vdc power supplies as specified and indicated.
B. Enclosed design with finger safe input and output terminal blocks.
C. Designed for DIN rail or back panel mounting.
D. DC power supply rated as follows:
   1. Input voltage: 95 to 130Vac.
   2. Output voltage: 24Vdc ±1%.
   3. Output current: 10A minimum. with a minimum 25% spare capacity.
   4. Line regulation: ±0.2% maximum.
   5. Load regulation: ±1.5% maximum.
   6. Ripple: <50 mV pk-pk.
   7. No overshoot for turn on, turn off, or power failure.
   8. Operating temperature: -25°C to +60°C.
   9. Overload and short circuit protection.
   10. Indicating lights for status.
E. DC UPS System:
   1. Provide DC power supplies equipped with a UPS System for the following control panels:
      a. Outdoor security, network, or PCS cabinets not supplied by a centralized UPS power supply.
   2. Shall charge and monitor the battery.
   3. Shall automatically switch without interruption to battery power if the primary 120Vac source is lost and switch back automatically to the 120Vac source when power is restored.
   4. The UPS system shall utilize maintenance free lead-acid batteries rated a minimum of 7Ah to provide a minimum of 60 minutes of backup time for the connected load.
   5. Provide a support rack for the batteries designed for DIN rail or back panel mounting.
   6. Equipped with a resettable over current protection to protect the batteries.
   7. The batteries shall be field replaceable.
      a. The unit shall be equipped with an on/off switch to bypass the battery system and allow for replacement of the batteries while the power supply is in operation.
   8. The system shall provide relay outputs rated a minimum of 0.25A at 24Vdc to indicate the following:
      a. AC Power Failure.
      b. Low Battery.
   9. Conform to UL 1778.
F. Redundancy Module.
   1. Provide DIN rail mounted redundancy diode module that provides complete isolation between two 24Vdc power supplies as required.
   2. Unit shall accept two 24Vdc inputs and provide one redundant 24Vdc output.
   3. Current rating as required.
   4. Operating temperature: -25°C to +60°C.
   5. Provide status light and dry output contact that opens when either of the 24Vdc inputs is lost. Output contact shall be rated a minimum of 2 Amps at 30Vdc.

2.19 CONVENIENCE RECEPTACLES:

A. Interior Mounted Receptacle:

1. DIN rail mounted, 15-A duplex three-wire grounding GFCI type receptacle with enclosure.
2. Equipped with terminal blocks for power connection.
3. Outlet shall be protected with a 5 Amp circuit breaker.
4. One mounted inside control panel for use in powering laptops and test equipment for service of the panel.

2.20 INTERIOR ILLUMINATION:

A. Provide LED type panel lights.
B. Minimum 50,000 hour life.
C. Size and quantity designed to provide a minimum 50 foot-candles at the base of the panel.
D. Powered from 120Vac. Provide required power supply.
E. Door interlocked switch.

2.21 FIBER-OPTIC PATCH PANELS AND PATCH CORDS:

A. Provide fiber-optic patch panels in control panels as indicated and specified. Refer to Section 40 66 00 – Network and Communications Equipment for requirements.

2.22 PANEL MOUNT NETWORK SWITCHES AND NETWORK ACCESSORIES:

A. Provide Ethernet switches as indicated and specified. Refer to Section 40 66 00 – Network and Communications Equipment for requirements.

2.23 PROGRAMMABLE LOGIC CONTROLLERS (PLC):

A. Provide Allen-Bradley ControlLogix series PLC hardware as specified and indicated for plant control system (PCS) Cabinets.
   1. General:
      a. The PLC platform shall consist of PlantPAx System listed components and architecture.
      b. The programmable controller shall receive status intelligence, perform logic functions, issue control commands, and provide alarms and status information for the systems described in these Specifications.
      c. The PLC shall support the following programming languages:
         (1) Relay ladder.
         (2) Structured text.
         (3) Function block.
         (4) Sequential function charts.
      d. The programmable controller Equipment shall consist of a solid-state control system which has user programmable memory for storage of instructions to implement specific functions.
      e. The PLC Equipment shall be purposely designed as an industrial control system which can perform functions equivalent to a relay panel or a wired solid-state logic system.
      f. All PLC Equipment provided shall be capable of operation in ambient temperatures of 0°C to 60°C, and 5 to 95% relative humidity (non-condensing), without fans or other cooling equipment.
      g. All external connection points shall be capable withstanding the IEEE surge withstand capability (SWC) test as defined in IEEE C37.90.1.
      h. The PLC's shall be capable of being configured as a redundant controller.
   2. Chassis:

a. Provide PLC chassis as required to accommodate the I/O and communications modules required and indicated.
b. Provide slot fillers for all unused chassis spaces.

3. Power Supplies:
   a. Provide power supplies for the processor chassis and expansion chassis as required.
   b. Power supply shall be sized to supply required power for all installed modules and any spare spaces within the chassis.
   c. Input voltage shall be 120Vac as indicated.
4. Processor:
   a. The processor shall be an Allen Bradley model 1756-L81EP.
   b. The processor shall be of solid-state design on modular printed circuit boards.
   c. The processor shall be equipped with a USB 2.0 communications port for programming.
   d. The processor shall have user-programmable memory with provisions to prevent unauthorized changes.
   e. The processor shall be equipped with a minimum of 3 Mbytes of user memory.
      (1) The complete memory capacity specified shall be available for use by the user.
      (2) Memory shall be SDRAM
   f. The processor shall continuously perform diagnostics analysis with a predetermined failure mode in the event of a fault.
   g. The ladder diagram logic shall be scanned and solved at a rate not to exceed 1 milliseconds per kiloword of logic.
   h. All I/O including analog shall be scanned and updated at a rate not to exceed 0.3 milliseconds for all I/O.
   i. The ladder logic programming shall include support for subroutines.
   j. The processor shall include a real time clock and calendar accessible for use by the user program.
   k. The processor shall have at least two (2) operating modes: Run and Program. These operating modes shall be user changeable via front panel switches and over the PLC communications network.
   l. The processor shall allow the logic to be modified, in ladder logic format, while the processor is in the Run mode without affecting the operation of those portions of the logic not being modified.
   m. The processor shall allow disabling and forcing on and off of individual input and output when the processor is in the Run mode.
   n. The processor shall provide selectable timed interrupt capabilities for the user to incorporate into the ladder logic.
   o. The processor shall provide user defined fault routine capabilities.
   p. The processor shall automatically clear all output and update all input on power-up and prior to scanning and solving any logic.
   q. The processor shall provide the user with a status bit for use in the ladder logic for initialization purposes. This status bit shall be set/reset based on the indicating the first ladder logic scan.
   r. The processor shall provide a comprehensive instruction set including:
      (1) Relay Contact Input:
         (a) Normally open.
         (b) Normally closed.
         (c) Transitional.

(2) Relay Coil Output:
  (a) Standard.
  (b) Retentive.
(3) Timers:
  (a) On delay.
  (b) Off delay.
  (c) Duration.
  (d) Retentive
  (e) Time bases of 1.0 sec, 0.1 sec, and 0.01 sec.
(4) Counters:
  (a) Count up.
  (b) Count down.
(5) Arithmetic:
  (a) Single-precision.
  (b) Double-precision.
  (c) Integer.
  (d) Add.
  (e) Subtract.
  (f) Multiply.
  (g) Divide.
  (h) Square root.
  (i) Less than.
  (j) Greater than.
  (k) Equal.
(6) Logical:
  (a) And.
  (b) Or.
  (c) Exclusive or.
  (d) Compare.
(7) PID.

5. Communications Hardware:
  a. Provide EtherNet/IP communication modules as indicated for communications via an Ethernet PLC communications network.
    (1) All data within a PLC shall be accessible to any operator station or PLC.
      (a) Programming functions shall be possible over the Ethernet communications network.
      (b) Unloading and downloading of programs shall be possible over the Ethernet communications network.
    (2) The operating mode of the PLC shall be changeable via the Ethernet communications network.
    (3) Provide quantity of communication modules to physically segment the PCS operator interface/HMI network from device and motor control I/O networks.
      (a) Each PLC shall incorporate a minimum of one dedicated module for the device I/O communications, or multiple where indicated.
      (b) Each PLC shall incorporate one dedicated module for the PCS operator/HMI network, or dedicated connection through the processor integral Ethernet/IP port as applicable for the supplied processor.
    (4) Provide communications module 1756-EN2T or better.
6. PLC Input and Output Modules:

a. Digital Input Modules:
   (1) Provide module 1756-IA16.
   (2) 120Vac nominal input voltage with an on state voltage of 79 to 132Vac and an off state voltage less than 20Vac.
   (3) Shall have a maximum of 16 inputs per module.
   (4) Maximum hardware input delay time of 10 ms.
   (5) Maximum inrush current of 0.25 Amps.
   (6) Operating temperature of 0 to 60°C at 5 to 95% non-condensing relative humidity.

b. Relay Output Modules:
   (1) Provide module 1756-OW16I.
   (2) Rated 2.0 Amps nominal at 120Vac.
   (3) Shall have a maximum of 16 individually isolated relay outputs per module.
   (4) Maximum output delay time of 13 ms.
   (5) Make rating of 15 Amps and a break rating of 1.5 Amps at 120Vac.
   (6) Operating temperature of 0 to 60°C at 5 to 95% non-condensing relative humidity.
   (7) Provide individual surge suppressors for each output to protect module from surges caused by inductive load switching.

a. Digital Output Modules:
   (1) Provide module 1756-OA16I.
   (2) Rated 0.5A per point (4.0A per module) nominal at 120Vac.
   (3) Shall have a maximum of 16 outputs per module.
   (4) Maximum output delay time of 10 ms.
   (5) Operating temperature of 0 to 60°C at 5 to 95% non-condensing relative humidity.
   (6) Digital output modules shall require the use of interposing relays within the associated control panel for all connected outputs.

b. Analog Input Modules:
   (1) Provide module 1756-IF8I.
   (2) Shall have 8 differential type, 4-20 mA current inputs.
   (3) Each input shall have a minimum 16-bit resolution.
   (4) Provide 2550Vdc channel to backplane isolation.
   (5) Programmable input filter.
   (6) Operating temperature of 0 to 60°C at 5 to 95% non-condensing relative humidity.

c. Analog Output Modules:
   (1) Provide module 1756-OF8I.
   (2) Eight individually isolated, 4-20 mA current outputs.
   (3) Each output shall have a minimum 16-bit current resolution.
   (4) Provide 1700Vdc channel to channel isolation and channel to backplane isolation.
   (5) Maximum scan time of 25 ms for all channels.
   (6) Operating temperature of 0 to 60°C at 5 to 95% non-condensing relative humidity.

d. Provide screw clamp removable terminal block connectors for each module.

B. Provide Allen-Bradley CompactLogix series PLC hardware as specified and indicated for vendor supplied packaged control panels.

1. General:
   a. The PLC platform shall consist of PlantPAx System listed components and architecture.
   b. The programmable controller shall receive status intelligence, perform logic functions, issue control commands, and provide alarms and status information for the systems described in these Specifications.
   c. The programmable controller Equipment shall consist of a solid-state control system which has user programmable memory for storage of instructions to implement specific functions.
   d. The PLC Equipment shall be purposely designed as an industrial control system which can perform functions equivalent to a relay panel or a wired solid-state logic system.
   e. All PLC Equipment provided shall be capable of operation in ambient temperatures of 0°C to 60°C, and 5 to 95% relative humidity (non-condensing), without fans or other cooling equipment.
   f. All external connection points shall be capable withstanding the IEEE surge withstand capability (SWC) test as defined in IEEE C37.90.1.
2. Power Supplies:
   a. Provide power supplies for the PLC hardware and any expansion I/O as indicated or required.
   b. Input voltage shall be 120Vac.
3. Processor:
   a. The processor shall be an Allen Bradley model 5069-L320ERP, unless specified otherwise.
   b. The processor shall be of solid-state design on modular printed circuit boards.
   c. The processor shall be equipped with a USB communication port and an Ethernet communication port for programming and communication of data.
   d. The processor shall have user-programmable memory with provisions to prevent unauthorized changes.
   e. The processor shall be equipped with a minimum of 2 Mbytes of user memory.
      (1) The complete memory capacity specified shall be available for use by the user.
      (2) All memory shall be nonvolatile SDRAM.
   f. Provide with a SD memory card slot and a 1GB memory card for storage of the PLC program and other user specific information.
   g. The processor shall continuously perform diagnostics analysis with a predetermined failure mode in the event of a fault.
   h. The ladder diagram logic shall be scanned and solved at a rate not to exceed 1 milliseconds per kiloword of logic.
   i. All I/O including analog shall be scanned and updated at a rate not to exceed 0.3 milliseconds for all I/O.
   j. The ladder logic programming shall include support for subroutines.
   k. The processor shall include a real time clock and calendar accessible for use by the user program.
   l. The processor shall have at least two (2) operating modes: Run and Program. These operating modes shall be user changeable via front panel switches and over the PLC communications network.

m. The processor shall allow the logic to be modified, in ladder logic format, while the processor is in the Run mode without affecting the operation of those portions of the logic not being modified.
n. The processor shall allow disabling and forcing on and off of individual input and output when the processor is in Run mode.
o. The processor shall provide selectable timed interrupt capabilities for the user to incorporate into the ladder logic.
p. The processor shall provide user defined fault routine capabilities.
q. The processor shall automatically clear all output and update all input on power-up and prior to scanning and solving any logic.
r. The processor shall provide the user with a status bit for use in the ladder logic for initialization purposes. This status bit shall be set/reset based on the indicating the first ladder logic scan.
s. The processor shall provide a comprehensive instruction set including:
    (1) Relay Contact Input:
        (a) Normally open.
        (b) Normally closed.
        (c) Transitional.
    (2) Relay Coil Output:
        (a) Standard.
        (b) Retentive.
    (3) Timers:
        (a) On delay.
        (b) Off delay.
        (c) Duration.
        (d) Retentive
        (e) Time bases of 1.0 sec, 0.1 sec, and 0.01 sec.
    (4) Counters:
        (a) Count up.
        (b) Count down.
    (5) Arithmetic:
        (a) Single-precision.
        (b) Double-precision.
        (c) Integer.
        (d) Add.
        (e) Subtract.
        (f) Multiply.
        (g) Divide.
        (h) Square root.
        (i) Less than.
        (j) Greater than.
        (k) Equal.
    (6) Logical:
        (a) And.
        (b) Or.
        (c) Exclusive or.
        (d) Compare.
    (7) PID.

4. Communications Hardware:

a. The PLCs shall be capable of communicating with each operator station and with each other over a EtherNet/IP communications network.
   (1) All data within a PLC shall be accessible to any operator station or PLC.
      (a) Programming functions shall be possible over the network.
      (b) Unloading and downloading of programs shall be possible over the network.
      (c) The operating mode of the PLC shall be changeable via network.
b. Provide (dual) RJ-45 Ethernet communication ports to connect the PLCs to the Ethernet network as indicated. The communications protocol shall be EtherNet/IP.

5. PLC Input and Output Modules:
   a. AC Digital Input Modules:
      (1) Provide module 5069-IA16..
      (2) 120Vac nominal input voltage with an on-state voltage of 79 to 132Vac and an off state voltage less than 20Vac.
      (3) Shall have a maximum of 16 inputs per module.
      (4) Maximum hardware input delay time of 10 ms.
      (5) Maximum inrush current of 0.25 Amps.
      (6) Operating temperature of 0 to 60°C at 5 to 95% non-condensing relative humidity.
   b. Relay Output Modules:
      (1) Provide module 5069-OW4I.
      (2) Rated 2.5 Amps nominal at 120Vac.
      (3) Shall have a maximum of 4 individually isolated relay outputs per module.
      (4) Maximum output delay time of 10 ms.
      (5) Make rating of 15 Amps and a break rating of 1.5 Amps at 120Vac.
      (6) Operating temperature of 0 to 60°C at 5 to 95% non-condensing relative humidity.
      (7) Provide individual surge suppressors for each output to protect module from surges caused by inductive load switching.
   c. Analog Input Modules:
      (1) Provide module 5069-IF4IH.
      (2) Four individually isolated, differential type, 4-20 mA current inputs.
      (3) Each input shall have a minimum 16-bit resolution.
      (4) Shall be accurate to 0.35% full scale at 25°C (77°F).
      (5) Provide 710Vdc channel to channel isolation and channel to backplane isolation.
      (6) Programmable input filter.
      (7) Operating temperature of 0 to 60°C at 5 to 95% non-condensing relative humidity.
   d. Analog Output Modules:
      (1) Provide module 1769-OF8.
      (2) Eight, single ended type, 4-20 mA current outputs.
      (3) Each output shall have a minimum 16-bit current resolution.
      (4) Provide 710Vdc channel to channel isolation and channel to backplane isolation.
      (5) Maximum scan time of 110 ms for all channels.
      (6) Operating temperature of 0 to 60°C at 5 to 95% non-condensing relative humidity.

C. Distributed I/O:
1. Provide Allen-Bradley distributed I/O rack where indicated and specified for connection of hardwired I/O to the Ethernet network.
2. Provide 1756-EN2T EtherNet/IP communications interface module for backplane.
3. Refer to ControlLogix series section above for hardware requirements.

2.24 OPERATOR INTERFACE TERMINAL (OIT):

A. Industrial Graphic Terminals:
1. Provide for manufacturer supplied control panel OITs where indicated and specified.
2. Provide a 15" flat panel color TFT display (18-bit color, minimum).
3. Luminance shall be a minimum of 300 cd/m2 (Nits) with a field replaceable backlight.
4. Operating systems shall be Microsoft Windows CE 6.0 R3 or newer.
5. CPU shall be an x86 with 1.0 GHz clock speed minimum.
6. Display unit shall have a minimum of 512MB or DDR2-533Mhz RAM.
7. Environmental operating temperature range shall be 0 to 55°C, at 5 to 95% non-condensing relative humidity.
8. Shall be panel mounted with a NEMA rating to match the associated enclosure rating.
9. Provide the following external ports and interfaces as minimum:
   a. One SD Card (SDHC).
   b. One USB-2.0 host ports for peripheral connections.
   c. One USB device port for connection of host computer.
10. Communication interfaces shall include the following as minimum:
   (1) One RJ-45 Ethernet (10/100 Mb Autosensing).
11. Shall accept input power from 24VDC. Provide DIN-rail 120Vac AC-to-DC power supply as required.
12. Software shall include FactoryTalk ME, PDF viewer, ActiveX controls, and other software required for specific installation.
13. Shall be capable of communicating over the EtherNet/IP network as indicated.
14. Provide Allen-Bradley PanelView Plus 7 series.

B. Industrial Thin Client Terminals:
1. Provide for Plant Control System PLC cabinets and other locations indicated or specified.
2. OITs shall be industrial thin clients with panel mounted touch screens running a secure thin client node of Intouch for System Platform.
3. Provide industrial thin client hardware with a panel mount TFT-LCD (LED backlit) panel mounted touchscreen.
4. Provide industrial grade thin client terminals, optimized for ACP ThinManager.
   a. Designed to operate on an ACP ThinManager 11 or greater operating system.
5. The processor shall be a 4-core AMD Ryzen or equivalent processor rated at 2.0Ghz or greater.
6. Provide 4.0 Gigabytes (minimum) of DDR4 RAM designed to operate on a front side bus (FSB) speed of 1333 MHz (2666 MT/s) or greater.
7. Support M.2 and 2.5” HDD/SSD storage devices.
8. Minimum of one full size mPCIe socket.
9. Graphics processor shall be Radeon Vega 8 or equivalent multi-display type supporting up to four monitors. Provide resolutions up to 4096 x 2160 at 60Hz or greater.
10. External ports shall include the following as minimum:
   a. 4- DisplayPort 1.3/DP+ ports.
   b. 2- Gb LAN ports.
   c. 2- USB 3.2 Gen 2 ports.

d. 2- USB 2.0 ports.
e. 2- RS-232/422/485 COM ports.

11. Enclosure shall be aluminum or steel with fanned cooling. Operational temperature range of 0-50°C.
12. Powered from 12Vdc. Provide required power supply adapter.
13. Provide Rockwell 6200 Versaview 5200 non-display series or equal.
14. Monitor (TFT-LCD):
    a. The integral monitor shall be a 22”-inch (minimum) active matrix TFT-LCD type resistive touchscreen designed for panel mounting.
    b. Contrast Ratio of 1000:1, minimum.
    c. Brightness of 250 nits (cd/m^2), minimum.
    d. Pixel pitch of 0.28 mm, maximum.
    e. Response time of 5ms, maximum.
    f. Viewing angle (horizontal and vertical) of 160 degrees minimum.
    g. Support resolution of 1920x1080 at 60 Hz minimum.
    h. Monitor shall be NEMA 4X rated or IP equivalent.
    i. Accept DVI-I, HDMI, or DisplayPort input connection.
15. Software:
    a. Client license and ACP Thinmanager software.
    b. Provide any additional drivers or applications required software for a fully operational system.
    c. Refer to Section 40 61 96 – Process Control Software Programming and Reports for additional requirements.
16. Enclosures and Mounting Hardware:
    a. Provide the necessary stand-alone enclosures or necessary panel mounting hardware with face plates for mounting to control panels.
    b. For stand-alone installations, provide a pendant or articulating arm mounting system as required.

2.25 PLC I/O:

A. Refer to the I/O Lists at the end of Section 40 61 96 – Process Control Software Programming and Reports for a list of I/O required to be provided for the plant control system.

2.26 ELECTRICAL SYSTEM:

A. Wiring:
1. UL style 1015 (AWM), or UL style 1063 machine tool wire (MTW), 600V, 90°C.
2. No. 14 AWG (minimum), 41 strand, for all control wiring.
3. No. 18 AWG (minimum), shielded twisted pairs and triads as applicable for all instrumentation wiring.
    a. Color code shall be black/red pair (black/red/white triad) with black [or blue] PVC jacket.
4. Wire Colors (UL508A):
    a. Black: 240V or 480V AC wiring.
    b. Red: 120V AC wiring.
    c. White: AC neutral.
    d. Green: Ground.
    e. Blue: DC(+).
    f. White w/ Blue Tracer: DC(-) grounded.
    g. From alternate power source that remains energized when main disconnect is open:

(1) Yellow: Un-switched power.
(2) White w/Yellow Tracer: Un-switched neutral.

B. Wire Markers:
1. Heat shrinkable, tube-type sleeve markers, constructed of polyolefin material.
2. White sleeves with black thermal printed text.
3. Identify both ends of wire with the same unique wire number.
4. Assign wire numbers where specific designations are not indicated.
5. Markers sized for snug fit for wire size.

C. Wiring Duct:
1. Provide wide slot wiring duct in panel for routing of panel wiring. Slots shall be a minimum of 0.25-inches.
2. Provide with dual hinge, push-on cover that opens a minimum of 100 degrees to either side.
3. Wiring ducts shall be sized to accommodate all installed wire plus a minimum of 25% spare capacity.

D. Ground Bus:
1. Provide copper ground bus for power circuits.
2. Provide isolated copper ground bus for instrument shields.

2.27 ARC FLASH LABEL:

A. Provide a 6 x 4 inch (minimum), plastic arc flash label for each control panel.
B. Label shall be orange and white.
C. Label shall read as follows: WARNING – Arc Flash and Shock Hazard. Appropriate PPE and Tools Required When Working on this Equipment.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Verify site conditions are suitable for installation of equipment.
B. For indoor control panels final or temporary HVAC systems shall be in place and operational to maintain the ambient temperatures and humidity conditions at occupancy levels prior to energizing panel and shall be maintained for the remainder of the construction period.

3.02 PANEL FABRICATION:

A. Install all components in the panel as required and recommended by the manufacturer.
B. Provide master nameplate and nameplates for all operator interfaces. Interior nameplates shall be provided for individual component identification including, but not limited to, power supplies, PLCs, control relays, terminal blocks, Ethernet switches, circuit breakers, etc.
C. Provide interior illumination for all panels equipped with a PLC and/or network equipment.
D. Control panels supplied with 480V motor starting equipment installed shall be designed to provide physical isolation between the 480Vac components section and the control section (120Vac and below) to reduce the hazards associated with arc flash.
E. Power Distribution:
1. Provide circuit breakers for protection of equipment in the panel and distribution of power to equipment powered from the control panel. Fuses shall only be used for special protection when circuit breakers aren't suitable.
2. Provide main power disconnect operable from the exterior of the panel for all panels supplied with 480-volts. For panel supplied with 480-volt power provide properly sized control power transformer and required circuit breakers for distribution of power within

the panel. Provide dedicated circuit breakers for all 480-volt equipment powered from the panel.

1. Control panels shall include provisions for connection of a 120Vac, 20Amp supply as minimum.
    a. Control panels served by the centralized UPS system shall include provisions for connection of two (2) 120Vac, 20Amp supply circuits. One circuit shall be used as "House" power for lights, fans, receptacles, etc. The second circuit shall be derived from the centralized UPS system and serve all PLC, network, and control system related loads.
        (1) Dual 120Vac feed requirements are applicable for the following control panels:
            (a) Plant Control System PLC Cabinets.
            (b) Manufacturer supplied control panels containing PLCs and network equipment.
2. Provide 120Vac circuit breakers to distribute power within the control panel. Circuit breakers shall be sized based upon connected load. As a minimum, a dedicated circuit breaker shall be provided for the each of the following:
    a. Incoming power sources.
    b. UPS power source.
    c. Each device such as lights, fans, heaters, receptacles installed within the panel.
    d. PLC power supplies (120Vac).
    e. 24Vdc power supplies.
    f. Each 120Vac digital input or output module.
    g. Each 120Vac instrument or device powered from the panel.
3. Provide 24Vdc circuit breakers to distribute power within the control panel. Circuit breakers shall be sized based upon connected load. As a minimum, a dedicated circuit breaker shall be provided for each of the following:
    a. Output of 24Vdc power supply.
    b. PLC power supply (24Vdc).
    c. Each 24Vdc digital input or output module.
    d. Each loop powered instrument.
    e. Each analog input module, if required.
    f. Each analog output module, if required.
    g. Each 24Vdc instrument or device powered from the panel.
4. Provide signage on panel to clearly indicate that the panel is powered from multiple sources if applicable.

F. Surge Protection:
1. Provide surge protection on the incoming power supply and 120Vac distribution systems within the panel to protect electronic components from transient voltage surges.
2. Provide surge protection on all power circuits to instruments installed outside of the building envelope in which the control panel is installed. The terminal block type surge suppressor shall be the termination point for the field cabling.
3. Provide surge protection on all inputs and outputs that are connected to equipment outside of the building envelope in which the control panel is installed. The terminal block type surge suppressor shall be the termination point for the field cabling.

G. Component Mounting:
1. Operator interfaces and indicating lights shall be installed in the door of the panel at a convenient height for operator interaction.

2. Components shall be mounted to provide complete accessibility to all terminals, relay sockets, and other devices without dismantling of panel equipment.
3. Provide sufficient space around and layout components to allow for proper heat dissipation.
4. Provide sufficient space at the [top] [and] [bottom] of the panel for conduits and cable entry. Conduit entry locations shall be coordinated with the installing Contractor.

H. PLC I/O:
1. Provide interposing relays for all discrete outputs from the PLC including prepared spare points.
2. Provide interposing relays for all relay outputs from the PLC driving loads that exceed 1.5A and when indicated.
3. Wire all inputs and outputs from the PLC to terminal blocks.
4. Dry contact outputs for relay output modules and interposing relays shall be provided with surge-suppressors (snubbers) across relay coils and load field terminals as applicable to protect against transient EMI when driving inductive loads.

I. Wiring Methods:
1. Route main groups of wires in plastic nonflammable wiring duct.
2. Smaller groups of wire shall be cabled and secured with nylon cable clamps and ties or plastic spiral wraps.
3. Maintain physical separation of power, control and instrumentation cables within the panel.
4. Provide dedicated wiring ducts for management of field cables within the panel. Wiring ducts shall be sized to accommodate multi-conductor control cables. Assume a minimum of 25% spare conductors and provide a minimum of 25% spare capacity when sizing wiring ducts.

J. Terminal Blocks and Connections:
1. Provide terminal blocks for all external connections.
2. Make all connections on terminal blocks.
3. Follow manufacturer’s recommendations for terminal block installation.
4. Connect terminal blocks for instrumentation cable shields to isolated ground bus.
5. Provide required grounding type terminal blocks.

K. Spare Capacity:
1. Provide a minimum of 20 percent spare or 2 circuit breakers, whichever is greater, for each power source (Vac and Vdc) present within the panel. All spare circuit breakers shall be mounted, wired, and include provisions to terminate associated neutral or negative conductors.
2. Provide a minimum of 20 percent spare slots in each PLC chassis. Provide blank filler modules for all empty slots.
3. Provide a minimum of 20 percent or 4 points, whichever is greater, spare PLC inputs and outputs for each type in each panel. All spare points shall be wired to field terminal blocks. Fifty percent of spare analog inputs shall be configured to provide loop power.
4. Provide a minimum of 20 percent spare terminal blocks of each type mounted in the panel.
5. Provide spare DIN rail space for the installation of terminal blocks for all spare slots in the PLC chassis.

L. Provide labeling on all terminal blocks, wiring and relays to match panel drawings.

3.03 UNINTERRUPTIBLE POWER SUPPLY INSTALLATION:

A. When applicable, install UPS systems in control panel as specified.

B. Startup and initial charging shall be as required by the UPS manufacturer.
C. Install the Maintenance Bypass Switch and make the required connections to UPS and loads served.

3.04 ETHERNET SWITCH INSTALLATION:

A. Install Ethernet switches in control panels and make connections as indicated.
B. Arrange with proper clearances from other equipment and material to obtain accessibility for operation and maintenance.
C. Shall provide adequate ports for connection to the plant control system, PLC, OIT, and other included networked equipment, and provide a minimum of one spare programming port.

3.05 PLC PROGRAMMING:

A. Refer to Section 40 61 96 – Process Control Software Programming and Reports for PLC programming requirements.
B. The PLC shall be programmed to perform the required logic for proper operation of the equipment.
C. The PLC program shall be thoroughly documented with explanations in the program of the operation performed in each program line or rung.
D. The PLC shall monitor power status to the control panel. Logic shall be implemented that shall clear run contacts when power is lost and perform routine startup of equipment after a power restoration.
E. Control and status points specified to be communicated with the plant control system shall be tagged as specified and indicated and shall be organized to provide efficient communication with the plant control system.
F. Shall be programmed utilizing the latest version of RSLogix Studio 5000 programming software.
G. Soft copy of the program shall be provided to the Owner.

3.06 OIT PROGRAMMING:

A. The OIT shall be programmed to provide required operator interfaces with the equipment.
B. Shall be programmed utilizing the latest version of Windows based programming software from the manufacturer.
C. Screens shall be laid out in a logical order with a main overview screen and links from each screen back to the main overview screen. The graphic displays shall be developed using design elements and concepts intended to enhance the operator's "Situational Awareness". The development, design, and implementation of the system displays shall comply with ISA 101.01 – Human Machine Interfaces for Process Automation Systems.
D. The color scheme shall utilize a grey scale color palette for equipment and backgrounds with colors only being utilized for operator setpoints, variables, warnings, and alarm conditions.
    1. The color standards shall conform to KC Water SCADA System Software Standards and Conventions.
E. Operator adjustable set points shall be password protected.
F. A soft copy of the program shall be provided to the Owner.

3.07 INSTALLATION:

A. Control Panels:
    1. Conform to manufacturer's written instructions.
    2. Surface-mount wall mount enclosures on structural supports or wall approximately 4 feet to center line above the floor when possible.

3. Install floor mounted enclosures where indicated and bolt to floor using expansion type concrete anchors.
4. Install all necessary openings in panels.
5. Arrange with proper clearances from other equipment and material to obtain accessibility for operation and maintenance.
6. Mount plumb and level.

B. Electrical Connections:
1. Install wire and cable as specified in Division 26.
2. Conform to manufacturer's wiring diagrams.
3. Install circuits to field-mounted equipment as indicated and required.
4. Installation shall conform to NFPA 70 (NEC).

C. Place arc flash label on equipment.

3.08 FIELD QUALITY CONTROL:

A. Manufacturer's Field Services:
1. The panel supplier shall provide the field services of a trained technician for the amount of time required to commission, test and start-up all equipment provided.
2. All travel and living expenses shall be included for all trips to the site. All equipment required for testing, start-up and performance verification shall be provided by the start-up technician.

B. Check all internal and external connections and tighten as required.
C. Perform I/O checkout on all points and verify proper operation.
D. Verify proper connection of communication cabling and proper communication system configuration.
E. Field verify proper operation of all inputs and outputs.
F. Record results of I/O checkout and submit test reports as specified in Division 01.

3.09 FINISHES:

A. Control panel coatings shall be free from scratches, rust, or other defects.
B. All damaged or defective coatings shall be repaired prior to final acceptance.
C. Field Painting:
1. Touch Up:
a. Contractor shall prepare surfaces and touch up manufacturer applied coatings as required for any damage during shipment and installation.
b. Field painting shall be performed based on manufacturer's recommended procedures.
c. Contractor shall provide the necessary quantity of Manufacturer's touch-up paint to match the factory applied finish.

3.10 ADJUSTING AND CLEANING:

A. After field installation and final wiring terminations are completed the control panel wiring and cables shall be adjusted and neatly secured with tie wraps, hook-and-loop straps, or the like.
B. Wiring duct covers shall be replaced and secured as required.
C. Prior to final acceptance control panel interior and exterior shall be wiped clean and free from dust and debris.

3.11 TRAINING:

A. Provide a minimum of 4 hours of training for each panel provided at the customer's facility for operations, maintenance and service personnel.

1. The training session shall include classroom discussion on the theory of operation of the equipment, as well as maintenance and service methods for the purchased equipment.
2. Topics covered shall include safety, hardware layout and functions, power and control wiring, diagnostic indicators, keypad/display interface, faults, diagnostic tools, troubleshooting, and preventive maintenance.
3. Hands-on training shall be provided on equipment.
4. Documentation shall be provided which shall include actual manuals for the equipment and drawings and schematics of equipment supplied for this project.

B. Contractor shall record the training sessions and provide a final edited version to the Owner in electronic video file format.

C. Training shall conform to the requirements of Section 01664 – Training.

END OF SECTION 40 67 00

SECTION 40 68 00 – PROCESS CONTROL SOFTWARE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. Contractor shall furnish a complete PlantPAx control software package including Run Time and Development for the Todd Creek WWTP. Provide all software packages and required license for the control network. The control network shall consist of the following as minimum:
   1. The plant control system software shall be based on the Rockwell PlantPAx platform.
   2. The visualization software shall be the latest version of Factory Talk View SE Distributed System.
   3. The data analysis and trending software shall be the latest version of Factory Talk Historian.
   4. HMI screens shall be developed using the latest version of the Factory Talk View Studio development package. The development software package shall be provided and installed on the server or engineering workstation designated by the Owner.
   5. Reports shall be generated as required by the Owner.
   6. One fault tolerant network server shall be provided and configured. Refer to Section 40 61 96 – Process Control Software Programming and Reports for details on the servers and software configurations.
   7. The system shall have the following minimum client nodes:
      a. Two Operator Workstation industrial thin client nodes as indicated.
      b. Five OIT Industrial Thin client nodes.
   8. All software packages shall have the latest service packs installed.
      a. Operating system service packs shall be the latest that is compatible with the current shipping version of the control system software.

1.03 RELATED REQUIREMENTS:

A. Section 40 61 96 – Process Control Software Programming and Reports.
B. Section 40 62 00 – Computer System Hardware and Ancillaries.
C. Section 40 66 00 – Process Control Networks.

1.04 REFERENCE STANDARDS:

A. Applicable Codes and Standards: Furnish software which conforms in all respects to applicable industry standards and sound engineering practice.
B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
C. International Society of Automation (ISA).
   1. ISA 101.01 – Human Machine Interfaces for Process Automation Systems.
D. Kansas City MO Water Services.
   1. Wastewater SCADA System Software Standards and Conventions.

1.05 SUBMITTALS:

A. Submit as specified in Division 1.
B. Product Data: Submit for each type of product specified and included the following as minimum:

1. Data sheets for each software package.
2. List of all provided licenses.

C. Qualification Statements:
1. Installer's qualifications.

D. Closeout Submittals: Final documentation shall include the following as minimum:
1. Operation and Maintenance Manuals including the following:
a. Copies of all approved Product Data and licenses.
b. Software Technical Support Information.
c. Contractor Information.

E. Maintenance Material Submittals:
1. Software:
a. Original files on flash drives or SSD containing all software furnished.

1.06 QUALITY ASSURANCE:

A. All software furnished shall have an acceptable history of satisfactory use and reliability for a period of at least two years.

B. Newly released versions of the software will be considered if it has been adequately tested and proven in the market, meets the requirements of this Contract, and is approved by Engineer and Owner. Such software shall be noted in the proposal for review.

C. Installer Qualifications:
1. Prior to installation and development, submit data of installer's experience and qualifications.
2. Installers shall have experience with the provided software which shall include 5 years on projects of similar complexity.
3. Include installers specific experience history in installing and developing with the specified software for projects of similar design.
4. Include names and locations of two projects successfully completed using the specified software platform.
5. Include written certification from users that systems have performed satisfactorily for not less than 18 months.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Control, Historian and Data Analysis Software:
1. Rockwell Automation, Inc.

B. Design and Programming Software:
1. RSLogix 5000, Rockwell Automation, Inc.
2. RSLinx, Rockwell Automation, Inc.

C. Thin Client Management Software:
1. Automation Control products (ACP).

2.02 GENERAL:

A. Contractor shall provide all software and application specific firmware as required to provide a control system which meets the functional requirements of this Part.

B. The control software shall be a full function process monitoring and control package. It shall be capable of simultaneously performing all of its functions in a multi-tasking environment.

C. The control software shall provide at least the following capabilities as an integrated function:
1. Input/output functions.

2. Modulating controls.
3. Digital controls.
4. Data processing and communications.
5. Alarm functions.
6. Sequence of events.
7. Log functions.
8. Operator display functions.
9. Printing functions.
10. Operator console functions.
11. Programming functions.
12. Historical data storage.
13. Historical and real-time trending functions.
14. Support thin client remote desktop services.

D. The control software shall provide a mechanism to generate data to files with a standard format. These data files shall be accessible to other programs such as spreadsheets and database managers and shall be used to generate reports and perform data analysis outside of the control program itself.

E. The development, design, and implementation of the control system software shall comply with ISA 101.01 – Human Machine Interfaces for Process Automation Systems and Owner standards.

2.03 SOFTWARE AND LICENSES:

A. As a minimum the following software and licenses shall be provide. If additional software or licenses are required for a fully operational system, they shall be provided.
1. FactoryTalk View Site Edition Server Unlimited Display.
   a. Provide required licenses to allow for instant failover from primary server to the secondary server as specified.
   b. Provide necessary licenses for 10 thin client connections.
2. FactoryTalk Historian Site Edition Server – 2,500 Rockwell Data Points.
   a. Provide necessary licenses for 10 concurrent client sessions.
3. FactoryTalk View Site Edition Client.
   a. Provide as required for the indicated and specified clients.
4. FactoryTalk View Machine Edition (ME).
   a. Provide licenses required for the specified stand-alone OITs:
5. ACP Thinmanager and RDS, 10 client licenses (typical for each server).
   a. Provide for the Primary and Secondary Servers as required for a failover configuration.
6. RSLogix Studio 5000 Professional Edition.
   a. Includes RSLinx and RSNetworx for EtherNet/IP.
   b. Provide and install on the specified engineering server virtual machine unless otherwise designated by the Owner.
7. Refer to Section 40 61 96 – Process Control Software Programming and Reports for details on the virtual machines and software configurations.
8. All software versions shall be coordinated with the Owner's current SCADA standards.
9. Provide a minimum of 2 years of Rockwell Automation technical support for the control system software from date of software purchase. Includes software upgrades through the maintenance period.

10. Provide a minimum of 2 years of manufacturer's software maintenance and support for all third-party applications. Includes free software upgrades and technical support through the maintenance period.

2.04 COMMUNICATIONS AND PREPROCESSING:

A. General: The communications and preprocessing portion of the control software shall perform the following functions:
   1. Communicate with the PLC's located on the plant control system Ethernet network.
   2. Support mutual data exchange between each operator station and PLCs on network.
   3. Support multiple communications networks and protocols concurrently.
   4. Validate, convert, process and alarm check all data received by any of the communications interfaces according to the criteria selected for each data point.
   5. Scans shall be performed continuously on all communications channels. Scans shall be sequential for those devices on the same communications network and the different communications networks shall be scanned in parallel.
   6. Periodic scan rates at different priorities shall be definable on an individual point basis or by groups of points. The scan rates shall be definable.
   7. Unsolicited messages shall be accepted and processed when sent over any of the communication networks.
   8. Processing by exception will be allowed provided the deadband is operator assignable on a point basis. The deadband will be used to inhibit preprocessing of data which has not changed by more than the preset deadband from the previous scan. The deadband shall be assignable in engineering units or as a percentage of the scale range. An entry of zero (0) shall be acceptable for the deadband.
   9. If the preprocessing functions have not been completed for certain data before new data for the same points is received in the next scan, appropriate diagnostic messages shall be directed to output devices, operator screen, printer, audible alarm, and related items, selected during system configuration.
   10. Communications throughput shall be limited solely by the communications networks and not by the control software/hardware provided in this Section.
   11. Provide the means to control the plant equipment or to initiate start and stop sequences from any operator station. From the operator station the operator shall have complete control of the PLC's.
   12. Update displays for all points at least once every 50 milliseconds. The system shall update its own data base simultaneously. Screen call-up time for any graphic shall not exceed 3 seconds for static and dynamic data.

B. PLC Communications:
   1. The control software shall include the communications interface from the application server to the PLC network.
   2. Multiple scans per PLC at different priority scan rates shall be supported.
   3. The software shall perform any and all translations of PLC communication messages that may be required to transfer/receive data between the real-time database and the communications protocol.
   4. The communications interface shall provide all necessary error-checking and retransmission capabilities to ensure no data transmission errors.

C. Data Preprocessing:
   1. Analog Inputs:
      a. The system shall perform calculations required in the handling of analog input data including but not limited to averaging, time integrations, ranging, summations on flow measurements, and square root extractions.
      b. All analog input points shall be checked against high and/or low process limits. An analog input outside these limits shall be considered in alarm.
      c. All analog input points shall have re-alarm capabilities. Once a point is in alarm, it will re-alarm if its value continues to increase or decrease beyond the re-alarm limit assigned to that point. Re-alarm limits shall be specified in percent of input range.
      d. All analog input points shall have the capability of being assigned high and low alarm dead bands. Alarm dead bands represent the value that an input point must decrease or increase above or below an alarm set point before it activates a high or a low alarm.
      e. It shall be possible to automatically inhibit the alarming of any analog input or composed point (either analog or digital) by the state of one or more contact closure input, digital logic output, or the values of analog variables in order to eliminate nuisance alarms (e.g. low temperatures alarms disabled during start-up). The inhibiting contact closure or analog value could be different for each analog or composed point if required. When inhibiting, no alarm indication will be given to the operator and it will not be shown on alarm groups. Upon restoration of alarm functions, the point will be scanned for alarming and, if in alarm, the normal operator indication shall occur.
      f. All inhibited alarms shall be automatically logged. A summary of inhibited alarms shall be provided.
      g. Provisions shall be made to avoid erroneous alarms on rate of change alarms when scanning of a point first resumes.
      h. A method of differentiating between high or low alarms and "BAD" (alarms outside reasonable limits for a point) alarms should be used so that types of alarms are easily identifiable.
   2. Analog Composed Points:
      a. Analog composed points are defined as points resulting from calculations involving two or more analog points. The results of these calculations shall be assigned point numbers and shall be capable of being alarmed, displayed, trended, or logged.
      b. Each subsystem shall have the capacity to process analog composed points. This number is in addition to any composed points per subsystem required by the system for logs. It is also in addition to any integrations, averages, weighted averages, and necessary calculations of input points.
      c. Analog composed point capabilities shall be the same as specified for analog inputs.

2.05 ALARM FUNCTIONS:

A. General:
   1. The system shall compare all analog input points, composed points, etc., against high and/or low alarm limits. If an input is determined to be beyond either of these limits or if a contact input designated as an alarm is determined to be in alarm, the system shall record a time-tagged alarm message to the alarm database. Simultaneously, a similar alarm message will be displayed on the operator workstation screen.
   2. Once an analog point is in alarm, it shall re-alarm if its values continue to increase or decrease beyond the re-alarm limit.

3. All alarms shall have an assignable time delay to prevent an alarm message from being printed or displayed until the alarm has been present for the duration of the time delay.

B. Alarm Priorities/Levels:
1. The system shall have the capabilities to assign different priorities to points in alarm. There shall be at least four levels of alarm priorities for combinations of display, print out, or audible.
2. All points shall have the capability of pre-assignment to one of four levels for the operator screen display color to identify the alarm criticality.

C. Alarm sequence shall be as follows:
1. Alarm Occurs (Priority 1): Event recorded to alarm log and the operator screen displays alarm with a similar message in flashing magenta.
2. Alarm Acknowledgement (Priority 1): Operator onscreen alarm display remains magenta but stops flashing and alarm acknowledgement recorded to alarm log.
3. Return to Normal (Priority 1): Alarm display changes to a lighter shade of magenta. Alarm display clears when the point has been acknowledged. A return to normal is recorded in the alarm log.
4. Re-alarms: Re-alarms are treated like new alarms.
5. Alarm Priorities (1 through 4): Additional priority alarm assignments shall be treated in similar fashion but with alternate color assignments. Color assignments for priority levels shall be as defined below:
   a. Priority 1 (Low): Magenta.
   b. Priority 2 (Medium): Yellow.
   c. Priority 3 (High): Orange.
   d. Priority 4 (Urgent): Red.
6. Additional alarm management and classifications: Alarms shall be capable of being suppressed, inhibited, and shelved. In these cases, color assignments shall uniquely identify the alarm status and current alarm classification.
7. Coordinate alarm sequence and priorities with Owner's standard conventions.

D. One common alarm acknowledgement scheme shall be used for all alarms on the operator screens so that only one action is required by the operator to acknowledge.

2.06 OPERATOR DISPLAY FUNCTIONS:

A. General:
1. All standard displays shall be accessible from any operator workstation on the Ethernet network. Displays shall be in high resolution color graphics.
2. The system shall have full flexibility in specifying or changing tags, tag descriptions, ranges, scale factors, or grouping the various displays.
3. All graphic displays should be built interactively using the supplied control system software library and graphics development program with the maximum flexibility for ease of graphics building or revision.
4. Displays shall allow windowing for additional graphics and faceplates.
5. The operator shall be able to use a variety of input devices to interact with the control software including keyboard, mouse, touchscreen, etc.

B. Trend Displays:
1. The system shall have the capability to trend single variables or groups of variables simultaneously on the operator screens.
2. The system shall allow the operator to define a minimum of 50 group trend displays.
3. Any analog or composed point may be assigned by the operator to the trend display.

4. Trend display for each point shall include the point description, time base, and ordinate magnitude.
5. The trend time base shall be assignable.
6. Trending of historical information shall be available. The operator shall be able to scroll backward or forward through data.

C. Custom Graphic Displays:
1. The system shall have capabilities to easily design and display custom displays. These displays may take the form of icon objects, plant schematics, bar graphs, and tabular data.
2. The custom displays shall be fully interactive displays providing full process monitoring and manipulation. This interaction shall allow for the changing of set point, output, mode, ratio, bias, and function for modulating parameters. The interaction shall also allow for issuance of start/stop and open/close commands for loops.
3. The system shall have a standard group of objects and symbols from which can be made and stored in a symbol library. Manufacturer standard symbols and objects shall also be provided in the library.
4. Pixel manipulation of shapes and creation of symbols and graphics for library storage shall be available.

D. Alarm Displays:
1. Alarm Summary Display:
   a. The alarm summary display shall differentiate between the priority levels of alarm.
   b. The highest priority alarm summary shall list all primary alarms as well as points exceeding re-alarm limits. These alarms shall be listed in the sequence they were detected with the newest alarm at the top of the page.
   c. The other alarm summaries shall be displayed below the primary alarms. These alarms shall also be listed in order of detection.
   d. A point in alarm shall flash on either alarm summary display until acknowledged from the keyboard or pointing device.
   e. Messages for alarms, displayed on the screens, shall include the following information:
      (1) Point tag (ID).
      (2) Point description.
      (3) Value or status.
      (4) Engineering units (if applicable).
      (5) Limit exceeded (if applicable).
   f. Alarms should be available for historical retrieval for operator information. The operator shall be able to shift pages or scroll through the alarm history for alarm review.
2. Alarm Group Display:
   a. Alarm groups shall be able to be displayed on any operator workstation. Each alarm group shall represent those alarm points associated with a specific piece of equipment, operating unit, or portion of the plant.
   b. The point ID of a point in alarm shall flash on the alarm group display, until it is acknowledged from the keyboard or pointing device. The size of each alarm group shall be selectable.
   c. Any alarm group shall be capable of being disabled in its entirety or individual alarms shall be capable of being disabled selectively.
3. Alarm Diagnostics: The alarm diagnostic function shall be available to the Operator for programming specific recommended actions to the acting operator when certain alarms

occur. The recommendations shall appear on the operator workstation screen in response to certain alarm conditions as an aid in operator response.

E. Point Summary Displays:
   1. It shall be possible for the operator to display summaries listed below.
   2. Display of a point summary shall include at least the following:
      a. Time.
      b. Summary heading.
      c. Point ID and description for each point in the summary.
      d. Pertinent data for each point in the summary, such as value, alarm status, alarm limits, etc.
      e. Point summaries available for operator print or display shall include at least the following:
         (1) Analog input points.
         (2) Composed points.
         (3) Contact input points.
         (4) Alarm summary.
         (5) Inputs deleted from scan.
         (6) Inserted value summary.
         (7) Bad inputs summary.
         (8) High/low reasonable limit summary.
         (9) Sequence of events logs.
   3. It shall be possible for the operator to cancel a running summary at any time.
   4. Summaries shall be displayed on any of the operator screens.

2.07 PRINTING FUNCTIONS:

A. The following defines the minimum printing functions and printing formats that shall be available on the printer(s).

B. Single Point Print:
   1. Printout of a single input point shall include at least the following:
      a. Time.
      b. Point tag (ID).
      c. Point description.
      d. Value or status.
      e. Engineering units (if applicable).
   2. It shall be possible for the operator to trend a single point on the printer. Trend interval shall be adjustable by operator.

C. Alarm Printout:
   1. The operator shall be able to print an alarm list at any time. The operator shall be able to define the number of alarm points to print.

D. Operator Screen Printout: Any display on any of the operator screens for a unit shall be able to be printed out as required to provide a hard-copy record.

E. Trend Printout:
   1. It shall be possible to print trend charts as displayed on the operator workstation.

2.08 PROGRAMMING FUNCTIONS:

A. The system shall permit the plant personnel to perform programming functions listed below. It shall be possible to perform these functions with the system on-line. All programming functions shall be under password protection.

B. All operations required to implement these changes shall be accomplished in a conversational mode via the operator screens and keyboards.
C. Programming functions shall include at least the following:
   1. Add and define new input points up to the system capacity.
   2. Modify point definition.
   3. Delete input points.
   4. Add or delete points for any group log, except for those group logs reserved for operator definition.
   5. Add or delete points to any periodic log. Change headings of period logs.
   6. Construct new graphic displays or modify existing ones.
   7. Prepare special summaries.
   8. Have the capability to add new logic programs or modify existing system logic programs with the system on-line.
   9. Modify or add performance calculations as required.
   10. Modify or add reports as required.
D. Software Maintenance:
   1. All programs required to enable the programmer to perform software maintenance functions shall be provided.
   2. These shall include program routines to permit dumping of memory, loading of memory, memory print, and related operations.
E. The control software shall include an integral interface supporting access to all real-time database entries.
   1. All database entries shall be accessible for reading, modifying and updating. Calculated results shall be capable of being stored directly onto the database.
   2. The control software shall process all data modified or stored in the database by the user programs in the same manner as all other database entries.
F. The control software shall include an integral interface allowing direct real-time access to all database items by Microsoft EXCEL and the specified historian and reporting applications.

2.09 HISTORICAL DATA STORAGE:

A. Contractor shall furnish a fully operational FactoryTalk Historian package.
B. The system shall store information taken at pre-defined intervals for at least 2500 of any operator selected variables.
C. The system shall utilize a Microsoft SQL database.
D. Access to all historical data storage functions shall be through a user-friendly, interactive menu driven type client interface.
E. All data in the real-time database shall be accessible for historical data storage.
F. All historic data required for display and report generation shall be saved on-line for a period specified by operator.
G. The amount of data stored on-line shall be limited only by the amount of available disk space.
H. Any point may be added or deleted from historical data storing at any time, on-line or off-line, without disrupting the historical data storage function.
I. Sampling of historical data storage points shall be enabled or disabled without requiring addition or deletion of these points and without disrupting the historical data storage function.
J. Provide the password protected capability to edit any data stored by the historical data storage function on-line.
K. Provide an on-line library-type interface for tracking points assigned to historical data storage.
L. The system shall include an alarm/operator action log. The log shall consist of any assigned alarms and operator actions.

M. All data shall be automatically stored and retrieved from hard disk drives in the operator stations.
N. No data shall be lost during a power interruption and no special manual boot-up procedure shall be required by the operator or technician.
O. The system shall provide an adjustable operator alarm whenever the drive capacity exceeds 80% of maximum capacity.
P. All data files shall be manually or automatically (operator selectable) archived. Archived data files shall be retrievable and the system shall have an integrated function capable of displaying retrieved archived data.
Q. Provide an on-line library-type interface for tracking archival media.

2.10 DATA QUALITY:

A. Every database entry, including but not limited to scanned data from the PLC, both discrete and analog, calculated data and data received over networks, shall include indicators for data quality. The data quality indicator shall be updated every time communications with the associated device are attempted or successfully complete. The data quality indicators shall include, but not be limited to:
   1. Old/Bad Data - The point was not able to be scanned when attempted.
   2. Off Scan - The data for this point is not being updated. This indicator may be set as a result of operator request. Only an operator request can place this point back on scan.
   3. Operator Inserted Valve - this indicator is set by the greater on reset when the data is updated by scanned data.
B. A calculated point will have the old/bad data quality if any of its inputs have the old/bad or off scan quality and are not manually entered.
C. Operator entered values are considered good data.
D. Operator entered and off scan, indicators may be set and reset on calculated points by operator action and are independent of the indicators on the calculations input points.

2.11 SECURITY:

A. The control software shall provide a fully integrated password protection scheme by restricting access to system features, functions, and database points. The password protection scheme shall consist of multiple levels of access one of which shall be full access.
B. The ability to assign and modify the access levels shall be restricted to the full access level.
C. The system shall allow assignment of multiple passwords to each access level.
D. The assignment of functions to the various access levels shall be user configurable and restricted to the full access level.

2.12 UTILITY AND SUPPLEMENTAL PROGRAMS:

A. Backup and Recovery Software:
   1. Provide backup and recovery software package as required to perform routine scheduled backups of the plant control system servers.
   2. Shall be compatible with the operating systems supplied.
   3. Synology DiskStation Manager or approved equal. Coordinate with the supplied NAS equipment specified in Section 40 62 00 – Computer System Hardware and Ancillaries.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Sever Based Control Software:
   1. Install all the software and configure system for proper operation.
   2. Configure system for automatic failover as specified.
   3. Provide "staging," checkout, training, and start-up as specified and indicated.

B. Client Software:
   1. Install all the software and configure system for proper operation.
   2. Configure client software for automatic failover as specified.
   3. Configure system to automatically logoff workstations installed after 30 minutes of inactivity. Time period shall be adjustable by the Owner.
   4. Provide "staging," checkout, training, and start-up as specified and indicated.

C. Utility and Supplemental Software:
   1. Install all the software and configure system for proper operation.

3.02 CUSTOMIZED PROGRAMMING AND SCREEN DEVELOPMENT:

A. Refer to Section 40 61 96 – Process Control Software Programming and Reports for customized programming and screen development requirements.

3.03 TRAINING:

A. Refer to Section 40 61 96 – Process Control Software Programming and Reports for training requirements.

B. Training shall conform to the requirements of Section 01664 – Training.

END OF SECTION 40 68 00

SECTION 40 70 00 – INSTRUMENTATION FOR PROCESS SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes the requirements for measuring and controlling instruments.

1.03 RELATED REQUIREMENTS:

A. Section 40 67 00 – Process Control Panels and Hardware.

1.04 REFERENCE STANDARDS:

A. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

B. American Society of Mechanical Engineers (ASME):
   1. ASME B16.5 – Pipe Flanges and Flanged Fittings.

C. International Society of Automation (ISA).
   1. ISA S20 – Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves.

D. National Electrical Manufacturers Association (NEMA).

1.05 SUBMITTALS:

A. Submit as specified in Division 1.

B. Manufacturer with prime responsibility shall assume responsibility for all Compliance Submittals.

C. Product Data: Submit for each type of product specified and included the following as minimum:
   1. Individual specifications and technical data for instruments and similar major system components to conform to ISA S20.
   2. Electrical and mechanical connection diagrams for all instruments.
   3. Physical dimensions for each instrument.

D. Special Procedure Submittals:
   1. Test Plan:
      a. Provide a complete and detailed calibration and test plan for the supplied instrumentation.
      b. Include procedures for certification, validation, and testing.
   2. Syllabus for Owner training.

E. Test and Evaluation Reports:
   1. Factory test and calibration reports.
   2. Field test and calibration reports.

F. Closeout Submittals: Final documentation shall include the following as minimum:
   1. Operation and Maintenance Manuals including the following:
      a. Operation and maintenance manuals for all instruments furnished.
      b. Copies of all approved Product Data.
      c. Copies of all approved Test and Calibration Reports.
      d. Spare parts and supply list.
      e. Warranty Information.
      f. Contractor Information.

g. Training Materials. Includes final edited training videos.

G. Maintenance Material Submittals:
1. Spare Parts:
a. Provide five (5) spare fuses of each type used.
b. Provide any cabling and serial to USB converters necessary to setup and calibrate supplied instrumentation from a laptop computer.
2. Software:
a. Manufacturer supplied software required for setup and calibration of instrumentation shall be provided.

1.06 QUALITY ASSURANCE:
A. Factory Tests:
1. As a minimum, the manufacturer's standard tests and calibration procedures shall be conducted on all instruments.

1.07 DELIVERY, STORAGE, AND HANDLING:
A. Instrumentation and associated equipment shall be packaged and shipped to the project site to avoid damage.
B. All instrumentation shall be stored according to the manufacturer’s instructions.

1.08 WARRANTY:
A. Instruments shall be provided with a minimum 1-year manufacturer’s warranty.
B. In the event a component or instrument fails to perform as specified or is proven defective during the warranty period, the manufacturer shall promptly repair or replace the defective part at no cost to the Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:
A. Radar Level Transmitters:
1. Endress+Hauser, Inc.
2. Magnetrol International, Inc.
3. Rosemount, Emerson Electric Co.
4. Vega.
B. Laser Level Transmitters:
1. ABB.
C. Ultrasonic Flow and Level Transmitters:
1. Rosemount, Emerson Electric Co.
2. Siemens.
3. Magnetrol International, Inc.
D. Float Switches:
1. Anchor Scientific, Inc.
2. Contegra.
3. Flygt.
4. Magnetrol.
E. Point Level Switches:
1. Warrick, GEMS.
2. Engineer Approved Equal.

F. Leak Level Switch:
   1. Flowline, Inc.
G. Magnetic Flow Meters – Inline Type:
   1. ABB.
   2. Endress+Hauser, Inc.
   3. Foxboro, Schneider Electric.
   4. Rosemount, Emerson Electric Co.
H. Thermal Mass Flow Meters:
   1. ABB Inc.
   2. Endress & Hauser.
   3. Magnetrol.
I. Rotameters:
   1. ABB.
   2. Brooks Instrument.
   3. Krohne.
   4. Engineer approved equal.
J. Dissolved Oxygen Analyzers:
   1. Hach Company.
K. pH, ORP, and Conductivity Equipment:
   1. Hach Company.
L. Phosphate Analyzer Equipment:
   1. Hach Company.
M. UVT Analyzers:
   1. Hach Company.
N. Gas Detection Equipment:
   1. Rosemount, Emerson.
   2. MSA.
O. Ozone Detection Equipment:
   1. Teledyne.
   2. BMT.
   3. Engineer-approved Equal.
P. Pressure Transmitters:
   1. ABB.
   2. Foxboro, Schneider Electric.
   3. Rosemount, Emerson Electric Co.
Q. Pressure Switches:
   1. Allen-Bradley, Rockwell Automation, Inc
   2. Ashcroft, Inc.
   3. Barksdale, Inc.
   4. Dwyer Instruments, Inc.
   5. SOR, Inc.
R. Pressure Gauges:
   1. Ashcroft.
   2. McDaniel, Inc.
   3. Engineer-approved equal.
S. Temperature Transmitters:
   1. ABB.
   2. Endress+Hauser, Inc.
   3. Foxboro, Schneider Electric.

4. Rosemount, Emerson Electric Co.
5. Siemens.

T. Temperature Switches:
1. Ashcroft, Inc.
2. Barksdale, Inc.
3. United Electric Controls.

U. Limit Switches:
1. ABB.
2. Allen-Bradley, Rockwell Automation, Inc.
3. Honeywell International, Inc.
4. Square D, Schneider Electric.

V. Flow Switches:
1. B/W Controls, Ametek, Inc.
2. Dwyer Instruments, Inc.
3. Fluid Components, Inc.
4. Magnetrol International, Inc.
5. McDonnell & Miller.

W. Solenoid Valves:
1. ASCO Valve, Inc.
2. DeZURIK.

X. Indicators:
1. Precision Digital Corporation.
2. Red Lion Controls, Inc.

Y. Audible and Visual Devices:
1. Edwards Signaling, United Technologies Corporation.
2. Federal Signal Corporation.

2.02 INSTRUMENTS:

A. Refer to the instrument list at the end of this Section for a list of instruments specified to be provided by this Division.

B. Refer to Division 46 for instruments to be provided with packaged equipment.

2.03 GENERAL:

A. Transmitters shall have an output signal of 4 to 20 mA dc into a minimum load range of 0-600 ohms at 24Vdc.

B. All analog indicating and recording receivers shall have evenly graduated scales.

C. Provide all mounting brackets, pipe stands, and accessories required to install all field mounted instruments. All mounting brackets and hardware for instruments installed in exterior locations or within process areas shall be stainless steel. Wall-mounted brackets for level sensors shall be slotted at end for sensor removal.

D. Furnish and install all accessories required for complete and working systems as specified and indicated.

E. Provide sun shades for all exterior mounted transmitters.

F. All flanged instruments shall comply with ASME B16.5.

G. All instruments or instrument wetted parts contacting the process stream directly shall comply with NSF 61 for contact with potable water.

2.04 RADAR LEVEL TRANSMITTERS:

A. Provide loop powered radar level transmitter for continuous level detection of liquids.

B. Provide 316 stainless steel, PTFE encapsulated, or equivalent antenna. Minimum horn size of 2-inch. Antenna extensions of 8-inch and greater shall be provided as required for the indicated application and mounting style.
   1. Maximum beam angle of 8 degrees for liquid applications, unless otherwise specified.
   2. Radar level transmitters for the Coarse Screening System and Influent Pump Station Wet Well shall have a maximum beam angle of 3 degrees or be laser level transmitter type.
   3. The cone shall be sealed from the process environment.

C. Process connection of 6-inch 150lb flange unless required or indicated otherwise.

D. NEMA 4X aluminum housing with LCD display.

E. Provide 4-20mA analog signal proportional to level.

F. System accuracy shall be within ±0.25-inch.

G. Unit shall be capable of mapping out unwanted obstructions via user friendly interface software. Provide required software and cable to connect to the unit.

H. Provide waveguide extension for proper mounting when required for the indicated application.

I. Provide sunshield for outdoor mounted units.

J. Provide a stainless-steel mounting bracket for units indicated to be wall mounted.

2.05 LASER LEVEL TRANSMITTERS:

A. Provide loop powered laser level transmitter in lieu of radar level transmitter where maximum beam angle of 3 degrees is not possible.

B. Shall use an eye safe laser beam for measurement. Maximum beam angle of 0.5 degrees.

C. Measurement range shall be 2 – 100 feet for liquids and 2 – 330 feet for solids

D. Mounting:
   1. Process connection shall be a 2-inch 150lb stainless-steel flange unless required otherwise.
   2. Provide stainless steel mounting bracket for units when indicated to be wall mounted.

E. NEMA 4 aluminum housing with LCD display.
   1. Provide Intrinsically Safe, Class 1, Division 1 rated housing for units installed within classified hazardous areas.

F. Provide 4-20mA analog signal proportional to level.
   1. Provide with HART communication capability. Provide device type manager (DTM) software module for use in HART device setup and monitoring software if required.

G. System resolution shall be within ±0.2-inch. System accuracy shall be within ±0.4-inch.

H. Provide sunshield for outdoor mounted units.

I. Provide screwed-on stainless steel nameplate with instrument tag number as identified on Contract Documents.

J. Provide ABB LLT100 series or Engineer-approved equal.

2.06 ULTRASONIC LEVEL AND FLOW TRANSMITTERS:

A. System shall consist of an ultrasonic transponder and a separately mounted transceiver and transmitter to measure level or flow in the locations specified and indicated.

B. System accuracy shall be within ±0.5% of calibrated span.

C. Transducer:
   1. Shall be completely encapsulated in a PVDF housing.
   2. Process connection of 2-inch NPT unless required otherwise. Provide with threaded connection and bracket hardware as required for the indicated mounting.
   3. Provide a temperature sensor at the transducer housing to sense ambient temperature.
   4. Transducer range shall be as specified.

5. Provide the cable to connect the transducer to the transmitter. Coordinate length with installing Contractor.
6. Provide a sun shield over transducers exposed to direct sunlight.
7. Shall be rated for installation in a Class 1, Division 1 or 2, Group D hazardous environments when installed within classified areas.

D. Transceiver and Transmitter:
1. Microprocessor based digital design.
2. Provide temperature compensation to correct for speed variations of the ultrasonic signal due to air temperature changes.
3. Field calibration of zero and span shall be accomplished by keypad or wireless remote.
4. Provide a linear 4-20mA output signal proportional to level or flow of liquid as applicable.
5. Shall have an integral display.
6. Enclosure shall be rated NEMA 4X.
7. Shall have the capability to map out obstructions in the beam path.
8. Shall operate from 120Vac, 60-hertz.
9. Enclosures installed outdoors shall have a thermostatically controlled strip heater to prevent condensation.

2.07 FLOAT SWITCHES:

A. Rigid float switch constructed of 316 stainless steel, PVC, polypropylene, or equivalent materials.
B. One N.O. contact rated 1.0 Amps, 120Vac minimum.
C. Furnished with necessary length of cable and weight kit for cable suspension.
D. Float switches shall be mercury free.
E. Provide intrinsically safe barrier relay for hazardous locations. Intrinsically safe barriers shall be as specified in Section 40 67 00 – Process Control Panels and Hardware.

2.08 POINT LEVEL SWITCH:

A. Provide conductivity type level switches for liquid or solids level detection.
B. Provide additional reference probe.
C. Wetted parts shall be 316 stainless-steel.
D. Probe electrode shall be housed in plastic shielding.
E. Probe shall be designed to be suspended in liquid with PVC-insulated wires.
F. Provide length of cable as required for installation.
G. Process connection shall be as required.
H. Provide necessary adapter kits and fittings. Materials for adapter kits and fittings shall be 316 stainless steel, PVC, or Teflon.
I. NEMA 4X housing.
J. Powered from 120Vac.
K. Provide intrinsically safe barrier control relay for use in hazardous locations. Intrinsically safe barriers shall be as specified in Section 40 67 00 – Process Control Panels and Hardware.
1. Relay shall provide 1 N.O. and 1 N.C. output contact rated 0.5Amps at 120Vac.
2. Relay sensitivity shall be field adjustable and provide for a minimum of 200 feet of wire from relay to probe.

2.09 LEAK LEVEL SWITCH:

A. Optical leak detection level switch.
B. NEMA 6 polypropylene housing with 3/4-inch NPT mounting thread.

C. When the switch is mounted 1/8-inch above finished floor, the sensor shall be able to detect a liquid level at or below 3/8-inch above floor.
D. Minimum accuracy to ± 1/16 inch.
E. Shall operate from 24Vdc.
F. Provide normally open relay contact that closes when liquid is detected. Contact shall be rated a minimum of 1 Amp at 24Vdc.
G. Provide with a minimum of 10-foot of cable. Provide additional length when required to interface designated termination junction box.

2.10 MAGNETIC FLOW METERS- INLINE TYPE:

A. The flow meter system shall consist of a flow element and an indicating transmitter remotely or integrally mounted to the meter tube assembly.
B. System shall be accurate to within ±0.5% of flow rate for velocities between 3 and 30 feet per second and shall measure flow in either direction.
C. Meter Body:
    1. Stainless steel tube with carbon steel flanges.
    2. Flanges shall be type ASME Class 150 below 24-inch and AWWA Class D above 24-inch.
    3. Electrodes shall be 316 stainless steel or Hastelloy/C22 unless indicated otherwise. Provide Hastelloy/C22 electrodes for chemical feed applications.
    4. Liner shall be hard rubber or equivalent.
    5. Sizes as specified in this Section.
    6. Shall be rated IP68 for continuous submergence when installed in below grade vaults. Provide “potted” cabling with adequate length of cable between the flow tube and the remote mounted transmitter.
    7. When installed within classified areas, the meter and transmitter shall be rated for installation in Class 1, Division 2, Group D Hazardous Environment.
D. Transmitter:
    1. Magnetic flow meter shall have "DC" excited coils.
    2. The transmitter electronics shall be microprocessor based.
    3. Shall accept the millivolt input from the meter and provide a 4-20mA linear output signal proportional to flow.
    4. LCD display and keypad.
    5. Provided with empty pipe detection that will automatically detect an empty pipe and zero the flow display and output signal.
    6. Remote Mount:
        a. Provide wall mounted transmitter as indicated.
        b. NEMA 4X polycarbonate enclosure.
        c. Shall operate from 120Vac, 60 hertz.
    7. Integral Mount:
        a. Provide integral mounted transmitter as indicated.
        b. NEMA 4X or NEMA 6 coated aluminum enclosure.
        c. Shall operate from 120Vac.
    8. Flow meter shall be capable of measuring forward and reverse flow. Provide an output dry contact to indicate flow direction. Contact shall close when reverse flow is detected. Dry contact shall be rated a minimum of 1 Amp at 24Vdc.

E. Accessories:
   1. Cabling between transmitter and meter body shall be provided by the meter manufacturer. When not available, cabling shall be provided and installed to meet the manufacturer's requirements.
   2. Provide length of cable as required for installation.
   3. Provide a stainless-steel grounding ring on the inlet and outlet.

2.11 THERMAL MASS FLOWMETERS:

A. Insertion style or flanged in-line thermal mass flowmeters shall be provided for gas flow monitoring as specified.
B. Flow element shall be 316L stainless steel and suitable for measurement of process air.
C. Process connection shall be 1″ NPT or flanged where required for small diameter piping. Connection type shall be as recommended by the manufacturer or equipment supplier for each application.
D. Minimum turn down ratio of 20:1 or as required to meet requirements of full operating range.
E. Minimum accuracy of ±1% of reading, ±0.5% of full scale and repeatability of ±0.5% of reading.
F. Transmitter:
   1. Integral mounted transmitter shall include LCD readout display and required interface for programming and instrument setup.
   2. Shall include a minimum of one 4-20mA outputs proportional to flow.
   3. Enclosure shall be NEMA 4X rated, coated aluminum or stainless steel.
   4. Powered from 120Vac.
G. Each meter shall be factory calibrated and provided with a certificate of calibration.
H. Unit shall be programmed using project-specific application data.
I. Provide sunshield for outdoor mounted units.

2.12 ROTAMETERS:

A. General performance rotameters shall be provided as indicated and specified for each application.
B. Materials:
   1. Tube/Body: Acrylic plastic.
   2. Float: Glass or 316 stainless-steel.
   3. End fittings: 316 stainless-steel.
C. Design and Fabrication:
   1. Integral needle valve.
   2. Direct reading scale.
   3. Clean-out plugs.
   4. Accuracy: ±10%.
D. Design pressure: 100 psi.
E. Flow range shall be selected as required for each application.

2.13 ANALYTICAL INSTRUMENTATION:

A. Dissolved Oxygen Analyzers:
   1. The system shall consist of a sensing probe and analyzer/transmitter.
   2. Sensing Probe:
      a. The sensing probe shall be a continuous-reading probe utilizing luminescent sensor technology.

b. The probe shall be constructed of foamed Noryl or equal, and 316 stainless-steel. All parts of the probe shall be corrosion-resistant and fully immersible.
c. The measurement range shall be 0.00 to 20.00 mg/L (or ppm) dissolved oxygen and be accurate with ± 0.2ppm of span.
d. The probe shall be rated for 0 to 50°C operation.
e. The probe shall have an integral sensor cable with a continuous length of cable for connection to the transmitter at location indicated. The cable shall be terminated with a quick-disconnect plug.
f. The sensing probe shall be capable of being remotely mounted up to 100 meters from the transmitter, or 1,000 meters when used with a termination box.
(1) Mounting Hardware:
(2) The probe shall be provided with a pole or ball-float mounting hardware as required for the application or as indicated otherwise.
(3) Provide handrail mounting hardware when required for the application or as indicated.
g. The probe shall be rated for use in Class I, Division 2, Group D hazardous locations.
h. Shall be LDO Probe (Model 2) as manufactured by Hach Company.
i. Analytical Controller/Transmitters shall be as specified in this Section.

B. pH Analyzers:
1. The system shall consist of a digital sensor electrodes, preamplifier, and analyzer/transmitter.
2. pH Sensor:
a. Differential type with two measuring electrodes and an internal reference electrode.
b. Replaceable salt bridge.
c. Encapsulated electronics.
d. Built-in temperature sensor for automatic temperature compensation and transmitter display.
e. Operating range shall be 2-12 pH.
f. Combination measuring/reference assembly.
g. Operating Range of -5 to 70°C.
h. Measuring electrode shall be glass tip with silver-chloride internal element.
i. Reference electrode shall be gel type, non-flowing silver-chloride in saturated potassium chloride electrolyte.
j. The probe shall be rated for use in Class I, Division 2, Group D hazardous locations.
k. Hach Company pH sensor Model DPD1P1 or equal.
3. Electrode Mounting Assembly:
a. Convertible style with 1-inch NPT threads on each end and suitable for flow through, insertion, or immersion as specified in this Section.
b. Shall be provided with a guard to protect glass electrode tips from breakage.
c. Wetted parts shall be constructed of a material compatible with the solution being measured.
d. Provide a temperature sensor for automatic temperature compensation.
e. Provide cable length as required between sensor and transmitter.

C. ORP Analyzers:
1. The system shall consist of a digital sensor, preamplifier, and analyzer/transmitter.
2. ORP Sensor:

a. The ORP sensor shall be of differential electrode technique design using two measuring electrodes to compare the process value to a stable internal reference standard buffer solution. The standard electrode shall have non-flowing and fouling-resistant characteristics. Reference electrode shall be gel type, nonflowing silver silver chloride in saturated potassium chloride electrolyte.
b. The sensor shall be suitable for immersion applications and shall be constructed of 316 stainless steel with a platinum or gold electrode.
c. The built-in electronics of the sensor shall be completely encapsulated for protection from moisture and humidity.
d. The sensor shall include built-in digital electronics.
e. The sensor signal shall have an integral temperature sensor to automatically compensate measured values for changes in process temperature.
f. The sensor shall include a titanium ground electrode to eliminate ground loop currents in the measuring electrodes.
g. The probe shall be rated for use in Class I, Division 2, Group D hazardous locations.
h. Provide with mounting hardware style and accessories as indicated.
i. The sensor shall be HACH DRD1P5 or engineer approved equal.

3. Electrode Mounting Assembly:
a. Designed for flow through, insertion, or immersion as specified in this Section.
b. Immersion type shall be provided with a guard to protect glass electrode tips from breakage.
c. Wetted parts shall be constructed of a material compatible with the solution being measured.
d. Provide with an integrated temperature sensor for automatic temperature compensation.
e. Provide a preamplifier mounted in the electrode assembly.

D. Total Suspended Solids (TSS) Analyzers:
1. The suspended solids system shall consist of an immersion/insertion style sensing probe and analyzer/transmitter.
2. The system shall measure turbidity and suspended solids in the range of 0-9999 NTU and 0-500g/L respectively. Final
3. Accuracy shall be less than 5% of measured value or ±0.01 NTU, whichever is greater for turbidity.
4. Repeatability shall be better than 3.0% of reading for turbidity and 4.0% for solids (TS).
5. Sensor:
a. Double optical system with two pulsating infrared LEDs and four receivers.
b. Light shall be scattered with the receivers detecting the incident light at 90 and 120 degree angles for suspended solids and at 90-degrees for turbidity in accordance with DIN/E27027/ISO 7027.
c. The wavelength for both parameters shall be 860nm.
d. The measurement system shall be equipped with bubble and temperature compensation software.
e. Sensor shall be capable of immersion in a tank [or inserted into a pipe depending on the application].
f. Shall be constructed of stainless steel.
g. High polished sensor head for self-cleaning action and a scratch-resistant sapphire window for harsh environments.
h. Provide interconnecting cable between sensor and transmitter.

i. Rated for use in Class I, Division 2, Group D hazardous locations.
j. Hach Company sensor Model TSS Ex1 sc for hazardous locations and TSS sc for non-hazardous locations.

6. Accessories:
   a. Provide Stainless Steel ball valve and Tri-Clamp mounting hardware for pipe mounting when indicated.
   b. Provide pole mounting hardware when indicated.
   c. Provide all required fittings and accessories for complete installation.

E. Ultraviolet Transmittance (UVT) Analyzer:
1. The system shall consist of a sensing probe and analyzer/transmitter.
2. Sensing Probe:
   a. The sensing probe shall be designed to continuously monitor UV absorbance and percent transmittance in water.
   b. Method of measurement shall be determining the Spectral Absorption Coefficient (SAC) at a wavelength of 254 nm using a 2-beam ultra-violet absorption technique with a 1, 2, 5 or 50 mm path length.
   c. Sensor path length shall be selected by the UV System Equipment Supplier.
   d. The sensing probe shall be constructed of a 316-stainless steel. All parts of the probe shall be corrosion-resistant and fully-immersible.
   e. Sensor shall include a self-cleaning wiper system to automatically clean the detector window.
   f. The probe shall be rated for sample temperatures of 2 to 40°C, with a pH range of 4.5 to 9.
   g. The probe shall have an integral sensor cable with a continuous length of cable for connection to the transmitter at location indicated. The cable shall be terminated with a quick-disconnect plug. Cable length shall be 30 feet minimum.
   h. The probe shall be provided with a 90 degree adapter and mounting hardware as required for the application or as indicated.
   i. Shall be UVAS plus sc as manufactured by Hach Company.

F. Phosphate Analyzer:
1. The analyzer shall utilize the vanadomolybdate yellow colorimetric method to measure ortho-phosphate.
2. Housing shall be NEMA 4X/IP55 rated and designed for wall mounting.
3. The measurement range shall be 0.05 to 15.00 mg/L and be accurate with ±2% of calibrated span.
4. Operating temperature range of -20 to 45°C operation.
5. The sample response time shall be 5 minutes maximum, including sample preparation.
6. Sample temperature range of 4 to 40°C.
7. Analyzer shall be self-cleaning and zero-calibrate automatically and equipped with self-diagnostics.
8. A sample filtration system shall be provided to condition the sample for the analyzer.
   a. The sampling system shall consist of a control unit, submersible filter module holder and sample delivery hose to deliver a sample at a rate of up to 900mL/h.
   b. Enclosures shall be constructed of stainless steel and rated IP55. The control unit enclosure shall be internally heated for outdoor installation and suitable for an operating range of -20 to 40°C (-4 to 104°F).
   a. Suction and Sample delivery hoses shall be heated. Provide length of hose as required for the indicated installation.

b. The controller shall include a menu-driven display for monitoring the unit. Self-diagnostics shall provide monitoring of components and include alarm notification for operator error messages.
(1) The controller shall include two programmable alarm relays rated for 120Vac, 3A as minimum.
c. The system shall include a built-in air purge system to reduce adhesion of solids to the filter membranes.
d. The unit shall operate from a single 120Vac power supply.

9. The Analyzer shall operate from 120Vac as supplied from the controller/transmitter or from the "power box" accessory. Provide an accompanying analytical controller/transmitter as specified in this section.
10. Provide the necessary rail mounting kit and associated hardware for the analyzer housing and the required transmitter.
11. Provide Hach Company PHOSPHAX sc Phosphate Analyzer, Filtrax filtration system, and SC4500 controller with power box accessory.

G. Analytical Controllers/Transmitters:
1. Controller/Transmitters shall be provided for each of the specified analytical sensors. The transmitter shall be a microprocessor-based controller with plug and play connection of associated sensors.
2. Menu driven software to allow for straight forward calibration and selection of display parameters.
3. A backlit touchscreen TFT color display shall be provided for programming and displaying operating parameters.
4. The transmitter shall be rated for -20 to 45°C operation at 20W or less sensor load.
5. Capable of monitoring a minimum of two separate sensing probes specified.
a. For areas that indicate more than two sensors are connected to a single transmitter, a multi-channel unit may be provided and combined with other analytical sensors specified in this Section.
6. The transmitter shall store all user settings in non-volatile memory (EEPROM).
7. The transmitter unit shall have a built-in data logger function.
8. Provide the following outputs:
a. Two SPDT, user programmable contacts each rated 5A at 120Vac.
b. Five independent analog 4-20mA outputs. Capable of handling an output impedance of up to 500 Ohms.
9. The controller shall include a minimum of two 10/100 Mbps Ethernet ports.
a. One port(s) shall be configured with EtherNet/IP communication protocols for integration into the indicated network.
10. Provide with a USB port for data download and software upload.
11. Enclosure shall be rated NEMA 4X and shall be capable of wall, pipe, or panel mounting.
12. Provide a sun shield for outdoor units to protect units from direct sun contact.
13. Shall operate on 120Vac.
14. Provide SC4500 controller or approved equal with specified options for up to two channel installations. Provide SC1000 controller base unit and an associated touchscreen unit or approved equal when more than two channels are required and indicated for a single location.

H. Instrumentation Mounting Panels (Wet Panels):
1. Transmitters, sensors, flow cells and sample piping shall be mounted, wired, and plumbed on an aluminum, PVC, or other heavy-duty non-metallic plate material suitable for wall mounting.

2. Refer to the Contract Drawings for group mounted instrument panel locations.

2.14 TOTAL SOLIDS (TS) METER:

A. The total solids (TS) metering system shall consist of a flow through sensor and transmitter with user interface.
B. The system shall utilize microwave-based technology to measure total solids in the range of 0-50% TS.
C. Sensitivity shall be 0.001% TS with a pressure measurement accuracy of ±1.5psi (0.1 bar) between 0-290psi (25bar).
D. Repeatability shall be better than ±0.01% for total solids (TS).
E. Sensor:
   1. Flow through design with AISI 316L stainless steel wetted parts.
   2. Sealing rings shall be EPDM (Rubber) or PTFE (Teflon).
   3. Stainless steel mounting hardware.
   4. Rated for use in Class I, Division 2, Group D hazardous locations.
   5. Provide interconnecting cable between sensor and transmitter. Length as required.
F. Unit shall be operable from -20 to 70°C (-4 to 158°F) and housed in a NEMA 4X rated enclosure.
G. Transmitter:
   1. The transmitter shall be a microprocessor-based controller plug type connection to sensor.
   2. A backlit touchscreen TFT color display shall be provided for programming and displaying operating parameters. The transmitter unit shall have a built-in data logger trending function.
   3. Suitable for operation within a -5 to 50°C (23 to 122°F) temperature range.
   4. Provide the following inputs and outputs:
      a. Two SPDT, user programmable output contacts each rated 2A at 120Vac.
      b. Two independent analog 4-20mA outputs. Capable of handling an output impedance of up to 500 Ohms.
      c. Four 24VDC/10mA isolated binary inputs.
   5. The controller shall include an Ethernet connection port and USB port for software updates and data backup.
   6. The enclosure shall be constructed of aluminum, rated NEMA 4X, and be capable of wall, pipe, or panel mounting.
   7. Shall operate on 120Vac, 10W or less sensor load.
H. Provide Valmet TS flow through sensor (TB) with Valmet Bridge operating terminal.

2.15 GAS DETECTION EQUIPMENT:

A. Controller:
   1. Provide a micro-processor based controller. The controller shall have a minimum of four channels designed to accept combustible or toxic gas detector head inputs as indicated and specified.
   2. Digital readout display for each channel that reads %LEL, PPM, or % Vol. Decimal may be set in any position.
   3. Inputs shall accept 4-20 mA signal for each channel.
   4. Controller shall have one 4-20 mA output for each channel.
   5. Housed in a NEMA 4X FRP or ABS enclosure.
   6. The controller shall include a minimum of one programmable alarm outputs per channel with an additional common fault alarm.

7. All functions shall be fully programmable through software or dip and push button switches.
8. UL Listed.
9. The unit shall be calibrated based on manufacturer recommendations for this project.
10. Provide MSA GasGard XL controller or Engineer approved equal.

B. Gas Sensing Transmitters:
1. Provide stand-alone combustible gas detection transmitters for gas monitoring as indicated.
2. Gas sensing transmitter shall include a 4-20mA output to indicate gas level.
3. Nonintrusive calibration via a magnetic wand.
4. User adjustable "calibration reminder" message.
5. LCD display with backlight for local indication.
6. Shall connect to Gas Controller as specified.
7. Housed in rugged, copper-free aluminum NEMA 4 explosion proof enclosure.
8. Gas type monitored shall be Methane or H2S as indicated.
9. Provide Rosemount, Emerson Millennium II series or Engineer approved equal.

C. Calibration Kit:
1. Provide one calibration kit for each type of Gas Detector Head provided.
2. Calibration kits shall be as recommended by the manufacturer for each type of detector used.

2.16 AMBIENT OZONE MONITORING EQUIPMENT:

A. Ambient ozone system monitoring shall be provided at the locations indicated in the Drawings and as specified.

B. The ambient ozone systems shall provide local and remote indication of an alarm condition.

C. At a minimum, units shall be provided as indicated on the project instrument list. If additional units are required to provide complete coverage and personnel protection within the space as determined by the ozone system supplier (OSS), they shall be provided.

D. Gas Detectors:
1. Provide ambient ozone units with sensing elements.
2. Ozone units shall be provided with integral sample pump and sample intake to allow sample to be collected near floor level. Provide required cabling and/or tubing for sampling.
3. Provide ozone destructor on sensor discharge of ozone monitors.
4. Transmitters:
a. Electronic, microprocessor based with an integral backlit LCD display and pushbuttons for unit setup.
b. Powered from 120Vac.
c. Provide with a 4-20mA outputs proportional to gas level. Provide one (1) output per sample stream.
d. Provide with one alarm relay and one fault relay rated a minimum rated for 5Amps at 30Vdc and 120Vac.
e. Enclosure shall be NEMA 4X rated designed for wall mounting.
f. The ambient ozone monitor shall have adjustable alarm setpoints and will energize an alarm for the following alarm setpoints:
(1) High alarm: 0.1 ppm (ozone concentration alarm setpoint not to exceed 0.1 ppmv).
(2) High-high alarm 0.3 ppm (ozone concentration alarm setpoint not to exceed 0.3 ppmv).

5. Ozone Sensors:
   a. Ultraviolet absorption ozone photometer-type instrument to detect Ozone concentration in air.
   b. Shall have a range of detection adjustable from 0-1 ppm to 0-500 ppm.
   c. Shall include an internal ozone scrubber.
      The sensor's exhaust shall be vented outdoors. All required piping and installation shall be provided by the OSS.
   d. The sensor shall include a minimum of three ozone sample streams. If additional streams are required to provide complete coverage and personnel protection within the space as determined by the ozone system supplier (OSS), they shall be provided.
6. OSS shall provide gases for startup, testing, and initial calibration.
7. Provide Teledyne 465L or Engineer-approved equal.

2.17 DIFFERENTIAL AND GAUGE PRESSURE TRANSMITTERS:

A. Electronic, two-wire type with a 4-20mA output and integral LCD display for use in both pressure and hydrostatic level applications.
B. Stainless steel Aluminum body with stainless steel wetted parts.
C. Sensor fill fluid shall be silicone oil unless recommended otherwise by the manufacturer.
D. Measuring element shall be a resonant wire or strain gauge type.
E. Process connections. Provide one of the following connection types as indicated or required for the application. Refer to instrument list and P&ID drawings for requirements.
   1. Provide unit with direct connect 2-inch ASME Class 150 flange when indicated.
   2. Provide 1/2-inch NPT when indicated.
   3. Provide with a fitted pressure sensor/annular seal when indicated.
F. Accuracy including hysteresis, linearity, and repeatability shall be within ±0.20% of calibrated span.
G. Provide zero, span, and damping adjustments. Zero adjustment shall be external.
H. Zero suppression or elevation shall be adjustable to a minimum of 100% of calibrated span.
I. Enclosure shall be NEMA 4X epoxy coated aluminum.
J. Enclosure shall be rated IP68 for continuous submergence when installed in below grade vaults.
K. For units installed in hazardous locations, shall be rated for use in a Class 1, Division 1 and 2, Group D atmosphere.
L. Designed for wall or pipe mounting.
M. Pressure Sensors/Annular Seals shall be as follows:
   1. Annular seals shall be provided for wastewater and harsh or abrasive chemical applications when indicated for pressure transmitters.
   2. Sensor shall be full flange, flow through design with flexible elastomer sensing ring around the full circumference. The pressure sensing ring shall measure pressure for 360° around the full inside circumference of the pipe.
   3. For level applications sensor accuracy shall be ±2" or better.
   4. Flexible sensing ring shall have a cavity behind the ring filled with fluid to transfer pressure to transmitter.
   5. Flange bolts shall pass through sensor body and flanges. Flange type and pressure class shall match the adjoining pipes flange type and pressure class.
   6. The manufacturer shall fill pressure sensor and transmitter assembly with silicone oil and calibrate unit prior to shipment.
   7. Pressure sensors shall be Red Valve Co. Series 40 or Engineer-approved equal.

N. Accessories:
1. Stainless steel three-valve manifold for all differential pressure transmitters.
2. Stainless steel two-valve block and bleed manifold for all pressure transmitters.
3. Provide stainless steel mounting bracket for units indicated to be wall mounted.
4. Provide sealing diaphragms for hydrostatic level applications and other locations indicated.
5. Provide pulsation dampeners (snubbers) in pressure transmitter sensing lines located at pump discharge.
6. Provide with remote atmospheric pressure compensation tube when required.

2.18 PRESSURE SWITCHES AND GAUGES:

A. Diaphragm Switches:
1. Diaphragm sealed pressure switch with stainless steel wetted parts.
2. NPT process connection, size as required.
3. Snap action SPDT switch rated 4 amps at 120Vac minimum.
4. Housed in a NEMA 4X enclosure, unless specified otherwise.
5. Adjustable pressure set point.

B. Bourdon Tube Switches:
1. Brass bourdon tube element.
2. SPDT switch rated 4 amps at 120Vac minimum.
3. Housed in a NEMA 4X enclosure, unless specified otherwise, with a front mounted glass viewing window for observing switch settings.
4. Adjustable differential with independent adjustment knobs for the upper and lower operating points. Adjustable over the operating range.

C. Pressure Gauges:
1. Shall be minimum 4-1/2” dial size.
2. Phenolic or aluminum case and ring. Case and ring material shall match.
3. Liquid filled (Glycerin).
4. Acrylic window with rotary movement.
5. Accuracy shall be ±0.5% of span.
6. Shall include 1/4 inch NPT process connection and stainless steel gauge cock unless specified otherwise.
    a. Process connection location shall be selected based on each application and as indicated for lower, top, and side connections.
7. Wetted components shall be 316 SS.
8. Pressure range shall be as specified for each application.

D. Pressure Sensor/annular seal shall be provided for pressure instrumentation as follows:
1. Provide pressure sensors when indicated.
2. Sensor shall be full flange design.
3. Sensor shall be flow through design with flexible elastomer sensing ring around the full circumference. The pressure sensing ring shall measure pressure for 360° around the full inside circumference of the pipe.
4. For level applications sensor accuracy shall be ±2" or better.
5. Flexible sensing ring shall have a cavity behind the ring filled with fluid to transfer pressure to transmitter.
6. Flange bolts shall pass through sensor body and flanges. Flange type and pressure class shall match the adjoining pipes flange type and pressure class.
7. The manufacturer shall fill pressure sensor and transmitter assembly with silicone oil and calibrate unit prior to shipment.

8. Pressure sensors shall be Red Valve Co. Series 40 or Engineer-approved equal.

2.19 TEMPERATURE TRANSMITTERS:

A. Provide loop powered temperature transmitter for monitoring of air or liquid temperature.
B. NEMA 4X aluminum housing with LCD display.
C. Provide 4-20mA analog signal proportional to temperature.
D. Suitable for wall or process mounting.
E. Spring loaded platinum RTD sensing element.
F. Provide compact stainless steel sensing element when used for ambient air sensing applications.
G. Provide stainless steel thermowell with a 4-inch immersion length and a 1-inch process connection when used for liquid or air sensing in a pipe.

2.20 TEMPERATURE SWITCHES:

A. Provide adjustable temperature switch as indicated and specified.
B. Nominal temperature setting shall be adjustable over the full operating range. Setpoints and ranges shall be as indicated.
C. Shall have a minimum of one SPDT relay output that shall close when the temperature drops below or rises above the set point as required for the application.
D. Relay output shall be rated a minimum of 5 Amps at 120Vac.
E. NEMA 4X enclosure for non-hazardous locations. NEMA 4X with hermetically sealed switch or NEMA 7 enclosure for use in Class I, Division 1 and 2 locations.

2.21 LIMIT SWITCHES:

A. SPDT contacts rated 5 amps at 120Vac minimum.
B. Snap action type switch in a NEMA 4 or 4X enclosure.
C. Operator type as required for the function specified or indicated.

2.22 FLOW SWITCHES:

A. Vane type:
   1. Liquid flow switch to detect a flow/no flow condition.
   2. For installation in line size(s) as specified or indicated. Paddle size shall be selected according to installed pipe size.
   3. 316 Stainless steel body. Wetted materials shall be 316 stainless steel.
   4. Process connection shall be 1″ NPT unless indicated otherwise.
      a. When required for high flow applications connection size may be increased per manufacturer recommendations.
   5. Sensitivity adjustment over units entire flow range. Flow range shall be selected based on the application.
   6. SPDT snap switch rated for 120Vac, 5A minimum.
   7. Integral termination enclosure with screw type terminal connections.
   8. NEMA 4X or 7 rated enclosure as applicable for the environment.
   9. Manufactured by McDonnell & Miller (FS series), Dwyer Instruments (Series V4), or approved equal.
B. Thermal dispersion type:
   1. Insertion flow switch. Suitable for detecting no flow condition of process fluid specified.
   2. Field adjustable switch point. Flow range shall be as specified or as selected by packaged system manufacturer.
   3. Install in piping with orientation as recommended by switch manufacturer.

4. Probe insertion length shall be as required for application and installation conditions.
5. Wetted parts constructed of: 316/316L stainless steel.
6. 120Vac supply voltage with two SPDT relays. Minimum contact rating of 5 Amps @ 120Vac.
7. Epoxy coated aluminum or 316 stainless steel, NEMA 4 enclosure with stainless steel identification tag.
8. Operating temperature range of -40 to +140°F minimum.
9. Magnetrol, Model TD1/TD2, or approved equal.

2.23 SOLENOID VALVES:

A. Solenoid operated, two way, three way, and four way control valves.
B. Molded Class F or Class H, 120Vac coil in NEMA Type 4X enclosure.
C. Shall be UL listed for Class 1, Division 2 locations when installed within a classified space.
D. Stainless-steel body.
E. Integral maintained manual operator.
F. Spring return to normal, except for double coil valves.
G. Provide with electrical transient surge suppressor installed across coil.

2.24 INDICATORS:

A. Digital Panel Meters (LED):
   1. 7-segment light emitting diode (LED) display.
   2. 0.5 inch high digits, number as specified.
   3. Input signal shall be 4-20 mA dc.
   4. Readout shall be in engineering units specified.
   5. A/D conversion shall be dual slope integration method.
   6. Zero offset and span adjustments shall be factory set as specified and shall be field adjustable.
   7. Shall operate from a 120Vac, 60 hertz power supply.
   8. Field selectable decimal point.
   9. Normal Mode Rejection Ratio shall be 40 dB or greater at 60 hertz and Common Mode Rejection Ratio shall be 80 dB or greater from dc to 60 hertz.
   10. Housed in a NEMA 4X, aluminum enclosure or panel mounted enclosure as applicable.
   11. Provide barrier terminal strips for external connections.
   12. Furnish with mounting brackets and trim strips.
   13. Shall include an isolated 4-20mA output when indicated or required to drive external inputs.

B. Digital Panel Meters (LCD, Loop Powered):
   1. Dual-line 7-segment liquid-crystal display (LCD) display with backlight.
   2. 0.5 inch high digits or greater. Shall have a minimum of 5 digits.
   3. Input signal shall be 4-20 mA dc.
   4. Readout shall be in engineering units specified.
   5. A/D conversion shall be dual slope integration method.
   6. Zero offset and span adjustments shall be factory set as specified and shall be field adjustable.
   7. Shall be powered from the 4-20mA loop power supply.
   8. Field selectable decimal point.
   9. Normal Mode Rejection shall be 60 dB or greater at 60 hertz.
   10. Housed in a NEMA 4X, high impact plastic or aluminum enclosure. Designed for panel mounting when indicated.

11. Provide barrier terminal strips for external connections.
12. Furnish with mounting brackets and trim strips.

C. Large Display Process Meters:
1. Seven segment LED display housed in a NEMA 4X aluminum enclosure.
2. Enclosure designed for wall mounting with provisions for conduit entry.
   a. When indicated provide enclosure designed for panel mounting. Provide necessary mounting bracket and trim strips.
3. Minimum 2.25-inch or 4-inch high red digits as indicated.
4. Minimum 4 1/2 digit display.
5. Powered from 120Vac.
6. Accuracy of ±0.05%.
7. Input signal shall be 4-20mA.
8. Screw type terminal blocks.
9. Shall include an isolated 4-20mA output when indicated.

D. Accessories:
1. Provide outdoor mounted indicators with stainless steel sunshield to protect display from sunlight and to allow for daylight viewing.

2.25 AUDIBLE AND VISUAL DEVICES:

A. Electro-Mechanical Horns:
1. Die-cast zinc housing with a corrosion-resistant grey powder-coat finish and stainless steel hardware
2. Shall be housed in a NEMA 4X, IP65 enclosure and be UL Listed for indoor/outdoor use.
3. Provide with panel gasket kit or weatherproof back box as applicable for the application.
4. Vibrating horn with stainless steel diaphragm produces 100dB @ 10 feet at maximum setting.
5. External volume control shall be provided by a set screw adjustment.
6. Shall operate from a 120Vac Power Source.
7. Suitable for indoor and outdoor use.
8. Provide Federal Signal Model No. 350WB-120 with WB backbox or Engineer approved equal.
9. Install at locations indicated.

B. Electro-Mechanical Horns (Hazardous Location):
1. Die-cast zinc housing with a corrosion-resistant polyurethane finish and stainless steel hardware
2. Vibrating horn with stainless steel diaphragm produces 100dB @ 10 feet at maximum setting.
3. External volume control shall be provided by a set screw adjustment.
4. Shall be housed in a NEMA 4X, IP66 enclosure and be UL listed for Class 1, Division 2 locations.
5. Shall operate from a 120Vac Power Source.
6. Suitable for indoor and outdoor use.
7. Provide Federal Signal Model No. 350WBX or Engineer approved equal.
8. Install at locations indicated.

C. Alarm Strobes:
1. Double flash, high intensity strobe light with a rate of 80 flashes per minute.
2. Red polycarbonate dome with a maximum dome height of 5 inches.
3. Shall operate from a 120Vac Power Source.
4. Shall be housed in a NEMA 4X, IP66 enclosure and be UL Listed for indoor/outdoor use.

5. Provide with the necessary mounting hardware required for wall mounting, panel mounting, or 1/2" NPT male pipe mounting.
6. Provide Federal Signal Model No. LP3M-120R or Engineer approved equal.
7. Install at locations indicated.

D. Alarm Strobes (Hazardous Location):
1. Double flash, high intensity strobe light with a rate of 80 flashes per minute.
2. Aluminum housing with stainless steel hardware.
3. Red polycarbonate dome.
4. Shall operate from a 120Vac power source.
5. Shall be housed in a NEMA 4X, IP66 enclosure and be UL listed for Class 1, Division 2 locations.
6. Provide with the necessary mounting hardware required for wall mounting, panel mounting, or 1/2" NPT male pipe mounting.
7. Provide Federal Signal Model No. 151XST or Engineer approved equal.
8. Install at locations indicated.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Verify site conditions are suitable for installation of instrumentation and associated equipment.

3.02 INSTALLATION:

A. Panel Mounted Devices: As specified in Section 40 67 00 – Process Control Panels and Hardware.

B. Field Mounted Devices:
1. Install as follows:
a. Mount on floor or wall as required.
b. Mount plumb and level.
c. Mount on walls with bottom of box or instrument four feet above floor unless indicated otherwise and instrument case spaced at least 1/2-inch away from wall.
d. Install supports as specified this Division and as indicated.
e. Install floor-mounted instruments on strut support racks.
f. Install measuring and controlling instruments in accordance with manufacturer's written instructions.
g. Install identification tags on all instruments.
2. Connect inputs and outputs as indicated on the manufacturer's shop drawings and as follows:
a. Transmitters requiring electric power shall be supplied from their associated control panels unless indicated otherwise.

3.03 FIELD QUALITY CONTROL:

A. Manufacturer's field services:
1. Manufacturer's field services shall be provided as specified in this Section, Section 40 60 00, and in Division 01.
2. Provide a minimum of 2 hours for each instrument to supervise/inspect installation, commission, test and start-up all equipment provided.
3. All equipment required for testing, start-up and performance verification shall be provided by the start-up technician.
4. All travel and living expenses shall be included.

B. Field Testing:
   1. Test and start-up supervision shall continue until the system is in proper operating condition as determined by Engineer.
   2. Provide manufacturer's supervision during Work to correct deficiencies in Equipment manufactured by them and to correct deficiencies in the installation and wiring of Equipment. Corrections shall be at no increase in the Contract Price.
   3. Functional Testing of Controls:
      a. Perform before equipment is placed in service.
      b. Include operating control system from each control point.
      c. Completely check each annunciator point and equipment alarm.
      d. Operate by hand all relays, pressure switches, limit switches and other system components that cannot be operated in normal manner with plant not in service.
      e. Repeat with plant in operation.
   4. Instrument Tests and Adjustments:
      a. Calibrate and startup measuring and controlling instruments in accordance with manufacturers recommendations.
      b. With each system variable transmitter disconnected from its normal source of input signal, apply an input with manometer, instrument potentiometer, or other device and adjust span and zero on all instruments transmitting, receiving, or retransmitting the resulting variable current, voltage, time duration or pneumatic signal and on all final control devices. Check instruments and final control devices at several points over the instrument measuring or control device span.
      c. Apply manually adjustable time duration or current signals directly to receivers where required to adjust zero and span and to check operation of the instrument over the measuring span.
      d. Accurately measure variable current, voltage, time duration and pneumatic signals as required to adjust all receivers, transmitters, transducers, and final control devices.
      e. Check operation of controller with various set points and system variable inputs; adjust controller proportional band, reset, and rate to conform to instructions from manufacturer's representative and Engineer.
      f. Check operation of each instrument with system in actual operation.
      g. Readjust controller settings as required to obtain desired control of the associated system variables.

3.04 TRAINING:

A. Provide a minimum of 2 hours of training at the customer's facility for operations, maintenance, and service personnel for each type of instrument provided.
   1. The training session shall include classroom discussion on the theory of operation of the equipment, as well as maintenance and service methods for the purchased equipment.
   2. Topics covered shall include safety, hardware layout and functions, power and control wiring, diagnostic indicators, keypad/display interface, faults, diagnostic tools, troubleshooting, and preventive maintenance.
   3. Hands-on training shall be provided on equipment.
   4. Documentation shall be provided which shall include actual manuals for the equipment and drawings and schematics of equipment supplied for this project.

B. Contractor shall record the training sessions and provide a final edited version to the Owner in electronic video file format.

C. Training shall conform to the requirements of Section 01664 – Training.

END OF SECTION 40 70 00

Todd Creek
WWTP - Instrument List

INSTRUMENT TAG NUMBER		TYPE	DESCRIPTION	FUNCTION	LOCATION	PROCESS CONNECTION(S)	MOUNTING		OUTPUT	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER	DRAWING	SPECIAL NOTES
TRANSMITTER	ELEMENT						TRANSMITTER	ELEMENT							
N/A	IPS-LSH-001	LEVEL SWITCH - FLOAT	INFLUENT COARSE SCREEN CHANNEL	LEVEL - HIGH	INFLUENT COARSE SCREEN CHANNEL	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	10.0	FEET	N/A	N/A	Y201	2, 4
IPS-AIT-001	IPS-AE-001	GAS LEVEL TRANSMITTER	COARSE SCREEN BUILDING COMBUSTIBLE GAS	LEVEL	COARSE SCREENS BUILDING	N/A	WALL	3/4"NPT	4-20mA	0-100	%LEL	3-WIRE	120VAC	Y201	
IPS-AIT-001	IPS-AE-003	GAS LEVEL TRANSMITTER	COARSE SCREEN BUILDING H2S GAS	LEVEL	COARSE SCREENS BUILDING	N/A	WALL	3/4"NPT	4-20mA	0-2000	PPM	3-WIRE	120VAC	Y201	
IPS-AIT-002	IPS-AE-002	GAS LEVEL TRANSMITTER	COARSE SCREEN BUILDING OZONE GAS	LEVEL	COARSE SCREENS BUILDING	N/A	WALL	N/A	4-20mA	0-1	O3 PPM	4-WIRE	120VAC	Y201	
IPS-LT-010A	IPS-LIT-010	LEVEL TRANSMITTER	COARSE SCREEN CHANNEL NO. 1	LEVEL	COARSE SCREEN CHANNEL NO. 1	N/A	ENCLOSURE	BRACKET	4-20mA	0 - 40	FEET	4-WIRE	120VAC	Y201	2, 6
IPS-LT-010B		LEVEL TRANSMITTER	COARSE SCREEN CHANNEL NO. 1	LEVEL	COARSE SCREEN CHANNEL NO. 1	N/A		BRACKET	4-20mA	0 - 40	FEET	4-WIRE	120VAC	Y201	2, 6
N/A	IPS-HRN-001	ALARM HORN	COARSE SCREEN BUILDING COMBUSTIBLE GAS	AUDIBLE ANNUNCIATION	COARSE SCREENS BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	IPS-HRN-002	ALARM HORN	COARSE SCREEN BUILDING COMBUSTIBLE GAS	AUDIBLE ANNUNCIATION	COARSE SCREENS BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	IPS-STB-001	ALARM STROBE	COARSE SCREEN BUILDING COMBUSTIBLE GAS	VISUAL ANNUNCIATION	COARSE SCREENS BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	IPS-STB-002	ALARM STROBE	COARSE SCREEN BUILDING COMBUSTIBLE GAS	VISUAL ANNUNCIATION	COARSE SCREENS BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
IPS-LIT-101	N/A	RADAR LEVEL TRANSMITTER	INFLUENT WET WELL NO. 1	LEVEL	INFLUENT WET WELL NO. 1	N/A	FLANGE	N/A	4-20mA	0 - 45	FEET	2-WIRE	LOOP	Y202	2, 5
IPS-LIT-102	N/A	RADAR LEVEL TRANSMITTER	INFLUENT WET WELL NO. 2	LEVEL	INFLUENT WET WELL NO. 2	N/A	FLANGE	N/A	4-20mA	0 - 45	FEET	2-WIRE	LOOP	Y202	2, 5
N/A	IPS-LSLL-101	LEVEL SWITCH - FLOAT	INFLUENT WET WELL NO. 1	LEVEL - LOW-LOW	INFLUENT WET WELL NO. 1	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	2.5	FEET	N/A	N/A	Y202	2, 4
N/A	IPS-LSL-101	LEVEL SWITCH - FLOAT	INFLUENT WET WELL NO. 1	LEVEL - LOW	INFLUENT WET WELL NO. 1	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	3.0	FEET	N/A	N/A	Y202	2, 4
N/A	IPS-LSH-101	LEVEL SWITCH - FLOAT	INFLUENT WET WELL NO. 1	LEVEL - HIGH	INFLUENT WET WELL NO. 1	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	8.5	FEET	N/A	N/A	Y202	2, 4
N/A	IPS-LSHH-101	LEVEL SWITCH - FLOAT	INFLUENT WET WELL NO. 1	LEVEL - HIGH-HIGH	INFLUENT WET WELL NO. 1	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	11.0	FEET	N/A	N/A	Y202	2, 4
N/A	IPS-LSLL-102	LEVEL SWITCH - FLOAT	INFLUENT WET WELL NO. 2	LEVEL - LOW-LOW	INFLUENT WET WELL NO. 2	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	2.5	FEET	N/A	N/A	Y202	2, 4
N/A	IPS-LSL-102	LEVEL SWITCH - FLOAT	INFLUENT WET WELL NO. 2	LEVEL - LOW	INFLUENT WET WELL NO. 2	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	3.0	FEET	N/A	N/A	Y202	2, 4
N/A	IPS-LSH-102	LEVEL SWITCH - FLOAT	INFLUENT WET WELL NO. 2	LEVEL - HIGH	INFLUENT WET WELL NO. 2	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	8.5	FEET	N/A	N/A	Y202	2, 4
N/A	IPS-LSHH-102	LEVEL SWITCH - FLOAT	INFLUENT WET WELL NO. 2	LEVEL - HIGH-HIGH	INFLUENT WET WELL NO. 2	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	11.0	FEET	N/A	N/A	Y202	2, 4
IPS-PIT-110	N/A	PRESSURE TRANSMITTER	IP NO. 1 DISCHARGE	PRESSURE	VALVE VAULT	2" FLANGE	PROCESS PIPE	N/A	4-20mA	0 - 150	PSI	2-WIRE	LOOP	Y202	2
IPS-PI-110	N/A	PRESSURE GAUGE	IP NO. 1 DISCHARGE	PRESSURE	VALVE VAULT	2" FLANGE	N/A	N/A	N/A	0 - 150	PSIG	N/A	N/A	Y202	
IPS-PIT-120	N/A	PRESSURE TRANSMITTER	IP NO. 2 DISCHARGE	PRESSURE	VALVE VAULT	2" FLANGE	PROCESS PIPE	N/A	4-20mA	0 - 150	PSI	2-WIRE	LOOP	Y202	2
IPS-PI-120	N/A	PRESSURE GAUGE	IP NO. 2 DISCHARGE	PRESSURE	VALVE VAULT	2" FLANGE	N/A	N/A	N/A	0 - 150	PSIG	N/A	N/A	Y202	
IPS-PIT-130	N/A	PRESSURE TRANSMITTER	IP NO. 3 DISCHARGE	PRESSURE	VALVE VAULT	2" FLANGE	PROCESS PIPE	N/A	4-20mA	0 - 150	PSI	2-WIRE	LOOP	Y202	2
IPS-PI-130	N/A	PRESSURE GAUGE	IP NO. 3 DISCHARGE	PRESSURE	VALVE VAULT	2" FLANGE	N/A	N/A	N/A	0 - 150	PSIG	N/A	N/A	Y202	
IPS-PIT-140	N/A	PRESSURE TRANSMITTER	IP NO. 4 DISCHARGE	PRESSURE	VALVE VAULT	2" FLANGE	PROCESS PIPE	N/A	4-20mA	0 - 150	PSI	2-WIRE	LOOP	Y202	2
IPS-PI-140	N/A	PRESSURE GAUGE	IP NO. 4 DISCHARGE	PRESSURE	VALVE VAULT	2" FLANGE	N/A	N/A	N/A	0 - 150	PSIG	N/A	N/A	Y202	
IPS-PIT-150	N/A	PRESSURE TRANSMITTER	IP NO. 5 DISCHARGE	PRESSURE	VALVE VAULT	2" FLANGE	PROCESS PIPE	N/A	4-20mA		PSI	2-WIRE	LOOP	Y202	2
IPS-PI-150	N/A	PRESSURE GAUGE	IP NO. 5 DISCHARGE	PRESSURE	VALVE VAULT	2" FLANGE	N/A	N/A	N/A	0 - 150	PSIG	N/A	N/A	Y202	
H2O2-LT-101	N/A	RADAR LEVEL TRANSMITTER	HYRDOGEN SULFIDE STORAGE	LEVEL	HYRDOGEN SULFIDE BULK TANK	N/A	FLANGE	N/A	4-20mA	TBD	FEET	2-WIRE	LOOP	Y204	
GRSC-PIT-001	N/A	PRESSURE TRANSMITTER	HEADWORKS PROCESS WATER	PRESSURE	HEADWORKS BUILDING	1/2" NPT	PROCESS PIPE	N/A	4-20mA	0 - 200	PSI	2-WIRE	LOOP	Y601	
GRSC-FIT-001	GRSC-FE-001	20-INCH MAGNETIC FLOW METER W/ INTEGRAL XMTR	INFLUENT PUMPING	FLOW	HEADWORKS BUILDING	FLANGE	INTEGRAL	PROCESS PIPE	4-20mA	0 - 15,000	GPM	4-WIRE	120VAC	Y301	2, 5

INSTRUMENT TAG NUMBER		TYPE	DESCRIPTION	FUNCTION	LOCATION	PROCESS CONNECTION(S)	MOUNTING		OUTPUT	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER	DRAWING	SPECIAL NOTES
TRANSMITTER	ELEMENT						TRANSMITTER	ELEMENT							
N/A	GRSC-LSH-100	POINT LEVEL SWITCH	INFLUENT SCREEN CHANNEL NO. 1	LEVEL - HIGH	INFLUENT SCREEN CHANNEL NO. 1	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	10.0	FEET	N/A	N/A	Y301	4, 6
GRSC-LE-100A	GRSC-LIT-100	ULTRASONIC LEVEL TRANSDUCER	INFLUENT SCREEN CHANNEL NO. 1	LEVEL	INFLUENT SCREEN CHANNEL NO. 1	N/A	ENCLOSURE	BRACKET	4-20mA	0 - 38	FEET	4-WIRE	120VAC	Y301	6
GRSC-LE-100B		ULTRASONIC LEVEL TRANSDUCER	INFLUENT SCREEN CHANNEL NO. 1	LEVEL	INFLUENT SCREEN CHANNEL NO. 1	N/A		BRACKET	4-20mA	0 - 38	FEET	4-WIRE	120VAC	Y301	6
N/A	GRSC-LSH-200	POINT LEVEL SWITCH	INFLUENT SCREEN CHANNEL NO. 2	LEVEL - HIGH	INFLUENT SCREEN CHANNEL NO. 2	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	10.0	FEET	N/A	N/A	Y301	4, 6
GRSC-LE-200A	GRSC-LIT-200	ULTRASONIC LEVEL TRANSDUCER	INFLUENT SCREEN CHANNEL NO. 2	LEVEL	INFLUENT SCREEN CHANNEL NO. 2	N/A	ENCLOSURE	BRACKET	4-20mA	0 - 38	FEET	4-WIRE	120VAC	Y301	6
GRSC-LE-200B		ULTRASONIC LEVEL TRANSDUCER	INFLUENT SCREEN CHANNEL NO. 2	LEVEL	INFLUENT SCREEN CHANNEL NO. 2	N/A		BRACKET	4-20mA	0 - 38	FEET	4-WIRE	120VAC	Y301	6
GRSC-AIT-001	GRSC-AE-001	GAS LEVEL TRANSMITTER	HEADWORKS BUILDING COMBUSTIBLE GAS	LEVEL	HEADWORKS BUILDING LEVEL 1	N/A	WALL	3/4"NPT	4-20mA	0-100	%LEL	3-WIRE	120VAC	Y302	
	GRSC-AE-002	GAS LEVEL TRANSMITTER	HEADWORKS BUILDING COMBUSTIBLE GAS	LEVEL	HEADWORKS BUILDING LEVEL 2	N/A	WALL	3/4"NPT	4-20mA	0-100	%LEL	3-WIRE	120VAC	Y301	
N/A	GRSC-HRN-001	ALARM HORN	HEADWORKS BUILDING COMBUSTIBLE GAS	AUDIBLE ANNUNCIATION	HEADWORKS BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	GRSC-HRN-002	ALARM HORN	HEADWORKS BUILDING COMBUSTIBLE GAS	AUDIBLE ANNUNCIATION	HEADWORKS BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	GRSC-HRN-003	ALARM HORN	HEADWORKS BUILDING COMBUSTIBLE GAS	AUDIBLE ANNUNCIATION	HEADWORKS BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	GRSC-HRN-004	ALARM HORN	HEADWORKS BUILDING COMBUSTIBLE GAS	AUDIBLE ANNUNCIATION	HEADWORKS BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	GRSC-STB-001	ALARM STROBE	HEADWORKS BUILDING COMBUSTIBLE GAS	VISUAL ANNUNCIATION	HEADWORKS BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	GRSC-STB-002	ALARM STROBE	HEADWORKS BUILDING COMBUSTIBLE GAS	VISUAL ANNUNCIATION	HEADWORKS BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	GRSC-STB-003	ALARM STROBE	HEADWORKS BUILDING COMBUSTIBLE GAS	VISUAL ANNUNCIATION	HEADWORKS BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	GRSC-STB-004	ALARM STROBE	HEADWORKS BUILDING COMBUSTIBLE GAS	VISUAL ANNUNCIATION	HEADWORKS BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	GRSC-STB-005	ALARM STROBE	HEADWORKS BUILDING COMBUSTIBLE GAS	VISUAL ANNUNCIATION	HEADWORKS BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	GRSC-STB-006	ALARM STROBE	HEADWORKS BUILDING COMBUSTIBLE GAS	VISUAL ANNUNCIATION	HEADWORKS BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	GRSC-STB-007	ALARM STROBE	HEADWORKS BUILDING COMBUSTIBLE GAS	VISUAL ANNUNCIATION	HEADWORKS BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	GRSC-VLV-125	THREE-WAY SOLENOID	INFLUENT SCREEN NO. 1 WASH WATER	VALVE	HEADWORKS BUILDING LEVEL 2	PROCESS PIPE	N/A	PROCESS PIPE	N/A	N/A	N/A	N/A	120VAC	Y301	
N/A	GRSC-VLV-225	THREE-WAY SOLENOID	INFLUENT SCREEN NO. 2 WASH WATER	VALVE	HEADWORKS BUILDING LEVEL 2	PROCESS PIPE	N/A	PROCESS PIPE	N/A	N/A	N/A	N/A	120VAC	Y301	
N/A	GRSC-PSL-001	PRESSURE SWITCH W/ GAUGE	HEADWORKS PROCESS WATER	PRESSURE - LOW	HEADWORKS BUILDING	ISOLATION VALVE W/ 1/2" NPT	N/A	PROCESS PIPE	N.O. CONTACT	40	PSIG	N/A	N/A	Y601	2, 4
N/A	GRSC-PSH-312	PRESSURE SWITCH W/ GAUGE	GRIT PUMPING DISCHARGE	PRESSURE - HIGH	HEADWORKS BUILDING	WAFER	N/A	PROCESS PIPE	N.O. CONTACT	5.0	PSIG	N/A	N/A	Y302	2, 4
N/A	GRSC-LSH-301	LEVEL SWITCH - FLOAT	GRIT SYSTEM EFFLUENT	LEVEL - HIGH	GRIT EFFLUENT CHANNEL	IMMERSION	N/A	SUSPENDED	N.O. CONTACT		FEET	N/A	N/A	Y302	2, 4
GRSC-FIT-311	GRSC-FE-311	4-INCH MAGNETIC FLOW METER W/ REMOTE XMTR	GRIT PUMPING DISCHARGE	FLOW	HEADWORKS BUILDING	FLANGE	WALL	PROCESS PIPE	4-20mA	0 - 500	GPM	4-WIRE	120VAC	Y302	2
N/A	GRSC-PI-311	PRESSURE GAUGE	GRIT PUMPING INTAKE	PRESSURE	HEADWORKS BUILDING	1/4" NPT	N/A	PROCESS PIPE	N/A	-15 to +15	PSIG	N/A	N/A	Y301	
AGS-AIT-001	AGS-AE-001	TSS ANALYZER	AGS INFLUENT	TSS	AGS UTILITY CORRIDOR	IMMERSION	WALL	PROCESS PIPE	4-20mA	0 - 10,000	mg/L	4-WIRE	120VAC	Y401	2
AGS-FIT-101	AGS-FE-101	30" MAGNETIC FLOW METER W/ REMOTE XMTR	AGS REACTOR NO. 1 INFLUENT	FLOW	AGS UTILITY CORRIDOR	FLANGE	RACK-MOUNT	PROCESS PIPE	4-20mA	0 - 15,000	GPM	4-WIRE	120VAC	Y401	2
AGS-FIT-201	AGS-FE-201	30" MAGNETIC FLOW METER W/ REMOTE XMTR	AGS REACTOR NO. 2 INFLUENT	FLOW	AGS UTILITY CORRIDOR	FLANGE	RACK-MOUNT	PROCESS PIPE	4-20mA	0 - 15,000	GPM	4-WIRE	120VAC	Y401	2
AGS-FIT-301	AGS-FE-301	30" MAGNETIC FLOW METER W/ REMOTE XMTR	AGS REACTOR NO. 3 INFLUENT	FLOW	AGS UTILITY CORRIDOR	FLANGE	RACK-MOUNT	PROCESS PIPE	4-20mA	0 - 15,000	GPM	4-WIRE	120VAC	Y401	2
AGS-FIT-401	AGS-FE-401	30" MAGNETIC FLOW METER W/ REMOTE XMTR	AGS REACTOR NO. 4 INFLUENT	FLOW	AGS UTILITY CORRIDOR	FLANGE	RACK-MOUNT	PROCESS PIPE	4-20mA	0 - 15,000	GPM	4-WIRE	120VAC	Y401	2

Todd Creek
WWTP - Instrument List

INSTRUMENT TAG NUMBER		TYPE	DESCRIPTION	FUNCTION	LOCATION	PROCESS CONNECTION(S)	MOUNTING		OUTPUT	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER	DRAWING	SPECIAL NOTES
TRANSMITTER	ELEMENT						TRANSMITTER	ELEMENT							
AGS-LI-101	N/A	DIGITAL PANEL METER INDICATOR	AGS BASIN NO. 1	LEVEL	AGS BASIN NO. 2	N/A	RACK-MOUNT	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y402	2, 5
AGS-LI-201	N/A	DIGITAL PANEL METER INDICATOR	AGS BASIN NO. 2	LEVEL	AGS BASIN NO. 2	N/A	RACK-MOUNT	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y402	2, 5
AGS-LI-301	N/A	DIGITAL PANEL METER INDICATOR	AGS BASIN NO. 3	LEVEL	AGS BASIN NO. 3	N/A	RACK-MOUNT	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y403	2, 5
AGS-LI-401	N/A	DIGITAL PANEL METER INDICATOR	AGS BASIN NO. 4	LEVEL	AGS BASIN NO. 4	N/A	RACK-MOUNT	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y403	2, 5
AGS-FIT-601	AGS-FE-601	8" MAGNETIC FLOW METER W/ REMOTE XMTR	SLUDGE BUFFER SUPERNATANT RETURN	FLOW	AGS PUMPING ROOM	FLANGE	WALL	PROCESS PIPE	4-20mA	0 - 1,200	GPM	4-WIRE	120VAC	Y405	2
AGS-FIT-701	AGS-FE-701	4" MAGNETIC FLOW METER W/ INTEGRAL XMTR	SLUDGE BUFFER SLUDGE PUMPING	FLOW	AGS PUMPING ROOM	FLANGE	INTEGRAL	PROCESS PIPE	4-20mA	0 - 500	GPM	4-WIRE	120VAC	Y405	2
AGS-FIT-801	AGS-FE-801	6" MAGNETIC FLOW METER W/ INTEGRAL XMTR	WLC TANK RETURN	FLOW	AGS UTILITY CORRIDOR	FLANGE	INTEGRAL	PROCESS PIPE	4-20mA	0 - 5,000	GPM	4-WIRE	120VAC	Y406	2
N/A	AGS-PI-610	PRESSURE GAUGE	SUPERNATANT PUMP NO. 1 DISCHARGE	PRESSURE	AGS PUMPING ROOM	1/4" NPT	N/A	PROCESS PIPE	N/A	0 - 50	PSIG	N/A	N/A	Y405	
N/A	AGS-PI-620	PRESSURE GAUGE	SUPERNATANT PUMP NO. 2 DISCHARGE	PRESSURE	AGS PUMPING ROOM	1/4" NPT	N/A	PROCESS PIPE	N/A	0 - 50	PSIG	N/A	N/A	Y405	
N/A	AGS-PI-630	PRESSURE GAUGE	SUPERNATANT PUMP NO. 3 DISCHARGE	PRESSURE	AGS PUMPING ROOM	1/4" NPT	N/A	PROCESS PIPE	N/A	0 - 50	PSIG	N/A	N/A	Y405	
N/A	AGS-PI-710	PRESSURE GAUGE	SLUDGE PUMP NO. 1 DISCHARGE	PRESSURE	AGS PUMPING ROOM	1/4" NPT	N/A	PROCESS PIPE	N/A	0 - 50	PSIG	N/A	N/A	Y405	
N/A	AGS-PI-720	PRESSURE GAUGE	SLUDGE PUMP NO. 2 DISCHARGE	PRESSURE	AGS PUMPING ROOM	1/4" NPT	N/A	PROCESS PIPE	N/A	0 - 50	PSIG	N/A	N/A	Y405	
N/A	AGS-PI-730	PRESSURE GAUGE	SLUDGE PUMP NO. 3 DISCHARGE	PRESSURE	AGS PUMPING ROOM	1/4" NPT	N/A	PROCESS PIPE	N/A	0 - 50	PSIG	N/A	N/A	Y405	
AGS-LI-510	N/A	DIGITAL PANEL METER INDICATOR	SLUDGE BUFFER TANK NO. 1	LEVEL	SLUDGE BUFFER TANK NO. 1	N/A	RACK-MOUNT	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y405	2, 5
AGS-LI-520	N/A	DIGITAL PANEL METER INDICATOR	SLUDGE BUFFER TANK NO. 2	LEVEL	SLUDGE BUFFER TANK NO. 2	N/A	RACK-MOUNT	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y405	2, 5
N/A	AGS-PI-810	PRESSURE GAUGE	WLC PUMP NO. 1 DISCHARGE	PRESSURE	AGS PUMPING ROOM	1/4" NPT	N/A	PROCESS PIPE	N/A	0 - 50	PSIG	N/A	N/A	Y406	
N/A	AGS-PI-820	PRESSURE GAUGE	WLC PUMP NO. 2 DISCHARGE	PRESSURE	AGS PUMPING ROOM	1/4" NPT	N/A	PROCESS PIPE	N/A	0 - 50	PSIG	N/A	N/A	Y406	
AGS-LI-801	N/A	DIGITAL PANEL METER INDICATOR	WLC TANK	LEVEL	WLC TANK	N/A	RACK-MOUNT	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y406	2, 5
UV-FIT-301	N/A	RADAR FLOW TRANSMITTER	PARSHALL FLUME	FLOW	EFFLUENT STRUCTURE	N/A	REMOTE	BRACKET	4-20mA	0 - 15,000	GPM	2-WIRE	LOOP	Y601	2
UV-FI-301	N/A	DIGITAL PANEL METER INDICATOR	PARSHALL FLUME	FLOW	EFFLUENT STRUCTURE	N/A	RACK-MOUNT	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y601	2
N/A	PW-PI-111	PRESSURE GAUGE	PW PUMP NO. 1 DISCHARGE	PRESSURE	UV DISINFECTION BUILDING	1/4" NPT	N/A	PROCESS PIPE	N/A	0 - 200	PSIG	N/A	N/A	Y601	
N/A	PW-PI-121	PRESSURE GAUGE	PW PUMP NO. 2 DISCHARGE	PRESSURE	UV DISINFECTION BUILDING	1/4" NPT	N/A	PROCESS PIPE	N/A	0 - 200	PSIG	N/A	N/A	Y601	
N/A	PW-PI-131	PRESSURE GAUGE	PW PUMP NO. 3 DISCHARGE	PRESSURE	UV DISINFECTION BUILDING	1/4" NPT	N/A	PROCESS PIPE	N/A	0 - 200	PSIG	N/A	N/A	Y601	
PW-FIT-101	PW-FE-101	4" MAGNETIC FLOW METER W/ INTEGRAL XMTR	PROCESS WATER PUMPING	FLOW	UV BUILDING	FLANGE	INTEGRAL	PROCESS PIPE	4-20mA	0 - 600	GPM	4-WIRE	120VAC	Y601	
UV-AIT-010	UV-AE-011	UV TRANSMITTANCE ANALYZER	UV DISINFECTION	UVT	UV INFLUENT CHANNEL	IMMERSION	WALL	BRACKET	4-20mA	0 -100	%	4-WIRE	120VAC	Y601	
PW-PIT-101	N/A	PRESSURE TRANSMITTER	PROCESS WATER PUMPING - UPSTREAM OF STRAINER	PRESSURE	UV BUILDING	1/2" NPT	PROCESS PIPE	N/A	4-20mA	0 - 200	PSI	2-WIRE	LOOP	Y601	
N/A	PW-PI-102	PRESSURE GAUGE	PRESSURE UPSTREAM OF STRAINER	PRESSURE	UV DISINFECTION BUILDING	1/4" NPT	N/A	PROCESS PIPE	N/A	0 - 200	PSIG	N/A	N/A	Y601	
PW-PIT-103	N/A	PRESSURE TRANSMITTER	PROCESS WATER PUMPING - DOWNSTREAM OF STRAINER	PRESSURE	UV BUILDING	1/2" NPT	PROCESS PIPE	N/A	4-20mA	0 - 200	PSI	2-WIRE	LOOP	Y601	
N/A	PW-PI-103	PRESSURE GAUGE	PRESSURE DOWNSTREAM OF STRAINER	PRESSURE	UV DISINFECTION BUILDING	1/4" NPT	N/A	PROCESS PIPE	N/A	0 - 200	PSIG	N/A	N/A	Y601	
N/A	PW-LSL-101	LEVEL SWITCH - FLOAT	PROCESS WATER PUMPING	LEVEL - LOW	PROCESS WATER WET WELL	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	2.5	FEET	N/A	N/A	Y601	
N/A	PW-LSH-101	LEVEL SWITCH - FLOAT	PROCESS WATER PUMPING	LEVEL - HIGH	PROCESS WATER WET WELL	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	8.0	FEET	N/A	N/A	Y601	
N/A	UV-LSL-101	LEVEL SWITCH	UV CHANNEL NO. 1	LEVEL - LOW	UV CHANNEL NO. 1	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	4.5	FEET	N/A	N/A	Y601	6
N/A	UV-LSL-201	LEVEL SWITCH	UV CHANNEL NO. 2	LEVEL - LOW	UV CHANNEL NO. 2	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	4.5	FEET	N/A	N/A	Y601	6

INSTRUMENT TAG NUMBER		TYPE	DESCRIPTION	FUNCTION	LOCATION	PROCESS CONNECTION(S)	MOUNTING		OUTPUT	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER	DRAWING	SPECIAL NOTES
TRANSMITTER	ELEMENT						TRANSMITTER	ELEMENT							
SPB-PIT-001	N/A	PRESSURE TRANSMITTER	SOLIDS PROCESSING BUILDING PROCESS WATER	PRESSURE	SOLIDS PROCESSING BUILDING	1/2" NPT	PROCESS PIPE	N/A	4-20mA	0 - 200	PSI	2-WIRE	LOOP	Y601	
N/A	SPB-PSL-001	PRESSURE SWITCH W/ GAUGE	PROCESS WATER AT SOLIDS PROCESSING BUILDING	PRESSURE - LOW	SOLIDS PROCESSING BUILDING	ISOLATION VALVE W/ 1/2" NPT	N/A	PROCESS PIPE	N.O. CONTACT	40	PSIG	N/A	N/A	Y601	
N/A	SPB-HRN-001	ALARM HORN	SOLIDS PROCESSING BUILDING VENTILATION FAILURE	AUDIBLE ANNUNCIATION	SOLIDS PROCESSING BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	SPB-HRN-002	ALARM HORN	SOLIDS PROCESSING BUILDING VENTILATION FAILURE	AUDIBLE ANNUNCIATION	SOLIDS PROCESSING BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	SPB-HRN-003	ALARM HORN	SOLIDS PROCESSING BUILDING VENTILATION FAILURE	AUDIBLE ANNUNCIATION	SOLIDS PROCESSING BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	SPB-STB-001	ALARM STROBE	SOLIDS PROCESSING BUILDING VENTILATION FAILURE	VISUAL ANNUNCIATION	SOLIDS PROCESSING BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	SPB-STB-002	ALARM STROBE	SOLIDS PROCESSING BUILDING VENTILATION FAILURE	VISUAL ANNUNCIATION	SOLIDS PROCESSING BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	SPB-STB-003	ALARM STROBE	SOLIDS PROCESSING BUILDING VENTILATION FAILURE	VISUAL ANNUNCIATION	SOLIDS PROCESSING BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	SPB-STB-004	ALARM STROBE	SOLIDS PROCESSING BUILDING VENTILATION FAILURE	VISUAL ANNUNCIATION	SOLIDS PROCESSING BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
N/A	SPB-STB-005	ALARM STROBE	SOLIDS PROCESSING BUILDING VENTILATION FAILURE	VISUAL ANNUNCIATION	SOLIDS PROCESSING BUILDING	N/A	N/A	WALL	N/A	N/A	N/A	N/A	120VAC	N/A	
WAS-LIT-101	N/A	RADAR LEVEL TRANSMITTER	THIN SLUDGE TANKS	LEVEL	THIN SLUDGE TANK NO. 1	N/A	BRACKET	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y702	2, 4
WAS-LI-101	N/A	DIGITAL PANEL METER INDICATOR	THIN SLUDGE TANKS	LEVEL	THIN SLUDGE TANK NO. 1	N/A	RACK-MOUNT	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y702	2
WAS-AIT-101	WAS-AE-101	DISSOLVED OXYGEN ANAYLYZER	THIN SLUDGE TANKS	DISSOLVED OXYGEN	THIN SLUDGE TANK NO. 1	IMMERSION	RACK-MOUNT	POLE	4-20mA	0 - 10	mg/L	4-WIRE	120VAC	Y702	2, 5
N/A	WAS-LSH-101	LEVEL SWITCH - FLOAT	THIN SLUDGE TANKS	LEVEL - HIGH	THIN SLUDGE TANK NO. 1	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	22.0	FEET	N/A	N/A	Y702	2, 3, 4
N/A	WAS-LSL-101	LEVEL SWITCH - FLOAT	THIN SLUDGE TANKS	LEVEL - LOW	THIN SLUDGE TANK NO. 1	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	2.0	FEET	N/A	N/A	Y702	2, 3, 4
WAS-LIT-201	N/A	RADAR LEVEL TRANSMITTER	THIN SLUDGE TANKS	LEVEL	THIN SLUDGE TANK NO. 2	N/A	BRACKET	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y702	2, 4
WAS-LI-201	N/A	DIGITAL PANEL METER INDICATOR	THIN SLUDGE TANKS	LEVEL	THIN SLUDGE TANK NO. 1	N/A	RACK-MOUNT	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y702	2
WAS-AIT-201	WAS-AE-201	DISSOLVED OXYGEN ANAYLYZER	THIN SLUDGE TANKS	DISSOLVED OXYGEN	THIN SLUDGE TANK NO. 2	IMMERSION	RACK-MOUNT	POLE	4-20mA	0 - 10	mg/L	4-WIRE	120VAC	Y702	2, 5
N/A	WAS-LSH-201	LEVEL SWITCH - FLOAT	THIN SLUDGE TANKS	LEVEL - HIGH	THIN SLUDGE TANK NO. 2	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	22.0	FEET	N/A	N/A	Y702	2, 3, 4
N/A	WAS-LSL-201	LEVEL SWITCH - FLOAT	THIN SLUDGE TANKS	LEVEL - LOW	THIN SLUDGE TANK NO. 2	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	2.0	FEET	N/A	N/A	Y702	2, 3, 4
N/A	WAS-PSL-310a	PRESSURE SWITCH W/ GAUGE	THIN SLUDGE PUMP NO. 1 SUCTION	PRESSURE - LOW	THIN SLUDGE PUMP NO. 1	WAFER	N/A	PROCESS PIPE	N.O. CONTACT	-5.0	PSIG	N/A	N/A	Y702	6
N/A	WAS-PSH-310B	PRESSURE SWITCH W/ GAUGE	THIN SLUDGE PUMP NO. 1 DISCHARGE	PRESSURE - HIGH	THIN SLUDGE PUMP NO. 1	WAFER	N/A	PROCESS PIPE	N.O. CONTACT	35.0	PSIG	N/A	N/A	Y702	6
N/A	WAS-PSL-320A	PRESSURE SWITCH W/ GAUGE	THIN SLUDGE PUMP NO. 2 SUCTION	PRESSURE - LOW	THIN SLUDGE PUMP NO. 2	WAFER	N/A	PROCESS PIPE	N.O. CONTACT	-5.0	PSIG	N/A	N/A	Y702	6
N/A	WAS-PSH-320B	PRESSURE SWITCH W/ GAUGE	THIN SLUDGE PUMP NO. 2 DISCHARGE	PRESSURE - HIGH	THIN SLUDGE PUMP NO. 2	WAFER	N/A	PROCESS PIPE	N.O. CONTACT	35.0	PSIG	N/A	N/A	Y702	6
N/A	WAS-PSL-330A	PRESSURE SWITCH W/ GAUGE	THIN SLUDGE PUMP NO. 3 SUCTION	PRESSURE - LOW	THIN SLUDGE PUMP NO. 3	WAFER	N/A	PROCESS PIPE	N.O. CONTACT	-5.0	PSIG	N/A	N/A	Y702	6
N/A	WAS-PSH-330B	PRESSURE SWITCH W/ GAUGE	THIN SLUDGE PUMP NO. 3 DISCHARGE	PRESSURE - HIGH	THIN SLUDGE PUMP NO. 3	WAFER	N/A	PROCESS PIPE	N.O. CONTACT	35.0	PSIG	N/A	N/A	Y702	6
WAS-AIT-301	WAS-AE-301	TOTAL SOLIDS ANALYZER - MICROWAVE	RDT FEED	TS	RDT NO. 1 FEED LINE	FLANGE	INTEGRAL	PROCESS PIPE	4-20mA	0 - 5	%	4-WIRE	120VAC	Y702	5
WAS-AIT-302	WAS-AE-302	TOTAL SOLIDS ANALYZER - MICROWAVE	RDT FEED	TS	RDT NO. 2 FEED LINE	FLANGE	INTEGRAL	PROCESS PIPE	4-20mA	0 - 5	%	4-WIRE	120VAC	Y702	5
WAS-FIT-301	WAS-FE-301	4" MAGNETIC FLOW METER W/ INTEGRAL XMTR	RDT FEED	FLOW	RDT NO. 1 FEED LINE	FLANGE	INTEGRAL	PROCESS PIPE	4-20mA	0 - 600	GPM	4-WIRE	120VAC	Y702	
WAS-FIT-302	WAS-FE-302	4" MAGNETIC FLOW METER W/ INTEGRAL XMTR	RDT FEED	FLOW	RDT NO. 2 FEED LINE	FLANGE	INTEGRAL	PROCESS PIPE	4-20mA	0 - 600	GPM	4-WIRE	120VAC	Y702	
STH-AIT-131	STH-AE-131	TOTAL SOLIDS ANALYZER - MICROWAVE	THICKENED SLUDGE PUMPING	TS	THICKENED SLUDGE PUMP NO. 1	FLANGE	RACK-MOUNT	PROCESS PIPE	4-20mA	0 - 5	%	4-WIRE	120VAC	Y703	5
N/A	STH-PSH-130	PRESSURE SWITCH W/ GAUGE	THICKENED SLUDGE PUMPING	PRESSURE - HIGH	THICKENED SLUDGE PUMP NO. 1	WAFER	N/A	PROCESS PIPE	N.O. CONTACT	95.0	PSIG	N/A	N/A	Y703	6
STH-FIT-131	STH-FE-131	4" MAGNETIC FLOW METER W/ INTEGRAL XMTR	THICKENED SLUDGE PUMPING	FLOW	THICKENED SLUDGE PUMP NO. 1	FLANGE	INTEGRAL	PROCESS PIPE	4-20mA	0 - 200	GPM	4-WIRE	120VAC	Y703	

INSTRUMENT TAG NUMBER		TYPE	DESCRIPTION	FUNCTION	LOCATION	PROCESS CONNECTION(S)	MOUNTING		OUTPUT	RANGE/ SET POINT	ENGINEERING UNIT	XMTR TYPE	POWER	DRAWING	SPECIAL NOTES
TRANSMITTER	ELEMENT						TRANSMITTER	ELEMENT							
STH-AIT-231	STH-AE-231	TOTAL SOLIDS ANALYZER - MICROWAVE	THICKENED SLUDGE PUMPING	TS	THICKENED SLUDGE PUMP NO. 2	FLANGE	RACK-MOUNT	PROCESS PIPE	4-20mA	0 - 5	%	4-WIRE	120VAC	Y703	5
N/A	STH-PSH-230	PRESSURE SWITCH W/ GAUGE	THICKENED SLUDGE PUMPING	PRESSURE - HIGH	THICKENED SLUDGE PUMP NO. 2	WAFER	N/A	PROCESS PIPE	N.O. CONTACT	95.0	PSIG	N/A	N/A	Y703	6
STH-FIT-231	STH-FE-231	4" MAGNETIC FLOW METER W/ INTEGRAL XMTR	THICKENED SLUDGE PUMPING	FLOW	THICKENED SLUDGE PUMP NO. 2	FLANGE	INTEGRAL	PROCESS PIPE	4-20mA	0 - 200	GPM	4-WIRE	120VAC	Y703	
SCIN-LIT-101	N/A	RADAR LEVEL TRANSMITTER	THICKENED SLUDGE STORAGE	LEVEL	THICKENED SLUDGE TANK NO. 1	N/A	FLANGE	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y704	2,4
N/A	SCIN-LSH-101	LEVEL SWITCH - FLOAT	THICKENED SLUDGE STORAGE	LEVEL - HIGH	THICKENED SLUDGE TANK NO. 1	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	22.0	FEET	N/A	N/A	Y704	2, 3, 4
SCIN-LIT-201	N/A	RADAR LEVEL TRANSMITTER	THICKENED SLUDGE STORAGE	LEVEL	THICKENED SLUDGE TANK NO. 2	N/A	FLANGE	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y704	2,4
N/A	SCIN-LSH-201	LEVEL SWITCH - FLOAT	THICKENED SLUDGE STORAGE	LEVEL - HIGH	THICKENED SLUDGE TANK NO. 2	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	22.0	FEET	N/A	N/A	Y704	2, 3, 4
N/A	SCIN-PSL-110	PRESSURE SWITCH W/ GAUGE	THICKENED SLUDGE PUMPING	PRESSURE - LOW	SLUDGE LOADOUT PUMP NO. 1	WAFER	N/A	PROCESS PIPE	N.O. CONTACT	-5.0	PSIG	N/A	N/A	Y704	6
N/A	SCIN-PSH-110	PRESSURE SWITCH W/ GAUGE	THICKENED SLUDGE PUMPING	PRESSURE - HIGH	SLUDGE LOADOUT PUMP NO. 1	WAFER	N/A	PROCESS PIPE	N.O. CONTACT	75.0	PSIG	N/A	N/A	Y704	6
SCIN-FIT-111	SCIN-FE-111	8" MAGNETIC FLOW METER W/ REMOTE XMTR	THICKENED SLUDGE PUMPING	FLOW	SLUDGE LOADOUT PUMP NO. 1	FLANGE	WALL	PROCESS PIPE	4-20mA	0 - 600	GPM	4-WIRE	120VAC	Y704	
SCIN-FI-111	N/A	LARGE DISPLAY PROCESS INDICATOR	THICKENED SLUDGE PUMPING	FLOW	SLUDGE LOADOUT PUMP NO. 1 EXTERIOR	N/A	WALL	N/A	4-20mA	0 - 600	GPM	4-WIRE	120VAC	Y704	
N/A	SCIN-PSL-210	PRESSURE SWITCH W/ GAUGE	THICKENED SLUDGE PUMPING	PRESSURE - LOW	SLUDGE LOADOUT PUMP NO. 2	WAFER	N/A	PROCESS PIPE	N.O. CONTACT	-5.0	PSIG	N/A	N/A	Y704	6
N/A	SCIN-PSH-210	PRESSURE SWITCH W/ GAUGE	THICKENED SLUDGE PUMPING	PRESSURE - HIGH	SLUDGE LOADOUT PUMP NO. 2	WAFER	N/A	PROCESS PIPE	N.O. CONTACT	75.0	PSIG	N/A	N/A	Y704	6
SCIN-FIT-211	SCIN-FE-211	8" MAGNETIC FLOW METER W/ REMOTE XMTR	THICKENED SLUDGE PUMPING	FLOW	SLUDGE LOADOUT PUMP NO. 2	FLANGE	WALL	PROCESS PIPE	4-20mA	0 - 600	GPM	4-WIRE	120VAC	Y704	
SCIN-FI-211	N/A	LARGE DISPLAY PROCESS INDICATOR	THICKENED SLUDGE PUMPING	FLOW	SLUDGE LOADOUT PUMP NO. 2 EXTERIOR	N/A	WALL	N/A	4-20mA	0 - 600	GPM	4-WIRE	120VAC	Y704	
N/A	WAS-PDS-401	PRESSURE DIFFERENTIAL SWITCH	SLUDGE BLOWERS INTAKE	PRESSURE - HIGH	SLUDGE BLOWERS ROOM	N/A	N/A	FILTER	N.O. CONTACT	-	PSIG	N/A	N/A	Y705	
POL-LIT-101	N/A	RADAR LEVEL TRANSMITTER	POLYMER TOTE NO. 1	LEVEL	POLYMER TOTE NO. 1	N/A	BRACKET	N/A	4-20mA	TBD	FEET	2-WIRE	LOOP	Y707	
POL-LI-101	N/A	DIGITAL PANEL METER INDICATOR	POLYMER TOTE NO. 1	LEVEL	POLYMER TOTE NO. 1	N/A	RACK-MOUNT	N/A	4-20mA	TBD	FEET	2-WIRE	LOOP	Y707	
POL-LIT-201	N/A	RADAR LEVEL TRANSMITTER	POLYMER TOTE NO. 2	LEVEL	POLYMER TOTE NO. 2	N/A	BRACKET	N/A	4-20mA	TBD	FEET	2-WIRE	LOOP	Y707	
POL-LI-201	N/A	DIGITAL PANEL METER INDICATOR	POLYMER TOTE NO. 2	LEVEL	POLYMER TOTE NO. 2	N/A	RACK-MOUNT	N/A	4-20mA	TBD	FEET	2-WIRE	LOOP	Y707	
PSEW-LIT-101	N/A	RADAR LEVEL TRANSMITTER	PLANT SEWER RETURN PUMP STATION WET WELL	LEVEL	PLANT SEWER RETURN PUMP STATION WE T WELL	N/A	FLANGE	N/A	4-20mA	0 - 15	FEET	2-WIRE	LOOP	Y801	2, 5
N/A	PSEW-LSHH-101	LEVEL SWITCH - FLOAT	PLANT SEWER RETURN PUMP STATION WET WELL	LEVEL - HIGH-HIGH	PLANT SEWER RETURN PUMP STATION WE T WELL	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	12.0	FEET	N/A	N/A	Y801	2, 3, 4
N/A	PSEW-LSH-101	LEVEL SWITCH - FLOAT	PLANT SEWER RETURN PUMP STATION WET WELL	LEVEL - HIGH	PLANT SEWER RETURN PUMP STATION WE T WELL	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	10.0	FEET	N/A	N/A	Y801	2, 3, 4
N/A	PSEW-LSL-101	LEVEL SWITCH - FLOAT	PLANT SEWER RETURN PUMP STATION WET WELL	LEVEL - LOW	PLANT SEWER RETURN PUMP STATION WE T WELL	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	2.0	FEET	N/A	N/A	Y801	2, 3, 4
N/A	PSEW-LSLL-101	LEVEL SWITCH - FLOAT	PLANT SEWER RETURN PUMP STATION WET WELL	LEVEL - LOW-LOW	PLANT SEWER RETURN PUMP STATION WE T WELL	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	1.5	FEET	N/A	N/A	Y801	2, 3, 4
PSEW-FIT-101	PSEW-FE-101	8" MAGNETIC FLOW METER W/ REMOTE XMTR	PLANT SEWER RETURN PUMPING	FLOW	HEADWORKS BUILDING	FLANGE	WALL	PROCESS PIPE	4-20mA	0 - 1,000	GPM	4-WIRE	120VAC	Y301	2

Todd Creek
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INSTRUMENT TAG NUMBER		TYPE	DESCRIPTION	FUNCTION	LOCATION	PROCESS	MOUNTING		OUTPUT	RANGE/	ENGINEERING	XMTR	POWER	DRAWING	SPECIAL
TRANSMITTER	ELEMENT					CONNECTION(S)	TRANSMITTER	ELEMENT		SET POINT	UNIT	TYPE			NOTES
AGS-FIT-102	AGS-FE-102	THERMAL MASS FLOW METER W/ INTEGRAL XMTR	AGS BASIN NO. 1 PROCESS AIR	FLOW	AGS BASIN NO. 1 WALKWAY	1" NPT INSERTION	INTEGRAL	PROCESS PIPE	4-20mA	0 - 15,000	SCFM	4-WIRE	120VAC	Y402	2, 6
AGS-PIT-101	N/A	PRESSURE TRANSMITTER	AGS BASIN NO. 1	PRESSURE	AGS BASIN NO. 1	1/2" NPT	PROCESS PIPE	N/A	4-20mA	0 - 25	PSIG	2-WIRE	LOOP	Y402	2, 6
AGS-LT-101	N/A	SUBMERSIBLE LEVEL TRANSDUCER	AGS BASIN NO. 1	LEVEL	AGS BASIN NO. 1	N/A	PIPE	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y402	2,4, 6
AGS-AIT-110	AGS-AE-111	NH4 TRANSMITTER	AGS BASIN NO. 1	NH4	AGS BASIN NO. 1	IMMERSION		POLE	4-20mA	0 - 100	mg/L	4-WIRE		Y402	2, 6
AGS-AIT-120	AGS-AE-121	pH ANALYZER	AGS BASIN NO. 1	pH	AGS BASIN NO. 1	IMMERSION	RACK-MOUNT	POLE	4-20mA	0 - 14	SU	4-WIRE	120VAC	Y402	2, 6
	AGS-AE-122	DISSOLVED OXYGEN ANALYZER	AGS BASIN NO. 1	DISSOLVED OXYGEN	AGS BASIN NO. 1	IMMERSION		POLE	4-20mA	0 - 10.0	mg/L	4-WIRE		Y402	
	AGS-AE-123	TSS ANALYZER	AGS BASIN NO. 1	TSS	AGS BASIN NO. 1	IMMERSION		POLE	4-20mA	0 - 50,000	mg/L	4-WIRE		Y402	
	AGS-AE-124	ORP ANALYZER	AGS BASIN NO. 1	ORP	AGS BASIN NO. 1	IMMERSION		POLE	4-20mA	-1,500 - 1,500	mV	4-WIRE		Y402	
N/A	AGS-LSH-101	LEVEL SWITCH - FLOAT	AGS BASIN NO. 1	LEVEL - HIGH	AGS BASIN NO. 1	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	24	FEET	N/A	N/A	Y402	2, 4, 6
AGS-FIT-202	AGS-FE-202	THERMAL MASS FLOW METER W/ INTEGRAL XMTR	AGS BASIN NO. 2 PROCESS AIR	FLOW	AGS BASIN NO. 2 WALKWAY	1" NPT INSERTION	INTEGRAL	PROCESS PIPE	4-20mA	0 - 15,000	SCFM	4-WIRE	120VAC	Y402	2, 6
AGS-PIT-201	N/A	PRESSURE TRANSMITTER	AGS BASIN NO. 2	PRESSURE	AGS BASIN NO. 2	1/2" NPT	PROCESS PIPE	N/A	4-20mA	0 - 25	PSIG	2-WIRE	LOOP	Y402	2, 6
AGS-LT-201	N/A	SUBMERSIBLE LEVEL TRANSDUCER	AGS BASIN NO. 2	LEVEL	AGS BASIN NO. 2	N/A	PIPE	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y402	2,4, 6
AGS-AIT-210	AGS-AE-211	NH4 TRANSMITTER	AGS BASIN NO. 2	NH4	AGS BASIN NO. 2	IMMERSION		POLE	4-20mA	0 - 100	mg/L	4-WIRE		Y402	2, 6
AGS-AIT-220	AGS-AE-221	pH ANALYZER	AGS BASIN NO. 2	pH	AGS BASIN NO. 2	IMMERSION	RACK-MOUNT	POLE	4-20mA	0 - 14	SU	4-WIRE	120VAC	Y402	2, 6
	AGS-AE-222	DISSOLVED OXYGEN ANALYZER	AGS BASIN NO. 2	DISSOLVED OXYGEN	AGS BASIN NO. 2	IMMERSION		POLE	4-20mA	0 - 10.0	mg/L	4-WIRE		Y402	
	AGS-AE-223	TSS ANALYZER	AGS BASIN NO. 2	TSS	AGS BASIN NO. 2	IMMERSION		POLE	4-20mA	0 - 50,000	mg/L	4-WIRE		Y402	
	AGS-AE-224	ORP ANALYZER	AGS BASIN NO. 2	ORP	AGS BASIN NO. 2	IMMERSION		POLE	4-20mA	-1,500 - 1,500	mV	4-WIRE		Y402	
N/A	AGS-LSH-201	LEVEL SWITCH - FLOAT	AGS BASIN NO. 2	LEVEL - HIGH	AGS BASIN NO. 2	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	24	FEET	N/A	N/A	Y402	2, 4, 6
AGS-FIT-302	AGS-FE-302	THERMAL MASS FLOW METER W/ INTEGRAL XMTR	AGS BASIN NO. 3 PROCESS AIR	FLOW	AGS BASIN NO. 3 WALKWAY	1" NPT INSERTION	INTEGRAL	PROCESS PIPE	4-20mA	0 - 15,000	SCFM	4-WIRE	120VAC	Y403	2, 6
AGS-PIT-301	N/A	PRESSURE TRANSMITTER	AGS BASIN NO. 3	PRESSURE	AGS BASIN NO. 3	1/2" NPT	PROCESS PIPE	N/A	4-20mA	0 - 25	PSIG	2-WIRE	LOOP	Y402	2, 6
AGS-LT-301	N/A	SUBMERSIBLE LEVEL TRANSDUCER	AGS BASIN NO. 3	LEVEL	AGS BASIN NO. 3	N/A	PIPE	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y403	2,4, 6
AGS-AIT-310	AGS-AE-311	NH4 TRANSMITTER	AGS BASIN NO. 3	NH4	AGS BASIN NO. 3	IMMERSION		POLE	4-20mA	0 - 100	mg/L	4-WIRE		Y403	2, 6
AGS-AIT-320	AGS-AE-321	pH ANALYZER	AGS BASIN NO. 3	pH	AGS BASIN NO. 3	IMMERSION	RACK-MOUNT	POLE	4-20mA	0 - 14	SU	4-WIRE	120VAC	Y403	2, 6
	AGS-AE-322	DISSOLVED OXYGEN ANALYZER	AGS BASIN NO. 3	DISSOLVED OXYGEN	AGS BASIN NO. 3	IMMERSION		POLE	4-20mA	0 - 10.0	mg/L	4-WIRE		Y403	
	AGS-AE-323	TSS ANALYZER	AGS BASIN NO. 3	TSS	AGS BASIN NO. 3	IMMERSION		POLE	4-20mA	0 - 50,000	mg/L	4-WIRE		Y403	
	AGS-AE-324	ORP ANALYZER	AGS BASIN NO. 3	ORP	AGS BASIN NO. 3	IMMERSION		POLE	4-20mA	-1,500 - 1,500	mV	4-WIRE		Y403	
N/A	AGS-LSH-301	LEVEL SWITCH - FLOAT	AGS BASIN NO. 3	LEVEL - HIGH	AGS BASIN NO. 3	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	24	FEET	N/A	N/A	Y403	2, 4, 6

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INSTRUMENT TAG NUMBER		TYPE	DESCRIPTION	FUNCTION	LOCATION	PROCESS	MOUNTING		OUTPUT	RANGE/	ENGINEERING	XMTR	POWER	DRAWING	SPECIAL
TRANSMITTER	ELEMENT					CONNECTION(S)	TRANSMITTER	ELEMENT		SET POINT	UNIT	TYPE			NOTES
AGS-FIT-402	AGS-FE-402	THERMAL MASS FLOW METER W/ INTEGRAL XMTR	AGS BASIN NO. 4 PROCESS AIR	FLOW	AGS BASIN NO. 4 WALKWAY	1" NPT INSERTION	INTEGRAL	PROCESS PIPE	4-20mA	0 - 15,000	SCFM	4-WIRE	120VAC	Y403	2, 6
AGS-PIT-401	N/A	PRESSURE TRANSMITTER	AGS BASIN NO. 4	PRESSURE	AGS BASIN NO. 4	1/2" NPT	PROCESS PIPE	N/A	4-20mA	0 - 25	PSIG	2-WIRE	LOOP	Y402	2, 6
AGS-LT-401	N/A	SUBMERSIBLE LEVEL TRANSDUCER	AGS BASIN NO. 4	LEVEL	AGS BASIN NO. 4	N/A	PIPE	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y403	2,4, 6
AGS-AIT-410	AGS-AE-411	NH4 TRANSMITTER	AGS BASIN NO. 4	NH4	AGS BASIN NO. 4	IMMERSION		POLE	4-20mA	0 - 100	mg/L	4-WIRE		Y403	2, 6
AGS-AIT-420	AGS-AE-421	pH ANALYZER	AGS BASIN NO. 4	pH	AGS BASIN NO. 4	IMMERSION	RACK-MOUNT	POLE	4-20mA	0 - 14	SU	4-WIRE	120VAC	Y403	2, 6
	AGS-AE-422	DISSOLVED OXYGEN ANALYZER	AGS BASIN NO. 4	DISSOLVED OXYGEN	AGS BASIN NO. 4	IMMERSION		POLE	4-20mA	0 - 10.0	mg/L	4-WIRE		Y403	
	AGS-AE-423	TSS ANALYZER	AGS BASIN NO. 4	TSS	AGS BASIN NO. 4	IMMERSION		POLE	4-20mA	0 - 50,000	mg/L	4-WIRE		Y403	
	AGS-AE-424	ORP ANALYZER	AGS BASIN NO. 4	ORP	AGS BASIN NO. 4	IMMERSION		POLE	4-20mA	-1,500 - 1,500	mV	4-WIRE		Y403	
N/A	AGS-LSH-401	LEVEL SWITCH - FLOAT	AGS BASIN NO. 4	LEVEL - HIGH	AGS BASIN NO. 4	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	24	FEET	N/A	N/A	Y403	2, 4, 6
AGS-AIT-701	AGS-AE-701	TSS ANALYZER	SLUDGE BUFFER SLUDGE PUMPING	TSS	AGS PUMPING ROOM	INSERTION	RACK-MOUNT	PROCESS PIPE	4-20mA	0 - 50,000	mg/L	4-WIRE	120VAC	Y302	6
AGS-LT-510	N/A	SUBMERSIBLE LEVEL TRANSDUCER	SLUDGE BUFFER TANK NO. 1	LEVEL	SLUDGE BUFFER TANK NO. 1	N/A	PIPE	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y301	2,4, 6
N/A	AGS-LSH-510	LEVEL SWITCH - FLOAT	SLUDGE BUFFER TANK NO. 1	LEVEL - HIGH	SLUDGE BUFFER TANK NO. 1	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	16.0	FEET	N/A	N/A	Y405	2, 3, 4, 6
N/A	AGS-LSL-510	LEVEL SWITCH - FLOAT	SLUDGE BUFFER TANK NO. 1	LEVEL - LOW	SLUDGE BUFFER TANK NO. 1	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	1.5	FEET	N/A	N/A	Y405	2, 3, 4, 6
N/A	AGS-LSLL-510	LEVEL SWITCH - FLOAT	SLUDGE BUFFER TANK NO. 1	LEVEL - LOW-LOW	SLUDGE BUFFER TANK NO. 1	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	1.0	FEET	N/A	N/A	Y405	2, 3, 4, 6
AGS-LT-520	N/A	SUBMERSIBLE LEVEL TRANSDUCER	SLUDGE BUFFER TANK NO. 2	LEVEL	SLUDGE BUFFER TANK NO. 2	N/A	PIPE	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y405	2, 4, 6
N/A	AGS-LSH-520	LEVEL SWITCH - FLOAT	SLUDGE BUFFER TANK NO. 2	LEVEL - HIGH	SLUDGE BUFFER TANK NO. 2	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	16.0	FEET	N/A	N/A	Y405	2, 3, 4, 6
N/A	AGS-LSL-520	LEVEL SWITCH - FLOAT	SLUDGE BUFFER TANK NO. 2	LEVEL - LOW	SLUDGE BUFFER TANK NO. 2	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	1.5	FEET	N/A	N/A	Y405	2, 3, 4, 6
N/A	AGS-LSLL-520	LEVEL SWITCH - FLOAT	SLUDGE BUFFER TANK NO. 2	LEVEL - LOW-LOW	SLUDGE BUFFER TANK NO. 2	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	1.0	FEET	N/A	N/A	Y405	2, 3, 4, 6
AGS-LT-801	N/A	SUBMERSIBLE LEVEL TRANSDUCER	WLC TANK	LEVEL	WLC TANK	N/A	PIPE	N/A	4-20mA	0 - 25	FEET	2-WIRE	LOOP	Y406	2, 4, 6
N/A	AGS-LSHH-801	LEVEL SWITCH - FLOAT	WLC TANK	LEVEL - HIGH-HIGH	WLC TANK	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	18.0	FEET	N/A	N/A	Y406	2, 3, 4, 6
N/A	AGS-LSH-801	LEVEL SWITCH - FLOAT	WLC TANK	LEVEL - HIGH	WLC TANK	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	16.0	FEET	N/A	N/A	Y406	2, 3, 4, 6
N/A	AGS-LSL-801	LEVEL SWITCH - FLOAT	WLC TANK	LEVEL - LOW	WLC TANK	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	1.5	FEET	N/A	N/A	Y406	2, 3, 4, 6

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WWTP - AGS Instrument List

INSTRUMENT TAG NUMBER		TYPE	DESCRIPTION	FUNCTION	LOCATION	PROCESS	MOUNTING		OUTPUT	RANGE/	ENGINEERING	XMTR	POWER	DRAWING	SPECIAL
TRANSMITTER	ELEMENT					CONNECTION(S)	TRANSMITTER	ELEMENT		SET POINT	UNIT	TYPE			NOTES
N/A	AGS-LSLL-801	LEVEL SWITCH - FLOAT	WLC TANK	LEVEL - LOW-LOW	WLC TANK	IMMERSION	N/A	SUSPENDED	N.O. CONTACT	1.0	FEET	N/A	N/A	Y406	2, 3, 4, 6
AGS-PIT-901	N/A	PRESSURE TRANSMITTER	AERATION BLOWER HEADER	PRESSURE	AERATION BLOWER HEADER	1/2" NPT	PROCESS PIPE	N/A	4-20mA	0 - 25	PSIG	2-WIRE	LOOP	Y408	2, 6
N/A	AGS-PDS-912	PRESSURE DIFFERENTIAL SWITCH	AERATION BLOWERS INTAKE NO. 1	PRESSURE - HIGH	EXTERIOR BLOWER BUILDING	N/A	N/A	FILTER	N.O. CONTACT	PER SUPPLIER	PSIG	N/A	N/A	Y407	6
N/A	AGS-PDS-922	PRESSURE DIFFERENTIAL SWITCH	AERATION BLOWERS INTAKE NO. 2	PRESSURE - HIGH	EXTERIOR BLOWER BUILDING	N/A	N/A	FILTER	N.O. CONTACT	PER SUPPLIER	PSIG	N/A	N/A	Y407	6
N/A	AGS-PDS-932	PRESSURE DIFFERENTIAL SWITCH	AERATION BLOWERS INTAKE NO. 3	PRESSURE - HIGH	EXTERIOR BLOWER BUILDING	N/A	N/A	FILTER	N.O. CONTACT	PER SUPPLIER	PSIG	N/A	N/A	Y407	6
N/A	AGS-PDS-942	PRESSURE DIFFERENTIAL SWITCH	AERATION BLOWERS INTAKE NO. 4	PRESSURE - HIGH	EXTERIOR BLOWER BUILDING	N/A	N/A	FILTER	N.O. CONTACT	PER SUPPLIER	PSIG	N/A	N/A	Y408	6
N/A	AGS-PDS-952	PRESSURE DIFFERENTIAL SWITCH	AERATION BLOWERS INTAKE NO. 5	PRESSURE - HIGH	EXTERIOR BLOWER BUILDING	N/A	N/A	FILTER	N.O. CONTACT	PER SUPPLIER	PSIG	N/A	N/A	Y408	6
UV-AIT-020	UV-AIT-021	TOTAL PHOSPHATE ANALYZER	UV DISINFECTION	TP	UV INFLUENT CHANNEL	SAMPLE LINE	WALL	WALL	4-20mA	TBD	TBD	4-WIRE	120VAC	Y601	2, 6

NOTES:

1. 120VAC POWER SOURCE FOR INSTRUMENT TRANSMITTER SHALL BE SUPPLIED FROM WITHIN THE ASSOCIATED PLC CABINET
2. PROVIDE SURGE PROTECTIVE DEVICE(S) (SPD) FOR INSTRUMENT.
3. RANGE INDICATED IS DESIGN BASIS. COORDINATE FINAL INSTRUMENT RANGE WITH ACTUAL TANK SUPPLIED
4. INSTALL INTRINSICALLY SAFE BARRIER (DISCRETE SIGNAL) IN THE ASSOCIATED CONTROL PANEL/PLC CABINET FOR THE INDICATED INSTRUMENT. POWER FOR INSTRINSICALLY SAFE BARRIER SHALL BE SUPPLIED FROM THE ASSOCIATED CABINE˙
5. SUPPLY INSTRUMENT WITH MANUFACTURER CABLE FOR CONNECTION OF ELEMENT TO TRANSMITTER AS SPECIFIED
6. INSTRUMENT IS SUPPLIED BY VENDOR OF THE PROCESS SYSTEM. RANGE/SETPOINT TO BE DETERMINED BY VENDOR.

SECTION 40 71 90 – PARSHALL FLUME LINER

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes the furnishing and installation of a Parshall flume liner as indicated in the Contract Drawings and in accordance with the Manufacturer's recommendations.

B. Related Work Specified Elsewhere:

1. Instrumentation for Process Systems: Section 40 70 00.

1.02 REFERENCES:

A. Applicable Codes and Standards: Design, fabricate, assemble, and test Equipment and Materials so that upon installation in accordance with the manufacturer's recommended procedures for this application, the Equipment will conform to the requirements of the Federal Occupational Safety and Health Standards and the applicable provisions of:

1. U.S. Department of Agriculture Soil Conservation Service (USDA-SCS):
   a. Circular No. 843, Measuring Water in Irrigation Channels with Parshall Flumes &* Weirs.
   b. National Engineering Handbook, Section 15, Chapter 9.
2. U.S. Department of the Interior, Bureau of Reclamation (BUREC):
   a. Water Measurement Manual.

1.03 SUBMITTALS:

A. Submit as specified in Division 1.

B. Submittals shall include, but not be limited to, the following:

1. Drawing or illustration showing liner dimensions, construction, structural support, and anchorage.
2. Drawing or illustration showing level staff gauge, construction, markings, and anchorage.
3. Certified listing of materials of construction for the liner and staff gauge.
4. Manufacturer's recommended installation procedure.
   a. Leveling, lifting, and alignment procedures and requirements.
   b. Internal and external bracing requirements.
5. Certificates and Affidavits: As specified in Divisions 2 through 16.

C. Submit shop test reports and performance data specified in paragraph 1.04A below.

D. Submit complete operation and maintenance manuals for all equipment.

1.04 QUALITY ASSURANCE:

A. As specified in Division 1.

B. Factory Tests and Reports:

1. Include all manufacturer's standard factory tests on Equipment and Material.
2. The written test reports shall be provided within seven days after completion of the final test. Retesting will be required if written test reports are not received in timeframe indicated or if tests fail requirements.
3. Submit test reports to Engineer.

1.05 FACTORY ASSEMBLY:

A. As specified in Division 1.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. As specified in Division 1.

B. Delivery, storage, and handling shall conform to the following requirements:

1. Provide bracing and protection to avoid damage to the liner and staff gauge during shipment, storage, and handling.
2. Maintain bracing and protection until the liner and gauge are ready for installation.
3. Avoid handling liner with hooks, clamps, or other surface damaging devices.

1.07 WARRANTY:

A. As specified in Division 1.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Badger Meter, Inc., Precision Products Division.
B. B.I.F. Industries – Unit of General Signal.
C. Fischer & Porter.
D. Hinde Engineering Co. of California, Inc.
E. F. B. Leopold Company, Inc. – Mueller Co.
F. Plasti-Fab Inc.
G. Warmister Fiber Glass, American Meter Div., Singer Co.
H. Kenco Plastics Company, Inc.
I. Engineer Approved Equal.

2.02 PARSHALL FLUME LINER:

A. Constructed of fiberglass reinforced polyester plastic resin:
   1. Not less than 30% fiberglass by weight.
   2. Sanitary satin finish on all surfaces exposed to flow.
   3. One-piece unit construction with integrally molded external ribs and flanges for strength and anchorage.
   4. Provide resin for temperature limit to 150°F.
B. Sufficiently rugged to withstand normal handling and installation.
C. Dimensions to conform to USDA-SCS Circular No. 843.
D. Operational sizing parameters:

Throat Size (inches)	Minimal Wall, t (inches)	Minimum Flow (MGD)	Maximum Flow (MGD)
36	¼	2.0	15.0

   1. Provide all attachment materials, fasteners, and appurtenant connections.
   2. Discharge flow rates are free flow capacity values.

2.03 LEVEL STAFF GAUGE:

A. Provide a level staff gauge as an integral part of the side wall of the flume.
   1. Fabricate from materials compatible with the fluid measured without discoloration, deterioration, or corrosion.
   2. Provide for future removal and replacement of attached gauge.
   3. Resistant to ultraviolet light and weather extremes.
B. Color of the gauge face: white.
C. Color of all gauge markings: black.
D. Graduations of the gauge in hundreths of a foot with:
   1. 5/8-inch high numerals at each 0.1 feet.

2. Offset 1-inch high numerals at each 1.0 foot.
3. Increase length of graudation at each 0.1 and 1.0 foot interval.

E. Minimum width of gauge: 2-1/2 inches.
F. Length of gauge: Full depth of flume liner.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Refer to “Manufacturers Field Services” in Division 1 for requirements for startup.
B. Installation, start-up, and testing of all Equipment and associated construction shall conform to Manufacturer's recommendations.
   1. The floor of the inlet or converging section must be level in both directions.
C. Adequately brace and protect liner during installation to prevent deformation or damage.
   1. Provide full face bracing or formwork inside the liner.
      a. On sidewalls and bottom.
      b. Make an integral part of the channel formwork.
      c. Bracing joints at least 12 inches from edge of liner.
   2. Limit surface deflection to 1/8-inch in 4 feet in any direction.
D. Install roofing felt between liner and bracing or formwork to prevent damage to the liner surface.
E. All metal fastners or appurtenances – 304 stainless steel.
F. Cover all penetrations in the shop or field with fiberglass and resin.
   1. Furnished by the Manufacturer for this purpose.
   2. Apply in accordance with Manufacturer’s recommendations.
G. Level instrumentation shall be provided and installed for the flume according to Section 40 70 00 and as indicated on the Contract Drawings.

3.02 FIELD TESTING:

A. As specified in Division 1.

3.03 MANUFACTURER TRAINING:

A. As specified in Division 1.

3.04 INSPECTION:

A. As specified in Division 1.

END OF SECTION 40 71 90

SECTION 41 22 00 - CRANES AND HOISTS

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes the following types of Equipment:
   1. Trolley hoist on monorail beam(s).
      a. Location: Influent Pump Station (qty 1)
      b. Location: AGS Pipe Gallery (qty 3)

B. General requirements for crane and hoist required are defined in this Specification.

C. Related Work Specified Elsewhere:
   1. Electrical: DIVISION 26.
   2. Structural: See drawings for monorail beam length(s).

1.02 REFERENCES:

A. Applicable Standards:
   1. American Institute of Steel Construction (AISC):
      a. Code of Standard Practice for Steel Buildings and Bridges.
   2. American National Standards Institute (ANSI/ASME):
      a. B30.2 - Overhead and Gantry Cranes (Top Running Bridge, Single or Multipole Girder, Top Running Trolley Hoist).
      b. B30.11 - Monorail and Underhung Cranes.
      c. B30.16 - Overhead Hoists (Underhung).
   3. American Society for Testing and Materials (ASTM):
      a. A36 - Structural Steel.
      b. A48 - Gray-Iron Castings.
      c. A148 - Steel Castings, High-Strength, for Structural Purposes.
      d. A536 - Ductile-Iron Castings.
      e. A668 - Steel Forgings, Carbon and Alloy, for General Industrial Use.
      f. B766 - Electrodeposited Coatings of Cadmium.
   4. Crane Manufacturers Association of America (CMAA):
      a. No. 70 - Specifications for Electric Overhead Traveling Cranes.
      b. No. 74 - Specification for Top-Running and Under-Running Single- Girder Electric Overhead Traveling Cranes.
   5. Hoist Manufacturers Institute (HMI):
      a. HMI 100 - Standard Specifications for Electric Wire Rope Hoists.
   6. Federal Specification (FS):
      a. RR-W-410 - Wire Rope.
   7. Forging Industry Association Handbook.
   8. Institute of Electrical and Electronics Engineers (IEEE).
   9. Master Car Builder (MCB).
   10. National Electrical Code (NEC), Article 610.
   11. National Electrical Manufacturers Association (NEMA).
   12. Society of Automotive Engineers (SAE).

1.03 SUBMITTALS:

A. Submit as specified in DIVISION 01.

B. Include, but not limited to, the following:
   1. Product Data:
      a. Specifications and manufacturer's data.
      b. Catalog cuts.
      c. Fabrication and erection Drawings, and details.
      d. Operation and maintenance manuals.

1.04 QUALITY ASSURANCE:
A. Provide the services of a factory representative to place cranes and hoists in service in the event it does not function in an acceptable manner, or in the event of erection difficulties requiring expert advice from the manufacturer.
B. When more than one trolley hoist is furnished under this Contract, all trolley hoists shall be supplied by one manufacturer only.

1.05 DELIVERY, STORAGE, AND HANDLING:
A. Store and handle crane(s) to prevent warping or racking of members.
B. Protect all components from damage by weather and operations on the Site.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:
A. Subject to compliance with requirements specified, provide products of one of the following:
   1. Trolley Hoists:
      a. ACCO – Acco Material Handling Solutions
      b. Or Architect approved equal.

2.02 TROLLEY HOIST:
A. General Requirements:
   1. Conform to ANSI/ASME B30.16 except as otherwise indicated.
   2. Conform to requirements for individual cranes and trolley hoists as indicated on Drawings and Specifications.
   3. Paint system shall be standard of manufacturer.
   4. Rated capacity shall be permanently marked one each side of unit.
B. Electric-Motor Operated Trolley Hoist:
   1. Required capacity at the Influent Pump Station: 3 ton.
      a. Environment: Outdoor, uncovered.
      b. Quantity: 1
      c. Type:
         (1) Electric, heavy-duty, lug-mount hoist.
         (2) Double-reeved, wire rope.
         (3) Single-speed lift. 22 fpm minimum.
         (4) Required hook lift: 55’- 0”
         (5) Trolley to be motorized drive and lift type.
         (6) Harsh environment hoist motor w/heater & weatherproof brake.
         (7) Harsh environment trolley motor w/heater & weatherproof brake.
         (8) NEMA 4X fiberglass or stainless enclosure.
         (9) Control heater w/T-stat.
         (10) Drop down lugs w/rubber bumpers.
         (11) Synthetic oil in hoist gearbox.
         (12) Drum coated w/Rust-Guard or Architect approved equal.

(13) Epoxy type urethane enamel hoist paint.
(14) All conduit entries at bottom of enclosures.

d. Manufacturer's model shall be as follows:
(a) ACCO – Acco Material Handling Solutions
Wright
Work Rated
New Century Series
Electric Wire Rope Hoists
3 Ton Monorail Hoist
Series 32
2 part double reeved
3/8 diameter rope
C2W03D060-22*2D0

2. Required capacity at the AGS Pipe Gallery: 1 ton.
a. Environment: Interior with moisture.
b. Quantity: 3
c. Type:
(1) Electric, heavy-duty, lug-mount hoist.
(2) Double-reeved, wire rope.
(3) Single-speed lift. 15 fpm minimum.
(4) Required hook lift: 30'- 0"
(5) Trolley to be motorized drive and lift type.
(6) Control heater w/T-stat.
(7) Drop down lugs w/rubber bumpers.
d. Manufacturer's model shall be as follows:
(a) ACCO – Acco Material Handling Solutions
Wright
Speedway
New Century Series
Electric Wire Rope Hoists
1 Ton Monorail Hoist
Series 31
2 part double reeved
3/16 diameter rope
C1W01D032-15*2D0

3. General Construction:
a. Conform to HMI 100.
b. Unit shall have automatic weston mechanical load brake, automatic upper-limit switch, geared upper and lower hook travel limit switch, overload device, and safety hook latch.
c. Motor shall be fully enclosed, heavy-duty, with high starting torque.
d. Trolley shall be provided with electronic soft-start controllers for smooth starting.
e. Disc type hoist motor brake.
f. Trolley motor brake.

4. Operation:
a. Operation shall be by means of control pendant suspended from a cable reel on the trolley hoist for operation with top of station located 3'-0" above the lower-level floor at the AGS and top of concrete at the Influent Pump Station.
b. Individual 6 push buttons to control hoist and trolley for electric operation. Pendant shall also have "start-stop" button to actuate the main line contactor.

c. Pendant shall be of nonconductive material.
d. Control(s) shall be single-speed, magnetic-type consisting of heavy-duty reversing type contactors interlocked and energized by push buttons. Control voltage shall be 115V ac.
(1) Control panels shall be enclosed in nonventilated enclosures conforming to NEMA 4X.

5. Electrification:
a. Electric Power: 3 phase, 60 hertz, 460Vac.
b. Electrical system for powering the hoist and trolley shall be Rigid "C" track festoon system with flat wire cross conductors for power and controls.
(1) "C" track to be minimum of 14-gauge galvanized steel.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Inspect all areas and surfaces for conditions detrimental to proper installation. Do not proceed with installation until conditions are satisfactory.

3.02 INSTALLATION:

A. Provide a complete installation including all Materials and Equipment necessary for Operation of the Equipment. Place all specified Equipment into operation, including machinery lubrication.
B. Install hoist and trolley level and in alignment.
C. Adjust Equipment to operate properly, including adjustment of stops to prevent overtravel, and tension to prevent travel when not in use.
D. Touch-up damaged paint surfaces with matching paint system same as used in the shop.
E. Lubricate all bearings, gears, and other items requiring lubrication before placing crane in operation.

3.03 TESTING:

A. Prior to initial use and as needed at other intervals until date of acceptance, test operate and load test crane as required by Occupational Safety and Health Administration Part 1910.179.
1. Contractor to coordinate this with the demolition schedule. Testing will be most efficient once demolition has occurred.
2. Provide Engineer one weeks' notice of the load test.
B. Perform annual inspection of new hoist.
C. Send copies of test report to Architect and Owner and place on file at Project Site.
1. Testing shall be performed by Contractor or under direction of authorized persons.

END OF SECTION 41 22 00

SECTION 43 11 33 - POSITIVE DISPLACEMENT BLOWERS

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes the following:
   1. Positive Displacement Blowers and accessories including:
      a. Inlet Air Filter / Silencers.
      b. Inlet and Discharge Silencers.
      c. Sound Attenuating Enclosures with instrumentation and components specified herein.
   2. Granular Sludge Biological Treatment System (Series 400) Blowers:
      a. Five (5) blowers shall be provided by Equipment Supplier providing equipment specified under Section 46 53 60 Granular Sludge Biological Treatment System. Blowers shall meet specifications herein.
   3. Thin Sludge Tanks (Series 700) Blowers:
      a. Three (3) blowers shall be provided as specified herein.

B. Furnish all labor, equipment, and material for complete and proper installation, testing, and start-up of all blowers and accessories. Disconnect switch, power and control field wiring from and to blower skid shall be provided by others.

C. Related Work Specified Elsewhere:
   1. SECTION 46 05 13 - Common Motor Requirements for Water and Wastewater Equipment.

1.02 REFERENCES:

A. American National Standards Institute (ANSI):
   1. B16.1 - Cast-Iron Pipe Flanges and Flanged Fittings (Class 125).
   2. B16.5 – Pipe Flanges and Flanged Fittings.

B. American Gear Manufacturer's Association (AGMA).

C. American Society of Mechanical Engineers (ASME).

D. Antifriction Bearing Manufacturer's Association (AFBMA):
   1. 9-Load Rating and Fatigue Life for Ball Bearings.

E. Antifriction Bearing Manufacturer's Association (AFBMA):
   1. MG-1 - Motors and Generators.

F. International Organization for Standardization (ISO):
   1. 1217 – Displacement Compressors – Acceptance Tests.

G. National Electrical Code (NEC).

H. National Electrical Manufacturer’s Association (NEMA).

I. National Fire Protection Association (NFPA).

1.03 QUALITY ASSURANCE:

A. Blower shall be sized such that the specified speed of operation at the specified conditions does not exceed 95% of the maximum blower design speed set forth by the manufacturer.

B. Factory test all units with all components installed through full range with all data documented.
   1. Factory performance testing per ISO 1217.

1.04 SUBMITTALS:

A. Submit as specified in DIVISION 01.

B. Includes, but not limited to, the following:

1. Equipment Submittals.
   a. Submit performance test data for blower and motor according to the site conditions specified in SECTION 01810 Project Design Criteria.
   b. Submit power and control schematic diagrams indicating factory and field wiring. All diagrams shall be complete and have uniquely numbered terminals, wires and devices.
   c. Submit manufacturer's rating, performance data for the blower and accessories.
2. Test Reports
   a. Prepare and submit a bound logbook recording all running tests and time including duration of tests and all malfunctions and corrections. List causes and adjustments of blower, motor, or connected accessories.
   b. The indicated capacities at the listed conditions shall be at or above the minimum acceptable efficiency. The blower selected shall meet the design criteria while operating at or near its mid-range capabilities to ensure the equipment is not undersized for its application.
   c. Submit complete motor nameplate data and motor information as indicated in SECTION 46 05 13.
3. Closeout Submittals
   a. Submit manufacturer's rating, performance data for all blower accessories.
   b. Before completion of installation and successful start-up, submit complete operation and maintenance manual for blowers and accessories.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Aerzen.
B. Gardner-Denver.
C. Kaeser
D. Universal Blower
E. Atlas Copco

2.02 POSITIVE DISPLACEMENT BLOWERS:

A. Table 1: Design Criteria

Service	QTY	Tags	Motor HP	SCFM	Discharge Pressure (psi)*
Granular Sludge Biological Treatment System (Series 400)	5	AGS-BLOW-910 AGS-BLOW-920 AGS-BLOW-930 AGS-BLOW-940 AGS-BLOW-950	200	2,430	10.9
Thin Sludge Tanks (Series 700)	3	WAS-BLOW-410, WAS-BLOW-420 WAS-BLOW-430	100	1,200	11.5

C. Blowers: Provide positive displacement rotary-lobe type blower and all specified accessories and controls assembled into a blower package.
   1. Quantity and capacity: refer to Table 1.

D. The discharge pressure shall be as indicated in Table 1 plus additional pressure required to overcome losses in the manufacturer blower package system at the following inlet conditions:
   a. Elevation: 872.00 feet above sea level.
   2. The discharge pressure does not include pressure loss through the blower intake filter, silencer, discharge check valve, and other appurtenances. The blower manufacturer shall be responsible for these losses in determining the discharge pressure at the blower. Refer to SECTION 01810 Project Design Criteria for inlet air conditions.
   3. Each blower shall have two dynamically balanced three-lobe, low pulsation rotors constructed of high-strength cast iron.
   4. Blower casings shall be one piece with separate head plates and shall be made of close-grained cast iron. The casings shall be suitably ribbed for maximum strength and to prevent distortion under the operating conditions. Inlet and outlet connections shall be flanged.
   5. Timing gears shall be helical type or spur gear, forged and heat treated with a minimum AGMA quality rating of 10.

E. All bearings shall be oil-splash lubricated from an oil-tight housing. Oil level sight glasses shall be provided.

F. Blower operating speed at the stated conditions shall not exceed 4,000 rpm.
   1. Blower noise rating at the stated conditions shall not exceed 80 dBA at 3 feet from the enclosure.

G. Construction:
   1. The blower and associated motor shall be mounted on a rigid adjustable motor base or an automatic belt tensioner.
   2. Blower shall be designed for continuous service providing specified pressure while operating without internal rotor contact.

H. Electric Motor:
   1. The motor shall be horizontal, TEFC, 460/3/60 in accordance with SECTION 46 05 13.
   2. The blower manufacturer shall provide the electric motor on the blower skid.
   3. Motor shall be designed for operation with variable frequency drive.
   4. Provide two normally closed temperature switches embedded in each phase winding for high temperature protection. Switches shall be rated for use with 120Vac.
   5. Provide factory installed, maintenance free, circumferential, conductive micro fiber shaft grounding ring to discharge shaft currents to ground.
   6. Provide motor with service factor of 1.15.
   7. Belt drive shall be sized for 140% rated horsepower of the blower and shall include a drive guard.
   8. Belts shall be automatically tensioned by use of pivoting swing frame motor base with adjustable spring assistance and visual indication of belt tension.
   9. The blower will be driven by a variable frequency drive by Others.

I. Accessories: Provide for the blower accessories as indicated in the Process and Instrumentation Diagrams (P&IDs) and as follows:
   1. Flanged Intake Connections:
      a. Series 400 Blowers: Furnish 12" , ASME B16.5, 150#, SCH STD carbon steel flanged connection exterior of enclosure for connection of air piping. All piping shall be properly supported from the inlet connection.

b. Series 700 Blowers: Furnish 10" , ASME B16.5, 150#, SCH STD carbon steel flanged connection exterior of enclosure for connection of air piping. All piping shall be properly supported from the inlet connection.

2. Flanged Discharge Connections:
   a. Series 400 Blowers: Furnish flanged expansion joint with 10" ASME B16.4, 150# flanged connection outside of enclosure for connection of air piping.
   b. Series 700 Blowers: Furnish flanged expansion joint with 8" ASME B16.4, 150# flanged connection outside of enclosure for connection of air piping.
   c. Expansion joints shall be rated for maximum anticipated discharge temperature with a 25 degree F safety factor.
3. Refer to Section 40 70 00 for all instrument requirements as indicated and specified herein.
4. Inlet and Discharge Silencers: Provide silencers designed for silencing at the design blower speed. The silencers shall be of the wear-free absorptive type absorption type with matching flanges and shall be of all welded steel construction.
5. Inlet Air Filter: Each blower enclosure shall be provided with an inlet filter sized such that pressure loss through the entire filter shall not exceed 3 inches H_2O at the specified airflow with a new element. The filter shall be equipped with a pleated radial fin paper or polyester wrap element suitable for outdoor service. Each filter shall be supplied with a pressure differential switch. Filter media shall be minimum 99% efficiency at 5 micron.
6. Check Valve: Shall have cast iron or steel body, aluminum, steel, or stainless-steel internals, resilient seat capable of operating with 350°F discharge air.
7. Discharge Pressure Relief Valve: A spring type pressure relief valve shall be provided on the blower package discharge.
8. Discharge Temperature Switch: Provide a discharge temperature switch to allow blower shut down in the event of high discharge air temperature. Provide a N.C. contact that opens when the discharge temperature reaches 250 degrees F (adjustable), or as recommended by Blower manufacturer. Contacts shall be rated for 120Vac operation.
9. Blower Enclosure Inlet Filter Differential Pressure Switch: Provide a N.O. contact that closes when the differential pressure falls below the manufacturer recommended set point. Contacts shall be rated for 120Vac operation.
10. Motor shall be provided with integral thermal overload protection.
11. Pressure Instruments: A suction pressure gauge and a discharge pressure gauge (0-30 psig) shall be provided and mounted on package enclosure.
12. All interconnecting piping for unit and accessories provided within the enclosure. Vibration isolation pads made of rubber in steel footing designed to bear the weight of the entire blower package assembly without deflecting.
13. Structural steel base designed to support all operating loads and of sufficient size to hold the blower, all associated engineered accessories.
14. Spare Parts: Provide the following spare parts with the blower supplied:
    a. One spare filter element.
    b. One set spare V-belts.

J. Blower Enclosure:
1. Entire package shall be housed in an enclosure with a minimum of one removable access panel. Latches shall be weather resistant material suitable for outdoor application.
2. Provide integral ventilation fan. Ventilation capacity to maintain maximum temperature of 10°F above ambient. Fan shall be energized/de-energized via thermostat, if applicable.

a. Thermostat shall be provided, installed, and wired by manufacturer.
b. Thermostat set points per manufacturer's recommendations.
c. Thermostat contacts shall be rated for full voltage starting of the supplied fan.
d. Ventilation fan shall be powered from 120Vac and shall be fractional horsepower in size. Fan motor shall be provided with integral thermal overload protection.
(1) Blower motor shaft-mounted ventilation fan shall be acceptable in lieu of ventilation fan driven by separate circuit as long as cooling is adequate at maximum blower turndown.

3. Enclosure shall include integral, NEMA 4 junction box with terminal strips for landing all power and control wire.
4. Provide with oil drip pan if required per Supplier's package.
5. Designed to attenuate noise. Noise level 3 feet from blower enclosure shall not exceed 80 dbA.

K. Unit Base: Rigid steel frame suitable for moving with hand-operated fork-cart.
L. Factory coat assembly with manufacturer's standard coating suitable for service intended. Provide 1 quart of touch-up paint if enclosure is painted.
M. Anchor bolts
1. Contractor shall provide 316 SST anchor bolts as required for installation of equipment and of size and length as indicated on Drawing S005.
N. The blower skid shall include the manufacturer's standard means for monitoring blower pressure and temperature. Items shall be manufacturer's standard and shall include the following as a minimum:
1. Enclosure inlet air filter pressure differential, including gauge for local readout.
2. Discharge pressure, including gauge for local readout.
3. Discharge temperature, including gauge for local readout.
4. NEMA 4X high discharge temperature switch.
5. Enclosure inlet air filter differential pressure switch.
O. Intake Filter / Silencer Assemblies:
1. Series 400 Blowers: For each blower, manufacturer shall provide a dedicated intake filter / silencer assembly to be installed by Contractor on the exterior of the Blower Building.
a. Five (5) intake filter / silencer assemblies shall be provided.
b. Intake filter / silencers shall be provided with 12", ASME B16.5, 150# flanged connection. Flange shall be located on top of assembly.
c. Minimum capacity of each filter / silencer assembly shall be 5,000 cfm.
d. Filter element shall be provided with 10-micron openings.
e. Filter / silencer assembly shall be Endustra Filter Model TM09RL-E047935, or Engineer approved equal.
f. Intake Filter / Silencer Differential Pressure Switch: Provide a N.O. contact that closes when the differential pressure falls below the manufacturer recommended set point. Contacts shall be rated for 120Vac operation.
2. Series 700 Blowers: One (1) common intake filter / silencer assembly shall be provided to be installed by Contractor on a common intake pipe on the exterior of the Solids Processing Building.
a. Intake filter / silencer shall be provided with 12", ASME B16.5, 150# flanged connection. Flange shall be located on top of assembly.
b. Minimum capacity of each filter / silencer assembly shall be 5,000 cfm.
c. Filter element shall be provided with 10-micron openings.

d. Filter / silencer assembly shall be Endustra Filter Model TM09RL-E047935, or Engineer approved equal.Intake Filter / Silencer Differential Pressure Switch: Provide a N.O. contact that closes when the differential pressure falls below the manufacturer recommended set point. Contacts shall be rated for 120Vac operation.

P. Intake Filter Silencer Assemblies (Series 400 Blowers Only):
1. For each blower, manufacturer shall provide a dedicated intake silencer assembly to be installed by Contractor interior to the Blower Building. Intake silencer shall be capable of being installed in the footprint shown in the Contract Drawings.
a. Five (5) intake silencers assemblies shall be provided.
b. Intake silencers shall be provide with 12", ASME B16.5, 150# flanged connections. Inlet flanged connection shall be perpinduclar to discharge flange connections, as shown in Contract Drawings.
c. Intake silencers shall be Stoddard Silencer Model L61H-10 fabricated with 12" flanged connections.

2.03 SPARE PARTS:
A. Provide the following spare parts as a minimum:
1. One set of new and unused special tools required for installation, operation, and maintenance.
2. One (1) spare inlet air filter for each blower enclosure provided.
3. One (1) blower replacement V-belt for each blower enclosure provided.

PART 3 - EXECUTION

3.01 MANUFACTURER'S FIELD SERVICES:
A. Field services shall be provided by an experienced factory-based representative of the equipment manufacturer specializing in start-up and training, with expertise in controls capable of minor or major field adjustment of electrical, electronics, or mechanical components of blowers. Manufacturer's local sales representative is not acceptable.

3.02 INSTALLATION:
A. Install and align blower and motor in conformance with manufacturer's recommendations.
B. Make all electrical and control connections.
C. Complete all piping and supports, and install all indicated and specified gauges and instrumentation prior to start-up.
D. All aeration piping and equipment shall be installed and basin filled with water prior to start-up of the blowers.
E. Provide all necessary lubrication for initial start-up, testing and final acceptance.

3.03 PERFORMANCE TESTS:
A. Factory Performance Tests:
1. All critical dimensions of the blower components actually provided by the manufacturer shall be verified and documented prior to assembly.
2. The rotating parts of the blower actually provided by the manufacturer shall be statically and dynamically balanced before final assembly. The blower alone shall operate without vibration in excess of the limits stated in the latest revision of NEMA MG-1.

3. On completion of final assembly of the packaged blower and prior to shipment, the packaged blower shall be mechanically run for a minimum of 15 minutes at the design conditions.
4. Blower shall be tested in accordance with ISO 1217.

B. Field Performance Tests:
1. Function Test: After installation and prior to system startup, the packaged blower shall be inspected by a supplier's representative for proper alignment, proper connection, and proper function by means of a startup check.
2. Performance Test: The Supplier's manufacturer's representative shall be present and shall direct start-up, perform all checks, and shall perform tests to demonstrate that the packaged blower conforms to the Specifications to the satisfaction of the Engineer. Blower performance shall be documented by obtaining concurrent readings showing supply voltage, motor amperage, blower speed, blower inlet pressure, blower outlet pressure, blower inlet temperature, and blower outlet temperature. The packaged blower motor lead shall be checked for proper current balance.
3. Blower shall operate at rated capacity for 4 continuous hours. Blower will then be run at 30 minutes on at rated capacity and 10 minutes off for a period of 4 hours.
4. Packaged blower failing to meet the Specifications to the satisfaction of the Engineer will be corrected and retested by the installing Contractor. If a packaged blower fails the second test, the unit will be rejected and the Supplier shall furnish a unit which will perform as specified at no additional cost to the Owner.
5. A test log shall be submitted to the Engineer on completion of each test which records the blower model number, blower serial number, test date, beginning test time, ending test time, motor horsepower, motor speed, and all of the performance documentation parameters specified in this Section.

3.04 TRAINING:

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain blowers. Training shall be for a minimum of four hours, on-site, at a time mutually agreed upon by Owner and service representative. Two complete training sessions shall be provided. The Owners, at their option, shall be allowed to video record all training sessions for future reference. Training shall occur after blower installation is complete. Contractor shall coordinate with Client and blower Manufacturer.

END OF SECTION 43 11 33

SECTION 43 23 57 – PROGRESSIVE CAVITY PUMPS

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes the supply, delivery, installation, and commissioning of progressive cavity pump units, including:
   1. Two (2) variable speed progressive cavity Thickened Sludge Pumps.
   2. Two (2) constant speed progressive cavity Sludge Loadout Pumps.

B. Contractor shall supply all equipment, materials, and labor required for the installation and operation of the pumping units.

C. The Thickened Sludge Pumps will be used to pump thickened sludge from the Rotary Drum Thickener sludge hopper to the Thickened Sludge Storage Tanks.

D. The Sludge Loadout Pumps will be used to pump thickened sludge from the Thickened Sludge Storage Tanks to trucks for haul off.

E. Pumps shall be furnished complete with pump casings, suction connections, discharge connections, shafts, bearings, rotor, stator, seals, lubrication, anchor bolts, motors, speed reducers, and all other parts and accessories indicated, specified, or required for proper installation, operation, and maintenance.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. General Requirements: Division 1.
B. Manufacturer's Field Services: Division 1.
C. Protective Coatings: Section 09 90 00.
D. Instrumentation and Controls: Division 26.
E. Pressure Piping: Division 33.
F. Section 40 70 00 - Instrumentation For Process Systems
G. Section 46 05 13 - Common Motor Requirements for Water and Wastewater Equipment.

1.03 REFERENCES:

A. Applicable Standards:
   1. Anti-Friction Bearing Manufacturer's Association (AFBMA).
   2. American Gear Manufacturers Association (AGMA):
      a. 6010-E-88 – Spur, Helical, Herringbone, and Bevel Enclosed Drive
      b. 6019-E-89 – Gear Motors Using Spur, Helical, Herringbone, Straight Bevel, or Spiral Bevel Gears
      c. 6023-A88 – Design Manual for Enclosed Epicyclic Gear Drives
   3. American National Standards Institute (ANSI).
   4. American Society of Mechanical Engineers (ASME):
      a. B16.1 – Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
   5. American Society for Testing and Materials (ASTM):
      a. A48 – Gray Iron Castings.
      b. A53 – Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
      c. A108 – Steel Bars, Carbon, Cold-Finished, Standard Quality.
      d. A276 – Stainless and Heat-Resisting Steel Bars and Shapes.
      e. A307 – Carbon Steel Bolts and Studs, 60,000 psi Tensile.
      f. B505 – Copper-Base Alloy Continuous Castings.
      g. B584 – Copper Alloy Sand Castings for General Applications.
   6. American Welding Society (AWS)
   7. Hydraulic Institute Standards (HIS)

8. Institute of Electrical and Electronic Engineers (IEEE)
9. National Electrical Manufacturers Association (NEMA)
10. National Fire Protection Association (NFPA)
11. Underwriters Laboratories (UL)

1.04 SUBMITTALS:

A. Submit as specified in Division 1.

B. Compliance submittals: Data to be submitted shall include, but not be limited to, the following:
   1. Catalog data or illustrations showing principal parts and materials.
   2. Detailed layout dimensions.
   3. Protective coating system.
   4. Mechanical Details:
      a. Suction nozzle diameter.
      b. Discharge nozzle diameter.
      c. Joint or drive shaft design.
      d. Type of bearings.
      e. Bearing manufacturer and design life.
      f. Provisions for removing rotor and stator assembly and changing bearings, including clearance requirements from adjacent objects and obstructions.
   5. Support Details, Base Plate:
      a. Materials.
      b. Drawing indicating configuration, minimum thickness of members, stiffeners, method of supporting pump and motor, provisions for adjusting alignment and removing motor, stator, or rotor.
   6. Dimensions:
      a. Outline drawings of pump, drivers and base.
      b. Minimum clearance dimensions for rotor removal.
   7. Weights:
      a. Total each unit.
      b. Pump (with rotating assembly).
      c. Rotating assembly.
      d. Base plate.
      e. Removable section of casing.
      f. Motor and speed reducer.
   8. Accessories (type and manufacturer):
      a. Seal.
      b. Fittings.
      c. Dry-run protection device or temperature sensor monitoring and alarming devices
      d. Thickened Sludge Pumps discharge pressure monitoring and alarming devices
      e. Sludge Loadout Pumps suction and discharge pressure monitoring and alarming devices.
   9. Motor data including, but not limited to, the following:
      a. Manufacturer's name and serial number.
      b. Horsepower output.
      c. Temperature rise and method indicated.
      d. Maximum ambient temperature.
      e. Altitude rating, including any necessary derating
      f. Insulation class.

g. Rpm at rated load.
h. Frequency.
i. Number of phases.
j. Voltage.
k. Rated load amperes.
l. Locked rotor amperes or code letter.
m. Service factor.
n. Maximum noise level of pump/motor unit (dBA).
o. Efficiency, determined in accordance with IEEE Standard 112, Method B.
p. Dimensions for enclosure and shafts.
q. Weight.
r. Bearing information.

10. Standard performance curves for each pump model furnished. Curves shall cover range from shutoff to 120% of design flow rate at the conditions specified, and shall be submitted for the following parameters as a function of pump capacity, speed and TDH at design temperature:
    a. Total developed head.
    b. Required brake horsepower.
    c. Pump efficiency.
    d. Required NPSH.
    e. Minimum flow.
    f. Maximum recommended flow.
11. VFD performance curves for the Thickened Sludge Pumps model furnished. Curves shall include the following parameters as a function of pump capacity and speed at design temperature:
    a. Total head.
    b. Required brake horsepower.
    c. Pump efficiency.
    d. Required NPSH.
    e. Minimum flow.
    f. Maximum recommended flow.

C. Factory Tests and Reports:
1. Perform non-witnessed tests for speed, pressure, and flow rate at operation points as necessary per HI Standard section 3.6.4 for meeting class A requirements. Include hydrostatic test per HI Standard section 3.6.5.
2. Pumps shall be tested in position as they will be installed in the field with no exceptions.
3. Certification of design points.
4. Submit a written test report and graphic representation(s) of the test results. Test report data collected and provided shall meet the minimums of Hydraulic Institute Standards.
5. Test certificates and results.
6. Perform all manufacturer's standard tests to determine the performance of the motors.
7. Submit test reports to Engineer.

D. Submit all field test data.

E. Operation and Maintenance Manual in accordance with Section 01021 – Operation and Maintenance Data.
1. Installation instructions.
2. Recommended spare parts list and list of lubricants.
3. Installation assembly, disassembly and repair instructions.

F. Certifications:
   1. Manufacturer's Certificate of proper installation and start-up.
   2. Field performance test procedures.
   3. Submit complete, signed report of results of field inspection, operation, adjustments, and tests. Include the Manufacturer's certificate that the equipment is ready for permanent operation and that nothing in installation will affect Manufacturer's warranty in any manner, or render warranty null and void.
   4. Certification of compliance with the requirements of the American Iron and Steel (AIS) provisions.

1.05 QUALITY ASSURANCE:

A. All items of equipment specified herein shall be furnished by one Manufacturer. This Manufacturer shall have the responsibility of providing the equipment, accessories, installation supervision, and testing services required to provide a functioning system.
B. Like items of equipment provided hereunder shall be the end products of one Manufacturer in order to achieve standardization for appearance, operation, maintenance, spare parts, and Manufacturer's service.
C. Manufacturer to provide specific standard factory tests and reports for each pump.
D. Contractor shall make any necessary adjustments to the suction and discharge piping shown on the Drawings based on the selected pump manufacturer at no additional cost to the Owner.

1.06 DELIVERY, STORAGE AND HANDLING:

A. Pump/motor units shall be completely shop assembled and aligned prior to shipping.
B. After completion of the specified factory tests, pumps shall be prepared for shipment with the minimum amount of disassembly, and such that no field disassembly, cleaning, or flushing is required.
C. Any components removed for shipping shall be match-marked prior to removal and shipment.
D. Equipment shall be shipped pre-assembled to the degree that is practicable.
E. Manufacturer shall provide storage instructions indicating specific requirements to protect against damage to or deterioration of components. Provide short- and long-term storage instructions.
F. Ship such that minimum field assembly is required.
G. Protect machined surfaces, electrical equipment, and bearings and glands against corrosion and moisture.
H. All parts shall be properly protected so that no damage deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.
I. All equipment and parts must be properly protected against any damage during a prolonged period at the site.
J. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Owner.
K. Finished surfaces of all exposed pump openings shall be protected by wooden blanks, strongly built, and securely bolted thereto.
L. After hydrostatic or other tests, all entrapped water shall be drained prior to shipment, and proper care shall be taken to protect parts from the entrance of water during shipment, storage, and handling.
M. Each box or package shall be properly marked to show its net weight in addition to its contents.

N. Spare parts shall be packed in containers bearing packing lists clearly designating contents and pieces of equipment for which they are intended.

1.07 WARRANTY:

A. The warranty shall comply with the requirements of Section 01020 – Record Documents.
B. The manufacturer shall warrant that all Equipment shall be free of defects caused by faulty material or workmanship and shall replace those parts for at least a period of one (1) year from the date of start-up. Warranty shall not be prorated.
C. Multiple warranties for individual components shall not be acceptable.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Seepex, Inc.
B. Netzsch
C. Moyno

2.02 GENERAL

A. Furnish, install, and place into successful operation the Thickened Sludge Pumps and Sludge Loadout Pumps as described herein.
B. All equipment shall be designed and built for 24-hour continuous service at any and all points within the specified range of operation, without overheating, without cavitation, and without excessive vibration or strain.
C. Pumps must have design option to integrate a dry running protection temperature sensor in the rotor case to protect against extended periods of dry running.
D. The pumping units required under this section shall be complete. All parts shall be so designed and proportioned as to have adequate strength, stability, and stiffness and to be especially adapted for sludge pumping. Ample room for inspection repairs and adjustment shall be provided.
E. All working parts of the pumps and motors, such as bearings, wearing rings, shaft, and sleeves shall be standard dimensions built to limit gauges or formed to templates, such that parts will be interchangeable between like units and such that the Owner may, at any time in the future, obtain replacement and repair parts for those furnished in the original machines.
F. Mechanical equipment, including drives and electric motors shall be supplied and installed in accordance with applicable OSHA regulations. Guards shall be installed on all rotation assemblies. The noise level of motors, unless otherwise noted, shall not exceed 75 dBA measured 3 feet from the unit.
G. All lubrication fittings shall be brought to the outside of all equipment so that they are readily accessible from the outside without the necessity of removing covers, plates, housings, or guards.

2.03 THICKENED SLUDGE PUMPS DESIGN REQUIREMENTS:

A. Pumps shall perform under conditions as indicated.
B. There shall be no significant change in vibration and noise level over the entire listed range of operating conditions of the pumping system.
C. Motor sizing shall provide a minimum of 20% reserve HP as evidenced by specific requirements at maximum design condition on the certified performance curve.
D. Thickened Sludge Pumps will be speed-controlled with VFDs.
E. Thickened Solids Pumps and solids characteristics are as follows:

1.	No. of Units:	2
2.	Pump Capacity:	20-100 gpm
3.	Design Head:	90 psi
4.	Solids Handling Capacity:	1.0” sphere
5.	Maximum Pump Speed:	300 rpm
6.	Sludge Concentration:	4% min - 8% max
7.	Sludge Temperature:	32°F – 100°F
8.	Maximum Motor Speed:	1800 rpm
9.	Maximum Motor Horsepower:	15 hp
10.	Discharge Size:	4 inches
11.	Suction Size:	6 inches
12.	Number of Stages:	2
13.	Motor Mount Position	Direct Drive

2.04 SLUDGE LOADOUT PUMPS:

A. Pumps shall perform under conditions as indicated.

B. There shall be no significant change in vibration and noise level over the entire listed range of operating conditions of the pumping system.

C. Motor sizing shall provide a minimum of 20% reserve HP as evidenced by specific requirements at maximum design condition on the certified performance curve.

D. The Sludge Loadout Pumps will be constant-speed.

E. Sludge loadout Pumps and solids characteristics are as follows:

1.	No. of Units:	2
2.	Pump Capacity:	400 gpm
3.	Design Head:	50 psi
4.	Solids Handling Capacity:	1.0” sphere
5.	Maximum Pump Speed:	250 rpm
6.	Solids Concentration:	4% min - 8% max
7.	Solids Temperature:	32°F – 100°F
8.	Maximum Motor Speed:	1800 rpm
9.	Maximum Motor Horsepower:	40 hp
10.	Discharge Size:	8 inches
11.	Suction Size:	10 inches
12.	Number of Stages:	1
13.	Motor Mount Position:	Direct Drive

2.05 DRIVE UNITS:

A. Direct Drives:

1. Gear motors or gear reducers shall be designed in accordance with AGMA 6019-E (Class II). Motors shall be inverter-duty for variable speed operation using variable frequency drives for the thickened sludge pumps and constant speed for the sludge loadout pumps.
2. The gear reducer shall be sized for a minimum service factor of 1.5 and designed with a thrust load capability of 150 percent of the actual thrust load.
3. The gear motor reduction ratio shall be that required to operate the pump at its maximum operating speed when the motor is operating at its nominal rated full speed of 60 Hz.

2.06 MATERIALS AND CONSTRUCTION:

A. General:

1. Two-stage, progressive cavity type for the Thickened Sludge Pumps and single-stage progressive cavity type for Sludge Loadout pumps.
2. Suction location shall be as indicated on contract drawings.
3. Capable of withstanding high torque caused by across-the-line starting of motor.
4. Complete units, including motor, belt drive or gear-motor, and pump unit mounted on a common base plate.
5. Designed to permit complete removal of the stator tube without removing the discharge isolation valve.

B. Casings:
1. Mechanite or similar cast iron.
2. Casings shall not have been repaired by plugging, welding or other methods.
3. Provide hand holes on each side of the suction housing.
4. There shall be a top inspection cover to allow for inspection of rotor joint and clean out suction body.
5. The casing shall have multiple ¾" FNPT connections (Min 4) for vents, drains, and gauges. The connections shall be at the highest and lowest point of the housing regardless of suction orientation.
6. The suction and discharge connections shall be ANSI/B16.1 flanges sized for the pump specified. The discharge flange shall have a vent/gauge connection that can be rotated in 90 increments.
7. The pump housing shall be constructed as such to allow for easy access to both joints without having to disconnect piping or removing most of the housing.

C. Suction and discharge connections shall be ANSI, Class 125, flat face flanges unless otherwise specified.

D. Helical Rotor:
1. Rotor shall be constructed of chrome tool steel with Brinnell hardness not less than 550 or ASTM A331-90, grade 4150 or 4150 cold finish alloy steel with a hard chrome plate and a minimum thickness of 0.010 inches.
2. The removal of the rotor shall not require any disconnection of the suction or discharge piping. Pump shall be full service in place. Deviations or special adaptors are not allowed.

E. Stator:
1. Buna-N synthetic rubber, shore "A" durometer 65.5.
2. Enclosed in a steel pipe sleeve with a seal integral to the stator elastomer preventing the metal pipe sleeve from contacting the pumped liquid.
3. The removal of the stator shall not require any disconnection of the suction or discharge piping. Stators shall be two piece and replaceable without dismantling the pump suction or discharge flanges or any associated piping.Pump shall be full service in place. Deviations or special adaptors are not allowed.
4. Dry run protection
   a. Stator shall be fitted with a sensor sleeve and Pt-100 sensor.
   b. Controller shall be provided by Pump Supplier to continuously monitor stator temperature. Coordinate with the Contractor for installation within the associated VFD or RVSS. Temperature rise above set point shall indicate no flow condition.
   c. Field adjustable switchpoint range selected by pump manufacturer.
   d. 120 Vac supply voltage with two SPDT relays.
   e. Stand process configuration of –40 to +160 deg F.
   f. Refer to the Contract Drawings' Control Diagrams for other requirements.

F. Drive shaft:
   1. Drive shaft in seal area shall be chrome plated alloy steel, SAE 8620 or Chromium Nitride coated AISI D-6 hardened tool steel.
   2. Stainless steel shaft sleeves locked to shaft in a manner to withstand rotation in either direction and designed to prevent leakage between shaft and sleeve.
   3. Direct-coupled units shall be equipped with a plug-in drive shaft such that either the driven-end or the wet-end of the pump can be serviced without complete disassembly of the pumping unit. Coupling members shall be secured with coupling rod pins and retaining sleeves enclosed in an elastomeric universal joint sleeve.

G. Connecting Rod
   1. Cold-rolled carbon steel, SAE 316SS or SAE 420SS unless otherwise specified.
   2. Connections on connecting rod shall be universal gear type joints or positively sealed and lubricated pin joint. Universal joints shall be of alloy steel, SAE 8620, or air-hardened tool steel of 57-60 HRc. The joints shall include the warranty specified in Paragraph 1.05 regardless of the type of joint provided.
   3. The connecting rod shall be two piece design to allow for the rotor and stator to be removed from the suction housing together either up or off to the side. Horizontal removal is not acceptable. Disassembly of a joint is not acceptable.

H. Bearings:
   1. Renewable, grease lubricated anti-friction type.
   2. Design conforms to AFBMA Standards.
   3. Rated minimum life at least 50,000 hours B-10 when operated continuously at maximum design rpm and sustaining all normal loads to be incurred by this application.
   4. Thrust bearings capable of taking radial load and total thrust loads of rotating assembly and which may be imposed in either direction by flexible couplings and any unbalanced hydraulic loads and loading produced by vertical mounting.
   5. Radial bearings capable of taking maximum radial loads. Protected from dirt and moisture with devices proven capable of positive protection both while pump is running and idle.

I. Mechanical Seals:
   1. Cartridge type mechanical seals shall be provided for each pump with seal materials specified. The use of non-cartridge type mechanical seals will not be accepted.
   2. The rotating and static seal faces must be abrasive resistant silicon carbide to silicon carbide seal surfaces, with FPM elastomer.
   3. Each shaft seal must have flushing connections for grease or oil lubrication.
   4. Shaft seals must be front loading. Designs requiring the removal of the rotor case for seal replacement will not be acceptable.

J. Base Plate:
   1. Each complete pumping unit mounted on a common base plate.
   2. Continuous-box type of cast iron or steel construction, presenting a pleasing appearance, and adequately braced and reinforced so that minimum distortion will develop during shipment or erection.
   3. An adequate number of holes provided in top for placement and compaction of grout. Provide sufficient vent holes to eliminate voids in grouting.
   4. Drip base and drain connection with drain lines:
      a. 19 mm (3/4-inch) type L hard temper copper tubing.

2.07 MOTORS:

A. The motors shall be horizontal polyphase motors as specified in Section 46 05 13.
B. The motor shall be rated for 460 Vac, 3 phase, 60Hz operation.
C. Motor shall be designed for operation with variable frequency drive.
D. Provide two normally closed temperature switches embedded in each phase winding for high temperature protection. Switches shall be rated for use with 120Vac.
E. For VFD-powered motors: provide factory installed, maintenance free, circumferential, conductive micro fiber shaft grounding ring to discharge shaft currents to ground.
F. Provide motor with service factor of 1.15.
G. Manufacturer shall coordinate details of the pump, motor and drive design with particular attention to the range of flows specified and speeds required to produce such flows.

2.08 INSTRUMENTATION AND ACCESSORIES:

A. Include, with the pump and motor, the following
    1. Provide all instrumentation to protect the pumps and motor.
    2. Provide all instrumentation as specified in Section 40 70 00.
    3. Provide all instrumentation as specified on the P&IDs.
    4. Provide with skid-mounted pump junction box sized to permit connection of all control wires and shall be designed to accept the number and size of conduits indicated.
        a. Provide terminal strips for landing all control wire.
        b. Terminals shall be permanently identified.
        c. All pump instrumentation, including Pt-100 sensors and pressure switches, shall be pre-wired to pump junction box. Pt-100 wires shall be shielded and kept separate from other control wires.
        d. Epoxy coated aluminum NEMA 4 enclosure with stainless steel identification tag.
    5. Appurtenances and safety devices required for proper operation.
    6. All manuals, drawings, parts lists, and special tools required for assembly, operation, and maintenance.
    7. Lubricants necessary for start-up, testing, and one year of continuous operation.
    8. Stainless steel nameplates, with manufacturer's name and address; rated capacity; rated head; rated speed; and model number, securely attached to the pump and motor.
    9. All necessary fittings and cocks for vents and drainage.

2.09 ANCHOR BOLT ASSEMBLY:

A. Complete anchor bolt assembly (studs, nuts, washers, etc.) to be designed and provided by the manufacturer. Anchor bolt assembly must meet the requirements of Section 05 05 19 for nonlife safety anchors. Anchor material shall be 316 SST. Anchor size and embedment shall be clearly shown on the equipment drawings.

2.10 PRESSURE GAUGES, GAUGES, AND SWITCHES:

A. Provide the following for mounting to the pump suction flange for the Sludge Loadout Pumps:
    1. Vacuum Pressure Sensor: RKL Series W pressure sensor/isolator for factory filled diaphragm pressure seal, or Engineer-approved equal.
    2. Suction Vacuum Gauge: 4-inch liquid filled stainless steel case, 0 to 30 inches Hg range
    3. Pressure Switches:
        a. NEMA 4X enclosure.
        b. Snap action SPDT switch rated 4 amps at 120VAC.
        c. Operating range: 0-30 inches Hg vacuum.
        d. 4-1/2 inch diameter indicator.

e. Single set point to stop pump on excessive vacuum pressure condition. Set point shall be field adjustable.

4. Brass or stainless steel connecting nipples and fittings as necessary for factory mounting of gauge and switch to sensor.

B. Provide the following for mounting to the pump discharge flange for the Thickened Sludge Pumps and the Sludge Loadout Pumps:

1. Pressure Sensor: RKL Series W pressure sensor/isolator or ONYX PSW Iso-Ring for factory filled diaphragm pressure seal or engineer-approved equal.
2. Discharge Pressure Gauge: 4-inch liquid filled stainless steel case, 0 to 200 psig range.
3. Pressure switches:
   a. Indicating type to allow switch settings to be observed.
   b. NEMA 4X enclosure.
   c. Snap action SPDT switch rated 4 amps at 120 VAC.
   d. Operating range: 0 to 200 psig.
   e. 4-1/2 inch diameter indicator.
   f. Single set point control to stop the pump on high pressure conditions. Set point shall be field adjustable.
4. Brass or stainless steel connecting nipples and fittings as necessary for factory mounting of gauge and switch to sensor.

2.11 PROTECTIVE COATINGS:

A. Shop Painting:

1. Manufacturer shall prepare surfaces, prime and finish paint all iron and steel surfaces with manufacturer's standard coating system suitable for service intended (corrosive environment).
2. All stainless steel surfaces shall not be painted.

B. Field Painting:

1. Contractor shall touch up coatings damaged during shipment or installation.
2. Pump manufacturer shall furnish Contractor with an adequate quantity of touch-up paint.

2.12 SPARE PARTS:

A. One (1) set for each pump. Each set shall be packed in wooden containers labeled to show contents.

B. Each set shall include the following:

1. Set of universal joints.
2. Mechanical Seal.
3. Gaskets.
4. Stator.
5. Rotor
6. One complete set of any special tools required to dismantle pump.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. General:

1. Installation, start-up and testing of all equipment and associated construction shall conform to manufacturer's recommendations. Manufacturer's field services shall be provided as specified in Division 1.

2. Manufacturer's representative shall be on site for start-up and testing and shall supervise installation. Provide manufacturer's start-up services for progressive cavity pump and variable frequency drives. Contractor shall provide additional manufacturer's services for troubleshooting and to correct deficiencies as required.
3. Manufacturer's representative shall provide a minimum of four (4) hours training in operation and maintenance for Owner's personnel.
4. Provide all necessary lubricants for initial start-up and testing or as required for final acceptance. The grades of oil and grease and anchor bolts shall be in accordance with manufacturer's recommendations.
5. Lubricate all bearings, gears and items requiring lubrication before placing equipment in operation.

B. Pumping Units:
1. Do not grout base plates until units are in complete alignment.
2. Install pipe, valves, supports, and accessories to minimize stresses being placed on pump nozzles.
3. Connect stuffing box drains to floor drains adjacent to equipment pads.

3.02 MANUFACTURER'S FIELD SERVICES:

A. Field services shall be provided by an experienced factory-based representative of the equipment manufacturer specializing in start-up and training, with expertise in controls capable of minor or major field adjustment of electrical, electronics, or mechanical components of blowers. Manufacturer's local sales representative is not acceptable.

B. Manufacturer shall be present for a minimum of two person-days for installation assistance, inspection, testing and certification of installation.

3.03 FIELD QUALITY CONTROL:

A. Performance Tests:
1. Provide a minimum of two (2) days of services for startup and training.
2. Equipment Tests:
a. Check performance of all components as a functioning unit.
b. Verify conformance with specifications as well as possible with facilities available at the site of installation.
(1) Conduct all tests in the presence of authorized representatives of Owner and Engineer.
(2) Vibration Analysis and limits; pump and drive unit:
(a) Vibration velocity shall be measured at centerline of pump and in all planes.
(b) Maximum velocity, in inches per second, shall not exceed 0.12.
(c) If velocity exceeds that specified the defect shall be corrected at no expense to the Owner.
(d) Conduct all tests in the presence of authorized representatives of Owner and Engineer.
(e) Conduct tests at maximum pump rpm.

B. Operational Tests:
1. Conduct operational test as necessary to determine that the performance of equipment and controls is as specified.
2. Tests will generally consist of placing equipment in operation under varying conditions and observing performance. Provide tachometer to confirm rotational speed. Confirm

flow rates using the sludge flow meter at varying discharge pressures using pressure gauge and throttling discharge valve.

C. Submit copy of results of tests to Owner with copy to Engineer after the completion of the testing.

3.04 MANUFACTURER'S FIELD SERVICE:

A. As specified in DIVISION 01 and as follows:

B. The equipment suppliers shall furnish the services of a factory-trained representative on site for a period of no less than 4 days (two visits). The representative shall inspect, adjust, calibrate and place into operation the system, then train Owner operating personnel in its use for a minimum of two sessions, two hours each. If additional services are required to produce a fully operational system, they shall be provided at no cost to the Owner.

C. After installation and after all equipment and components are in operable condition, a field mechanical and electrical performance test shall be performed in the presence of the Engineer.
   1. Each piece of equipment shall be tested for normal start, stop, and emergency stop cycles.
   2. Each piece of equipment shall be field tested and the equipment calibrated to demonstrate to the Engineer that all equipment will satisfactorily perform the functions and criteria specified.
   3. Furnish test forms and procedures for field testing and provide all test apparatus required at no additional cost to the Owner.
   4. Follow testing procedures recommended by the equipment manufacturer and approved by the Engineer.
   5. The equipment supplier shall modify or replace any equipment necessary to obtain satisfactory performance.

D. Manufacturer shall certify in writing that all equipment has been properly installed, tested, and are operating satisfactorily prior to initial start-up. Submit a written report to Owner with copy to Engineer in letter form showing operations performed and results obtained. Submit as specified in DIVISION 01.

E. All labor, materials, and test apparatus necessary for conducting the above tests shall be furnished by the Contractor at no additional cost to the Owner, unless stated otherwise.

END OF SECTION 43 23 57

SECTION 43 23 58 – ROTARY LOBE PUMPS

PART 1 - GENERAL

1.01 SUMMARY:

A. This section includes all labor, materials, equipment, and incidentals required for delivery to the project site ready for installation, rotary lobe pump units, including:
   1. Three (3) variable speed Thin Sludge Pumps.

B. Contractor shall supply all equipment, materials, and labor required for the installation and operation of the pumping units.

C. The Thin Sludge Pumps will transfer municipal waste activated sludge generated from aerobic granule sludge process from the thin sludge tanks to the rotary drum thickeners.

1.02 RELATED REQUIREMENTS:

A. Division 1 – General Requirements.

B. Division 9 – Protective Coatings.

C. Section 46 05 13 – Common Motor Requirements for Water and Wastewater Equipment.

1.03 REFERENCE STANDARDS:

A. American Iron and Steel Institute (AISI).

B. American National Standards Institute (ANSI):
   1. B16.5 Class 150 Pipe Flanges.

C. Standards of the Hydraulic Institute (HI).

D. Institute of Electrical and Electronics Engineers (IEEE).

E. National Electrical Code (NEC).

F. National Electrical Manufacturers Association (NEMA).

G. Occupational Safety and Health Administration (OSHA).

1.04 SUBMITTALS:

A. Submit in accordance with requirements in Division 1.

B. Copies of all materials required establishing compliance with the specifications shall be submitted and shall include, but not be limited to the following:
   1. Certified shop and erection drawings showing all, important details of construction, dimensions, and anchor bolt locations.
   2. Descriptive literature, bulletins and/or catalogs of the equipment.
   3. Data on the characteristics and performance of each pump. Data shall include guaranteed performance curves, based on actual shop tests of similar units, which show that they meet the specified requirements for head, capacity, and horsepower. Curves shall be submitted on 8.5 in by 11 in sheets, at as large a scale as is practical. Catalog sheets showing a family of curves will not be acceptable.
   4. Standard and VFD performance curves for each pump model furnished. Curves shall include the following parameters as a function of pump capacity and speed at design temperature:
      a. Total head.
      b. Required brake horsepower.
      c. Pump efficiency.
      d. Required NPSH.
      e. Minimum flow.
      f. Maximum recommended flow.

g. Capacity curves showing anticipated lobe wear durations for design RPM and resulting decreased flow output.

5. Mechanical details including lobes, bearings, couplings and seals.
6. Submit layout, dimensional and cross-section drawings.
7. Manufacturer's standard protective coating system.
8. Motor performance data and results of shop test.
9. Pump nameplate data.
10. Motor nameplate data.
11. Weights.
12. Copies of all tests results, as specified.
13. A complete total bill of materials of all equipment (may be furnished with Operation and Maintenance manuals).
14. A list of the manufacturer's recommended spare parts shall be supplied. Include gaskets, packing, etc. on the list. List bearings by the bearings manufacturer's numbers only.
15. Complete motor and control systems data.

C. Factory Tests and Reports:
1. Perform non-witnessed tests for speed, pressure, and flow rate at operation points as necessary per HI Standard section 3.6.4 for meeting class A requirements. Include hydrostatic test per HI Standard section 3.6.5.
2. Pumps shall be tested in position as they will be installed in the field with no exceptions.
3. Certification of design points.
4. Submit a written test report and graphic representation(s) of the test results. Test report data collected and provided shall meet the minimums of Hydraulic Institute Standards.
5. Test certificates and results.
6. Perform all manufacturer's standard tests to determine the performance of the motors.
7. Submit test reports to Engineer.

D. Operation and Maintenance Manual includes, but not limited to, the following:
1. Special shipping, storage, protection, and handling instructions including dimensions of each container or package shipped.
2. Recommended unloading method at project site including implement (e.g., forklift, etc.) and maximum container or package weight.
3. Manufacturer’s printed installation instructions.
4. The manual shall be prepared specifically for this installation and shall include all required cuts, drawings, wiring diagrams, equipment lists, descriptions, etc. that are required to instruct operating and maintenance personnel unfamiliar with such equipment. The maintenance instructions shall include trouble shooting data, full preventative maintenance schedule and complete spare parts lists with order information. In addition the manuals shall include the following at a minimum:
a. Complete parts list cross-referenced to an exploded view assembly or equivalent drawing.
b. Dimensional drawings of all provided equipment with component weights.
c. Complete preventative maintenance procedures (including recommended intervals).

E. Certifications:
1. Manufacturer’s Certificate of proper installation and start-up.
2. Field performance test procedures.

3. Submit complete, signed report of results of field inspection, operation, adjustments, and tests. Include the Manufacturer's certificate that the equipment is ready for permanent operation and that nothing in installation will affect Manufacturer's warranty in any manner, or render warranty null and void.
4. Certification of compliance with the requirements of the American Iron and Steel (AIS) provisions.

1.05 QUALITY ASSURANCE:

A. All items of equipment specified herein shall be furnished by one Manufacturer. This Manufacturer shall have the responsibility of providing the equipment, accessories, installation supervision, and testing services required to provide a functioning system.
B. Like items of equipment provided hereunder shall be the end products of one Manufacturer in order to achieve standardization for appearance, operation, maintenance, spare parts, and Manufacturer's service.
C. Manufacturer to provide specific standard factory tests and reports for each pump.
D. Contractor shall make any necessary adjustments to the suction and discharge piping shown on the Drawings based on the selected pump manufacturer at no additional cost to the Owner.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. Equipment shall be shipped pre-assembled to the degree that is practicable.
B. Manufacturer shall provide storage instructions indicating specific requirements to protect against damage to or deterioration of components. Provide short- and long-term storage instructions.
C. Seal all openings for shipment as follows:
   1. Cover flanged connections with plywood bolted to the flange with not less than four bolts.
   2. Plug or cap all screwed connections with standard pipe plugs or caps.
D. Ship such that minimum field assembly is required.
E. Protect machined surfaces, electrical equipment, and bearings and glands against corrosion and moisture.
F. All parts shall be properly protected so that no damage deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.
G. All equipment and parts must be properly protected against any damage during a prolonged period at the site.
H. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Owner.
I. Finished surfaces of all exposed pump openings shall be protected by wooden blanks, strongly built, and securely bolted thereto.
J. After hydrostatic or other tests, all entrapped water shall be drained prior to shipment, and proper care shall be taken to protect parts from the entrance of water during shipment, storage, and handling.
K. Each box or package shall be properly marked to show its net weight in addition to its contents.
L. Spare parts shall be packed in containers bearing packing lists clearly designating contents and pieces of equipment for which they are intended.

1.07 WARRANTY:

A. The warranty shall comply with the requirements of Section 01020 – Record Documents

B. All equipment supplied under this section shall be warranted for a period of one (1) years from startup.
C. The equipment shall be warranted to be free from defects in workmanship, design, and materials. This warranty shall include, but not be limited too mechanical seals, wear plates, housing segments, and lobes. If any part of the equipment should fail during the warranty period, it shall be replaced in the machine and the unit restored to service at no expense to the Owner.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Boerger.
B. Netzsch.
C. Vogelsang

2.02 GENERAL:

A. Furnish, install, and place into successful operation rotary lobe positive displacement pumps as described herein.
B. All equipment shall be designed and built for 24-hour continuous service at any and all points within the specified range of operation, without overheating, without cavitation, and without excessive vibration or strain.
C. Pumps must have design option to integrate a dry running protection temperature sensor in the rotor case to protect against extended periods of dry running.
D. The pumping units required under this section shall be complete. All parts shall be so designed and proportioned as to have adequate strength, stability, and stiffness and to be especially adapted for sludge pumping. Ample room for inspection repairs and adjustment shall be provided.
E. All working parts of the pumps and motors, such as bearings, wearing rings, shaft, and sleeves shall be standard dimensions built to limit gauges or formed to templates, such that parts will be interchangeable between like units and such that the Owner may, at any time in the future, obtain replacement and repair parts for those furnished in the original machines.
F. Mechanical equipment, including drives and electric motors shall be supplied and installed in accordance with applicable OSHA regulations. Guards shall be installed on all rotation assemblies. The noise level of motors, unless otherwise noted, shall not exceed 75 dBA measured 3 feet from the unit.
G. All lubrication fittings shall be brought to the outside of all equipment so that they are readily accessible from the outside without the necessity of removing covers, plates, housings, or guards.

2.03 THIN SLUDGE PUMPS:

A. Pumps shall perform under conditions as indicated.
B. When operating at maximum design speed, the tip speed of the rotors shall not exceed 10 feet per second, to ensure long operating life.
C. There shall be no significant change in vibration and noise level over the entire listed range of operating conditions of the pumping system.

D. Motor sizing shall provide a minimum of 20% reserve HP as evidenced by specific requirements at maximum design condition on the certified performance curve.
E. All pumps will be speed-controlled with VFDs.
F. Thin Sludge Pumps:

1.	Number of Pumps:	3
2.	Service:	Thin Sludge Pumping
3.	Maximum Motor Speed:	1,800 rpm
4.	Maximum Pump Speed:	300 rpm
5.	Maximum Motor HP:	7.5
6.	Minimum Flow:	100 gpm
7.	Maximum Flow:	250 gpm
8.	Discharge Pressure:	15 psig
9.	Total Solids:	0.5-2.0%
10.	Suction Size:	6-inch
11.	Discharge Size:	6-inch

2.04 CONSTRUCTION:

A. Each pump shall be of positive displacement rotary lobe design.
B. Pump Housing:
   1. The pump housing shall be constructed of cast iron. Suction and discharge ports shall be 150 lb ANSI flanged.
   2. Radial housing section or wear plates shall be easily removable.
   3. The front cover shall incorporate a compression fit seal for sealing between front cover and rotor case. All fasteners shall be 316 stainless steel.
   4. Pumps without replaceable radial housing sections shall provide radial wear plates. The removable wear plates shall be 40 Rockwell C AISI 4140 carbon steel wear plates that will protect against wear of the rotor case. The wear plates must be easily removable and fixed or bolted at the inlet and outlet of the rotor case.
   5. Pumps must have rear and front wear plates. The front and rear wear plates shall be easily removable and accessible.
   6. All wear items shall be constructed of hardened steel.
C. Front Cover:
   1. The pumps shall be provided with a quick release removable front cover.
   2. The front cover shall be constructed of cast iron, with a minimum Brinell hardness of 230 to 260, and permit removal of the rotors without disturbing piping, bearings, and mechanical seals.
   3. The front cover shall be machined to accept a reversible front wear plate. Pumps not equipped with a removable wear plate and use the front door for its wear surface, are not acceptable.
   4. The quick release front cover must be held with only four screws at the housing.
D. Rotors:
   1. The pump shall be fitted with a pair of intermeshing rotors with a minimum of three lobes in helical low pulse design. Designs with lobes parallel to the shaft centerline will not be accepted. The convoluted lobes shall be specifically designed for pumping wastewater sludge, including aerobically digested waste activated sludge. Pumps utilizing lobe designs with fewer than three tips will not be considered.
   2. The rotors shall consist of solid grey cast iron cores that are covered with a layer of NBR 70, Durometer hardness 65-72. The geometry of the rotor core shall be the same as that

of the finished rotor. Rotors shall be keyed to the shaft by replaceable, hardened key ways, and secured to the shaft.

3. The elastomeric coated rotors shall be guaranteed against bonding failure, otherwise known as delamination.
4. The rotors shall be end-mounted on the shafts and held precisely in the radial position to ensure positive positioning of the rotors on the shaft and precise intermeshing clearances around the rotors. The rotors shall be axially locked into position.

E. Shafts:
1. The shaft shall be constructed of high tensile carbon steel fitted with replaceable stainless steel sleeves where passing through the seal area. Sludge wetted rotor/shaft connections are not acceptable.
2. Shafts shall be synchronized in their rotation by straight cut timing gears running in a separate oil chamber which also contains the ball and roller bearings for each shaft. Pumps requiring external re-timing in the event of blockage will not be considered.
3. The bearings and timing gears shall be located in a common oil-filled cast iron gearbox, fitted with a built-in sight glass to monitor oil level. The timing gear shall maintain non-contact between the rotors and be positioned on either side of the timing gears in order to give the best shaft support.
4. The shaft shall be a minimum of 60 mm in diameter where the rotors, bearings, and mechanical seals contact the shaft, to decrease the potential of torsional shaft fatigue. The use of step down shafts will not be acceptable.
5. The shaft sleeves where the mechanical seal rides, shall be removable through the front of the pump, without the use of special tools, and without disturbing the surrounding piping.
6. Shafts shall be non-wetted at all points and sealed from the pumping liquid.

F. Mechanical Seals:
1. Cartridge type mechanical seals shall be provided for each positive displacement pump with seal materials specified. The use of non-cartridge type mechanical seals will not be accepted. Pumps that require water flush or quench will not be accepted.
2. The rotating and static seal faces must be abrasive resistant silicon carbide to silicon carbide seal surfaces, with NBR elastomer.
3. Shaft seals must be front loading. Designs requiring the removal of the rotor case for seal replacement will not be acceptable.

G. The removable end cover shall be flush with no recesses or dead pockets where solids can accumulate. The cover shall be sealed with NBR O-ring and provide complete access to the pump chamber without disconnecting pipe work glands or bearings.

H. The pump, gear reducer, and motor shall be mounted on a steel base plate complete with necessary couplings, guards, and mounting hardware.

I. Vibration: Pumps and motors shall operate at any point within their operating range without undue noise and vibration. Vibration at any point in the operating range shall not exceed the limits allowed by the Hydraulic Institute.

J. The top and bottom housing segments of the pump shall be adjustable based on wear or spares shall be provided.

2.05 MOTORS:

A. The motor shall be rated for 460 Vac, 3 phase, 60Hz operation and conform to requirements of Section 46 05 13 and herein.
B. Motor shall be constant torque rated.
C. Motor shall be designed for operation with variable frequency drive.
D. Provide two normally closed temperature switches embedded in each phase winding for high temperature protection. Switches shall be rated for use with 120Vac.
E. Provide factory installed, maintenance free, circumferential, conductive micro fiber shaft grounding ring to discharge shaft currents to ground.
F. Provide motor with service factor of 1.15.

2.06 INSTRUMENTATION AND ACCESSORIES:

A. Include, with the pump and motor, the following:
    1. Instrumentation shall be in accordance with Section 40 70 00.
    2. Provide with skid-mounted pump junction box sized to permit connection of all control wires and shall be designed to accept the number and size of conduits indicated.
        a. Provide terminal strips for landing all control wire.
        b. Terminals shall be permanently identified.
        c. All pump instrumentation, including Pt-100 sensors and pressure switches, shall be pre-wired to pump junction box. Pt-100 wires shall be shielded and kept separate from other control wires.
        d. Epoxy coated aluminum NEMA 4 enclosure with stainless steel identification tag.
    3. All items necessary for complete assembly including base plate and anchor bolts.
    4. Appurtenances and safety devices required for proper operation.
    5. All manuals, drawings, parts lists, and special tools required for assembly, operation, and maintenance.
    6. Lubricants necessary for start-up, testing, and one year of continuous operation.
    7. Stainless steel nameplates, with manufacturer's name and address; rated capacity; rated head; rated speed; and model number, securely attached to the pump and motor.
    8. All necessary fittings and cocks for vents and drainage.
    9. Bolts and Nuts:
        a. Type 316 stainless steel.
B. Suction Vacuum Pressure Gauge and Switch:
    1. Provide the following for mounting to the pump suction gland.
    2. Vacuum Pressure Sensor: RKL Series W pressure sensor/isolator for factory filled diaphragm pressure seal, or Engineer-approved equal.
    3. Suction Vacuum Gauge: 4-inch liquid filled stainless steel case, 0 to 30 inches Hg range
    4. Pressure Switches:
        a. NEMA 4X enclosure.
        b. Snap action SPDT switch rated 4 amps at 120VAC.
        c. Operating range: 0-30 inches Hg vacuum.
        d. 4-1/2 inch diameter indicator.
        e. Single set point to stop pump on excessive vacuum pressure condition. Set point shall be field adjustable.
    5. Brass connecting nipples and fittings as necessary for factory mounting of gauge and switch to sensor.
C. Discharge Pressure Gauges and Switch:
    1. Provide the following for mounting to the pump discharge gland.

2. Pressure Sensor: RKL Series W pressure sensor/isolator for factory filled diaphragm pressure seal, or Engineer-approved equal.
3. Discharge Pressure Gauge: 4-inch liquid filled stainless steel case, 0 to 100 psi range,
4. Pressure Switches:
   a. NEMA 4X enclosure.
   b. Snap action SPDT switch rated 4 amps at 120VAC.
   c. Operating range: 0 to 100 psi.
   d. 4-1/2 inch diameter indicator.
   e. Set point control to stop the pump on high pressure condition. Set point shall be field adjustable.
5. Brass connecting nipples and fittings as necessary for factory mounting of gauge and switch to sensor.
6. Dry run protection
   a. Stator shall be fitted with a sensor sleeve and Pt-100 sensor.
   b. Controller shall be provided by Pump Supplier to continuously monitor stator temperature. Coordinate with the Contractor for installation within the associated VFD. Temperature rise above set point shall indicate no flow condition.
   c. Field adjustable switchpoint range selected by pump manufacturer.
   d. 120 Vac supply voltage with two SPDT relays.
   e. Stand process configuration of –40 to +160 deg F.
   f. Refer to the Contract Drawings' Control Diagrams for other requirements.

2.07 FINISHES:

A. Shop Painting:
   1. Manufacturer shall apply manufacturer's recommended protective coating to all carbon steel surfaces in the shop.
   2. Prepare surfaces, prime, and finish paint all iron and steel surfaces as specified in Section 09 90 00.
   3. Prepare surface of damaged and uncoated areas and touch-up as required for complete protection.
   4. All nameplates, bronze or stainless steel surfaces shall not be painted.
B. Touch Up:
   1. Prepare surfaces and touch up coatings damaged during shipment and installation.
   2. Obtain an adequate quantity of tough up paint from pump manufacturer.

2.08 TOOLS AND SPARE PARTS:

A. Include spare parts as required for the complete installation and operation of the system.
B. One set of all special tools required for normal operation, maintenance, servicing, and dismantling of the units shall be provided.
C. At a minimum, the following spare parts shall be provided:
   1. One set of cartridge mechanical seals, o-rings, and lip seals for each pump.
   2. One set of rotors, lobes and o-rings for each pump.
   3. One set of all replaceable wear components for each pump.
D. Spare Parts shall be properly bound and labeled for easy identification without opening the packaging and suitably protected for long-term storage.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Installation, start-up, and testing of all Equipment and associated construction shall conform to manufacturer's recommendations. The grades of oil and grease and anchor bolts shall be in accordance with manufacturer's recommendations.

3.02 MANUFACTURER'S FIELD SERVICES:

A. Manufacturer's field representative shall inspect Equipment after the Equipment has been installed and prior to start-up. A written report of the inspection shall be submitted to Owner.

B. Manufacturer shall be present for a minimum of two person-days for installation assistance, inspection, testing and certification of installation.

C. Training:

1. Manufacturer shall provide a means to video record all training and furnish edited electronic copies to Owner for later reference.
2. Provide a minimum of four hours of service for training of Owner's personnel.
3. Training shall include:
    a. Operation, start-up, shut-down, lock-out, emergency operating procedures, control, adjustment, maintenance, assembly, disassembly, and repair of the equipment including control sequences, identification systems, materials, spare parts, special tools, lubricants and fuels.
    b. Technical repair manual.
    c. Cleaning.
    d. Lubrication of equipment.
    e. Optimizing equipment and system performance.
    f. Capabilities of equipment and systems.
    g. Operational safety of equipment and systems.
    h. Emergency situation response of equipment and systems.

3.03 TESTING:

A. Conduct in the presence of Owner and/or Engineer.

B. Demonstrate the functional integrity of the mechanical, electrical and control interfaces of the equipment.

C. After the pumps have been completely installed and wired, the Contractor shall have the manufacturer perform the following, at a minimum:

1. Check performance of all components as a functioning unit. Conduct such operation tests as necessary to determine that the performance of equipment and controls is as specified.
2. Check alignment of each unit.
3. Megger stator and power cables.
4. Check seal lubrication.
5. Check for proper rotation.
6. Check power supply voltage.
7. Measure motor operating load and no load current.
8. Motors: Insulation (megger) test, rotational direction (bump) test and visual inspections required by NETA ATS.
9. Bump motor to check for correct rotation.
10. Noise and vibration tests shall be conducted in conformance with Hydraulic Institute Test Codes and OSHA Standards of Occupational Noise Exposure.

11. Make all necessary equipment adjustments and corrective work indicated by tests.

D. Submit a written test report to Contractor in a letter form stating operations performed and results obtained for each unit. The report should also state that the equipment has been installed properly, has been started up, and is ready for operation by Owner's personnel.

E. Operational Testing:
   1. Conduct in the presence of Owner and/or Engineer.
   2. Run pump:
      a. Record head (ft) versus flow (gpm) for each pump. Engineer shall compare results against the manufacturer's provided performance curve.
      b. If potable water is used, the Owner shall provide water at no cost to Contractor.

END OF SECTION 43 23 58

SECTION 44 31 19 – ODOR CONTROL SYSTEM

PART 1 - GENERAL

1.01 SUMMARY:

A. General:

1. This Section identifies the requirements for the odor control system for the Thickened Sludge Storage Tanks and Coarse Screening Channels. The odor control system shall run continuously and shall be designed to destroy odorous compounds within the proposed structure regardless of flows, temperature, or varying volumes of headspace in the Thickened Sludge Holding Tanks and Coarse Screening Channels.
2. The hydroxyl radical odor control system shall consume no external chemicals in its operation, nor shall there be any waste product to dispose of and there shall be no increase in total dissolved solids to the sludge or influent wastewater.

B. Scope:

1. Furnish all labor, materials, equipment and incidentals required to install odor control system for the control of atmospheric H2S, Ammonia, VOC and other noxious odors for the Coarse Screening Channels and two (2) Thickened Sludge Storage Tanks as shown on drawings and specified herein. The hydroxyl radical mist odor control system shall be an engineered system consisting of the following major components:
   a. Hydroxyl radical odor control base cabinet (outdoor rated)
   b. Blower
   c. Ozone Generator
   d. Applicable Flow Instruments, as deemed necessary.
   e. Nozzles:
      (1) Thickened Sludge Holding Tank: Six (6) HV nozzles. Three (3) per each tank.
      (2) Coarse Screening Channels: Three (3) HV nozzles.
   f. Oxidant Tubing
   g. Water Tubing
   h. PLC/HMI
   i. Installation Kit for Nozzle Assembly

1.02 REFERENCES:

A. Applicable Standards:

1. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
   a. ASHRAE 62.1 - Ventilation for Acceptable Indoor Air Quality.
2. NFPA:
   a. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

B. Related Work Specified Elsewhere:

1. Protective Coatings – 09 90 00
2. Electrical – Division 26
3. Process Control Panels and Hardware – Section 40 67 00
4. Instrumentation for Process Systems – Section 40 70 00
5. Common Motor Requirements for Water and Wastewater Equipment – Section 46 05 13

1.03 SUBMITTALS:

A. Submit in accordance with Division 1.

B. Items for Submittal:

1. Certified shop and erection drawings showing details of construction, dimensions, and anchor bolt locations shall be approved and stamped by Missouri Licensed Engineer.
2. Descriptive literature, bulletins and catalogs of the equipment.

3. Standard shutdown operation procedures.
4. The total weight of the packaged equipment as well as the weight of the single largest items.
5. A complete bill of materials.
6. Calculations showing theoretical output of hydroxyl radical mist, based on various hydrogen sulfide concentrations.
7. Wiring Diagrams: For power, signal, and control wiring.

1.04 QUALITY ASSURANCE:

A. Manufacturer's Qualifications:
   1. Products used in the Work of this Section shall be produced by the Manufacturer regularly engaged in the manufacture of equipment of this type and with a history of successful installations.
   2. All equipment shall be the product of a manufacturer having U.S. installations for municipal wastewater applications with satisfactory service.

1.05 DELIVERY, STORAGE AND HANDLING:

A. Deliver unit to the jobsite complete with factory-installed lifting lugs, as appropriate.
B. Handle odor control cabinet and other system appurtenances carefully to avoid damage to components, enclosures, frames, housings, or finishes. Do not install units that have been damaged; replace and return all damaged items to the original manufacturer. Perform all necessary work to restore the equipment to a "new" condition, in which the factory warranty remains in full effect. Replace all damaged or missing safety or instructional labeling.
C. Store odor control equipment, in a clean dry place.

1.06 WARRANTIES:

A. The manufacturer shall warrant the odor control system and all components for each intended service and for a period not less than one (1) year following the date of Substantial Completion. The Contractor shall purchase any and all extended warranties, as necessary, to comply with the Specifications.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Subject to compliance with requirements, provide products by one of the following:
   1. Vapex Environmental Technologies
   2. Engineer Approved Equal.

2.02 GENERAL

A. The system shall be designed to operate in a wastewater environment and shall be furnished by a manufacturer experienced in the design and supply of hydroxyl radical odor control systems. The manufacturer of the odor control system shall be responsible for the system design and performance.
B. The odor control system cabinet shall be factory pre-piped and wired and ready for connection to power and water supply.
C. In addition to the requirements listed in this section, all electrical equipment and components shall conform to requirements in DIVISION 26 and DIVISION 40.

2.03 ODOR CONTROL SYSTEM PERFORMANCE REQUIREMENTS:

A. General: The system will be used to destroy vapor phase hydrogen sulfide, amines, other reduced sulfur compounds and odorous compounds by the means of a hydroxyl radical mist.
B. Site Conditions:

1. Elevation: 858.50 feet above sea level
2.

C. Coarse Screening Channel design criteria:
   1. Quantity of HV Nozzles: 3
   2. Nozzle Location: Shall be determined by odor control supplier, unless specified elsewhere.
   3. Odor control unit will be located outside. Weather protection enclosure shall be provided.
   4. Average Sulfide Concentration: 10 ppmv
   5. Peak Sulfide Concentration:100 ppmv
   6. Minimum water supply pressure: 60 psi
   7. Maximum Required coverage area: 31,000 ft^3
   8. Enclosure: Heated outdoor rated enclosure.

D. Thickened Sludge Tank Design Criteria:
   1. Quantity of HV Nozzles: 6
   2. Nozzle Location: Shall be determined by odor control supplier, unless specified elsewhere.
   3. Average Sulfide Concentration: 20 ppmv
   4. Peak Sulfide Concentration:200 ppmv
   5. Minimum water supply pressure: 60 psi
   6. Maximum Required coverage area: 30,000 ft^3 (15,000 ft^3/tank)
   7. Enclosure: Heated outdoor rated enclosure.

E. Performance Criteria for Coarse Screening Channels:
   8. Performance requirement (H_2S)
      a. H_2S removal efficiency ≥ 99.5% for headspace H_2S concentrations ≥ 10 ppmv but ≤ 100 ppmv
      b. Outlet H_2S concentration is ≤ 0.1 ppmv for headspace H_2S concentrations ≤ 10 ppmv

F. Performance Criteria for Thickened Sludge Holding Tanks:
   9. Performance requirement (H_2S)
      a. H_2S removal efficiency ≥ 99.5% for headspace H_2S concentrations ≥ 20 ppmv but ≤ 200 ppmv
      b. Outlet H_2S concentration is ≤ 0.1 ppmv for headspace H_2S concentrations ≤ 20 ppmv

G. Unit Construction:
   1. The base cabinet shall be water resistant, sound resistant, and conform to NEMA 3R specifications.

2.04 ELECTRICAL WORK:

A. Electrical equipment, motors, motor efficiencies, conduit, and wiring shall be in accordance with DIVISION 26. Electrical motor driven Equipment specified shall be provided. Each motor shall conform to SECTION 46 05 13 and be of sufficient size to drive the Equipment at the specified capacity without exceeding the nameplate rating of the motor. All motors shall be continuous duty with the enclosure specified.

2.05 ODOR CONTROL SYSTEM CONTROL PANEL

A. Odor control systems shall be supplied with a local control panel and HMI designed to house all components required to control the system.

B. Control Panel HMI shall be provided in accordance with requirements detailed in Section 40 67 00 in addition to specific panel requirements listed below.
   1. The main control panel shall contain a door mounted OIT for local control.
      a. OIT shall be Allen-Bradley Panel View. Refer to Section 40 67 00.
      b. All manufacturer supplied graphics and applications shall be developed with FactoryTalk View Machine Edition.

c. The screens developed shall utilize a "High Performance" design conforming to ISA 101.01 – Human Machine Interfaces for Process Automation Systems to provide situational awareness to the operator. HMI design and associated color schemes shall conform to those listed in Section 40 61 96 – 3.02 HMI STANDARDS AND SCREEN DEVELOPMENT.

d. In addition to controlling the Manufacturers equipment the supplied PLC and OIT shall be used for interfacing specified I/O with the Plant Control System screens.

(1) Coordinate with the Systems Integrator for exchange of the necessary I/O.

e. The manufacturer shall provide the necessary coordination with the Systems Integrator to ensure a fully functional application for use in remote monitoring.

C. Control panel shall be rated to be installed outdoors.

D. A panel mounted combination main disconnect switch and circuit breaker shall be accessible without opening the door.

E. Control panel shall include thermal magnetic circuit breakers for each motor load.

F. The control panel shall adhere to the following specifications:

1. Enclosure Rating: NEMA 4X, SST Type 304 or 316
2. Voltage: 208 Volt
3. Phase: 1 Phase
4. Frequency: 60 Hz
5. SCCR: 22 kA
6. Mounting: Skid Mounted

G. All Odor control system devices and equipment requiring electrical power shall be supplied by 208Vac local control panel input power. Provide power distribution and power conversion devices as necessary, in accordance with Section 40 67 00.

H. The control panel shall communicate with the plant PLC via an EtherNet/IP network, all controller I/O shall be accessible via the Ethernet network.

1. The following signals shall be provided to the Odor Control System Control Panel from the Plant Control System. via the Ethernet/IP network.
   a. System Inhibit.
      (1) Discrete signal which prevents all associated system equipment from running.
2. Refer to the Project I/O List, Section 40 61 96 A, for the minimum odor control system I/O to be available to the plant PLC. Additional I/O shall be provided as recommended by the manufacturer.

I. The equipment shall include an output relay for operation status. The output contact shall be dry, Form C, and rated for 5A at 120Vac.

J. All odor control system electrical devices and equipment shall be pre-wired to the local control panel.

K. Control panel shall be attached to the system's frame and be positioned such that there are no obstructions in front of the control panel per related NFPA 70 requirements.

L. Description of Operation

1. Process module functions to deliver water, compressed air, and oxidant to the injection nozzle as seen in the drawings. Injection nozzle combines the three (3) raw components (water, air, and ozone) to form the atomized hydroxyl mist, whereas the mist is released from the nozzle to drive the reaction within the Thickened Sludge Tank head space and Coarse Screen Channels
2. Nozzle shall be adjustable, allowing an optimization of the air/water dispersion ratio.
3. The atomizing injection nozzle shall be designed and constructed, allowing up to 98% absorption of the produced ozone into the atomized water flow. The atomized water particle shall be no larger than 5-micron in diameter.
   a. Sequence of Operation:
      (1) The odor control unit system and ancillary equpment including the O2 compressors, O2 condenser, ozone generator and air blower shall start. As the previously mentioned equipment start, the three way water supply solenoid valve shall open.

Water, air and oxidant will be conveyed to the six (6) injection nozzles where the three fluids will combine and be injected into the head space of the thickened sludge tanks.

b. System Upsets and Procedures for Recovery:
   (1) The odor control base cabinet shall contain safety interlocks for low water flow, low nozzle air pressure, low oxygen concentration, low oxygen flow and high oxidant generator temperature. Any out of range condition will cause a shutdown of the affected system and will trigger an alarm.

2.06 ACCESSORIES

1. The manufacturer shall supply the oxidant tubing for conveying ozone to each injection nozzle. Size and material of tubing shall be specified by manufacturer.
2. The manufacturer shall supply the water tubing for conveying water to each injection nozzle. Size and material of tubing shall be specified by manufacturer.
3. Installation kit and accessories required for mounting the nozzles to the flat panel FRP covers shall be provided. The openings in the FRP cover for installing the six (6) nozzles shall each be 10” diameter openings.
4. The odor control system shall have the capability to turn off oxidant flow to one (1) of the two (2) Thickened Sludge Holding Tanks while maintaining oxidant flow to the other Thickened Sludge Holding Tank.
5. The PVC carrier pipe containing the oxidant and water tubbing serving the six (6) injection nozzles shall be Schedule 80. Piping, fittings, and pipe supports shall be installed and supplied by the contractor in accordance with odor control supplier instructions.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install and adjust equipment in accordance with the Drawings, approved shop drawings, and the manufacturer's instructions. Do not operate the equipment until the installation is approved by the manufacturer’s representative.
B. Remove protective coatings and oils used for protection during shipment and installation.
C. Clean ozone tubing, water tubing, and air tubing before use as required by the pipe supplier.
D. Check equipment for correct direction of rotation and freedom of moving parts.
E. Align equipment to Manufacturer's tolerances.
F. Adjust or modify equipment to ensure proper operation.

3.02 FACTORY TESTING:

A. All major system components shall be factory tested for compliance with the construction and functional requirements specified herein, and certification of the results of these tests shall be submitted to Engineer prior to delivery of the equipment.
B. Odor control system shall be air tested with water at the factory under design conditions continuously for 4 hours. After completion of the test, the vessel shall be thoroughly inspected for evidence of failure.
C. Manufacturer shall record test results. Written certification of the tests shall be submitted to Engineer.
D. Contractor shall test the unit to demonstrate that all components function properly.

3.03 FIELD TESTING AND BALANCING:

A. Upon completion of installation of the odor control system, the system shall be tested and balanced for conformance with performance requirements and the design calculations.
B. Prior to start-up, all equipment shall be inspected for proper alignment, and proper connection.
C. Maximum noise levels shall not exceed 85-dB three feet away from the odor control unit.

3.04 PERFORMANCE TESTING

A. The Owner may schedule acceptance testing after 14 days following, and within 30 days, of start-up. The period between start-up and acceptance testing shall not exceed 60 days, except as authorized by the Engineer.
B. The odor control suppplier shall supply sample collection equipment and hydrogen sulfide monitoring instruments.
C. The ambient headspace hydrogen sulfide concentration in one (1) of the Thickened Sludge Tanks will be monitored and logged continuously over 72 hours with the odor control unit offline. The Engineer will select the perferred Thickened Sludge Tank for conducting the performance testing. Similarily, the ambitent headspace hydrogen sulfide concentration of the Coarse Screening Channels will be monitored and logged continously over 72 hours with the odor control unit offline.
D. The outlet hydrogen sulfide concentration at the gooseneck vent on one (1) of the Thickened Sludge Tank covers will be monitored and logged continuously over 72 hours with the odor control unit online. The Engineer will select the perferred Thickened Sludge Tank for conducting the performance testing. Similarily, outlet hydrogen sulfide concentration at the gooseneck vent for Coarse Screening Channels will be monitroed and logged continously over 72 hours with the odor control unit online.
E. To pass the acceptance test, the each odor control system shall meet Criterion target Performance in Paragraph 2.03.
F. If the system fails the acceptance test, the supplier shall conduct up two additional rounds of testing at no additional cost to the Owner. If the system does not pass after the additional testing, the supplier shall make whatever provisions are required to meet the criteria specified herein. The final acceptance test shall be passed no later than 3 months of the initial acceptance test.

END OF SECTION 44 31 19

DIVISION 46 – WATER AND WASTEWATER EQUIPMENT

SECTION 46 05 13 – COMMON MOTOR REQUIREMENTS FOR WATER AND WASTEWATER EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section includes the following:
   1. Motors and accessories for mechanical, process, and other equipment.
   2. Unless specified or indicated otherwise, motors 1/2-horsepower or smaller shall be single phase and motors 3/4 horsepower or larger shall be polyphase.

1.03 RELATED REQUIREMENTS:

A. Section 26 05 26 – Grounding and Bonding for Electrical Systems.

1.04 REFERENCE STANDARDS:

A. Applicable Standards:
   1. American National Standards Institute (ANSI).
      a. ANSI B11.19 – Performance Criteria for Safeguarding.
   2. American Bearing Manufacturers Association (ABMA).
      a. ABMA 9 – Load Ratings and Fatigue Life for Ball Bearings.
   3. Institute of Electrical and Electronic Engineers (IEEE).
      a. IEEE 112 – Test Procedure for Polyphase Induction Motors and Generators.
   4. National Electrical Manufacturers Association (NEMA):
      a. NEMA MG 1 – Motors and Generators.

1.05 SUBMITTALS:

A. Submit as specified in Division 1.

B. Product Data: Submit the following as minimum:
   1. Nameplate information consisting of the following:
      a. Manufacturer's name and serial number.
      b. Horsepower output.
      c. Temperature rise and method indicated.
      d. Maximum ambient temperature.
      e. Rated Altitude
      f. Insulation class.
      g. Rpm at rated load.
      h. Operating frequency range.
      i. Number of poles.
      j. Number of phases.
      k. Voltage.
      l. Rated load amperes.
      m. Locked rotor amperes or code letter.
      n. Service factor.
      o. Power factor.
      p. Maximum noise level of pump/motor unit (dBA).

q. Efficiency, determined in accordance with IEEE 112, Method B.

2. Dimensions for enclosure and shafts.
3. Weight.
4. Bearing information.
5. Schematic diagrams for motor and specified motor accessories.
6. Statement from motor manufacturer specifying the variable frequency drive requirements for the motor to meet all requirements and recommendations of NEMA MG 1 – Part 30 and clause 31.4.4.2 Voltage Spikes NEMA MG 1 - Part 31 for all operational load and speed conditions specified and required.

C. Test and Evaluation Reports:
1. Factory test reports.
2. Field test reports.

D. Closeout Submittals: Final documentation shall include the following as minimum:
1. Operation and Maintenance Manuals including the following:
a. Operation and maintenance manuals for all components furnished.
b. Copies of all approved Product Data.
c. Copies of all approved Test Reports.
d. Warranty Information.
e. Contractor Information.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. Motors shall be packaged, skidded and shipped to prevent damage during shipment.
B. Stored motors shall be environmentally protected and maintained according to manufacturer's recommendations.
C. If supplied, energize space heaters during storage to prevent condensation within the motor enclosure.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Motors:
1. Baldor Electric Company.
2. General Electric Company.
3. Marathon Electric Manufacturing Corporation.
4. Reliance Electric.
5. Siemens Energy and Automation, Inc.
6. TECO-Westinghouse Motor Company.
7. U.S. Motors, Nidec Motor Corporation.
8. WEG Electric Corporation.

B. Shaft Grounding Ring:
1. AEGIS, Electro Static Technology, Division of Illinois Tool Works Inc.
2. Inpro/Seal, Waukesha Bearings Corporation.
3. Helwig Carbon Products, Inc.
4. Engineer approved equal.

C. Couplings:
1. Rexnord Corporation, Division of RBS Global.
2. Waldron Hartig Machinery Division, Midland Ross Corporation.
3. Engineer approved equal.

2.02 HORIZONTAL SINGLE-PHASE MOTORS:

A. Rated for 40°C ambient temperature and continuous operation.
B. Voltage: 115V or 115/230V, 60 hertz.
C. RPM: 1750 unless indicated or specified otherwise.
D. Minimum service factor of 1.15.
E. Efficiency: Shall meet the premium efficiency motor standards as defined by NEMA MG 1.
F. Permanent split capacitor designed for low starting torque loads and applications requiring silent operation.
G. Capacitor start designed for high starting torque loads.
H. Shall be protected by an integral thermal-overload protective device in compliance with the NEC. Device shall automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Protection device shall automatically reset when the motor temperature returns to normal range.
I. Adequate to drive equipment over the full operating range without exceeding service factor.
J. Bearings as specified in HORIZONTAL POLYPHASE MOTORS, this Section.
K. Open drip-proof enclosures for clean, dry atmospheres and totally enclosed enclosures for wet or dirty atmospheres.
L. Manufacturer shall prepare surfaces, prime, and finish paint all surfaces with manufacturer's standard coating system. Coating system and color shall be suitable for intended service.
M. Stainless steel or mylar nameplate data on enclosure with all lubrication and electrical data.

2.03 HORIZONTAL POLYPHASE MOTORS:

A. Rated for 460-volt, 3 phase, and 60-hertz operation. Designed for operation with variable frequency drive, when indicated.
B. Squirrel cage induction type for across-the-line or reduced voltage starting, as indicated.
    1. Where reduced-voltage starting is indicated or specified the motor shall have torque requirements capable of bringing up the specified load to full speed. The reduced voltage starting shall be limited to 65% of nominal.
C. NEMA Design:
    1. NEMA B: Normal starting duty applications.
    2. NEMA C: High starting duty applications.
D. NEMA Class B insulation except for installations where NEMA Class F is recommended by the manufacturer for the application.
E. When controlled by variable frequency drives, motors shall comply with NEMA MG 1 Part 31.
F. Efficiency: Shall meet the premium efficiency motor standards as defined by NEMA MG 1.
G. Enclosures:
    1. Totally enclosed fan cooled (TEFC) for indoor and outdoor process areas.
    2. Explosionproof in explosive atmospheres.
H. Horsepower Rating Requirements:
    1. Ambient Temperature: 40°C.
    2. 1800 rpm unless specified or indicated otherwise.
    3. Service factor of 1.15.
    4. Adequate to drive equipment without using service factor except in emergency conditions.
I. Bearings:
    1. Pre-lubricated ball bearings shielded to prevent entrance to foreign materials.

2. Re-lubrication fittings and flushing system.
3. Minimum L10 bearing life for continuous operation of 100,000 hours to conform to ABMA 9.

J. Sound Pressure Levels (SPL) of the motor shall not exceed the maximum levels as specified in NEMA MG 1 Table 9-1.
K. Manufacturer shall prepare surfaces, prime, and finish paint all surfaces with manufacturer's standard coating system. Coating system and color shall be suitable for intended service.
L. Stainless steel nameplate with all electrical and lubricating information.
M. Refer to Article 2.07 MOTOR ACCESSORIES this Section for additional requirements.

2.04 VERTICAL POLYPHASE MOTORS:

A. Rated for 460-volt, 3 phase, 60-hertz operation. Designed for operation with variable frequency drive, when indicated.
B. Squirrel cage, induction type.
C. Hollow shaft design with non-reversing ratchet.
D. NEMA Design B:
1. Minimum starting torque 100% of full load.
2. Maximum torque greater than 200% of full load.
3. Maximum starting current 650% of full load.
E. NEMA Class B insulation except for installations where NEMA Class F is recommended by the manufacturer for the application.
F. Efficiency: Shall meet the premium efficiency motor standards as defined by NEMA MG 1.
G. Shall be "Inverter Duty", comply with NEMA MG 1 Part 30 and clause 31.4.4.2 Voltage Spikes of NEMA MG 1 – Part 31, and be rated for a minimum of 10:1 speed range for variable or constant torque loads.
H. TEFC enclosure with stainless steel hardware unless specified otherwise.
I. Corro/severe duty rated when specified or recommended by the equipment manufacturer.
J. Motor shall be factory balanced to reduce vibration levels to meet the refined vibration standards.
K. Horsepower Rating Requirements:
1. Ambient Temperature: 40°C.
2. Temperature Rise Per Table:

Continuous Rated Motors (All Enclosures)	Class B Insulation	Class F Insulation	Class H Insulation
	Temperature Rise by Resistance - °C		
S.F. 1.0	80	105	125
S.F. 1.15	90	115	---
	Temperature Rise by Embedded Detector - °C		
S.F. 1.0	90	115	140
S.F. 1.15	100	125	---

3. Service factor of 1.15.
4. 1800 rpm unless specified or indicated otherwise.
5. Adequate to drive equipment without using service factor except in emergency conditions.

L. Bearings:
   1. Designed for static and dynamic, and continuous and momentary thrusts as required by the driven equipment.
   2. Grease or oil lubricated bearings with re-lubrication fittings and flushing system.
   3. Antifriction type.
   4. Visual level indicator for oil lubricated bearings.
   5. Minimum L10 bearing life for continuous operation of 100,000 hours to conform to ABMA 9.

M. Screened openings or other suitable means for safety and protection from rodents or other animals.

N. Drip covers and lifting lugs.

O. Sound Pressure Levels (SPL) of the motor shall not exceed the maximum levels as specified in NEMA MG 1 Table 9-1.

P. Manufacturer shall prepare surfaces, prime, and finish paint all surfaces with manufacturer's standard coating system. Coating system and color shall be suitable for intended service.

Q. Stainless steel nameplate with all electrical and lubrication information.

R. Refer to Article 2.07 MOTOR ACCESSORIES this Section for additional requirements.

2.05 MULTI-SPEED MOTORS:

A. Same as specified in HORIZONTAL POLYPHASE MOTORS, this Section except for stator windings.

B. Stator Windings:
   1. Two-speed, two winding type, with a separate winding for each speed.

C. Torque Characteristics:
   1. Horsepower to vary directly with speed on constant torque applications such as feeders and conveyors.
   2. Horsepower to vary as the square of the speed on applications such as fans and centrifugal pumps.
   3. Rated horsepower at any speed for constant horsepower motors.

2.06 SUBMERSIBLE MOTORS:

A. Vertical squirrel-cage induction type.

B. NEMA Design B, Class F insulation. Class H insulation shall be provided when recommended by manufacturer for the application.

C. Rated 460 volts, 3 phase, 60 hertz.

D. Designed for operation with variable frequency drive.

E. Shall be "Inverter Duty", comply with NEMA MG 1 Part 30 and clause 31.4.4.2 Voltage Spikes of NEMA MG 1 – Part 31

F. Totally enclosed construction suitable for submerged service.

G. When installed within hazardous areas motors shall be suitable for operation in Class I, Division 1 locations.

H. Rating:
   1. Ambient temperature: 40°C.
   2. Service factor: 1.15.
   3. Speed as specified or indicated for each piece of equipment driven.
   4. Adequate to drive equipment without using service factor except in emergency conditions.
   5. Rated for continuous duty, capable of withstanding a minimum of 15 starts per hour.

I. For units with water jacket cooling system, include three disc-type temperature switches imbedded in the stator windings (one per phase) to stop motor on high-temperature conditions. Wiring included in the manufacturers provided pump cables.
   1. Motor supplier shall provide thermal sensing relay for integration into motor controls.

J. Provide water seal leak detectors between first and second mechanical seals with wiring included in the manufacturers provided pump cables.
   1. Motor supplier shall provide moisture sensing relay for integration into motor controls.

K. Supply cable for each pump of adequate length to reach from the motor to the indicated motor terminating junction box or power disconnect switch when the motor is in operating position.

L. Cable shall be coated with Hypalon or approved equal.

M. Provide stainless steel mesh cable grips for each pump cable to relieve strain from cable exiting the junction box.

N. Manufacturer shall prepare surfaces, prime, and finish paint all surfaces with manufacturer's standard coating system. Coating system and color shall be suitable for intended services.

O. Stainless steel data nameplate with all lubrication and electrical data located at each motor.

2.07 MOTOR ACCESSORIES:

A. When indicated or specified, provide two normally closed temperature switches embedded in each phase winding for high temperature protection. Switches shall be rated for use with 120Vac.
   1. The temperature at which the contacts open will be chosen by the manufacturer to protect the motor when it overheats.

B. When indicated or specified, provide motor space heaters as follows:
   1. Motor space heaters shall be securely attached to the motor windings and sized to maintain the motor internal temperature above the dew point when the motor is not running.
   2. Space heaters shall be silicon rubber type designed for long life and low skin temperature.
   3. Motor space heaters shall be operated at 120Vac.

C. When indicated or specified, motor shall be fitted with a Pt-100 sensor for continuous temperature monitoring and over-temperature protection.
   1. Provide with temperature monitoring relay compatible with sensor provided for remote mounting and integration into the indicated motor controls.
      a. Motor manufacturer shall provide the required temperature set points for proper protection of motor supplied.
   2. Relay shall be designed for DIN-rail mounting.
   3. Provide sensor with sufficient length of cable to allow splicing for connection to the remote mounted temperature monitoring relay.

D. For motors controlled by variable frequency drives, provide factory installed, maintenance free, circumferential, conductive micro fiber shaft grounding ring to discharge shaft currents to ground. Motors rated 100HP and greater shall provide an insulated opposite drive end bearing.

E. Motor conduit boxes shall be oversized to permit solderless connection of external leads and shall be designed to accept the number and size of conduits indicated.
   1. Motor leads permanently identified and of sufficient length to allow easy connection of external leads.

F. Provision for grounding motor frame.

2.08 BELT GUARDS:

A. Fully enclose belts on both sides except where equipment forms one side.
B. Size to enclose next larger size driven pulley.
C. Two-piece construction when driven equipment and motor are on opposite sides of the belt guard.
D. Provide with tachometer holes and covers.
E. Protective guard shall conform to ANSI B11.19 – Performance Requirements for Safeguarding.

2.09 BELT DRIVES:

A. Single or multiple V-belt.
B. Rated 140% of motor horsepower.
C. Adjustable speed with maximum belt speed of 4,500 fpm.
D. Matched sets of belts on multiple belt drives.
E. Adjustable slide rail motor mounts.
F. Adjustable screw type LVP or MVP for over one groove on motors less than 50 hp.
G. Motors 50 hp and larger may be furnished with two nonadjustable motor pulleys, one for testing and for final operation.

2.10 COUPLINGS:

A. Type as required for specific application as acceptable to Engineer.
B. Protective guard shall conform to ANSI B11.19 – Performance Requirements for Safeguarding.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install to conform to manufacturer's instruction.
B. Lubricate all bearings, gears and items requiring lubrication before placing equipment in operation.

3.02 FIELD QUALITY CONTROL:

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust motors, assemblies, and associated equipment installations, including connections.
B. Field Testing:
   1. Provide manufacturer recommended testing prior to startup of motors.
   2. Testing shall be performed in accordance with IEEE 112.
   3. Check equipment ground to assure continuity of connections as specified in Division 26.
   4. Measure the insulation resistance of the stator winding before applying voltage. Compare this measured value against the manufacturer's value. If there is no insulation resistance value furnished by manufacturer, use the following:

Motor Voltage	Insulation Resistance
600 volts and below	5 megohms

a. If measured resistance values are lower than above, record room temperature and humidity and submit readings to Engineer before energizing. Dry out motors as required by accepted method of application of external heat, and do not apply voltage to motor until substandard resistance condition is corrected. Megger readings are to be one-minute duration, using a 500V megger for all motors 600V and below.

5. After the motor is placed in operation, observe the motor for heating at the bearings or windings. If the motor appears to be running hot, notify Engineer.
   a. Note: General purpose motors may reach temperatures up to 176ºF with a room temperature of 104ºF.
6. Take motor full load amps readings on all phases. Record voltage and current for each phase at time of measurement.
7. Prepare all results and submit field testing and startup report to Engineer.

3.03 FINISHES:

A. Equipment coatings shall be free from scratches, rust, or other defects.
B. All damaged or defective coatings shall be repaired prior to final acceptance.
C. Field Painting:
   1. Touch Up:
      a. Contractor shall prepare surfaces and touch up manufacturer applied coatings as required for any damage during shipment and installation.
      b. Field painting shall be performed based on manufacturer's recommended procedures.
      c. Motor manufacturer shall furnish Contractor with an adequate quantity of touch-up paint to match the factory applied finish.

END OF SECTION 46 05 13

SECTION 46 21 13 – COARSE SCREENING EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes the supply of two screens and all associated control systems as shown on the Drawings and specified herein. The treatment objective for the screens is to capture and remove particles from raw wastewater. The screenings are to be collected in a roll-off dumpster.

B. All equipment specified in this Section shall be suitable for installation in the structures as indicated. Any revisions necessary to accommodate the equipment furnished shall be the responsibility of the Supplier.

C. Related Work Specified Elsewhere:
   1. Contract Drawings.
   2. General Requirements: Division 1.
   3. Painting: Division 9.
   4. Section 40 66 00 – Process Control Networks
   5. Section 40 67 00 – Process Control Panels and Hardware
   6. Section 40 70 00 – Instrumentation for Process Systems
   7. Section 46 05 13 – Common Motor Requirements for Water and Wastewater Equipment

1.02 REFERENCES:

A. Applicable Standards:
   1. American Bearing Manufacturers Association (ABMA).
   2. American Gear Manufacturers Association (AGMA).
   3. American Iron and Steel Institute (AISI).
   4. American National Standards Institute (ANSI).
   5. American Society of Mechanical Engineers (ASME)
   6. American Society for Testing and Materials (ASTM):
      a. A36 - Structural Steel.
      b. A126 - Gray Iron Castings.
   7. National Electric Code (NEC)
   8. National Electrical Manufacturers Association (NEMA).
   9. National Fire Protection Association (NFPA).
   10. Occupational Safety and Health Act (OSHA).
   11. Underwriters Laboratories (UL).
   12. Institute of Electrical and Electronic Engineers (IEEE).

1.03 QUALITY ASSURANCE:

A. Refer to Division 01 for requirements.

1.04 SUPPLIER SUBMITTALS:

A. Submit as specified in DIVISION 01.

B. Includes, but is not limited to the following:
   1. Complete manufacturer's data, specifications, and detailed drawings for all equipment and materials which shall include complete descriptive data to define materials sizes, capacities, types, models, accessories, etc. Drawings and other information shall be suitable for erection and installation of equipment and materials.
   2. Recommended spare parts list.

3. Electric power requirements, wiring diagrams, and schematics for all electrical equipment and devices.
4. Control panel HMI screens.
5. All structural loads imparted to the structure.
6. Anchoring details.
7. Submit screen headloss calculations at peak and design flows. The calculations shall include clean screen 0% blinded and 30% of screen panel area blinded.
8. Manufacturer's surface preparation, shop priming, and machined metal surface rust inhibitive compound requirements.
9. List of installations, as described in Quality Assurance, including current Owner representative name, address, telephone number, and email.

C. Operation and Maintenance Manual includes, but not limited to, the following:
1. Special shipping, storage, protection, and handling instructions including dimensions of each container or package shipped.
2. Recommended unloading method at project site including implement (e.g., forklift, etc.) and maximum container or package weight.
3. Manufacturer’s printed installation instructions.
4. The manual shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, etc. that are required to instruct operating and maintenance personnel unfamiliar with such equipment. The maintenance instructions shall include trouble shooting data, full preventative maintenance schedule and complete spare parts lists with order information. In addition, the manuals shall include the following at a minimum:
a. Complete parts list cross-referenced to an exploded view assembly or equivalent drawing.
b. Dimensional drawings of all provided equipment with component weights.
c. Complete preventative maintenance procedures (including recommended intervals).
d. Alignment, adjustment, and repair instructions.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Deliver, store and handle all equipment and materials in accordance with the requirements in Division 01.

1.06 WARRANTY:

A. Shall be as specified in DIVISION 01.

PART 2 - PRODUCTS

2.01 ACCEPTABLE SUPPLIERS:

A. Subject to compliance with the specifications, provide one of the following suppliers:
1. Screens:
a. Duperon Corporation.
b. Parkson Corporation.

2.02 SERVICE CONDITIONS:

A. The screening system shall be used to screen raw domestic wastewater gravity fed from the collection system and prior to influent pumping.
B. Screenings captured and collected from the screens are to be collected in a roll-off dumpster supplied by the Owner.
C. Equipment to be installed indoors in Kansas City, Missouri.

2.03 DESIGN AND PERFORMANCE REQUIREMENTS:

A. Screens:
   1. Number of units: 2.
   2. Maximum effective spacing: 1/4 inch.
   3. Angle of screen: 80 degrees from horizontal.

B. Design Flows and Screenings Load:
   1. Peak flow per screen: 15 MGD.
   2. Current average daily plant flow: 2.2 MGD.
   3. Design average daily plant flow: 4.6 MGD
   4. Design screenings volume rate: 15 ft^3 per MG.

C. Dimensions and Elevations:
   1. Screen channel width: 3 feet.
   2. Screen channel depth: 42.33 feet (from screening structure floor to channel invert).
   3. Water level downstream at design average daily plant flow: 1.80 feet
   4. Water level downstream at peak flow: 2.75 feet.
   5. Maximum allowable hydraulic headloss at peak flow (at 30% blinding): 6 inches.
   6. Channel bottom elevation: 813.67 feet.
   7. Screen Room operating floor elevation: 856.0 feet. Screening equipment supports shall be mounted on 6-inch concrete bases.

D. All materials shall be 304L stainless steel unless otherwise specified.

2.04 MECHANICALLY CLEANED BAR SCREEN:

A. General:
   1. The mechanically cleaned screen shall be a stainless-steel link driven, front-cleaning, front-return type mechanically cleaned bar screen. The screen will be self-contained and shall capture and transport wastewater debris to the discharge point. The screen shall consist of 316SSTL teardrop shaped bars, spaced to create a fabricated and stiffened grid which is carried on supports spanning the channel. Back cleaned or rear-return type mechanically cleaned screens will not be acceptable.
   2. The screenings are mechanically cleaned from the bar rack by rakes with tine plates mounted on carriers attached to the links of the roller chains on each side of the screen. The complete screen is constructed such that it forms a strong and rigid integral structure which is secured to the support beams which span the width of the chamber.
   3. The mechanically cleaned screen shall clean continuously, from bottom to top, the entire width of the rake. The debris will be removed from the bar racks by the cleaning rakes, conveyed up the dead plate to the discharge point where the rakes will be cleaned by the rake wiper.
   4. The bar screen will include: cleaning rakes, rake wiper, links, shafts, bearings, drive unit complete with reducer, motor, side frames with lifting lugs, bar rack, dead plate, discharge chute, head section, side wall sealing plates, controls, and any other appurtenances required for a complete operating system.
   5. Wear parts requiring periodic inspection, maintenance, and replacement should be fully replaceable without having to remove the screen from the channel.
   6. The screen frame shall be supplied in one piece requiring no field assembly other than that necessitated by shipping requirements and protection of the equipment.
   7. All fasteners, bolts, and nuts shall be of AISI Type 316 stainless steel and furnished by the supplier. Anchor bolts shall be AISI Type 316 stainless steel and at least 1/2-inch diameter. Anchor bolts shall be provided by supplier.
   8. All non-corrosive materials shall be used in components traveling underwater.

9. The design shall be such to enable all maintenance to be accomplished at the operating floor level.

B. System Components:
   1. Side Frames:
      a. The side frames will be constructed of minimum 1/4 inch thick type 304 stainless steel plate and braced as required.
      b. The side frame will have a stainless steel guide system for both the carrying and return run of the screen chain. The guides will provide minimal clearance to prevent debris from coming in contact with the screen chains.
      c. Lower return guides shall allow for proper alignment of rakes as they engage the bar screen.
      d. Closures shall be provided to assure that there is no space wider than the opening between the bars, to prevent passage of larger solids, than allowed through the screen. Closures shall be incorporated into the side fabrication framework and return guides.
      e. Side wall seal plates with 1/4-inch thick neoprene strip will be furnished with the screen to close off the area between the side frames and channel walls. Stainless steel may be used in lieu of neoprene for closeout between side frame and channel wall as long as no opening greater the 1/4-inch is present. The seal plates will be not less than 14 gauge type 304L stainless steel and extend from the channel floor to at least 12-inches above maximum sewage depth.
      f. Lifting lugs or pick points will be provided on the side frames near the channel floor.
   2. Bar Screen:
      a. The bar rack will extend from the invert of the channel to the height indicated in Part 2.03.C where it will be connected to a dead plate on which the screenings will be lifted to the discharge apex prior to discharging into dumpster.
      b. The bar screen shall be of AISI Type 316 stainless steel and shall be spaced to maintain a 1/4 inch clear opening. The bar screen shall be able to withstand a 2 foot head differential.
      c. The bar screen anchors and fasteners shall be of stainless steel.
      d. Bars shall be removable from the bar rack assembly in individual bars or multiple bar subassemblies. Bars shall not be welded in place. Bar racks that use welded bars are not acceptable.
   3. Link System:
      a. The chain links shall be 316 stainless steel and shall be joined with stainless steel pins.
      b. The drive shaft will be stainless steel and be supported on each side by grease lubricated take-up bearing assemblies. The bearings may also be self-lubricating.
   4. Rakes:
      a. The rakes will be stainless steel, reinforced, and bolted to the stainless steel links on each side.
      b. The stainless steel rake tines shall penetrate into the screen bar spacing to such that screenings are completely cleared during each lifting operation. The rake tines shall be suitable shape to effectively clean the front and sides of the bars and shall have adequate stiffness and strength to cope with the specified duty cycle. The rake bar will be at least 1/4 inch thick stainless steel and shall be replaceable.
      c. Spacing between rakes shall be as determined by supplier to effectively remove the design screenings volume rate listed in part 2.03.D.
      d. The rake speed shall be as determined by the supplier to effectively remove the design screenings volume rate listed in part 2.03.D.

e. If scrapers are included, they shall be made of 1" thick wide UV resistant UHMW-PE and span the width of the bar rack. Scrapers shall have a serrated edge designed to clean the face of the bar rack. Units shall be provided with a stainless steel backing angle.

5. Dead Plate:
   a. Dead plate shall be at least 1/4 inch thick, AISI Type 304L stainless steel. Dead plate shall span the entire width of the screen and transition from bar rack to discharge point.
   b. The rake head teeth shall ride no closer than 1/16-inch from the dead plate and no further than ¼-inch from the dead plate.
6. Rake Wiper/Debris Blade:
   a. The wiper will be 304L stainless steel, pivoting and be easily adjustable.
   b. The wiper will have a replaceable UHMW Polyethylene blade.
   c. The design shall be such that the rack repositions the wiper mechanism. The wiper mechanism design shall allow the rake assembly to operate in reverse, through the wiper mechanism, without the need to manually lift the wiper assembly.
7. Discharge Chute:
   a. An enclosed discharge chute of minimum 11 gauge (1/8 inch) AISI Type 304 stainless steel shall be bolted or welded to the dead plate per supplier's recommendation and will discharge to the roll-off dumpster.
   b. The height of the discharge chute will be as required to accommodate roll-off dumpster as shown on Drawings.
8. Side Shields:
   a. Side shields shall be stainless steel 304L and shall be present from intermediate deck to operating deck.
9. Channel Bottom Plate:
   a. An AISI Type 304L stainless steel channel bottom plate shall be utilized as recommended by the supplier to fully engage rakes in the bar screen at the bottom of the channel.
   b. The channel bottom plate may require anchoring dependent upon site configuration and as recommended by the supplier.
10. Screen Enclosure:
    a. The portion of the screen above the top of operating level will have stainless steel guards.
    b. The guards will provide quick access panels for equipment maintenance.
    c. The panels shall be manufactured of 304L stainless steel held in place by latches. Each panel shall be provided with handles for panel removal/replacement. All handles and latches shall be 304L stainless steel.
11. Upper Bearings:
    a. Bearing shall be a non-lubricated no maintenance engineered polymer Thordon® or Vesconite® bearings and shall have a PV value that is less than the limiting PV value of the material. Bearings containing grease are not acceptable.
12. Drive Unit:
    a. Each mechanically cleaned screen unit shall operate independently and will have its own drive unit and driven components.
    b. The electric motor shall be TEFC, NEMA Design B with Class F insulation, rated for Class I, Division 2, Group D hazardous environment. The motor shall be no larger than 1 Hp, and run from a 460V, 3-phase, 60-hertz electrical supply.
    c. The enclosure shall be of weather protected design.

d. The drive unit speed reducer will be of the helical gear or spiral bevel type, fully housed, running in oil or grease, with anti-friction bearings throughout.
e. The drive unit will be assembled by the Supplier and shipped as a complete assembly to ensure proper assembly of all components.
f. Refer to the Drawings for orientation of drive units.

13. Spare Parts and Special Tools:
    a. Refer to 40 67 00
    b. One (1) wiper blade.
    c. Ten (10) retaining rings.
    d. Four (4) chain pins.
    e. Four (4) rake screws, nuts, and hardware.
    f. Four (4) scraper screws, nuts, and hardware.
    g. One (1) tube of Never Seez.
    h. Any additional recommended spare parts.

2.04 PROTECTIVE COATINGS:

A. Motor, gear reducer, and all metallic surfaces except aluminum and stainless steel shall be factory painted with the Supplier's standard coating equal to the 09 90 00 E-1 system and field touched-up.
B. Coatings other than those listed in 09 90 00, System E-1 may be submitted but must receive the approval of the Purchaser.
C. Provide field touch-up paint kit.

2.05 SCREEN SYSTEM CONTROLS AND INSTRUMENTATION:

A. The Screen System shall be supplied with a main system control panel designed to house all components required to control the screen system and associated equipment.
B. The screening equipment supplier shall provide all control components and instruments as specified herein.
C. System Components and Function:
    1. Screen System Main Control Panels: IPS-MCP-010, IPS-MCP-020.
        a. As described below.
    2. Bar Screens: IPS-SCR-010, IPS-SCR-020.
        a. Mechanical screen designed to remove solids and debris from the liquid stream
    3. Radar Level Transmitters as defined in the following table:

Bar Screen	Upstream Level Sensor	Downstream Level Sensor	Level Indicating Transmitter	High-Level Switch
IPS-SCR-010	IPS-LT-010A	IPS-LT-010B	IPS-LIT-010	IPS-LSH-010
IPS-SCR-020	IPS-LT-020A	IPS-LT-020B	IPS-LIT-010	IPS-LSH-020

D. Description of Operation
    1. The screening equipment shall be provided with a control panel equipped with a PLC and an operator interface for setpoint adjustment and monitoring.
    2. The system shall have control stations provided and mounted adjacent to the equipment to allow for local operation of the equipment.
    3. The supplier supplied control panel shall serve as the primary control point for the equipment and all controls described shall be available through an operator interface screen (HMI).

4. Bar Screens IPS-SCR-010 and IPS-SCR-020
   a. The screens shall be started and stopped at the HMI by Hand/Off/Auto operation selection. The functionality described below shall be per screen (i.e. each screen will have a dedicated differential measurement and control sequence)
      (1) In HAND mode, the equipment will run continuously until stopped by the operator.
      (2) In OFF mode the equipment will not run.
      (3) In AUTO mode, the equipment will be started and stopped by the screen system PLC. The PLC programming shall be as described below.
         (a) The screen shall be started and stopped by the system PLC based upon channel head differential across the screens as measured by the corresponding level transmitters.
         (b) The screen system shall start at normal speed when the upstream level reaches start level setpoint. An operator-adjustable start level setpoint shall be programmed.
         (c) The screen system shall run at high speed when the calculated differential level reaches differential level setpoint. An operator adjustable level differential setpoint shall be programmed.
         (d) The screen system shall operate continuously at high speed until the differential level falls below the differential level setpoint. The screen should then return to normal speed.
         (e) The screen system shall operate at normal speed until the upstream level falls below the start level setpoint. The screen system shall then operate for an operator adjustable length of time before stopping.
         (f) A backup timer shall be provided to operate the screens periodically and if a failure occurs with the level controls, the timer setpoint shall be adjustable through the operator interface mounted on the face of the main control panel.
         (g) The parameters for the upstream start level, channel head differential level, and cycle time between operations shall be set at the supplier provided operator interface on the main control panel.
         (h) A “CYCLE START” operator soft push button shall be provided on the face of the local control panel. If the CYCLE START push button is depressed, the PLC shall immediately initiate a screen cycle for the associated screen.
         (i) High Flow Mode and Remote Cycle:
            1) While in AUTO, the screen system shall accept a start signal from the plant control system for remote start capability.
   b. System Upsets and Procedures for Recovery:
      (1) If a screen failure occurs, the control system shall alarm the operator via the operator workstation.
      (2) If a power failure occurs, the equipment that was in operation prior to the power failure shall be automatically restarted by the manufacturer-provided control panel.
      (3) If a level transmitter signal is lost, the control system shall alarm the operator via the operator workstation.
      (4) If a jam or over-torque condition occurs in the screen that cannot be cleared by the system, the associated equipment shall automatically stop and initiate a failure alarm at the operator workstation.
      (5) Safety Devices:

(a) Emergency stop push buttons and pull cord switches, as applicable, shall be interlocked with the corresponding screen starting circuit.
(b) In the event of an emergency stop push activation, the corresponding equipment will shut down and alarm the operator. The emergency stops shall require a manual reset to restart the equipment.
(c) An emergency stop condition shall initiate an e-stop alarm at the operator workstation.

c. The upstream and downstream levels for each of the screens shall be available for display on the operator interface in units of feet. Operator adjustable upstream and differential level alarms shall be programmed for the screen.

E. Setpoints and Ranges:
1. Level Transmitters
a. All level transmitters shall be calibrated and configured to provide a range of measurement from the blanking distance of the transmitter to the bottom of the channel.
2. Screen System Operator Interface:
a. Screen Level Transmitters
(1) Display range measure value in feet for each level transmitter.
(2) High level alarm adjustable between 0-1 feet, initially set at 0.8 feet for the upstream level transmitter.
(3) Differential level setpoint adjustable between 0.25-2.00 feet, initially set at 0.5 feet for each screen.
b. Backup cycle timer adjustable between 0-30 minutes, initially set at 15 minutes.
3. System Upsets and Procedures for Recovery:
a. The system shall send an alarm for the screen to the Process Control System under any of the following conditions:
(1) Any motor or other component critical to the operation of the screens is faulted.
(2) If a level transmitter signal is lost.
(3) If a jam is not cleared.
b. If a power failure occurs, the screen shall be automatically restarted by the supplier provided main control panel without requiring a manual reset.
c. If a jam occurs in a screen, the screen control system shall automatically initiate the supplier standard reversing sequence and attempt to clear the jam. If the jam is not cleared, the control system shall initiate a failure alarm at the operator workstation.
d. If an overload occurs in the screen, the screen shall automatically stop and initiate and failure alarm at the operator workstation.
e. System in AUTO mode:
(1) If a level signal is lost, the screen shall operate on a timer. If the level signal is restored, the screen shall be returned to normal operation.
f. Safety Devices:
(1) Emergency stops shall be interlocked with all motor circuits in the screen.
(2) In the event of an emergency stop situation, the equipment will shut down and alarm the operator via the operator workstation.
(3) The system shall not restart until the operator clears the alarm from the equipment and/or the main control panel as applicable.
(a) The emergency stop pushbuttons require a manual reset to deactivate the alarm.

F. The screening equipment supplier shall provide all control components and instruments as specified herein.

G. Screen System Control Panel:
   1. Control panels and components shall conform to Section 40 67 00.
   2. The control panel shall be designed for installation within a conditioned electrical room.
   3. The control panel shall be a NEMA 12 rated enclosure with use of ventilation for thermal management as required.
   4. The control panel shall be equipped with an Allen-Bradley CompactLogix PLC to provide control and monitoring of the supplied equipment.
   5. The supplier supplied PLC shall be connected to the Plant Control System through an Ethernet network connection. Provide a network switch as required for communicating the Screen system data over an Ethernet/IP network as well as providing connectivity to the operator interface. The panel programmer shall provide a data/memory map to the project's systems integrator which includes all produced tags and assigned IP addresses as required to enable communication between the control panel and the communication network. Provide a network switch as required to provide a complete and functional system as specified in 40 66 00.
   6. IP address assigned to PLC for uplink to plant network shall be reconfigurable and on a separate subnet than the Screen System's local network.
   7. The enclosure width shall not exceed 3'-0".
   8. The control panel shall be powered from a single 480V, 3-phase power source.
   9. The control panel shall be supplied with a 480-120V control power transformer to provide power to 120V devices in the panel.
   10. The control panel shall include provisions for connection of one (1) 120Vac, 20-Amp field supplied circuit and the internal derived 120Vac circuit from the specified 480V-120V CPT. The CPT derived circuit shall be used as "House" power for lights, fans, receptacles, etc. The field connected circuit shall be derived from the centralized UPS system and shall power all PLC, network, OIT, and control system related loads within the control panel.
   11. The control panel shall contain all required components for complete control and monitoring of the screening units, level controls and other associated equipment. As a minimum, the following components shall be installed in the panel:
       a. Door interlocked main disconnect circuit breaker.
       b. Motor starters with solid state overloads and/or VFD's for the screen units.
       c. Control power transformer.
       d. Programmable Logic Controller (PLC).
       e. Operator interface touch screen.
       f. Required circuit breakers, control relays, power supplies, selector switches and indicating lights.
   12. Operator Interface Touch Screen:
       a. The control panel shall include a 15-inch operator interface touch screen.
       b. Provide an Allen-Bradley PanelView Plus as specified in Section 40 67 00.
       c. All supplier supplied graphics and applications shall be developed with FactoryTalk View Machine Edition.
       d. The screens developed shall utilize high performance graphic styles using gray scale color palettes for all equipment when possible.
       e. In addition to controlling the Suppliers equipment the supplied touch screen shall be used for interfacing with the Plant Control System. Supplier shall provide the developed screen system application files to the Systems Integrator to allow further development and addition of the screens.

f. Supplier shall provide the necessary coordination with the Systems Integrator to ensure a fully functional application.

13. All devices shall be factory installed, wired and tested. Terminal blocks shall be provided and labeled as required for power, control and instrumentation.
14. The Screen System Control Panel shall provide the following discrete signals for use by the Plant Control System. The signals shall be communicated via the Ethernet/IP network.
    a. Screen "Auto" Mode for both screens.
    b. Screen "Hand" Mode for both screens.
    c. Screen Run Status for both screens.
    d. Screen Emergency Stop for both screens.
    e. Screen Failure for both screens (Common alarm for all associated equipment with the associated screen).
15. The Screen System Control Panel shall provide the following analog values over the Ethernet/IP network for use by the Plant Control System.
    a. Screen Influent Level for both screens.
    b. Screen Effluent Level for both screens.
16. As a minimum the following functionality shall be available via the operator interface screen:
    a. Hand/Off/Auto switch position for each piece of equipment.
    b. Power On indication for each piece of equipment.
    c. Forward indication for each piece of equipment.
    d. Reverse indication for each screen.
    e. Fault or Failure indication for each piece of equipment.
    f. Motor overtemperature indication for each motor.
17. Additional status points and adjustment of set points and operating parameters shall be available via the operator interface screen. As a minimum, the following parameters and status points shall be viewable and/or adjustable via the operator interface screen:
    a. Upstream Start Level for each screen.
    b. Screen Head Differential for each screen.
    c. Screen Head Differential Set Point for each screen.
    d. Backup Timer Setting.
    e. Run Time.
    f. Run Status indication for all equipment.
    g. Identify cause of equipment Failure.

H. Screening Unit Local Control Station (one per screen):
1. Refer to Section 40 67 00 for control station requirements and component specifications.
2. The panel shall be a NEMA Type 4X 304 SST enclosure to be installed outside adjacent to each screen. All selector switches, pushbuttons, and indicators shall be hermetically sealed for installation in a Class I, Division 2, Group D area.
3. The panel shall contain all required components to implement the control functionality specified and allow for the electrical connection of the skid mounted equipment to the main control panel. As a minimum, the following components shall be installed in the face of the panel:
    a. Hand, Off, Auto selector switch
    b. Run/Stop indicating lights.
    c. Emergency stop pushbutton.
    d. Control Station Identification Label.
4. As a minimum the following shall be installed inside the panel.
    a. Terminal blocks for all field connections required.

I. Screen Level Sensors:
   1. The screening units shall be provided with radar level transmitters or laser level transmitters. The level transmitters shall initiate screen operation based on channel head differential and the parameters set in the operator interface.
      a. The PLC logic shall determine differential levels using signals from two separately mounted level transmitters.
      b. The first transmitter shall be installed upstream of the screen and measures the screen upstream head. The second transmitter shall be installed downstream of the screen and measures the downstream head of the screen.
      c. The head in front (upstream) of the screen shall be compared to the head downstream of the screen to determine the head differential.
   2. Level Transmitter IPS-LIT-010 and IPS-LIT-020:
      a. Provide a level transmitter mounted for each screening unit.
      b. The upstream and downstream sensors' 4-20mA level signal instrumentation cables shall terminate to the transmitter. The transmitter shall provide upstream and downstream levels to the main control panel via 4-20mA outputs. The transmitter shall display upstream, downstream, and differential level.
      c. The transmitter shall be rated for installation in a Class I, Division 2, Group D area. The transmitter shall provide intrinsically safe connections for the level transducers.
      d. Power for the level transmitter shall be provided from the main control panel via thermal magnetic circuit breaker.
   3. Level sensors shall be a 2-wire device and perform non-contacting liquid level measurements with signal outputs of 4-20mA to the screen system PLC.
   4. The level sensors shall be intrinsically safe and suitable for installation in a Class I, Division 2, Group D area. Required intrinsically safe barriers shall be installed in the main control panel if required for the indicating transmitter.
   5. Refer to Section 40 70 00 for level transmitter specifications. Provide quantity of sensors and transmitters as required with measurement ranges and blanking distances necessary for the measurement in the indicated screen channels.

J. High Level Probe:
   1. Provide a high-level conductivity probe for installation in each channel, upstream of each screen.
   2. The probes shall be intrinsically safe and suitable for installation in a Class I, Division 2, Group D area. Where required, provide and install intrinsically safe barriers in the main control panel.
   3. Provide and install an intrinsically safe control relay for each probe in the main control panel. Relay shall provide an alarm to the PLC via a N.O. and N.C. output contact upon high level detection by probe.
   4. Provide the necessary stainless steel hardware, mounting brackets or fittings, manufacturer cables, and strain relief for securing the probes in the channel. Installation shall be coordinated with the channel grating to allow access and removal.
   5. Refer to Section 40 70 00 – Instrumentation for Process Systems for conductivity probe specifications.

K.

L. Source Quality Control:
   1. The Screen System and controller shall be factory tested to ensure satisfactory operation.

M. Accessories:
   1. Provide all templates and special wrenches or tools necessary for proper installation and maintenance of equipment.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Motor, gear reducer, and all metallic surfaces except aluminum and stainless steel shall be factory painted for shipping purposes. Stainless steel and aluminum surfaces shall not be painted. Prepare surfaces in shop and finish all surfaces as specified in Division 9.
B. Store all Equipment as specified in Division 1 and as required to prevent damage.
C. Assemble and test drive units in factory.

3.02 INSTALLATION:

A. In accordance with manufacturer's instructions and as indicated.
B. Install all electrical conduits, wires, tubing, instrumentation and other appurtenances as required for satisfactory operation.
C. Prepare surface and paint or touch up all surfaces as specified herein and in Division 9.

3.03 FIELD QUALITY CONTROL AND ADJUSTMENTS:

A. Manufacturer's Field Services: Provide all services as specified in Division 1 and as follows:
B. The equipment suppliers shall furnish the services of a factory-trained representative on site for a period of no less than four days and two trips. The representative shall inspect, adjust, calibrate and place the system into operation. If additional services are required to produce a fully operational system, they shall be provided at no cost to the Owner.
C. Training:
    1. The on-site services provided by the factory-trained representative shall include training.
    2. The representative shall provide two complete training sessions to the Owner operating personnel in equipment operation and maintenance. Sessions shall be a minimum of two hours in length, or as required to complete the entire training.
    3. One of the sessions shall be video recorded, placed on a USB, and transmitted to Owner for use in training future personnel.
D. After installation and after all equipment and components are in operable condition, a field mechanical and electrical performance test shall be performed in the presence of the Engineer.
    1. Each piece of equipment shall be tested for normal start, stop, and emergency stop cycles.
    2. Each piece of equipment shall be field tested, and the equipment calibrated to demonstrate to the Engineer that all equipment will satisfactorily perform the functions and criteria specified.
    3. Furnish test forms and procedures for field testing and provide all test apparatus required at no additional cost to the Owner.
    4. Follow testing procedures recommended by the equipment manufacturer and approved by the Engineer.
    5. The equipment supplier shall modify or replace any equipment necessary to obtain satisfactory performance.
E. All labor, materials, and test apparatus necessary for conducting the above tests shall be furnished by the Contractor at no additional cost to the Owner, unless stated otherwise.

END OF SECTION 46 21 16

SECTION 46 21 16 - SCREENING EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes the furnishing and installation of two screens, two screenings washer/compactors, and all associated control systems as shown on the Drawings and specified herein. The treatment objective for the screens is to capture and remove particles from wastewater that has gone through coarse screening and influent pumping. The screenings are to be transported to a disposal container/roll-off dumpster.

B. All equipment specified in this Section shall be suitable for installation in the structure as indicated. Any revisions necessary to accommodate the equipment furnished shall be the responsibility of the Contractor.

C. Related Work Specified Elsewhere:
   1. Contract Drawings.
   2. General Requirements: Division 1.
   3. Painting: Division 9.
   4. Motors: Section 46 05 13 – Common Motor Requirements for Water and Wastewater Equipment

1.02 REFERENCES:

A. Applicable Standards:
   1. American Bearing Manufacturers Association (ABMA).
   2. American Gear Manufacturers Association (AGMA).
   3. American Iron and Steel Institute (AISI).
   4. American National Standards Institute (ANSI).
   5. American Society of Mechanical Engineers (ASME)
   6. American Society for Testing and Materials (ASTM):
      a. A36 - Structural Steel.
      b. A126 - Gray Iron Castings.
   7. National Electric Code (NEC)
   8. National Electrical Manufacturers Association (NEMA).
   9. National Fire Protection Association (NFPA).
   10. Occupational Safety and Health Act (OSHA).
   11. Underwriters Laboratories (UL).
   12. Institute of Electrical and Electronic Engineers (IEEE).

1.03 QUALITY ASSURANCE:

A. Refer to Division 1 for requirements.

1.04 SUBMITTALS:

A. Submit as specified in Division 1.

B. Includes, but is not limited to the following:
   1. Complete manufacturer's data, specifications, and detailed drawings for all equipment and materials which shall include complete descriptive data to define materials sizes, capacities, types, models, accessories, etc. Drawings and other information shall be suitable for erection and installation of equipment and materials.
   2. Recommended spare parts list.
   3. Electric power requirements, wiring diagrams, and schematics for all electrical equipment and devices.
   4. Control panel HMI screens.

5. All structural loads imparted to the structure.
6. Anchoring details.
7. Submit screen headloss calculations at peak and design flows. The calculations shall include clean screen 0% blinded and 30% of screen panel area blinded.
8. Manufacturer's surface preparation, shop priming, and machined metal surface rust inhibitive compound requirements.
9. List of installations, as described in Quality Assurance, including current Owner representative name, address, telephone number, and email.

C. Operation and Maintenance Manual includes, but not limited to, the following:
1. Special shipping, storage, protection, and handling instructions including dimensions of each container or package shipped.
2. Recommended unloading method at project site including implement (e.g., forklift, etc.) and maximum container or package weight.
3. Manufacturer’s printed installation instructions.
4. The manual shall be prepared specifically for this installation and shall include all required cuts, drawings, equipment lists, descriptions, etc. that are required to instruct operating and maintenance personnel unfamiliar with such equipment. The maintenance instructions shall include trouble shooting data, full preventative maintenance schedule and complete spare parts lists with order information. In addition, the manuals shall include the following at a minimum:
a. Complete parts list cross-referenced to an exploded view assembly or equivalent drawing.
b. Dimensional drawings of all provided equipment with component weights.
c. Complete preventative maintenance procedures (including recommended intervals).
d. Alignment, adjustment, and repair instructions.

D.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Deliver, store and handle all equipment and materials in accordance with the requirements in Division 1.

1.06 WARRANTY:

A. Shall be as specified in Division 1.

PART 2 - PRODUCTS

2.01 ACCEPTABLE SUPPLIERS:

A. Subject to compliance with the specifications, provide one of the following suppliers:
1. Screens and screenings washer/compactor:
a. Huber Technology Inc.
b. JWC Environmental.
c. Kusters Water, a Zima brand.
d. Parkson Corporation.
e. SAVECO North America, Inc.

2.02 SERVICE CONDITIONS:

A. The screening system shall be used to screen domestic wastewater that has been coarse screened and pumped from the collection system.

B. Screenings captured and collected from the screens are to be conveyed and deposited into a roll-off dumpster supplied by others.

2.03 DESIGN AND PERFORMANCE REQUIREMENTS:

A. Screens:
   1. Number of units: 2
   2. Maximum effective spacing: 6 mm
   3. Minimum Angle of screen: 60 degrees from horizontal

B. Washer/Compactors:
   1. Number of units: 2

C. Design Flows and Screenings Load:
   1. Peak flow per screen: 13.2 MGD
   2. Average daily plant flow: 4.6 MGD
   3. Minimum daily plant flow: 2.0 MGD

D. Dimensions and Elevations:
   1. Screen channel width: 4.0 feet.
   2. Screen channel depth: 6.0 feet (from operating floor to channel invert)
   3. Water level downstream at design average daily plant flow: 1.05 feet
   4. Water level downstream at peak flow: 1.75 feet
   5. Maximum allowable headloss at peak flow (at 30% blinding): 27 inches
   6. Channel bottom elevation: 932.50 feet.
   7. Screen Room operating floor elevation: 938.50 feet.
   8. Screening equipment supports shall be mounted on 6-inch concrete bases.

2.04 MECHANICAL PERFORATED PLATE TYPE SCREEN:

A. General:
   1. The screening of debris shall be accomplished by using a screen system comprised of a filter screen belt, rotating brush assembly, and drive unit.
   2. The screens shall be designed to be tilted out of the channel.

B. System Components:
   1. Screen Belt:
      a. Comprised of inclined, stainless steel, minimum 1/8-inch thick panel elements.
      b. The belt shall be continuous and travel in one direction within the screen frame.
      c. Clear spacing between adjacent panel elements, as measured in the horizontal direction, shall be 2.5 mm or less.
      d. A flange shall be provided, if required, on the bottom of each panel element to limit the separation at any point between adjacent elements to the thickness of the element material. Panel elements shall be interchangeable, one with the other.
      e. The screening rollers, if required, shall be minimum 1-3/4-inch diameter and shall ride on 1/2-inch thick type 304 stainless steel rails. A submerged, curved 1/2-inch thick stainless steel rail shall be provided at the foot of the screen. Alternatively, rotating guides may be provided to guide the chain and panel elements around the bottom of the screen.
      f. The screen shall be automatically self-cleaning through the interaction of the panel elements with or without external mechanical devices such as cleaner brushes. The driving force must be transmitted to clean, trash-free components to avoid mistracking or binding which render the screen inoperable and require manual cleaning and realignment. No auxiliary cleaning devices which cause trash to be dropped into the interior of the filtration belt will be allowed as this would tend to require periodic cleaning of trash from this area and may lead to jamming of the filtration belt.
   2. Rotating Brush Assembly:
      a. The screen belt assembly is cleaned by the interaction of the panel elements and the rotating brush assembly without other mechanical devices capable of jamming to remove the captured material.

b. The rotating brush assembly is supported by bearings on each side of the machine mounted externally to the machine frame. The brush is chain driven by the belt drive shaft or driven by a separate motor and gear reducer.
c. The brush is comprised of two separate components, the brush shaft, and the brush core. The shaft is made of stainless steel, type 304. The brush core is made of UHMW or PVC, with tufted nylon or polypropylene bristles.

3. Brush Drive Unit:
   a. The unit shall be driven by a 460 volt, 3-phase, 60 Hz TEFC motor connected to a reducer equipped with antifriction bearings and designed in accordance with AGMA recommendation for 24-hour, Class II service.
   b. The motor shall be rated for a service factor of 1.15, and operation with variable frequency drive. Motor shall conform to Section 46 05 13 – Common Motor Requirements for Water and Wastewater Equipment.
   c. The motor shall be no larger than 2.0 hp and suited for operation in a Class I, Division 2, Group D.
   d. Provide electronic overload protection. Overload device shall sense motor current draw and provides overcurrent and jam protection.
   e. Provide two normally closed temperature switches embedded in each phase winding for high temperature protection. Switches shall be rated for use with 120Vac.
4. Frame Assembly:
   a. Screen frame shall be fabricated of type 304 stainless steel plate, minimum 3/16-inch thickness, and shall be provided with cross-bar supports as required to ensure a structurally sound assembly for the anticipated operation conditions.
   b. Frame shall be provided with floor-level baseplates.
   c. The tension of the moving screen belt assembly shall be completely supported by a stainless steel link chain. The chain must connect the shaft ends on both sides of the belt assembly so that no weight is supported by the panel elements. The chain assembly shall provide a minimum cross-section of 0.144 in^2 at the weakest point of any complete, individual link.
   d. The portion of the screen which is above the channel shall be fitted with minimum 14-gage covers constructed of type 304 stainless steel. The covers shall be removable for unobstructed access to the screening belt and any affected maintenance items.
   e. A discharge chute shall be provided integral to the machine to direct the screenings to the collection equipment below.
   f. A manual lubrication system shall be provided with lubrication lines and grease fittings extending from all grease points to a centrally located area accessible from the operating floor to facilitate lubrication of the equipment.
   g. All moving wetted parts, all wetted parts on which the moving parts ride, or all screen belt components under guiding, bearing or driving loads including, but are not limited to, the shafts, links, guide rails shall be fully corrosion-resistant and shall be made of type 304 stainless steel or wear-resistant heat treated 400 series stainless steel except as noted below or in specific descriptions:
      (1) The roller and bushings shall be of 400 series heat treated stainless steel with a minimum Rockwell of 39C hardness for reduced wear and long life.
      (2) The side seals shall be made of 304 stainless steel or neoprene rubber with type 304 stainless steel backing plates.
      (3) All nuts and bolts will be type 316 stainless steel.
      (4) The discharge chute shall be type 304 stainless steel.
      (5) The take-up screws shall be constructed of type 304 stainless steel.
      (6) The brush shaft shall be type 304 stainless steel.

5. Chain and Sprockets:
    a. Each screen panel shall be mounted to the stainless steel roller or box link type chains driven by stainless steel sprockets mounted on the drive shaft.
    b. The chains shall be roller or box link type with stainless steel side plates. The rollers (if applicable), pins and bushings shall be hardened stainless steel.
    c. The stainless steel drive shaft shall be supported on each side by grease lubricated take-up bearing assemblies.
    d. The chain shall be 304 stainless steel.
    e. Chain guides shall be secured to the screen frame for the full height of travel. A guide track or rotating sprocket shall also be located at the bottom of screen to allow the chain to travel from a downward to an upward direction. The chain guides shall accurately guide the chain and panels.
6. Screen Drive Unit:
    a. Provide motors and accessories as specified in Section 46 05 13.
    b. The unit shall be driven by a 460 volt, 3-phase, 60 Hz TEFC motor connected to a reducer equipped with antifriction bearings and designed in accordance with AGMA recommendation for 24-hour, Class II service.
    c. The motor shall be rated for a service factor of 1.15, and operation with variable frequency drive. Motor shall conform to Section 46 05 13 – Common Motor Requirements for Water and Wastewater Equipment.
    d. The motor shall be no larger than 5.0 hp and suited for operation in a Class I, Division 2, Group D.
    e. Provide electronic overload protection. Overload device shall sense motor current draw and provides overcurrent and jam protection.
    f. Provide two normally closed temperature switches embedded in each phase winding for high temperature protection. Switches shall be rated for use with 120Vac.
7. Discharge Chute:
    a. An enclosed stainless steel discharge chute shall transport the discharge to a washer/compactor.
    b. The upper section of the discharge chute shall be hinged to allow complete access to the rotating brush assembly.SCREENINGS WASHER/COMPACTOR:

A. General:
1. The screw compactor shall be designed to dewater the screenings discharged from the screen and transport them to a screenings roll-off container. The dewatering screw compactor shall significantly reduce the volume of screenings, increase the solids content of the screenings, and reduce the overall weight of the screenings. The installed unit shall meet the EPA paint filter testing requirements when properly maintained and serviced.
2. Compactor Type: Shafted screw consisting of a sieve zone, wash zone, press zone, transport zone, discharge tube, drive system, and controls.
3. The washing operation occurs in a perforated plate underdrain section prior to the compaction section of the compactor. The spray system consists of a header, solenoid valves, and spray nozzles.
4. Operation: The washer/compactor is designed to be interlocked with the screen and will operate when the screen is operating.
5. Washwater shall be collected in a pan located beneath the screw trough and shall drain to screen channel by gravity.

B. Components:
1. Compactor Housing: The compactor housing shall be constructed of AISI Type 304 stainless steel and be a minimum of 11 gauge and connect to 3/8-inch flanges.
2. Augers: The shafted screw shall be manufactured from one concentric flight formed from carbon plate or hardened stainless steel and welded to form a single spiral. The

mechanical tubing shall be welded to an end shaft. The shafted screw diameter shall be 7.5-inches minimum.

3. Discharge Tube: The discharge tube shall be cylindrical and constructed of minimum 14 gauge AISI Type 304 stainless steel. The discharge tube shall increase in diameter over its length in order to reduce the potential for plugging. The discharge tube shall direct and discharge screenings at a maximum clear discharge height of 4 feet.
4. Hood Position Switch: The position switch shall be interlocked with the main control panel to prevent equipment operation when hood is not in position.

1. Motor: The electric motor shall be TEFC, NEMA Design B with Class F insulation, rated for Class I, Division 2, Group D hazardous environment. The motor shall be rated for 460-volt, 3 phase, 60-hertz operation, service factor of 1.15, and operation with variable frequency drive. Motor shall conform to Section 46 05 13 – Common Motor Requirements for Water and Wastewater Equipment.
    a. Provide two normally closed temperature switches embedded in each phase winding for high temperature protection. Switches shall be rated for use with 120Vac.
5. Gear Reducer: The design shall utilize a shaft mounted, helical type gear reducer driven by a direct coupled motor. The reducer shall have a cast iron housing and shall have a maximum output of 14 rpm. Service factor shall be a minimum of 1.0.
6. Spare Parts and Special Tools:
    a. A minimum of one standard spare parts package shall be provided which includes the following as applicable to the unit furnished:
        (1) One set of special tools required for maintenance.

2.06 PROTECTIVE COATINGS:

A. Motor, gear reducer, and all metallic surfaces except aluminum and stainless steel shall be factory painted with the Manufacturer's standard coating equal to the 09 90 00 "E-1" system and field touched-up as specified in Division 9.
B. Coatings other than those listed in Division 9, System "E-1" may be submitted but must receive the approval of the Purchaser.
C. Provide field touch-up paint kit.

2.07 SCREEN SYSTEM CONTROLS:

A. The Screen System shall be supplied with a main system control panel designed to house all components required to control the screen system.
B. System Components and Function:
    1. Screen System Main Control Panels (GRSC-MCP-100 and GRSC-MCP-200)
        a. As described below
    2. Fine Screens GRSC-SCR-110 and GRSC-SCR-210
        a. Mechanical screens designed to remove solids and debris from the liquid stream.
    3. Brush Drives GRSC-BR-115 and GRSC-BR-215
        a. Brush designed to remove material from screen.
    4. Deflector Roller Drives (if required) GRSC-DR-116 and GRSC-DR-216
        a. Deflector designed as a safety feature to remove stringy material, such as rags that may cling to panel lifting tines.
    5. Level Transducer GRSC-LE-100A and GRSC-LE-200A
        a. Ultrasonic level transducer for measuring fine screens GRSC-SCR-110 and GRSC-SCR-210 upstream level.
    6. Level Transducer GRSC-LE-100B and GRSC-LE-200B
        a. Ultrasonic level transducer for measuring fine screen GRSC-SCR-110 and GRSC-SCR-210 downstream level.

7. Level Transmitters GRSC-LIT-100 and GRSC-LIT-200
    a. Ultrasonic level transmitter for measuring fine screen GRSC-SCR-110 and GRSC-SCR-210 upstream and downstream levels. The transmitter shall monitor signals from the associated screen system transducer and provide analog level signals for each to the main control panel.
8. Level Switches GRSC-LSH-100 and GRSC-LSH-200
    a. Conductivity point level switch to provide a high level alarm for fine screen GRSC-SCR-110 and GRSC-SCR-210 located in the fine screen influent channel.
9. Temperature Switches GRSC-TSH-110 and GRSC-TSH-210
    a. Temperature switch to provide a high temperature alarm for fine screens GRSC-SCR-110 and GRSC-SCR-210.
10. Washer/Compactors GRSC-WC-120 and GRSC-WC-220
    a. Washes and separates solids and compacts materials for transport and disposal with discharge into the screening dumpster

C. Description of Operation:
1. The screening equipment shall be provided with a manufacturer supplied control panel equipped with a PLC and an operator interface for setpoint adjustment as specified in Section 40 67 00 – Process Control Panels and Hardware.
2. The system shall have a control panel provided and mounted at the indicated location to allow for local operation of the equipment.
3. The manufacturer supplied control panel shall serve as the primary control point for the equipment and all controls described shall be available through an operator interface screen (HMI).
4. A System Inhibit signal shall be provided to each main control panel from the Plant Control System. The signals shall be communicated via the Ethernet/IP network. If an inhibit signal is received, all associated system equipment shall be prevented from running.
5. Fine Screen GRSC-SCR-110 and GRSC-SCR-210
    a. The screen shall be started and stopped at the HMI by Hand/Off/Auto operation selection.
        (1) In HAND mode, the equipment will run continuously until stopped by the operator.
        (2) In OFF mode the equipment will not run.
        (3) In AUTO mode, the equipment will be started and stopped by the screen system PLC. The PLC programming shall be as described below.
            (a) The screen shall be started and stopped by the system PLC based upon channel head differential across the screen as measured by the corresponding level transmitters.
            (b) The screen system shall start when the calculated differential level reaches differential level setpoint. An operator adjustable level differential setpoint shall be programmed.
            (c) The screen will operate at high speed if the level reaches the high-speed differential level setpoint. The screen will continue to operate at high speed until the differential level falls below the differential level setpoint.
            (d) The screen system shall operate continuously until the differential level falls below the differential level setpoint. The screen system shall then operate for an operator adjustable length of time before stopping.
            (e) A backup timer shall be provided to operate the screen periodically and if a failure occurs with the level controls, the timer setpoint shall be adjustable through the operator interface mounted on the face of the main control panel.

(f) The parameters for the channel head differential and cycle time between operations shall be set at the manufacturer provided operator interface on the main control panel.

(g) A "CYCLE START" operator soft push button shall be provided on the face of the local control panel. If the CYCLE START push button is depressed, the PLC shall immediately initiate a screen cycle for the associated screen.

(4) The brush system shall operate in tandem with the screen in all modes of operation.

b. Refer to System Upsets and Procedures for Recovery section for additional programming requirements.

c. The upstream and downstream levels for each of the screens shall be available for display on the operator interface in units of feet. An operator adjustable level differential alarm shall be programmed for the screen.

6. Washer/Compactors GRSC-WC-120 and GRSC-WC-220

a. The washer-compactor shall be started and stopped at the HMI by Hand/Off/Auto operation selection

(1) In HAND mode, the equipment will run continuously until stopped by the operator.

(2) In OFF mode, the equipment will not run.

(3) In AUTO mode, the washer/compactor will be interlocked with the operation of the screen as described below:

(a) The screen system control panel shall start the washer/compactor when the screen starts.

(b) During normal flow conditions, the washing press shall be operated in a forward and reverse sequence via the main control panel's PLC. The screenings will be transported into the washing zone where the screw shall stop rotation.

(c) During peak loading conditions, the washing process shall automatically switch to operate in the forward direction to handle the larger amount of screenings with only short intervals of reversing to ensure that material does not accumulate on the shaft of the screw.

(d) Solenoid valves providing the wash water for the washer/compactor shall be operated by the manufacturer's control system when the equipment is in operation. The screen system main control panel shall operate the washer/compactor continuously until a configurable delay time after the fine screen stops running. This is to ensure complete separation and disposal of screened material.

(e) The compactor may optionally operate independent of the screen system as specified by the manufacturer.

b. Refer to System Upsets and Procedures for Recovery section for additional programming requirements.

c. The status points and alarms shall be displayed on the plant control system operator workstations for each screen. Alarm and status setpoints shall be communicated to the plant control system via the Ethernet/IP network.

7. Remote Control Stations:

a. The system (Screen and Washer/Compactor) shall be remotely controlled by a control station with an Hand/Off/Auto switch for each motor and valve that provides the following control:

(1) In Hand Mode, the equipment (screen, brush, and compactor) shall run.

(a) While in Hand Mode, the Washer/Compactor will operate in the direction selected by the Forward/Off/Reverse selector switch.
(2) In Off Mode, the equipment (screen, brush, and compactor) will not run.
(3) In Auto Mode, equipment operation will be based off the mode set in the HMI.

b. Remote indication shall reflect screen run/stop status.

D. Setpoints and Ranges:
1. Level Transducer GRSC-LE-100A and GRSC-LE-200A:
a. Ultrasonic level transducer provided by the screen system supplier.
b. Refer to 40 70 00 Instrument List for calibration Ranges.
2. Level Transducer GRSC-LE-100B and GRSC-LE-200B:
a. Ultrasonic level transducer provided by the screen system supplier.
b. Refer to 40 70 00 Instrument List for Calibration Ranges.
3. Level Switch GRSC-LSH-100 and GRSC-LSH-200:
a. Submersible level switch provided by the screen system supplier.
b. Refer to 40 70 00 Instrument List for Calibration Ranges.
4. Screen System Operator Interface:
a. Screen Level Transducers (GRSC-LE-100A, GRSC-LE-200A, GRSC-LE-100B, GRSC-LE-200B)
(1) Display range of 0-6 feet for each level transmitter.
(2) High level alarm adjustable between 0-5.5 feet, initially set at 4.0 feet for the upstream level transmitter.
(3) Differential level setpoint adjustable between 0.25-2.00 feet, initially set at 0.5 feet for each screen.
b. Backup cycle timer adjustable between 0-30 minutes, initially set at 15 minutes.
c. Washer/Compactor off delay timer adjustable between 0-300 seconds, initially set at 30 seconds

E. System Upsets and Procedures for Recovery:
1. The system shall send an alarm for the screen to the Process Control System under any of the following conditions:
a. Any motor or other component critical to the operation of the screen or compactor is faulted.
b. If a level transmitter signal is lost.
c. If a jam is not cleared.
2. If a power failure occurs, the equipment that was in operation prior to the power failure shall be automatically restarted by the manufacturer provided main control panel without requiring a manual reset.
3. Failure of a screen shall not inhibit the operation of the washer/compactor.
4. If an overload occurs in the screen or washer/compactor, the respective equipment shall automatically stop and initiate and failure alarm at the operator workstation.
5. System in AUTO mode:
a. If a level signal is lost, the screen shall operate on a timer. If the level signal is restored, the screen shall be returned to normal operation.
6. Safety Devices:
a. Emergency stops shall be interlocked with all motor circuits in the screen and compactor system.
b. In the event of an emergency stop situation, the equipment will shut down and alarm the operator via the operator workstation.
c. The system shall not restart until the operator clears the alarm from the equipment and/or the main control panel as applicable.

(1) The emergency stop pushbuttons and pull cord require a manual reset to deactivate the alarm.

F. The screening equipment supplier shall provide all control components and instruments as specified herein.

G. Screen System Control Panel:
1. Control panels and components shall conform to Section 40 67 00.
2. The control panel shall be a NEMA 12 free standing mild steel enclosure and be installed in the Electrical Room separate from the screening units.
3. The control panel shall be equipped with an Allen-Bradley CompactLogix PLC to provide control and monitoring of the supplied equipment.
4. The manufacturer supplied PLC shall be connected to the Plant Control System through an Ethernet network connection. Provide network switch and communications card as required for communicating the Screen system data over an Ethernet/IP network. The panel programmer shall provide a data/memory map to the project's systems integrator which includes all produced tags and assigned IP addresses as required to enable communication between the control panel and the communication network.
5. IP address assigned to PLC for uplink to plant network shall be reconfigurable and on a separate subnet than the Screen System's local network.
6. The control panel shall be powered from a single 480V, 3-phase power source.
7. The control panel shall be supplied with a 480-120V control power transformer to provide power to 120V devices in the panel.
8. The control panel shall include provisions for connection of one (1) 120Vac, 20-Amp field supplied circuit and the internal derived 120Vac circuit from the specified 480V-120V CPT. The CPT derived circuit shall be used as "House" power for lights, fans, receptacles, etc. The field connected circuit shall be derived from the centralized UPS system and shall power all PLC, network, OIT, and control system related loads within the control panel.
9. The control panel shall contain all required components for complete control and monitoring of the screening units, compactors, level controls and other associated equipment. As a minimum, the following components shall be installed in the panel:
   a. Door interlocked main disconnect circuit breaker.
   b. Motor starters with solid state overloads and/or VFD's for the screen units and washer/compactors.
   c. Control power transformer.
   d. Programmable Logic Controller (PLC).
   e. Operator interface touch screen.
   f. Required circuit breakers, control relays, power supplies, selector switches and indicating lights.
10. Operator Interface Touch Screen:
   a. The control panel shall include a 15-inch operator interface touch screen.
   b. Provide Allen-Bradley PanelView Plus 7 series as specified in Section 40 67 00.
   c. All manufacturer supplied graphics and applications shall be developed with FactoryTalk View Machine Edition.
   d. The screens developed shall utilize high performance graphic styles using gray scale color palettes for all equipment when possible.
   e. In addition to controlling the Manufacturers equipment the supplied touch screen shall be used for interfacing with the Plant Control System. Manufacturer shall provide the developed screen system application files to the Systems Integrator to allow further development and addition of the screens.
   f. Manufacturer shall provide the necessary coordination with the Systems Integrator to ensure a fully functional application.

11. Jam Protection for the Screening Units:
    a. Jam protection shall be provided for the screening units.
12. All devices shall be factory installed, wired and tested. Terminal blocks shall be provided and labeled as required for power, control and instrumentation.
13. The Screen System Control Panel shall provide the following discrete output signals for use by the Plant Control System. The signals shall be communicated via the Ethernet/IP network.
    a. Screen "Auto" Mode.
    b. Screen "Hand" Mode.
    c. Screen Run Status.
    d. Screen High Speed Status.
    e. Screen Emergency Stop.
    f. Screen Failure (Common alarm for all equipment associated).
    g. Screen Overtemperature Alarm.
    h. Brush Drive "Auto" Mode.
    i. Washer/Compactor "Hand" Mode.
    j. Brush Drive Run-Forward Status.
    k. Brush Drive Run-Reverse Status.
    l. Brush Drive Failure (Common alarm for all equipment associated with Wash/Compactor).
    m. Brush Drive Overtemperature Alarm.
    n. Washer/Compactor "Auto" Mode.
    o. Washer/Compactor "Hand" Mode.
    p. Washer/Compactor Run-Forward Status.
    q. Washer/Compactor Run-Reverse Status.
    r. Washer/Compactor Emergency Stop.
    s. Washer/Compactor Failure (Common alarm for all equipment associated with Wash/Compactor).
    t. Washer/Compactor Overtemperature Alarm.
    u. Screen High Level Switch status
14. The Screen System Control Panel shall provide the following analog outputs over the Ethernet/IP network for use by the Plant Control System.
    a. Screen Influent Level.
    b. Screen Effluent Level.
    c. Screen Differential Level.
15. As a minimum the following functionality shall be available via the operator interface screen:
    a. Hand/Off/Auto switches for each piece of equipment.
    b. Power On indicating light for each piece of equipment.
    c. Forward indicating lights for each piece of equipment.
    d. Reverse indicating lights for applicable equipment.
    e. Fault or Failure indicating lights for each piece of equipment.
    f. Motor overtemperature indicating light for each motor.
16. Additional status points and adjustment of set points and operating parameters shall be available via the operator interface screen. As a minimum, the following parameters and status points shall be viewable and/or adjustable via the operator interface screen:
    a. Screen Head Differential.
    b. Screen Head Differential Set Point.
    c. Screen High Speed Set Point.
    d. Backup Timer Setting.
    e. Jam protection current set point.

f. Run Time.
g. Run Status indication for all equipment.
h. Identify cause of equipment Failure.

H. Screening Unit Local Control Station GRSC-CST-110 and GRSC-CST-210:
1. Refer to Section 40 67 00 for panel requirements and component specifications.
2. The panel shall be a NEMA Type 4X 304 SST enclosure to be installed in an interior unconditioned area. All selector switches, pushbuttons, and indicators shall be hermetically sealed for installation in a Class I, Division 2, Group D area.
3. Refer to Section 40 67 00 – Process Control Panels and Hardware for panel requirements and component specifications.
4. The panel shall contain all required components to implement the control functionality specified and allow for the electrical connection of the skid mounted equipment to the main control panel. As a minimum, the following components shall be installed in the face of the panel:
   a. Screen:
      (1) Hand/Off/Auto selector switch.
   b. Brush Drive:
      (1) Hand/Off/Auto selector switch.
      (2) Forward/Off/Reverse selector switch. Switch shall be spring return from "Reverse" to "Off" and manual return from "Forward" to "Off".
   c. Solenoid Valve:
      (1) Open/Close/Auto selector switch.
   d. Emergency stop pushbutton.
   e. Control Station Identification Label.
5. As a minimum the following shall be installed inside the panel.
   a. Terminal blocks for all field connections required.

I. Screen Level Sensors:
1. The screening units shall be provided with ultrasonic level transducers and transmitters. The level transmitter level signals shall initiate screen operation based on channel head differential and the parameters set in the operator interface.
   a. The PLC logic shall determine differential levels using signals from two separately mounted ultrasonic transducers to a shared transmitter.
   b. The first transducer shall be installed upstream of the screen and measures the screen upstream head. The second transducer shall be installed downstream of the screen and measures the downstream head of the screen.
   c. The head in front (upstream) of the screen shall be compared to the head downstream of the screen to determine the head differential.
2. Level Transmitter GRSC-LIT-100 and GRSC-LIT-200:
   a. Provide a level transmitter mounted for each screening unit.
   b. The upstream and downstream transducers' 4-20mA level signal instrumentation cables shall terminate to the transmitter. The transmitter shall provide upstream and downstream levels to the main control panel via 4-20mA outputs. The transmitter shall display upstream, downstream, and differential level.
   c. The transmitter shall be rated for installation in a Class I, Division 2, Group D area. The transmitter shall provide intrinsically safe connections for the level transducers.
   d. Power for the level transmitter shall be provided from the main control panel via thermal magnetic circuit breaker.
3. The ultrasonic transducers shall be a 2-wire device and perform non-contacting liquid level measurements with signal outputs of 4-20mA to the screen system PLC via a shared transmitter.

4. The ultrasonic transducers shall be intrinsically safe and suitable for installation in a Class I, Division 2, Group D area. Required intrinsically safe barriers shall be installed in the transmitter enclosure.
5. Provide the required stainless-steel mounting hardware to allow mounting directly above, and centered in, the channel. Flanged connection shall be provided and allow for the installation of the transducer centered between the channel walls. Installation shall be coordinated with channel grating to allow access and removal. Refer to contract drawing for mounting details.
6. Refer to Section 40 70 00 for ultrasonic elements and transmitter specifications.
7. High Level Probe:
    a. Provide a high-level conductivity probe for installation in each channel, upstream of each screen.
    b. The probes shall be intrinsically safe and suitable for installation in a Class I, Division 2, Group D area. Where required, provide and install intrinsically safe barriers in the main control panel.
    c. Provide and install an intrinsically safe control relay for each probe in the main control panel. Relay shall provide an alarm to the PLC via a N.O. and N.C. output contact upon high level detection by probe.
    d. Provide the necessary stainless steel hardware, mounting brackets or fittings, manufacturer cables, and strain relief for securing the probes in the channel. Installation shall be coordinated with the channel grating to allow access and removal.
    e. Refer to Section 40 70 00 – Instrumentation for Process Systems for conductivity probe specifications.

J. Emergency Stop Switches:
1. The Washer/Compactor shall be equipped with an emergency stop safety switch pull cord; with two normally closed double break contacts.
    a. Contacts shall be manually reset.
    b. Switches shall be equipped with a latching mechanism, a weight and cable along the length of the screw conveyor for operation of the switch.
    c. Switches shall be opened by cable linkage mounted on all sides of the conveyor. Cables shall be plastic covered stainless-steel cable (orange color) and located within easy reach of operating personnel.
    d. NEMA 4X enclosure suitable for installation in a Class I, Division 2, Group D area.
    e. Shall be suitable for installation in a Class I, Division 2, Group D area.
    f. The screen equipment shall include the necessary brackets, cable eyes, and other necessary hardware required to mount the switch and pull cord to the unit.

K. Washer/Compactor Local Control Station GRSC-CST-120 and GRSC-CST-220:
1. Refer to Section 40 67 00 for enclosure requirements and component specifications.
2. The control station shall be a NEMA type 4X 304SS enclosure to be installed in an interior unconditioned area. All selector switches, pushbuttons, and indicators shall be hermetically sealed for installation in a Class I, Division 2, Group D area.
3. The control station shall contain all required components to implement the control functionality specified and allow for the electrical connection of the skid mounted equipment to the main control panel. As a minimum, the following components shall be installed in the face of the panel:
    a. Washer/Compactor:
        (1) Hand/Off/Auto selector switch
        (2) Forward/Off/Reverse selector switch. Switch shall be spring return from “Reverse” to “Off” and manual return from “Forward” to “Off”.
    b. Solenoid Valves:

(1) Open/Close/Auto selector switch for each associated wash valve.

c. Control Station Identification Label.

L. Source Quality Control:
1. The Screen System and controller shall be factory tested to ensure satisfactory operation.

M. Accessories:
1. Provide all templates and special wrenches or tools necessary for proper installation and maintenance of equipment.

N. Spare Parts:
1. The following spare parts shall be supplied for the supplier supplied control panel:
a. One spare LED indicating lamp for each type and color used.
b. One spare indicating light assembly.
c. Five spare control fuses of each voltage and current rating used.
d. One spare relay and base for each type used.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Motor, gear reducer, and all metallic surfaces except aluminum and stainless steel shall be factory painted for shipping purposes. Stainless steel and aluminum surfaces shall not be painted. Prepare surfaces in shop and finish all surfaces as specified in Division 9.

B. Store all Equipment as specified in Division 1 and as required to prevent damage.

C. Assemble and test drive units in factory.

3.02 INSTALLATION:

A. In accordance with manufacturer's instructions and as indicated.

B. Install all electrical conduits, wires, tubing, instrumentation and other appurtenances as required for satisfactory operation.

C. Prepare surface and paint or touch up all surfaces as specified herein and in Division 9.

3.03 FIELD QUALITY CONTROL AND ADJUSTMENTS:

A. Manufacturer's Field Services: Provide all services as specified in Division 1 and as follows:

B. The equipment suppliers shall furnish the services of a factory-trained representative on site for a period of no less than four days and two trips. The representative shall inspect, adjust, calibrate and place the system into operation. If additional services are required to produce a fully operational system, they shall be provided at no cost to the Owner.

C. Training:
1. The on-site services provided by the factory-trained representative shall include training.
2. The representative shall provide two complete training sessions to the Owner operating personnel in equipment operation and maintenance. Sessions shall be a minimum of two hours in length, or as required to complete the entire training.
3. One of the sessions shall be video recorded, placed on a USB, and transmitted to Owner for use in training future personnel.

D. After installation and after all equipment and components are in operable condition, a field mechanical and electrical performance test shall be performed in the presence of the Engineer.
1. Each piece of equipment shall be tested for normal start, stop, and emergency stop cycles.
2. Each piece of equipment shall be field tested and the equipment calibrated to demonstrate to the Engineer that all equipment will satisfactorily perform the functions and criteria specified.
3. Furnish test forms and procedures for field testing and provide all test apparatus required at no additional cost to the Owner.

4. Follow testing procedures recommended by the equipment manufacturer and approved by the Engineer.
5. The equipment supplier shall modify or replace any equipment necessary to obtain satisfactory performance.

E. All labor, materials, and test apparatus necessary for conducting the above tests shall be furnished by the Contractor at no additional cost to the Owner, unless stated otherwise.

END OF SECTION 46 21 13

SECTION 46 23 00 – GRIT REMOVAL AND TREATMENT EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the supply, delivery, installation, and commissioning of one (1) grit removal unit, one (1) horizontal vortex-type slurry pump, one (1) uninstalled complete shelf spare pump, and one (1) grit washing/classifying/dewatering unit as specified herein.

B. Related Work Specified Elsewhere.
   1. General Requirements: Division 1.
   2. Concrete Anchors: Section 05 05 19.
   3. Protective Coatings: Division 9.
   4. Process Control Panels and Hardware: Section 40 67 00.
   5. Common Motor Requirements for Water and Wastewater Equipment: Section 46 05 13.

1.02 REFERENCES

A. Applicable Standards
   1. American Society for Testing and Materials (ASTM).
   2. American National Standards Institute (ANSI).
   3. American Bearing Manufacturer's Association (ABMA).
   4. National Electrical Code (NEC).
   5. National Electrical Manufacturer's Association (NEMA).
   6. Institute of Electrical and Electronic Engineers (IEEE).
   7. American Gear Manufacturer's Association (AGMA).
   8. American Society of Mechanical Engineers (ASME).
   9. Occupational Safety and Health Act (OSHA).
   10. American Iron and Steel Institute (AISI).

1.03 SUBMITTALS:

A. Submit as specified in Division 1.

B. Technical Submittal includes, but not limited to, the following:
   1. Complete manufacturer’s data, specifications, and detailed drawings for all equipment and materials, which shall include complete descriptive data to define materials, sizes, capacities, types, models, accessories, etc. Drawings and other information shall be suitable for erection and installation of equipment and materials.
   2. General arrangement drawing of pump, motor and base with proposed equipment data highlighted. Manufacturer shall submit a statement indicating that the proposed installation is in compliance with HI and manufacturer requirements.
   3. All submittal data shall be labeled in English units. All Drawings shall be drawn to scale, and text shall be in English.
   4. Technical description of equipment.
   5. All structural loads imparted onto the structure.
   6. Anchor bolt design calculations sealed by a Professional Engineer licensed in the state of Missouri.
   7. Potable and/or non-potable water requirements.
   8. Catalog bulletins describing construction, dimensional sketches, equipment weights, list of materials used for construction and performance data for the grit classifier.
   9. Manufacturer’s surface preparation, shop priming, and machined metal surface rust inhibitive compound requirements.
   10. List of installations, as described in Quality Assurance, including current Owner representative name, address, telephone number, and fax number.

11. Control schematics and wiring diagrams for power, control, and instrumentation that clearly indicate factory and field wiring requirements. All field wiring shall terminate on terminal blocks clearly marked with identification matching control schematics.
12. Electric power requirements, wiring diagrams, schematics and datasheets for all electrical equipment and devices.
13. Panel layout including dimensions, bill of materials, and catalog data sheets. Provide power and control wiring diagrams and schematics to clearly show factor and field wiring.
14. Touch screen graphics (for each piece of grit removal system equipment) subject to Engineer approval.
15. Control wiring diagram showing wiring into and out of the control panel and terminal landing points.
16. Functional description of internal and external instrumentation and controls to be supplied including list of parameters monitored, controlled, and alarmed.
17. Refer to Section 40 67 00 for additional submittal requirements pertaining to control panels.
18. Refer to Section 46 05 13 for additional submittal requirements pertaining to motors.
19. Recommended spare parts list.
20. Standard performance curves for pump model furnished. Curves shall cover range from shutoff to 120 percent of design flow rate at the conditions specified, and shall be submitted for the following parameters as a function of pump capacity and speed at design temperature:
    a. Total developed head.
    b. Required brake horsepower.
    c. Pump efficiency.
    d. Required NPSH.
    e. Minimum recommended submergence.
21. Mechanical details including impellers, bearings, couplings, and seals.
22. Manufacturer's standard protective coating system.
23. Motor performance data and results of shop test.
24. Pump nameplate data.
25. Motor nameplate data.
26. Weights:
    a. Total each unit.
    b. Pump.
    c. Motor.

C. Operation and Maintenance Manual includes, but not limited to, the following:
1. Special shipping, storage, protection, and handling instructions including dimensions of each container or package shipped.
2. Recommended unloading method at project site including implement (e.g., forklift, etc.) and maximum container or package weight.
3. Manufacturer's printed installation instructions.

D. Certifications:
1. Manufacturer's Certificate of Proper Installation.
2. Field mechanical test procedures.
3. Submit complete, signed report of results of field inspection, operation, adjustments, and tests. Include the Manufacturer's certificate that the equipment is ready for permanent operation and that nothing in installation will affect Manufacturer's warranty in any manner, or render warranty null and void.

1.04 DELIVERY, STORAGE, AND HANDLING MATERIALS:

A. Equipment shall be shipped pre-assembled to the degree that is practicable.
B. Manufacturer shall provide storage instructions indicating specific requirements to ensure there is no damage to or deterioration of components.

1.05 QUALITY ASSURANCE:

A. All items of equipment specified herein shall be furnished by one Manufacturer. This Manufacturer shall have the responsibility of providing the equipment, accessories, installation supervision, and testing services required to provide a functioning system.
B. Like items of equipment provided hereunder shall be the products of one Manufacturer in order to achieve standardization for appearance, operation, maintenance, spare parts, and Manufacturer's service.
C. Products used in the Work of this Section shall be produced by the Manufacturer regularly engaged in the manufacture of equipment of this type.

1.06 WARRANTY:

A. As specified in Section 01020 – Record Documents and herein.
B. The Manufacturer shall warrant that all Equipment shall be free of defects caused by faulty material or workmanship and shall replace those parts for at least a period of one (1) year from the date of start-up.
C. Multiple warranties for individual components shall not be acceptable.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. The following Manufacturers are acceptable and the minimum equipment requirements that are allowed to meet the specified performance include:
    1. Grit Concentrator unit:
        a. Hydro International, HeadCell® grit removal unit
    2. Grit Pump:
        a. Gorman Rupp.
        b. Hayward Gordon.
        c. ITT Goulds.
        d. Wemco.
        e. Engineer approved equal.
    3. Grit Washer/Classifier unit:
        a. Hydro International, OpTeaCup® grit washing/classification unit
    4. Grit Dewatering unit:
        a. Hydro International, Grit Snail® grit dewatering unit
B. Manufacturers shall provide projects of similar size for municipal wastewater applications and shall furnish performance test results documenting that the System has achieved the specified performance requirement. Performance test reports must clearly show the performance of the entire grit removal system, including grit washing and/or dewatering units.

2.02 GENERAL REQUIREMENTS

A. Screened raw wastewater will continuously flow by gravity into the Grit Concentrator.
B. Nonpotable water shall be supplied and distributed to the Grit Concentrator fluidizing line. Manufacturer to provide nonpotable water valves and accessories.

C. Grit slurry from the Grit Concentrator shall be pumped to the Grit Classifying and Handling System continuously. Manufacturer to provide one (1) grit pump specifically designed to pump slurries of grit, debris, and organic solids without clogging and one (1) uninstalled shelf spare. De-gritted effluent will flow by gravity into the AGS Basins.
D. Each grit concentrator unit shall be placed in a concrete tank and receive the incoming screened flow. The grit concentrator shall provide sufficient surface area to remove the specified grit particles from the specified peak flow and concentrate the grit in a sump at the bottom of the unit.
E. The Grit Removal and Treatment Equipment and all appurtenances shall be supplied by a single Manufacturer.
F. The Grit Removal and Treatment Equipment shall include all equipment shown on the Contract Drawings and as specified herein. The system shall include, but not be limited to the following equipment:
    1. Grit Concentrator unit, stainless steel inlet connection and distribution header, stainless steel grit slurry underflow collector, and grit sump.
    2. Grit Classifier unit, flanged inlet and outlet connections.
    3. Grit Dewatering unit, stainless steel settling compartment, stainless steel housing, drive unit and motor, belt, rinse spray system, integrated controls and instrumentation, and programming.
    4. PLC, with OIT, based Control Panel.
    5. All items necessary for complete assembly.
    6. All appurtenances and safety devices required for proper operation.
    7. Lubricants (if required) for start-up procedure specified.
    8. Tool storage cabinet for any special tools required for operation and maintenance.
    9. Spare parts as required for the complete installation and operation of the system.
G. The Grit Classifier shall be designed to separate the grit collected from the Grit Concentrator unit.
H. The Grit Dewatering unit shall be designed to dewater grit from the Grit Classifier and thus reduce the volume and moisture content.
I. All Equipment shall be delivered completely assembled or in convenient sections as permitted by common carrier and required for installation.
J. All Equipment shall be designed and built for 24-hour intermittent or continuous service and for moderate shock without overheating, excessive vibration or strain.
K. The Grit Classifier and dewatering unit shall be constructed of 304 stainless steel.
L. All bolts, nuts, and washers shall be 304 stainless steel.
M. All electrical Equipment that is located in the Process Building shall be rated for installation in a Class 1, Division 1, Group D area; all such equipment shall be rated appropriately for installation in a classified space.
N. The control panel will be installed remotely from the grit equipment in an unclassified space.
O. The grit pumps shall be specifically designed to pump slurries of grit, debris, and organic solids without clogging.
P. The pumps shall be furnished complete with pump casings, shafts, bearings, mechanical seals, lubrication, motors, controls, and all other parts and accessories indicated, specified, or required for proper installation, operation, and maintenance.
Q. Pumps shall be capable of pumping settled grit containing 1% coarse solids.
R. All internal passages, impeller vanes, and recirculation ports shall all pass a 3.0-inch diameter solid.
S. Provide pump capable of operating continuously for extended periods of time without damage.
T. Pump shall operate at 80 to 120-percent of the best efficiency point.

U. The pump head-capacity curve shall be continuously falling from shutoff head.
V. Pump shall be easily removable for inspection or service.
W. Pump rotating assembly, which includes impeller, shaft, mechanical shaft seal, lip seals, bearings, sealplate, and bearing housing, must be removable as a single unit without disturbing the pump casing or piping.
X. Pump mounting feet shall be sized to prevent tipping or binding when pump is completely disassembled for maintenance.
Y. Pumps shall be specifically designed to both optimize wear resistance and maintain hydraulic performance as wear occurs.
Z. The pump's head vs. capacity curve shall slope upward toward shutoff in one continuous curve with no points of inflection capable of causing hunting at any pump operational speed.
AA. Pump(s) shall be equipped with slotted raised face flanges to receive 125 lb. standard bolting. Special case slots shall be cast in to retain bolts and to fasten the case to the bearing housing and to the intake for easy case removal.

2.03 DESIGN REQUIREMENTS:

A. The Equipment furnished shall be designed to classify, wash, and dewater grit from screened wastewater at a peak flow rate of 13.2 MGD. Screened wastewater will be pumped to the grit removal system. The washed grit will be collected in a dumpster, at the ground level in the Headworks Building. Processed effluent will continue by gravity to the AGS Basins.
B. The Grit Concentrator unit shall be placed in a concrete tank and receive the incoming screened flow. The Grit Concentrator shall provide sufficient surface area to remove the specified grit particles from the specified peak flow and concentrate the grit in a sump at the bottom of the unit. The de-gritted effluent from the Grit Concentrator shall be weir discharged.
C. The design parameters to be used for design of the Grit Removal and Treatment Equipment include:
    1. Design Flows:
        a. Avg Day Flow: 4.6 MGD
        b. Peak Hourly Flow: 13.2 MGD
    2. Grit Concentrator (see drawings for additional dimensions):
        a. Location of Grit Concentrator: Adjacent to the Headworks Building, as shown on the drawings.
        b. Number of Grit Concentrators: 1
        c. Diameter: 12 feet
        d. Number of Trays per Unit: 7 (expandable to 9)
        e. Maximum Head Loss at Peak Flow: 12 inches
        f. Maximum Head Loss at Avg Day Flow: 2 inches
        g. Length of Effluent Weir: 10 feet
        h. Location of Grit Discharge: Underflow outlet to Grit Pump in the Headworks Building.
        i. Location of Grit Pump: Headworks Building, as shown on the Drawings.
    3. Grit Pumps:
        a. Pump, motor, and sheave assembly shall be designed for the following:
            (1) Number of pumps: 2 (1 duty/1 shelf spare)
            (2) Design Capacity at Maximum Flow and Head: 200 gpm
            (3) Minimum Efficiency at 100% Speed: 50%
            (4) Total Dynamic Head: < 10 ft
            (5) Shutoff Head (minimum): 30 ft
            (6) Shutoff Head (maximum): 37.5 ft

(7)	Maximum Motor Speed:	1200 rpm
(8)	Maximum Motor Horsepower:	7.5 hp
(9)	Suction Diameter:	4 inches
(10)	Discharge Diameter:	3 inches

4. Grit Classifier Unit:
   a. Location of the Grit Washer/Classifier Unit: Process Building, as shown on the Drawings.

b.	Number of Units:	1
c.	Size:	24" diameter
d.	Performance:	95% removal of all grit Specific gravity 2.65 ≥ 75 microns at design flow
e.	Influent Solids Concentration:	≤ 1.0%
f.	Design Flow/Unit:	200 gpm with 27” of maximum headloss
g.	Influent Connection:	4” flanged pipe
h.	Effluent Connection:	8” flanged pipe
i.	Underflow Connection:	3” flanged pipe
j.	Material of Construction:	304 SS
k.	Operation:	Continuous / Intermittent minimum 10-15 minutes

5. Grit Dewatering Unit:

a.	Number of Units:	1
b.	Maximum Grit Load:	1.0 yd^3/hr
c.	Performance:	95% removal of all grit Specific gravity 2.65 ≥ 75 microns
d.	Belt Width:	6"
e.	Clarifier size:	48" square
f.	Min. Free Water Surface area:	10 ft^2
g.	Overflow Connection:	6" flanged pipe
h.	Drain Connection:	3" flanged pipe
i.	NPW Connection:	1" NPT
j.	Body Material:	304 SS
k.	Belt Material:	Neoprene Rubber, re-inforced with Polyester

2.04 GRIT CONCENTRATOR:

A. One (1) Grit Concentrator shall concentrate and remove grit from the wastewater.
   1. All flow passages shall be self-cleaning and free of sharp projections or fittings that may snag stringy or fibrous material. The Concentrator shall have no protruding screws or bolts within the water flow paths of the Concentrator’s inlet duct, nozzles, or stacked tray manifolds, to prevent ‘ragging’ and debris accumulation.
   2. Flow shall transition from the inlet channel or pipe to the trays via an inlet duct positioned above the trays. Each tray shall be connected to the inlet duct by a horizontal nozzle with a rectangular cross section and large clear openings. Round nozzles, which reduce cross-sectional area and can contribute to eddy currents and non-laminar flow shall not be allowed. Designs with hydraulic turns greater than 45 degrees shall not be allowed.

3. The velocity at the influent of the Grit Concentrator at its design peak flow shall be no more than 3 ft/s.
4. The Grit Concentrator shall have a maximum surface loading rate of 11.8 gpm/square foot to ensure adequate surface area for settling and specified particle removal efficiency. This modularity allows for more precise flow management of influent flow. No exceptions shall be allowed.
5. The unit shall contain a grit sump for the collection and removal of settled solids to the grit pump. The grit sump shall be installed in the contractor supplied concrete tank.
6. The Grit Concentrator shall be all-hydraulic, with no internal moving parts, and shall consist of self-cleaning, corrosion resistant, non-metallic trays.
7. Grit Concentrator trays shall be constructed with a minimum ¼-inch thick LDPE on the pans and sidewalls. Grit Concentrator trays shall be a seamless, smooth surface, molded thermoplastic. Trays shall be single-piece construction. Multi-piece fabricated plastic, ie…plastic welded, or stainless steel trays shall not be allowed.
8. A stainless steel grit collector shall be provided with the Grit Concentrator for collection and removal of settled solids.
9. Equipment using paddles or air to supplement or induce a vortex is not acceptable.

2.05 GRIT PUMPS:

A. Materials and Construction:

1. Casing:
   a. The parts exposed to abrasive wear – case, removable suction piece, impeller, and wearplate shall be of Hi-Chrome Iron ASTM A532, Class III, Type A material, and be a minimum of 650 Brinell hardness for maximum wear resistance.
   b. Test bars shall be cast integrally with the case and suction piece and shall remain attached to the casting upon final delivery to the owner. Test bars shall be of sufficient thickness to represent the average thickness of the cast part. After receipt of final delivery, the owner may at any time prior to the final acceptance, remove the test bar and independently verify compliance to the material and hardness specification. Failure of the tested bars to meet the specified requirements shall be cause for rejection.
2. Impeller:
   a. The pump(s) shall be of a fully recessed, slurry type design, with the impeller mounted completely out of the flow path between the pump inlet and discharge connection, so that solids are not required to flow through the impeller. All flow path clearances within the pump shall be equal to or greater than the discharge diameter, so that all solids which will pass through the discharge will pass through the pump.
   b. The impeller shall be constructed of 650 Brine Hi-Chrome Iron ASTM A532, Class III, Type A and specifically designed to maintain hydraulic pumping performance as wear occurs.
   c. The impeller shall be of cup design such that the deepest portion of the vane is not located at the vane tips and the tips are surrounded by a thick-sectioned rim.
   d. The hydraulic design shall be such that the length of the impeller vane increases as wear occurs to the rim, allowing as-new or better pumping performance throughout the wear cycle of the impeller.
   e. The hydraulic design of the impeller shall preferentially direct flow to a sacrificial, independently replaceable suction piece. The suction piece shall be easily

accessible and replaceable, without the need to disassemble any other component of the pump.

3. Bearing Housing:
   a. The bearing housing shall be of cast iron, ASTM A48CL-25A.
   b. The shaft shall be of AISI Grade 1045 (or equal) steel, and shall be protected throughout the packing area by a removable, hardened 416 or 420 stainless steel shaft sleeve.
   c. Bearings shall be oil bath lubricated. The oil reservoir shall be sealed at both ends to prevent entrance of foreign matter. The thrust bearings shall consist of three angular contact ball bearings for maximum protection from all thrust loads. The bearing housing will be equipped with a pressure venting device and oil fill and drain taps. A built-in sight glass shall be furnished to check proper oil level. The bearings shall be rated for a minimum B10 life of 100,000 hours, without credit for any rear pump-out vanes to balance hydraulic thrust.
4. Shaft Sealing:
   a. Mechanical Seal: A single cartridge mechanical seal requiring no external flushing shall be furnished in the pump.
   b. Manufacturer shall provide all components necessary for seal water for the grit pump to be field installed on the potable water line by Contractor.
   c. The seal shall utilize a rotational sealing ring with an o-ring or elastomeric cup mounted rotational ring, a stainless steel rotating body with an o-ring mounted stationary ring loaded by a non-fouling, conical spring encapsulated in Viton. Installation of the seal shall require no measurements or scribe marks on the shaft.
   d. The rotational sealing ring shall be made of tungsten carbide with a 6% cobalt binder, the surface of which shall be lapped to a flatness not to exceed three helium light bands.
   e. The stationary sealing ring shall be constructed of sintered silicon carbide. The surface shall be lapped to a flatness not to exceed three helium light bands. The stationary ring shall be o-ring mounted into the stainless steel stationary body.
   f. The spring that loads the rotational sealing ring shall be cone-type, non-fouling design and shall run in the pumped product without fouling or hang-up. The spring metal material shall be SAE1075 Carbon Steel, ASTM A-684 heat-treated to a Rockwell C hardness of 42 to 46 and be totally encapsulated in Viton for protection from the pumped fluid. The product side of the spring shall have a minimum 1/4" thick Viton rubber covering for corrosion/abrasion protection.
   g. To minimize the number of points where the slurry must be sealed, the mechanical seal assembly shall have no more than four (4) o-rings: two (2) seal face o-rings, one (1) shaft sleeve o-ring, and one (1) retainer o-ring. O-rings are to be made of Viton.
   h. The seal shall be fitted with an integral shaft sleeve. The shaft sleeve shall be made of CD4MCu ASTM A-743 duplex stainless steel or type 316 stainless steel. The rotating body of the seal shall be positively driven by no less than two (2) stainless steel drive keys.
   i. All metal components not encapsulated in Viton shall be constructed of abrasion-resistant CD4MCu ASTM A-743 duplex stainless steel or type 316 stainless steel. Surface finish shall be a maximum of 64 RMS.
   j. The seal shall be capable of running with up to ± 0.025" radial shaft deflection and ± 0.040" axial shaft deflection without damage or loss of performance.

k. A seal chamber of Hi-chrome iron, ASTM A-532, minimum 600 Brinell hardness, shall be provided to mount the seal and to provide a reservoir of adequate volume for the pumped product to contact and to lubricate the seal faces. The seal shall be installed into the seal chamber from the impeller side of the pump so that only the casing/suction piece and impeller need to be removed to gain complete access to the seal for inspection and/or maintenance.

5. Accessories:
   a. Mounting:
      (1) The pump manufacturer shall provide a common pump and motor base, constructed of minimum 3/8 inch thick fabricated steel, suitably reinforced to support the full weight of the pump, motor, belt drive and guards.
      (2) The pump manufacturer shall furnish and install a separate, vertically adjustable motor base. The motor base shall be provided with four (4) threaded screws for adjustment so that the motor can be easily moved for V-belt tensioning and adjustment. Each threaded screw shall be provided with four (4) nuts: two (2) for adjusting the height and two (2) for locking the motor into position.
      (3) The motor base shall be mounted directly above the pump bearing frame so as to minimize the footprint of the pump and motor assembly.
      (4) The pump manufacturer shall supply and install belts and sheaves to drive the pump at the speed necessary to meet the rated conditions.
      (5) The drive shall be of the stationary control variable speed TB Woods type JVS, type SVS, or equal, which allows a speed change by means of an adjustment to the motor sheave when the drive is not in operation.
      (6) An approved fabricated steel belt guard shall be provided to safely enclose the belt drive. If metal guards are furnished, they shall be of all 316 stainless steel construction.
   b. Pump Discharge Connection:
      (1) Cast or ductile iron.
      (2) Flanges shall conform to ANSI B16.1.

2.06 GRIT CLASSIFIER:

A. One (1) Grit Classifier unit shall wash and classify lighter organic material from heavier grit particles.
   1. The Grit Classifying unit shall receive the underflow from the Grit Concentrator. The unit shall be mounted above the Grit Dewatering unit and discharge the concentrated grit slurry into the Grit Dewatering unit. The de-gritted overflow shall be discharged upstream of the Grit Concentrator.
   2. The unit shall require only gravity flow from the Classifier grit underflow to the Grit Dewatering unit.
   3. Grit screw classifiers, grasshoppers, reciprocating rakes and similar type of units shall not be accepted.
   4. No mechanical or electrical components shall be required. Separation shall be achieved using only gravitational and centrifugal forces derived from the pumped grit or additional supply water.
   5. The unit shall be constructed of minimum 3/16-inch thick, 304 stainless steel with flanged inlet,outlet, and overflow connections.
   6. The unit shall contain a minimum 18” diameter access portal sufficiently sized to remove all internal elements.

7. The Grit Classifier unit shall be free standing on minimum three legs and mounted above the Grit Dewatering unit. Clearance shall be provided between the bottom of the grit underflow pipe and the Grit Dewatering unit clarifier surface.

2.07 GRIT DEWATERING UNIT

A. One (1) Grit Dewatering unit shall utilize the combination of a settling compartment and an inclined conveying mechanism to dewater and transport all grit discharged from the Grit Classifier unit to a disposal container.
   1. The Grit Dewatering unit shall be provided with an integral square clarifier which shall provide at least 3 inches of freeboard.
   2. The housing shall be fitted under the clarifier. The housing for the belt shall be stainless steel with urethane bonded to the internal surfaces inclined at 30 degrees.
   3. The belt housing shall be provided with clean out plates and one (1) flanged drain.
   4. The unit shall be supplied with a belt made of two-ply polyester-reinforced continuous conductor belting. The belt cleats shall be molded 90 Durometer neoprene and shall be vulcanized on the belt. The cleats shall attach to the belt with neoprene hinges.
   5. The unit shall be provided with a lagged headroll. The headroll shall be adjustable to allow take-up of slack in the belt. Adjustment of the headroll shall not affect the headroll retainer plate, scraper, or drive unit.
   6. The unit shall be provided with a headroll scraper having high density polyethylene (HDPE) contact surfaces with a HDPE retainer plate. Both retainer plate and scraper shall be loaded to keep belt cleats closed tightly around the headroll during operation.
   7. A tailroll shall be provided designed to mount internally to the unit belt housing with external sealed bearings.
   8. The unit shall be supported on a structure and anchored to a stable base.
   9. The unit shall be supplied with a factory installed rinse bar system. The system shall include:
      a. Two spray bars located above the belt and below the clarifier liquid level to enhance grit washing.
         (1) One spray bar located at the bottom of the clarifier as a tailroll area rinse.
         (2) All structural support members for the dewatering unit and separation unit shall be provided by Manufacturer.
   10. The unit shall be supplied with all equipment and accessories necessary to regulate and automate the system water supply.
   11. The unit shall be provided with a drive unit consisting of the motor and the helical gear reducer, mounted as a single integrated unit. All Bearings shall be anti-friction, ball, or roller type bearings.
      a. The motor shall be 3 phase, 460 VAC, 60 Hz, NEMA Design B, XPFC enclosure.
      b. The helical gear reducer shall have hardened alloy steel gears accurately cut to shape.
      c. A mechanical torque-limiting clutch shall be mounted on the headroll gear assembly to prevent an accidental overload of the drive unit and belt.
      d. The drive speed shall be adjusted by a variable speed drive housed in the control enclosure. The belt speed shall be adjustable from 1-5 ft/min.

2.08 MOTORS:

A. Shall be in accordance with Section 46 05 13 and herein.
B. All motors shall be of single-speed, premium-efficient, XPFC, squirrel cage induction design.

C. All motors shall be rated for 480V, 3-phase, 60-Hz operation with the service factor of 1.0. RPM rating shall be as required.
D. Designed for operation with variable frequency drive.
E. Provide two normally closed temperature switches embedded in each phase winding for high temperature protection. Switches shall be rated for use with 120Vac.
F. Provide factory installed, maintenance free, circumferential, conductive micro fiber shaft grounding ring to discharge shaft currents to ground.
G. Rated horsepower as required at 40° C ambient with Class F insulation.
H. Comply with the applicable provision of NEMA with a minimum B-10 bearing life of 100,000 hours.
I. The motor shall be UL listed for Class 1, Division 2, Groups D locations.

2.09 ELECTRICAL DEVICES:

A. Electrical devices associated with the Grit Pump, and the Grit Washer/Classifier and Dewatering units will be located in a Class 1, Division 2, Groups D area. Solenoid valves, proximity sensors, etc. shall be rated for Class 1, Division 2, Group D locations or shall be wired to meet the requirements for hazardous locations as defined in the applicable articles of the National Electrical Code.
B. Electrical devices shall be corrosion resistant and shall be housed in NEMA 4X enclosures for protection against corrosion. All selector switches, pushbuttons, and indicators shall be hermetically sealed for installation in a Class I, Division 2, Group D area.

2.10 CONTROLS AND INSTRUMENTATION

A. Control Panel
1. One (1) control panel shall be furnished in accordance with Section 40 67 00
a. Panel mounted combination main disconnect switch and circuit breaker shall be accessible without opening the door.
2. The control panel shall adhere to the following specifications:
(1) Enclosure Rating: NEMA 12
(2) Voltage: 480 Volt
(3) Phase: 3 Phase
(4) Frequency: 60 Hz
(5) SCCR: 65 kA
(6) Load: NTE 30A
(7) Logic: PLC
3. The Control panel shall contain all timers, starters, VFDs, switches, indicator lights, and other components necessary to operate the following equipment:
(1) One (1) Grit Pump
(2) One (1) Grit Pump Discharge MOV.
(3) One (1) Grit dewatering Unit
4. Control panel shall be PLC based.
a. PLC shall be Allen-Bradley CompactLogix. Refer to Section 40 67 00 for requirements.
5. Control panel shall contain an OIT for local control, located on the exterior of the control panel.
a. Provide Allen-Bradley PanelView Plus 7 series as specified in Section 40 67 00. All manufacturer supplied graphics and applications shall be developed with FactoryTalk View Machine Edition.

b. The screens developed shall conform to ISA 101 "high performance" standards. High use of color and animation graphics will not be accepted.
c. Manufacturer shall provide the necessary coordination with the Systems Integrator to ensure a fully functional application.
d. The OIT shall not be the sole source of equipment control and shall be supplemented with the door mounted operators as required to operate the grit removal system in the event the OIT fails.

6. The control panel shall be supplied from a single 480V, 3-phase power source.
7. The control panel shall be supplied with a 480-120V control power transformer to provide power to 120V devices in the panel.
8. The control panel shall include provisions for connection of one (1) 120Vac, 20-Amp field supplied circuit and the internal derived 120Vac circuit from the specified 480V-120V CPT. The CPT derived circuit shall be used as "House" power for lights, fans, receptacles, etc. The field connected circuit shall be derived from the centralized UPS system and shall power all PLC, network, OIT, and control system related loads within the control panel.
9. The control panel shall be supplied with applicable control relays and time delay relays with a minimum one extra normally closed and one extra normally opened contact is provided for each relay.
10. The Automatic Grit Discharge Valve (GRSC-VLV-314) shall be supplied and powered by Others. The grit handling control panel shall provide open/close control to the valve with the following signals:
    a. Discrete outputs:
        (1) Open.
        (2) Close.
    b. Discrete inputs:
        (1) Open indication
        (2) Closed indication.
        (3) Fail indication.
11. The following signals shall be provided to the grit handling control panel from the Plant Control System. The signals shall be communicated via the Ethernet/IP network. Refer to Section 40 61 96 – I/O List for all other signal requirements.
    a. Grit Slurry Flow Meter, GRSC-FIT-311.
        (1) Analog signal measured at the grit pump/bypass discharge.
    b. System Inhibit.
        (1) Discrete signal which prevents all associated system equipment from running.
12. The grit handling control panel shall communicate with the plant PLC via an EtherNet/IP network, all controller I/O shall be accessible via the Ethernet network, including but not limited to:
    a. Grit Handling System running status.
    b. Grit Handling System alarm.
    c. Grit Pump "Auto" Mode status.
    d. Grit Pump "Hand" Mode status.
    e. Grit Pump running status.
    f. Grit Pump fail status.
    g. Grit Pump high temperature alarm.
    h. Grit Pump high discharge pressure
    i. Grit Dewatering "Auto" Mode status.
    j. Grit Dewatering "Hand" Mode status.
    k. Grit Dewatering run status.

l. Grit Dewatering fail status.
m. Grit Dewatering E-Stop alarm.
n. Grit Dewatering zero speed alarm.
o. Grit Dewatering valve status (typical all valves).

13. The OIT graphics shall include the following functionality and indication:
    a. System Alarm Reset.
    b. Grit Pump:
        (1) Running indication.
        (2) HOA.
        (3) Fail indication.
        (4) Manual start/stop.
    c. Grit Discharge Valve:
        (1) Open indication
        (2) Closed indication.
        (3) Fail indication.
    d. Grit Slurry Flow Meter:
        (1) Flow output indication.
        (2) Fail indication.
        (3) High Flow Alarm.
        (4) Low Flow Alarm.
    e. Grit Dewatering Unit:
        (1) Running indication.
        (2) HOA.
        (3) Alarm/fail indication.
        (4) Manual start/stop.
        (5) Manual speed adjustment.
        (6) Rinse water valve HOA.
        (7) Rinse water valve position indication.
        (8) Alarm reset.
        (9) Local/remote selection for escalator speed control.
14. The following devices shall also be provided in the control panel door.
    a. Push-to-test Control Power On indicating light.
    b. System Emergency Stop push button .
    c. Hand/Off/Auto switches for each piece of equipment.
    d. Power On indicating light for each piece of equipment.
    e. Fault or Failure indicating lights for each piece of equipment.
15. The panel manufacturer shall provide a data/memory map to the project's systems integrator which includes all produced tags and coordinated IP addresses as required in order to enable communication between the control panel and the communication network.
    a. The manufacturer shall be responsible for programming and verifying the IP Addresses, Subnet, and Default Gateways, when applicable, for all devices on the network.
    b. The network IP addresses shall be defined based on the Ethernet Network TCP/IP Addresses provided later.

B. Emergency Pull-Cord Stop Switch:
1. The grit washer/classifier unit shall be equipped with an emergency stop safety switch; with two normally closed double break contacts.
2. Contacts shall be manually reset.

3. Switches shall be equipped with a latching mechanism, a weight and cable along the length of the equipment for operation of the switch.
4. Switches shall be opened by cable linkage mounted on all sides of the equipment. Cables shall be plastic covered stainless-steel cable (orange color) and located within easy reach of operating personnel.
5. Shall be suitable for installation in a Class I, Division 2, Group D area.

C. Sequence of Operation
1. The system shall be controlled to provide automatic or manual operation, manual starting and stopping and system shut down when a fault is detected.
   a. When HOA switches are placed in "Hand", the associated equipment will start and run.
   b. When HOA switches are placed in "Auto", the associated equipment operate according to the specified timers and setpoints.
2. Screened raw wastewater will flow by gravity from the Perforated Plate Screens into the Grit Concentrator.
3. Plant Reuse / Process Water shall be supplied and distributed between the Grit Concentrator fluidizing line, the Grit Washing/Classifier Unit and the Grit Dewatering Unit.
4. Grit Classifier Unit
   a. Grit slurry shall be continuously transferred from the Grit Concentrator to the Grit Classification unit. Grit slurry shall normally be transferred using the Grit Pump.
   b. The control system shall be capable of running in a Grit Pump Bypass mode wherein plant staff must isolate the pump and open a bypass pinch valve around the pump. Automatic Grit Discharge Valve GRSC-VLV-314 (provided by Others), shall be controlled by the Grit Removal System manufacturer as needed to achieve acceptable performance. The automatic grit discharge valve shall be provided with an electric motor actuator and shall be operated as an OPEN/CLOSE valve.
   c. An accumulating timer (AT) shall reset and begin timing out when a signal is received indicating flow of plant influent to the Grit Classification unit. The AT regulates the length of time between Grit Blowdown Cycles. When the AT times out, it shall send a signal to initiate a Grit Blowdown Cycle. The AT shall be adjustable between 5 min to 480 minutes, initially set at 180 minutes. The panel shall be equipped with two timers, one for dry weather, and one for wet weather. For higher grit loads, the wet weather timer shall increase the frequency of the Grit Blowdown Cycle as compared with the dry weather timer. The timer being used shall be selected by a local switch or by remote contact closure on terminals provided in the panel.
   d. During the Grit Blowdown Cycle, the grit pump will stop and the contents of the Grit Classification unit will empty into the Grit Dewatering Escalator. In Grit Pump Bypass mode, GRSC-VLV-314 shall close during the blowdown cycle, and reopen once the cycle is completed.
5. Grit Dewatering Unit
   (1) The grit dewatering belt shall run whenever grit slurry is being transported to the unit.
   (2) While the Dewatering Unit is running, water shall be directed to the tailroll self cleaning mechanism and grit rinse system.
   (3) The belt speed shall be adjustable via a manual input at the OIT.
   (4) A motion sensor shall be installed on the side of the Grit Dewatering Unit takeup frame and shall detect movement of the headroll scraper arm. Lack of

motion of the headroll scraper arm shall indicate lack of belt movement, drive unit failure and/or scraper arm overload. Lack of belt movement or scraper arm overload shall interrupt signal from the motion sensor to the timer. If the motion sensor fails to reset the timer, the Grit Dewatering Unit shall stop and the failure light illuminate.

(5) After a system shut down the Grit Dewatering Unit shall continue to operate for a pre-determined amount of time to allow for the removal and dewatering of all grit accumulated in the clarifier.

D. Setpoints and Ranges:
   1. Grit Slurry Flow Meter GRSC-FIT-311.
      a. Refer to 40 70 00 Instrument List for calibration range.
      b. High Flow Alarm adjustable between 0-400 gpm, initially set at 250 gpm.
      c. Low Flow Alarm adjustable between 0-400 gpm, initially set at 150 gpm.

2.11 PROTECTIVE COATINGS:

A. All non-stainless-steel surfaces shall be factory painted with protective coating according to Manufacturer's recommendation.
B. Color shall be standard of the Manufacturer’s.
C. Stainless steel or aluminum components shall not be painted.
D. Moving parts of operating units, mechanical and electrical parts, linkages, sensing devices, motor and fan shafts, etc., shall not require finish painting.
E. Miscellaneous accessories such as gear boxes, motors and controls may be finished with Manufacturer's standard paint finish.
F. Provide field touch-up coating system which includes the Manufacturer’s standard prime coating system.
G. Coatings are subject to the review and approval of the Engineer.

2.12 SPARE PARTS:

A. All spare parts shall be properly packaged for storage and labeled. Store as recommended by the equipment Manufacturer.
B. Spare parts shall include, but not be limited to, the following:
   1. Lubricants sufficient for one year’s operation at Manufacturer’s recommended service intervals.
   2. One (1) of each part designed for wear.
   3. Pump spare parts:
      a. One mechanical seal
      b. One set of bearings
      c. One set of V-belts
      d. One wear plate
      e. One set of gaskets and o-rings
   4. Manufacturer’s recommended spare parts.
C. Special Tools and Accessories:
   1. Manufacturer shall supply one set of all special tools as required to assemble and disassemble the screening equipment.

2.13 ANCHOR BOLT ASSEMBLY:

A. Complete anchor bolt assembly (studs, nuts, washers, etc.) to be designed by the Manufacturer and provided by the Contractor. Anchor material shall be 316 SST. Anchor size and embedment shall be clearly shown on the equipment drawings.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. The Contractor shall install equipment in conformance with the Manufacturer's written instructions.
B. The Contractor shall accurately place anchor bolts using templates furnished by the Manufacturer.
C. The Contractor shall coordinate and arrange with Manufacturer an appropriate time to verify and accept proper installation. Manufacturer shall provide certificate of proper installation to Contractor, Owner, and Engineer prior to mechanical testing.

3.02 FIELD QUALITY CONTROL:

A. Installation Check:
   1. The Manufacturer shall provide the services of a factory field engineer to initially check installation of the equipment, make electrical control panel modifications as necessary, and to place the equipment in service in accordance with the quality control section.
   2. The field engineer shall also be responsible for instructing operating personnel as to proper operational process and maintenance procedures.

B. Mechanical Startup Tests:
   1. After equipment is completely installed and the qualified representative of the Manufacturer has checked the installation and found it to be in accordance with the Manufacturer's recommendations, a field mechanical startup test shall be performed by the Contractor with the assistance of the Manufacturer's field representative. The Owner and Engineer will observe all tests. The date for the start of testing shall be set in mutual agreement with the Owner.
   2. All equipment shall be calibrated in the presence of the Engineer before and after the tests. Contractor and equipment Manufacturer shall provide any information requested by the Engineer.
   3. All labor, materials, and test apparatus necessary for conducting the field acceptance test shall be furnished by Manufacturer at no additional cost.

3.03 MANUFACTURER'S SERVICES:

A. The equipment shall be started by a Manufacturer's representative, who shall certify to the Engineer that all equipment is properly installed and the plant operator has been instructed concerning proper operation and maintenance. Operator training shall include all items contained in the operation and maintenance manual.
B. Manufacturer's Authorized Representative: Present at work site or classroom designated by the Owner, for the minimum person-days listed below, travel time excluded.
   a. One (1) person-days for installation assistance, inspection, and certification of installation.
   b. One (1) person-days for testing.
   c. One (1) person-days for pre-startup classroom or job site training. Training shall include, at a minimum, proper operation, proper maintenance, troubleshooting, handling/disposal of lamps, safety, and calibration of instrumentation. The session shall also be attended by the local equipment Manufacturer's representative.

END OF SECTION 46 23 00

SECTION 46 33 33 – POLYMER PREPARATION AND FEED SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION:

A. This Section includes the fabrication, delivery, installation and placement into successful operation of two (2) complete polymer systems including a liquid emulsion polymer handling system, flexible suction piping, polymer activation system, metering pump, tote/drum mixer, post dilution assembly and all accessories and appurtenances as indicated and required for complete operation.

B. The automatic polymer preparation, metering, and post dilution system shall be an integrated equipment package capable of automatically preparing a high molecular weight flocculent-type polymer into a homogenous polymer solution. The system shall be an automatically controlled unit capable of preparing a polymer solution from liquid emulsion polymer. The system shall continuously supply polymer solution and be designed to automatically meter, dilute, and feed polymer solution upstream of the rotary drum thickener.

C. The system shall be capable of preparing a homogeneous polymer solution within the time limitations resulting from the maximum feed rates specified.

D. Homogenous polymer solution shall be defined as having no visible "fish-eyes" and exhibiting a viscosity at the end of the mixing cycle within ±10% of the polymer manufacturer's published value for an activated solution at the prepared solution strength (e.g., 0.5% solution by weight).

E. Electrical and Controls:

1. Primary control for the polymer preparation and metering system shall be through the Rotary Drum Thickener (RDT) Control System. The RDT Control System will have the ability to control all elements of the thickening process including: the feed pumps, flocculation tank, RDT, thickened sludge pumps, polymer feed system, and wash water system. The RDT Control System will interface with the polymer system local control panel for feed start/stop, system fail, metering pump feed rate, and polymer pacing rate. See Rotary Drum Thickener 46 71 33.
2. A local control panel shall be provided for each polymer preparation metering system meeting the minimum control requirements of this Section.

F. Polymer will be provided by the Owner.

1.02 QUALITY ASSURANCE:

A. Polymer preparation system, pumps, control panels, post dilution assembly, and accessories shall be furnished from a single source. This source being responsible for coordinating system components to provide a complete functioning system. The polymer unit shall be pre-wired and pre-piped with minimal field assembly required.

B. Prior to shipment the system shall be inspected for quality of construction verifying all fasteners and fittings are tight, all wires are secure and connections whisker-free.

C. The complete system shall be fully factory tested prior to shipment. Testing shall include: setting and verification of all instrumentation and sensors per the design requirements of the application; pressure testing all plumbing systems for a minimum of one hour at 125 psi. If leaks are found they shall be fixed and a new test shall be conducted for one hour at 125 psi until the plumbing system is verified to be leak free; verification of system design flow rates, and complete functional simulation of operation.

D. Polymer preparation systems utilizing eductors, conventional wetting bowls, or systems that merely meter polymer into a water vortex for initial wetting of polymer shall not be allowed under any circumstances.

1.03 REFERENCES:

A. Applicable Standards:
1. Anti-Friction Bearing Manufacturers Association (AFBMA).
2. American Gear Manufacturers Association (AGMA).
3. American National Standards Institute (ANSI).
4. American Society for Testing and Materials (ASTM).
5. American Water Works Association (AWWA).
6. Institute of Electrical and Electronic Engineers (IEEE).
7. Manufacturers Standardization Society (MSS).
8. National Electrical Manufacturers Association (NEMA).
9. National Electrical Code (NEC).
10. Pipe Fabrication Institute (PFI).
11. Standards of the Hydraulic Institute.
12. Underwriters Laboratories, Inc. (UL).

B. Related Work Specified Elsewhere:
1. Rotary Drum Thickener – Section 46 71 33.
2. Process Control Panels and Hardware – Section 40 67 00
3. Instrumentation for Process Systems – Section 40 70 00
4. Common Motor Requirements for Water and Wastewater Equipment – Section 46 05 13.

1.04 SUBMITTALS:

A. Submit in accordance with Division 01.

B. Provide motor nameplate information consisting of manufacturer's name and serial number, horsepower output, temperature rise, maximum ambient temperature, altitude rating (and derating, if applicable), insulation class, rpm at rated load, frequency, number of phases, voltage, full load current, locked rotor current, service factor, maximum noise level (dBA), efficiency determined by IEEE 112, Method B, and weight information.

C. Equipment and Accessories:
1. Manufacturer's name, type, and model.
2. Detailed calculations showing compliance with specified conditions and requirements.
3. Protective coating systems.
4. General arrangements, dimensions and mounting details.
5. All details for accessories including materials of construction, pressure ratings, and specific information that addresses specified criteria.
6. Pump characteristic curves (head vs. flow) and all mechanical details.
7. Control panel schematic diagrams, bill of materials, details, and elevations. Identify field and factory wiring.
8. General arrangement drawings of all equipment.
9. Anchor bolt requirements
10. Weights of all components.
11. Operation and Maintenance Manuals including, but not limited to:
    a. System operation.
    b. Schedule of maintenance requirements, routine maintenance procedures, complete with specifications for consumable items.
    c. Calibration procedures.
    d. Trouble shooting.
    e. Listing of common spare parts along with prices and ordering information.
    f. Appendices containing O&M manuals of ancillary equipment.
    g. Project bill of materials including mechanical and electrical components utilized.

1.05 WARRANTY:

A. The manufacturer shall warrant that all Equipment shall be free of defects caused by faulty material or workmanship and shall replace those parts for at least a period of one (1) year from the date of start-up.

B. Multiple warranties for individual components shall not be acceptable.

1.06 DELIVERY, STORAGE, AND HANDLING:

A. Delivery, storage, and handling shall conform to the following requirements:

1. Ship equipment as completely assembled as is possible.
2. Tag each item of equipment with contract number and equipment number.
3. Protect connections with suitable pipe end protection.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

1. Velodyne.
2. UGSI.
3. Wallace & Tiernan.
4. Fluid Dynamics.

2.02 GENERAL

A. The polymer feed systems shall prepare, dilute, and feed a uniform homogenous solution of polymer from emulsion dispersion or solution type neat polymer.

B. The systems shall include, but not be limited to neat polymer metering pump, mechanical activation chamber, flow indicator, pressure regulator, integral controls and all necessary valves and piping necessary to make a complete package unit.

C. The unit shall be skid-mounted and factory pre-piped and wired and ready for connection to power and water supply indicated.

D. Polymer will be provided by the Owner.

E. In addition to the requirements listed in this section, all electrical equipment and components shall conform to requirements in DIVISION 26 and DIVISION 40.

2.03 SYSTEM PERFORMANCE REQUIREMENTS:

A. General: The system will be used to condition waste activated sludge from aerobic granule process prior to thickening and shall be capable of preparing homogeneous polymer solution according to the design criteria outlined below:

1. Polymer type: liquid emulsion
2. Dilution Water Range:
    a. Minimum: 180 gph
    b. Maximum: 1,800 gph
3. Neat Polymer Feed Range:
    a. Minimum: 0.5 gph
    b. Maximum: 4.2 gph
4. Stock emulsion polymer active concentration: 30%-40%.
5. Water Pressure Available: 50-75 psi.
6. Water Type Available: Non-Potable.
7. Neat polymer viscosity range 200-6,000 cps.

2.04 MANUFACTURED UNITS:

A. Number of units: 2.
B. Each system shall be an integrated package pre-piped, pre-wired, skid-mounted system. This configuration shall provide for complete polymer preparation systems occupying the available floor space.

2.05 POLYMER STORAGE EQUIPMENT

A. Emulsion polymer will be stored in and fed from two 330-gallon totes.
B. Manufacturer shall include flexible PVC spiralite piping (or equal) suitable for pump suction. Flexible piping shall include two isolation ball valves, cam-lock or similar connection and threaded connection compatible with a standard 330-gallon tote. Adequate length shall be provided for connecting polymer preparation system to tote location as indicated drawings.
C. Manufacturer shall provide a vertical mechanical mixer suitable for mounting on each drum and tote to keep the emulsion polymer in suspension.

2.06 POLYMER PREPARATION EQUIPMENT:

A. Polymer Preparation System:
    1. Polymer Activation Device:
        a. Provide one polymer activation device for each polymer feed skid.
            (1) Liquid polymer shall be pumped to the Manufacturer's standard mechanical and liquid polymer activation chamber.
                (a) Include all necessary accessories.
                (b) Provide a neat polymer check valve specifically designed to isolate neat polymer from dilution water. Check valves which are installed inside the mixing chamber, or which require mixing chamber disassembly for servicing will not be accepted.
                (c) The mechanical polymer activation devices shall be driven by a wash-down duty motor.
            (2) Provide two neat polymer metering pumps (1 duty, 1 standby).
                (a) The neat polymer metering pumps shall be a progressive cavity type.
                (b) Each neat polymer metering pump shall have a capacity to meet the requirements in ARTICLE 2.03.
    2. All polymer preparation system components shall be skid mounted, requiring single connection points for polymer feed, activation/dilution water, power, and controls.
    3. All polymer skid motors shall be adjustable speed. The speed of each motor shall be adjustable on the face of the control panel.
    4. Polymer tote mixer motor shall be rated for 120Vac, 1 phase, 60Hz operation. The motor shall be powered through a cord and plug, pre-wired to the motor. Motor-rated switch and timer shall be provided on the motor assembly to start/stop the motor.
    5. Polymer Preparation System Water Flow:
        (1) Dilution water flow shall be maintained by means of a flow control valve. A differential pressure indicator/switch shall be supplied to display water differential pressure. Low differential pressure switch shall shut down system and energize panel mounted alarm light and audible alarm after delay.
    6. Dilution Assembly:
        (1) The dilution water flow rate shall be monitored by a rotameter having the appropriate range for the minimum to maximum dilution water flow for the polymer system as specified in ARTICLE 2.03. Unions or flanges shall be provided on the rotameter to allow easy removal for cleaning.

(2) The unit shall have an electric solenoid valve for on/off control of total dilution water flow.
(3) A differential pressure type low water differential pressure alarm shall be provided. The switch shall be adjustable between 25 and 100 psig.
(4) Provide a pressure gauge to monitor dilution water inlet pressure.
(5) Provide a pressure gauge to monitor system discharge pressure.

b. The dilution system shall automatically cease water flow by shutting the water supply solenoid valve when polymer feed pumps are de-energized.

2.07 POLYMER PREPARATION SYSTEM CONTROL PANEL:

A. Each Polymer System shall be supplied with a single local control panel designed to house all components required to control the polymer system.
B. Control Panel shall be provided in accordance with requirements detailed in Section 40 67 00 in addition to specific panel requirements listed below.
C. Control panels will be installed indoors in a non-classified space.
D. Control panel shall be sized to provide heat dissipation such that, at a 110°F ambient temperature, the operating temperature rating of the lowest-rated component in the panel is not exceeded.
E. A panel mounted combination main disconnect switch and circuit breaker shall be accessible without opening the door.
F. Control panel shall include thermal magnetic circuit breakers for each motor load.
G. The control panel shall adhere to the following specifications:
1. Enclosure Rating: NEMA 4X, FRP or SST Type 316
2. Voltage: 120 Volt
3. Phase: 1 Phase
4. Frequency: 60 Hz
5. SCCR: 22 kA
6. Mounting: Skid Mounted
H. All Polymer Feed System devices and equipment requiring electrical power shall be supplied by 120Vac local control panel input power. Provide power distribution and power conversion devices as necessary, in accordance with Section 40 67 00.
I. All Polymer Feed System electrical devices and equipment shall be pre-wired to the local control panel. All wiring for analog 4-20mA signals shall be shielded, twisted cabling.
J. Control panel shall be attached to the system's frame and be positioned such that there are no obstructions in front of the control panel per related NFPA 70 requirements.
K. Control panel shall include the following switches on the front panel at minimum:
1. Local-Off-Remote three position selector switch
2. Pump 1-Off-Pump 2 three position selector switch
3. System Reset pushbutton
L. Control panel shall include the following push-to-test indicator lights on the front panel:
1. Power On
2. Feed Pump #1 Run
3. Feed Pump #1 Fail
4. Feed Pump #2 Run
5. Feed Pump #2 Fail
6. Polymer Activation Device Run
7. Polymer Activation Device Fail
8. System Fail
9. Feed Pump #1 High Pressure

10. Feed Pump #2 High Pressure
11. Low Polymer Flow
12. Dilution Water Low Differential Pressure

M. Control panel shall include potentiometers on the face of the panel for local speed control of the following motors:
   1. Feed Pump #1
   2. Feed Pump #2
   3. Polymer Activation Device

N. Control panel shall include an electronic flow metering display for each feed pump on the face of the panel. Metering displays shall meet the following requirements:
   1. Calculate flow with pump motor speed as input variable.
   2. Display feed rate in GPH.

O. The control panel shall interface with the Plant Control System PLC via hard-wired I/O points. The following points shall be provided as minimum with additional points available per manufacturer recommendations:
   1. Inputs to Polymer System from PCS:
      a. Feed Pump #1 Remote Start / Stop (Discrete)
      b. Feed Pump #2 Remote Start / Stop (Discrete)
      c. Feed Pump #1 Pump Speed Signal (Analog, 4-20mA)
      d. Feed Pump #2 Pump Speed Signal (Analog, 4-20mA)
   2. Outputs from Polymer System to PCS:
      a. System Running with Feed Pump #1 (Discrete)
      b. System Running with Feed Pump #2 (Discrete)
      c. Remote Mode (Discrete)
      d. Common Alarm (Discrete)
      e. Polymer Feed Pump #1 Rate (Analog, 4-20mA)
      f. Polymer Feed Pump #2 Rate (Analog, 4-20mA)

P. Description of Operation:
   1. The polymer system shall be capable of being controlled locally at the local control panel or remotely by the Plant Control System PLC when the HAND/OFF/REMOTE switch is in REMOTE.
      a. HAND Control:
         (1) When the polymer system is in HAND control, starting, stopping, and polymer feed rate adjustment of the feeder shall be controlled at the local control panel.
         (2) The pump selector switch shall determine which feed pump will begin to run when placed in HAND. The selected pump and mixing device will start and run if the LOR switch is in HAND and a feed pump is selected.
         (3) Speed rates of the feed pumps shall be controlled by potentiometers located on the face of the panel.
      b. REMOTE Control:
         (1) When the polymer feeder is in REMOTE control, starting, stopping, and polymer feed rate adjustment of the feeder shall be controlled by the Plant Control System PLC.
         (2) When the start/stop contact associated with the polymer feeder is closed, the polymer feeder and activation device shall start. When the start/stop contact associated with the polymer feeder is opened, the polymer feeder and activation device shall stop.
      c. Sequence of Operation

(1) As per manufacturer's recommended sequence of startup and shutdown of the polymer feed system and ancillary components.

d. System Upsets and Procedures for Recovery:

(1) If a pump failure or other system failure occurs, the polymer system shall alarm the operator via the control panel indicator lights and the common alarm discrete output.

2.08 ACCESSORIES:

A. Each polymer feed system shall be provided with the following in the minimum number indicated on Drawings, specified, or required for full proper operation.

B. Pressure Relief Valves:

1. Valve shall have materials of construction compatible with the specified chemical.
2. Valve shall be field adjustable from near zero to a maximum required pressure set point.
3. Discharge from relief valves shall be piped together to one connection point. Contractor shall route piping from connection point to polymer totes.
4. Valves shall be sized for maximum flow conditions of the supplied chemical pump system.
5. Supplier shall confirm maximum flow rate based on supplied units.
6. Valves shall have SCH 80 PVC body with connections as required.

C. Check Valves:

1. To minimize check valve plugging due to normally occurring polymer agglomerations, the minimum open area up to and including the valve seat shall be 3/16" without exception.
2. The valve body shall be constructed of Teflon with Viton seals. The valve poppet and spring shall be stainless steel. The spring shall be outside of the polymer flow path to prevent build-up and plugging.
3. The valve shall be readily accessible for cleaning and shall not require tools for removal, cleaning or replacement.

D. Calibration Column Ball Valves:

1. Quantity required shall be determined by manufacturer/supplier.
2. Acceptable Manufacturers:
   a. Chemtrol, Celanese Piping Systems, Inc., TU Series.
   b. Hayward.
   c. Plasts-O-Matic.
   d. Spears.
   e. No Substitutions Allowed.
3. Suitable for required chemical solution feed.
4. Suitable for working pressure of 125 psi.
5. All PVC Type 1 Grade 1.
6. 3-inch and Smaller Valves:
   a. Seals shall be Viton O-rings.
   b. Shall be double union design which permits removal of valve from line without cutting or disassembling pipe.
   c. Shall have socket ends.
   d. Seats shall be Teflon.
   e. Body shall have full unrestricted circular inlet and outlet with diameter equal to rated size of valve.
   f. Totally enclosed operating mechanism mounted on and attached to valve body.
   g. Movable ball having unobstructed circular opening.

h. Install in lines indicated.

E. Pressure Gauges:
1. Shall be Ashcroft Model 1379 or equal.
2. Minimum gauge diameter of 4-1/2 inches.
3. Gauge material shall be suitable for the intended service environment with the appropriate pressure range and reading for each chemical feed system.
4. Provide PVC diaphragm seal.
5. Refer to Section 40 70 00 for other requirements.

F. Diaphragm Pressure Switches:
1. Diaphragm sealed pressure switch with stainless steel wetted parts.
2. NPT process connection, size as required.
3. Snap action SPDT switch rated 4 amps at 120Vac minimum.
4. Housed in a NEMA 4X enclosure, unless specified otherwise.
5. Adjustable pressure set point.
6. Refer to Section 40 70 00 for other requirements.

G. Flow switches:
1. Refer to Section 40 70 00 for requirements.

H. Piping:
1. All polymer feed and dilution water piping shall be Schedule 80 PVC meeting ASTM D1785 and ASTM D2467.

I. Calibration Column
1. Provide a calibration column with Viton O-rings and full port PVC ball valves to allow isolation of each pump and calibration column.
2. The column shall be calibrated for a one minute draw-down at maximum pump rate and read in GPH and milliliters.
3. The calibration column shall be rigidly mounted to the system's frame.

J. Refer to Section 40 70 00 for requirements of all other instruments not specified herein.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. All work shall conform to manufacturer's recommendations.
B. Chemical feed equipment shall be installed in accordance with manufacturer's instructions and as indicated.
C. Install all equipment as required for successful operation.
D. The final routing shall be determined in the field by the Contractor prior to installation and after approval by the Owner. This work shall be performed at no additional cost to Owner.
E. Piping materials shall be schedule 80 PVC.

3.02 MANUFACTURER'S FIELD SERVICES:

A. Provide a minimum of two (2) days of field services for startup and training, excluding travel time.
B. Provide a minimum on one (1) day of installation supervision, excluding travel time.

3.03 PERFORMANCE TESTS:

A. Conduct in the presence of Contractor, Engineer, and Owner.
B. Equipment Tests:
1. Check performance of all components as a functioning unit.
2. Check alignment of each unit.

C. Operational Test:
   1. Conduct such operational tests as necessary to determine that the performance of equipment and controls is as specified.
D. Make all necessary equipment adjustments and corrective work indicated by tests.
E. Retesting: If any deficiencies are revealed during any test, such deficiencies shall be corrected, and the tests shall be reconducted.
F. Within 7 days, submit a written test report to General Contractor with one copy to Owner in the form of a letter, stating operations performed and results obtained for each unit.

END OF SECTION 46 33 33

SECTION 46 42 57 – LARGE BUBBLE MIXING SYSTEM

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section details the furnishing of a complete large bubble mixing system to mix thickened waste activated sludge stored in two (2) thickened sludge holding tanks. The complete large bubble mixing system shall include two (2) compressors, a receiver tank, two (2) valve control panels, compressed gas mixing system, instrumentation, auxiliary equipment, and accessories as specified herein and as required for a complete working system.

B. The system shall control the mixing of the sludge holding tanks through instrumentation feedback with the ability for manual operation of the mixing devices.

C. The mixing system shall intermittently and sequentially inject compressed air through fixed nozzles located on the basin floor to mix the tank contents with a total solids content of 4-8 wt %.

D. Related Work Specified Elsewhere:

1. Protective Coatings: Division 9.
2. Process Control Panels and Hardware: Section 40 67 00.
3. Common Motor requirements for Water and Wastewater Equipment: Section 46 05 13.

1.02 REFERENCES:

A. Applicable Standards:

1. ASTM International (ASTM)
   a. A240/A240M, Standard Specification for Chromium and Chromium Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and General Applications.
   b. A276, Standard Specification for Stainless Steel Bars and Shapes.
   c. A312, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipe.
   d. A380, Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
   e. D3915 Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds for Plastic Pipe and Fittings.
   f. D3034 Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
   g. A774 Standard Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.
   h. A554 Standard Specification for Welded Stainless Steel Mechanical Tubing.
   i. A778 Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products.

1.03 SUBMITTALS:

A. Submit in accordance with DIVISION 1.

B. Shop drawings.

C. Operation and maintenance data.

D. Installation, inspection and start-up report.

E. The following shall be submitted with the Shop Drawings:

1. Catalog data or illustrations showing principal parts and materials.
2. Detailed layout drawings.
3. Electrical schematics.
4. Operating and maintenance instructions and parts list.
5. Compressor support locations and loads transmitted to bases and foundations.
6. Compressor electrical schematics and field termination wiring.

7. Compressor performance data.
8. List of recommended accessories to maintain operation other than those specified.
9. Field inspection reports.
10. Qualifications of field service engineer.
11. Recommendations for short and long-term storage.
12. Testing procedures.
13. Special tool requirements.
14. Printed warranty.

1.04 QUALITY ASSURANCE:

A. The compressed gas mixing system shall be furnished by a single manufacturer.

B. Manufacturer must have at least five (5) municipal wastewater installations within North America that have been installed in the last 36 months. Manufacturer shall provide a list of said installations, including the Owner's name, address, contact name, telephone number, date of start-up, and system design summary.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. EnviroMix, Inc.
B. Pulsair
C. Engineer-Approved Equal.

2.02 GENERAL REQUIREMENTS:

B. Performance and design of the compressed gas mixing system shall be as follows:
   1. Sludge Holding Tanks:
      a. Number of basins: 2.
      b. Basin Length: 37.5 ft.
      c. Basin Width: 24 ft.
      d. Minimum Side Water Depth:4 ft.
      e. Maximum Side Water Depth: 20 ft.
      f. Maximum Volume: 134,658 gal / EA tank.
      g. Minimum Solids Content: 4 wt%
      h. Typical Solids Content:4-6%
      i. Maximum Solids Content: 8 wt%
   2. Basin Mixing shall be uniform throughout the basin with effective mixing confirmed through a Field Performance Test as specified.
   3. Minimum nozzle density in each thickened sludge tank shall be 41 ft^2/nozzle.
   4. Air Distribution and balancing shall be sufficient to maintain suspended solids in a state of suspension over entire depth of basins.
   5. Air mixing system equipment and piping shall be sized to thoroughly mix the contents of the basins for which the systems are designed.
   6. Air mixing system shall be capable of effectively mixing entire tank contents for both tanks when operating at a solids concentration up to 8% total solids.
   7. Mixing Process shall use the design as follows:
      a. Sludge Holding Tanks:
         1) Number of Valve Control Panels (VCPs): 1 per tank
         2) Number of Air Control Valves per VCP: Varies
         3) Number of Nozzle Headers: Varies.
         4) Number of Nozzles per Nozzle Header: Varies.
         5) Minimum Number of Nozzles: Varies
         6) Header Supply Pipe Diameter: 1.5 in.

2.03 MATERIALS AND CONSTRUCTION:

A. Header Supply Piping:
   1. Provide threaded connections only where required.
   2. Schedule 5S or Schedule 40S, stainless steel Press technology system (Victaulic, Viega, or equal), comprised of stainless-steel press technology fittings, couplings, and pipe, unless specified otherwise.
   3. Maximum working pressure of 150 psi.
   4. Couplings and fittings: Press technology products formed of Type 304/304L stainless steel tubing including a self-contained o-ring seal(s) molded of synthetic FKM rubber.
   5. Pipe: Type 304/304L ASTM A312 stainless steel.

B. Nozzle Headers:
   1. Schedule 10S or Schedule 40S, 304/304L stainless steel with 1” Schedule 40S, stainless steel nozzle offsets
   2. Nozzle couplings: 1” NPT, 150 lb, 304/304L stainless steel
   3. Delivered from the manufacturer pre-assembled to the extent practicable to minimize field assembly error and installation time.
   4. Pipe: Type 304/304L ASTM A312 stainless steel.
   5. Provide nozzle headers in maximum 20-ft segments with two bolt 304/304L stainless steel flexible gasketed coupling connections and removable end caps. Flexible couplings shall be rated for a maximum working pressure of 150 psi.

C. Nozzles:
   1. Top plate fabricated from 1/8” stainless steel plate, ASTM A240/A240M, Type 304/304L with a 2D finish.
   2. Bottom plate fabricated from HDPE and gasketed to prevent air from leaking between the top plate and the bottom plate.
   3. Top and bottom nozzle plates shall be joined together using Type 304/304L stainless steel hardware. Nozzles shall come pre-assembled.
   4. Adequate strength to withstand vertical thrust of mixing air.
   5. Threaded Rod Anchors: Use Hilti HIT-RE 500 adhesive or equal to be provided by the contractor. A minimum of two threaded rods shall be installed per nozzle for flat floor installations, one each on opposite diagonal corners. Three threaded rods shall be installed per nozzle for slope floor installations.
   6. Nozzles shall be installed in the locations as shown on the Drawings.

D. Appurtenances:
   1. Miscellaneous: Nuts, bolts, washers, threaded rod, and other non-welded parts shall be stainless steel, ASTM A240/A240M, Type 304/306L. Threaded assemblies shall be chemically treated or lubricated prior to assembling to prevent galling.

E. Fabrication:
   1. The piping used for the air mixing system shall be Type 304/304L stainless steel unless otherwise noted.
   2. Shop fabricate welded metal parts and assemblies from stainless steel, ASTM A240/A240M, Type 304/304L with a 2D finish.
   3. Shop fabricate non-welded parts and pieces from sheets and plates of stainless steel, ASTM A240/A240M, Type 304 or from bars of stainless steel ASTM A276, Type 304, unless specified otherwise.
   4. Welds and Welding Procedure
   5. Shop weld with filler wire using MIG, TIG or shield-arc, or plasma-arc welding inert gas processes. Provide a cross-section equal to or greater than parent metal.
   6. Provide full penetration welds to interior surface with gas shielding to interior and exterior of joint
   7. Provide smooth, evenly distributed interior weld beads with an interior projection not exceeding 1/16 inch beyond inner diameter of nozzle header or fittings

8. Field welding is not permitted
9. Clean all welded stainless steel surfaces and welds after fabrication to remove weld splatter and finish clean all exterior welds, carbon deposits and contaminants per ASTM A380 Section 6.2.11.

2.04 VALVE CONTROL PANELS

A. Each tank shall be equipped with a Valve Control Panel (VCP).
B. Valve Control Panels (VCP) shall be provided in accordance with requirements detailed in Section 40 67 00 in addition to specific panel requirements listed below.
C. Valve Control Panels will be installed outdoors at grade on the south wall of sludge holding tank No. 2 and north wall of sludge holding tank No. 1. Refer to drawings for locations of VCPs.
D. Valve Control Panels shall be sized to provide heat dissipation such that, at a 110°F ambient temperature, the operating temperature rating of the lowest-rated component in the panel is not exceeded.
E. The valve control panel shall be provided with a hinged lockable cover.
F. All panels shall accept a single source 120 VAC power connection.
G. Control panel shall have short circuit current rating (SCCR) of 22 kA.
H. Lightning and surge protection shall be provided on the incoming line power.
I. The air control valves shall be poppet style valves, mounted to a common manifold. The valves shall have a life expectancy of 20,000,000 cycles.
J. Each valve control panel shall be equipped with a manually adjustable regulator to adjust the pressure to the air control valves and corresponding header supply piping. The regulator shall be pre-plumbed into the valve control panel and be equipped with a pressure gauge. The regulator shall have an aluminum body and bonnet, plated steel screws, brass internals, and Buna N seals.
K. Each valve control panel shall include a pre-plumbed maximum 40-micron filter with an auto-drain to remove fine particles, water vapor, and oil from the air supply. The filter shall be Watts F603D or approved equal.
L. The VCP shall be supplied with a means to alarm operators should a valve fail to open or close.
    1. A flow switch or pressure switch in the valve control panel to initiate a valve failure alarm should a switch fail to operate when a valve is commanded open or closed.
    2. When either a fail to open or fail to close alarm occurs the controller shall send an alarm signal to the Plant Control System. The output shall be provided through dry, form C contacts, rated 5A at 120Vac.
    3. The VCP shall include a top mounted exterior alarm beacon that shall provide an indication of an active alarm.
M. A stainless steel nameplate shall be provided on the valve control panel. The nameplate shall be securely fastened in a conspicuous place and clearly inscribed with the manufacturer's name, year of manufacture, and serial number.

2.05 CONTROL AND OPERATION:

A. All control features shall be adjustable from the VCP provided by the manufacturer.
B. Control features shall be adjustable at any time during the operation of the system.
C. Control features shall be initially set according to manufacturer recommendations.
D. Mixing Parameters:
    1. The operator shall be able to enable/disable mixing operation, the firing duration and the frequency of firing.
    2. Minimum control features selected through the VCP shall include the following:
        a. Enable / Disable: ACV firing can be started and stopped at any point during operation without powering down the system.
        b. Firing Duration: Length of time an individual ACV is open during a firing event. The duration shall be operator adjustable within programmed limits and configurable for each ACV individually.

c. Firing Frequency: Length of time to complete the firing sequence. Frequency shall be operator adjustable within programmed limits.
d. Valve Isolation: Individual ACVs or specific groups of ACVs may be added and/or removed from the firing sequence at any point during operation.

E. Alarm Indication:
1. When the following alarms occur, a red general alarm light shall be illuminated on the VCP:
a. Low system pressure.
2. The specific alarm shall be indicated and shall remain indicated until the fault is corrected or the system is turned off.

2.06 AIR COMPRESSORS:

A. High Pressure Air Compressors:
1. Two (2) air compressor module shall be as noted in the design requirements below.
2. Each compressor module shall be completely factory assembled requiring only field connection of electrical power and air pipe and condensate drain piping.
3. Each compressor shall be of the single stage, positive displacement, oil-flooded, rotary screw type.
4. The two compressors shall be designed to operate in a duty standby configuration and will be located indoors.
5. The compressor shall be provided with an integral skid or lifting lugs for unloading and placement.
6. Compressor rotor shall be asymmetrical, steel or high strength ductile iron integral shafts, and dynamically balanced. Housings shall be cast iron. Rotors and housings shall be precision machined for accurate bearing positioning and running clearances. The drive arrangement shall be a gear driven design.
7. Positive pressure lubrication shall be provided by an inherent pressure differential system. Lubricant shall be provided as recommended by the manufacturer. A lubricant filter shall have a high-capacity 10 micron rating.
8. An air/oil separator reservoir shall be provided for each compressor. The reservoir shall be designed and constructed in accordance with the ASME Code for Unfired Pressure Vessels and shall bear the code stamp. The reservoir shall include two-stage filtration to remove oil from air stream. Oil carry-over downstream of compressor modules shall not exceed 3 mg/m^3.
9. Each air compressor module shall have automatic controls integral to the unit which open (loaded condition) and close (unloaded condition) the inlet valve to the air end to deliver appropriate volume to meet demand and maintain system target pressure. On sensing a low demand, the motor will keep running but the air end inlet valve will close, resulting in a decreased “idling” power draw on the motor. The valve shall reopen when system pressure drops below the set point.
10. Each baseplate shall be constructed of one-piece folded mild-steel with structural members and shall be designed for no measurable deflection with the equipment mounted thereon and the baseplate supported around its perimeter.
11. Each base shall be designed so that all equipment bolted to it can be removed without access to the underside of the plate and with a flat top surface for ease of cleaning. Structural stiffeners shall be located under the compressors at the compressor anchor points.
12. Valves and piping within the enclosure shall be the compressor manufacturer’s standard. Relief valves shall be provided for equipment protection on the air and coolant systems as required.
13. Each compressor shall be provided with an integral, dry-type intake filter. Intake filters shall have replaceable filter element(s). Particle arrestance shall be not less than 99.9% efficient at 10 microns and above.
14. Each compressor shall be supplied in a sound attenuated enclosure. The enclosure shall reduce the measured sound to a maximum of 70 decibels, while the compressor is operating and the sound level is measured a distance of three feet from the enclosure.

15. A high air/fluid temperature shutdown system shall be provided. The unit must have safety devices mounted and wired. Safety devices shall include motor thermal overload and high compressor discharge temperature shut-down. These systems must be designed to prevent the compressor from running in an over-temperature situation or motor from running in an overload condition.

B. Refrigerated Dryer:
   1. An air dryer shall be provided of cycling refrigerated air type.
   2. The dryer shall produce an ISO Class 5, 7°C dew point at the dryer exit when operating continuously at the rating conditions of 2°C and RH of 60%.
   3. The dryer shall be capable of continuously drying the maximum discharge capacity of the air compressor.
   4. The dryer shall be integral or separately mounted to the compressor package.

C. Compressor System Particulate and Coalescing Oil Filters
   1. Replaceable-cartridge primary particulate and secondary high-efficiency oil-removal filters shall be provided for the compressor packages. Following both filters, the maximum particulate size removal shall be to 1 micron and coolant removal shall be to 0.1 mg/m3 at 21°C.
   2. The filters shall be rated for the maximum discharge capacity of the air compressor.

D. Compressor System Electrical:
   1. All electrical and control equipment for the air compressor module shall be furnished as required for a complete installation, requiring only field connection of 480 VAC, three phase power supply
   2. The compressor electric motor shall be rated 460 volts, 60 Hz, three phase and meet the requirements of Section 46 05 13.
   3. Remote mounted fusible disconnects with time delay fuses shall be provided by the Contractor.

E. Compressor System Control Panel:
   1. All control panel devices shall meet the requirements of Section 40 67 00.
   2. An enclosure-integrated control panel mounted on the compressor module shall include:
      a. Full voltage, non-reversing, motor starters sized as required by the manufacturer. Disconnects with time delay fuses shall be provided by others.
      b. Control power transformers shall have both primary leads fused, one secondary lead fused, and one secondary lead grounded.
      c. Control panel shall have short circuit current rating (SCCR) of 65 kA.
      d. Terminal blocks for all system wiring. Internal panel wiring shall be neatly bundled and tied and shall be identified with suitable wire markers
      e. Controller shall be provided to indicate the following conditions:
         1) Differential pressure across fluid filter.
         2) Discharge pressure.
         3) Compressor discharge temperature.
         4) Power on.
         5) Hours of operation.
         6) Operating mode.
         7) Differential separator.
         8) Percent capacity.
         9) Air filter.
      f. A contact which closes under alarm conditions shall be provided for the compressor for remote “FAIL” alarm. The contact shall close when any alarm occurs for the compressor.
      g. The control panel shall interface with the Plant Control System PLC via hard-wired I/O points. Discrete outputs shall be provided through dry, form C contacts, rated 5A at 120Vac. The following points shall be provided as minimum with additional points available per manufacturer recommendations:
         1) Air Compressor Running (Discrete Output).
         2) Dirty Filter Warning (Discrete Output).
         3) Common Alarm (Discrete Output, See Above).

F. Compressor System Performance and Design Requirements
   1. The compressed air equipment shall be designed for the following operating conditions:
      a. Ambient conditions:
         1) Maximum air temperature: 100 deg F.
         2) Minimum air temperature: 0 deg F.
         3) Relative humidity: 80%.
         4) Barometric pressure: 14.2 psia.
      b. Compressors:
         1) Number of units: 1 duty / 1 standby.
         2) Maximum discharge pressure: 104 psig.
         3) Capacity at operating target pressure: 44 CFM.
         4) Maximum Motor size: 10 HP.
         5) Maximum motor speed: 3600 rpm.
         6) Maximum free field noise ± 3 dB(A) when measured in free field conditions at a distance of 1 m according to ISO 1217: 70 dB.
      c. Receivers:
         1) Number of units: 1.
         2) Nominal volume: 120-150 gal.
         3) Receiver shall be external to compressors and located indoors.
         4) Solenoid valve to drain shall be powered by 120Vac NEMA 5-15 power cord.

2.07 SPARE PARTS:
A. Provide spare parts that are identical to and interchangeable installed parts:
   1. One (1) Air Control Valves (ACVs) rebuild kit.
   2. One (1) pilot air filter assembly.
   3. One (1) solenoid.
   4. One (1) valve plug and cable assembly.
   5. One (1) relay.
   6. One (1) 5-micron pilot air filter.
   7. One (1) compressor intake air filter element per compressor provided.
   8. One (1) compressor air-oil separator filter element per compressor provided.
   9. One (1) each compressor primary/secondary element per compressor provided.
   10. Any other standard parts recommend by the Manufacturer.

PART 3 – EXECUTION

3.01 INSTALLATION:
A. Make all electrical connections.
B. Install items in accordance with approved shop drawings, manufacturer's printed instructions and as indicated.

3.02 MANUFACTURER'S FIELD SERVICES:
A. Refer to DIVISION 1.
B. The services of a qualified manufacturer's technical representative shall be provided for installation inspection, testing, startup and training. The system manufacturer shall include the following site visits and days on site:
   1. Installation Inspection and Testing:
      a. Number of Trips: 2.
      b. Number of Days/Trip: 2.
   2. Compressor Installation Inspection and Testing:
      a. Number of Trips: 1.
      b. Number of Days/Trip: 1.

3. Startup and Training:
   a. Number of Trips: 1.
   b. Number of Days/Trip: 1.

3.03 FIELD PERFORMANCE TESTING AND GURANTEE:

A. All mixer components shall be field tested with the respective basins full to the maximum water surface elevation.

B. Exposed air piping shall be tested by Contractor for leaks using soapy water on all joints and applying 100 psi test pressure. Buried air piping shall be tested using this method before the trench is filled. Air piping in the tanks may be tested by submersing the piping in non-potable water and pressurizing the piping to 100 psi, in lieu of using soapy water on all joints. Pressure testing requirement shall not apply to supply piping downstream from VP or pre-manufactured nozzle headers.

C. The Contractor shall operate each mixing system at the maximum water surface elevation in the basins for a continuous period of not less than 72 hours. The Contractor shall correct and resolve all operating problems, deficiencies, etc., determined as a result of the tests.

D. After the above testing is complete, field mixing performance testing of the installed Air Mixing System shall be performed by the manufacturer as described below:
   1. Mixing performance testing shall be conducted in both basins.
   2. All personnel and equipment necessary to conduct and supervise all testing shall be provided by the mixer manufacturer. Engineer and Owner shall be notified of the test to witness at their option and expense.
   3. Prior to performing the tests, the basin which will be tested must have been in normal operating mode for at least two days with TSS in typical operating ranges of 50,000 – 70,000 mg/L. No flow shall enter or exit the respective basin for two hours prior to and during the test.
   4. The compressed gas mixing system manufacturer shall conduct total suspended solids (TSS) testing using a Cerlic TSS probe, or equal, suspended solids analyzer.
   5. Testing Procedure:
      a. Four horizontal-plane sample sites for the basin to be tested shall be selected by the Engineer. At each sample site, three vertical samples shall be collected as follows: 24-inches from the surface, tank sidewall mid-point and 24-inches above the tank sidewall bottom. Each sample site must be a minimum of 4 ft away from any structure within the tank. The samples for each location shall be analyzed as described above.
      b. The Coefficient of Variation (Cv) shall be determined for the sample set, excluding the maximum and minimum samples. The Cv shall be calculated by taking the resultant set of ten (10) samples as follows: Cv = (100 x Standard Deviation of Ten Samples)/(Mean Value of Ten Samples).“
      c. If the Cv is less than or equal to 10%, then the mixer performance shall be acceptable for that location.
      d. If the Cv is greater than 10%, then the mixer performance shall be unacceptable for that location and the Contractor and/or Manufacturer shall make all necessary improvements (at no additional cost to the Owner) and repeat the testing procedure at no additional cost to the Owner until the Cv is less than or equal to 10% for that location.

END OF SECTION 46 41 47

SECTION 46 51 21 - MEDIUM BUBBLE MEMBRANE DIFFUSERS

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section defines the requirements for the air diffusers, air piping manifolds and laterals, piping supports, anchor bolts, pipe anchors, and any additional materials required by the manufacturer's design to be installed to aerate and mix sludge in two (2) Thin Sludge Holding Tanks.

B. Manufacturer shall furnish necessary diffuser equipment and configuration to meet the specified criteria. All diffused aeration equipment shall be suitable for installation as indicated. Any revisions required as a result of the equipment manufacturer selected shall be the responsibility of the Contractor and be made at no additional cost to the Owner.

C. All equipment specified in this Section shall be fabricated, assembled, and tested in full conformity with Drawings, Specifications, engineering data, instructions, and recommendations of the equipment Manufacturer unless exceptions are noted by the Engineer. All equipment shall be provided by the same manufacturer and shall be suitable for installation. Any revisions necessary to accommodate the equipment furnished shall be the responsibility of the Contractor.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Contract Drawings.
B. General Requirements: Division 1.
C. Concrete: Division 3.
D. Electrical: Division 26.
E. Aeration Blowers: Section 43 11 33 – Positive Displacement Blowers.

1.03 REFERENCES:

A. Applicable Standards:
   1. American Society for Testing and Materials (ASTM):
      a. A182 - Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
      b. A240 - Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
      c. A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
      d. A312 - Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
      e. A380, Standard Practice for Cleaning, De-scaling, and Passivation of Stainless Steel Parts, Equipment and Systems.
      f. A778, Standard Specifications for Welded, un-annealed Austenitic Stainless Steel Tubular Products.
      g. D395 or DIN 53.505, Test Methods for Rubber Property – Compression Set.
      h. D412, ASTM D624B, and DIN 53.504 SII, Test Methods for Rubber Properties in Tension.
      i. D1171, Standard Test Method for Rubber Deterioration-Surface Ozone Cracking Outdoors or Chamber (Triangular Specimens).
      j. D2240, Standard tests Method for Rubber Property – Durometer Hardness.
      k. ASTM 403 - Wrought Austenitic Stainless Steel Piping Fittings.
   2. American Standard Taper Pipe Thread (NPT).

1.04 SUBMITTALS:

A. Submit as specified in Division 1.

B. All submittal data shall be labeled in English units. All Drawings shall be drawn to scale, and text shall be in English. Submittals utilizing only metric units will be rejected.

C. Shop Drawings:

1. Manufacturer's catalog information, descriptive literature, specifications, and identification of materials of construction.
2. Detailed mechanical drawings showing equipment fabrications and interface with other items. Include dimensions, size, and locations of connections to other work, and weights of associated equipment.
3. Detailed drawings of proposed aeration equipment layout showing air line sizes and lengths, air distribution headers, and location of diffusers, supports, and expansion joints. Drawings shall include plan, elevation, cross sections, and anchor locations.
4. Supports, vibrations, anchors shall be approved and sealed by a Missouri Licensed Engineer.
5. Diffuser, diffuser connector, balancing orifices, and system head loss curves covering range of airflow rates specified.
6. Complete aeration system headloss calculations shall be provided by Manufacturer. Headloss calculations shall be derived using air at standard conditions.
7. Calculations for air requirements and numbers of diffusers to be provided.
8. Suggested spare parts list to maintain the equipment for a period of two years and five years. Include a list of special tools required for checking, testing, parts replacement, and maintenance with current price information.

D. Information Submittals:

1. Special shipping, storage and protection, and handling instructions.
2. Routine maintenance requirements prior to startup.
3. Manufacturer's printed installation instructions.
4. Diffuser membrane longevity test reports as specified.
5. Performance test reports as specified.
6. Startup test reports and certificates.
7. Operation and Maintenance Manual:
    a. See Section 01300 - Submittals.
    b. Include manufacturer's written/printed installation instructions with erection drawings indicating, by piece marking, how entire assembly is to be shipped and field assembled.

E. Submit complete, signed report of results of field inspection, operation, adjustments, and tests. Include the Manufacturer's certificate that the equipment is ready for permanent operation and that nothing in installation will affect Manufacturer's warranty in any manner.

1.05 QUALITY ASSURANCE:

A. Refer to requirements in Division 1.

B. The Work requires that the medium bubble diffuser system, complete with all accessories and appurtenances be the end product of one responsible system manufacturer. Unless otherwise indicated, the Contractor shall obtain each system from the responsible supplier of the equipment, which supplier shall furnish all components and accessories as necessary to place the equipment in operation in conformance with the specified performance, features, and functions indicated without altering or modifying the Contractor's responsibilities under the Contract Documents. The Contractor is responsible to the Owner for providing the equipment systems as specified herein.

C. The Contractor and Manufacturer shall assume responsibility for the satisfactory installation and operation of the entire medium bubble membrane diffuser system and controls as specified.
D. All materials and equipment supplied shall be new and free from all defects that might affect installation and operation of this system.
E. A manufacturer's representative with complete knowledge of the equipment and installation as specified herein shall be provided under this section to assist in the installation, testing, startup, and training for the equipment.
F. Manufacturer of equipment must have experience in the design and manufacture of the type of apparatus proposed. Manufacturer must be able to reference at least three similar installations, three years or older currently in operation.

1.06 DELIVERY:

A. Deliver, store, and handle all equipment and materials in a manner to protect equipment condition, to prevent damage from exposure to the elements, and in accordance with requirements of Division 1.

1.07 WARRANTY:

A. As specified in Division 1.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Environmental Dynamics, Inc.
B. SSI Aeration.
C. Gummi Jaeger Aeration
D. Sanitaire.

2.02 DESIGN CRITERIA:

A. The influent to the Sludge Holding Tank consists of waste activated sludge from the aerated granular sludge process.
B. The aeration equipment shall mix and transfer oxygen in the basin contents by diffusing air into waste sludge.
    1. Solids Concentration: 0.5% to 2.0%.
    2. pH Range: 5.5-7.5.
    3. Temperature: 50-86 °F.
    4. Allowable diffuser mounting distance above basin floor:
        a. Minimum (Inches floor-to-diffuser element): 10.
        b. Maximum (Inches floor-to-diffuser element): 12.
    5. Basin Dimensions:
        a. Number of Sludge Holding Tanks: 2
        b. Length: 30 ft.
        c. Width: 37.5 ft.
    6. Minimum Sidewater Depth: 4ft
    7. Maximum Sidewater Depth: 20 ft.
    8. Maximum Volume Per Tank: 168,322 gallons

9. Total Airflow per Tank: 1,200 scfm per Tank
10. Maximum Available Pressure(psig): 11.5 psig at a maximum air rate of 1,200 scfm including static pressure, pressure loss through air piping, and pressure loss through the membrane.

2.03 GENERAL:

A. Shop fabricate welded metal parts and assemblies from Type 304L stainless steel conforming to ASTM A312 and A788. Field welding of stainless steel is not acceptable.

B. Shop fabricate nonwelded parts and pieces from sheets and plates of Type 304 stainless steel conforming to ASTM A240, unless specified otherwise. After fabrication, pickle and passivate stainless steel assemblies per ASTM A380 and parts by immersion in a pickling solution of 6% nitric acid and 3% hydrofluoric acid at 140°F (60°C) for 15 minutes. Neutralize by immersing in a hot water bath.

C. Header and Header Support System: Allow for expansion and contraction over a temperature range of 125°F when installed.

2.04 PERFORMANCE REQUIREMENTS:

A. Airflow Rate Output shall not differ by more than 10%, at minimum and maximum airflows, for any two system diffusers (based on diffuser with lower flow rate).

B. Air Distribution and Balancing: Control by use of orifices and proper header size selection only.

C. Do not use flow distribution control devices requiring automatic or manual operation.

D. Provide adequate mixing as defined by the following: the variation in suspended solids (total residue) shall be less than 10% between the mean value of samples taken at any two depths along any vertical line extending between water surface and elevation of the top of diffusers. Refer to paragraph 3.02.

2.05 DROPLEG, AIR MANIFOLD, AND DISTRIBUTION HEADERS:

A. Dropleg:
1. Diffuser manufacturer shall provide a Schedule 10 stainless steel dropleg to a point two (2) feet above the manifold for each Thin Sludge Holding Tank. A stainless steel flange will be provided at the end of each dropleg. Thickened Sludge Tank will be provided as shown on the Contract Drawings. The diffuser manufacturer will be responsible for providing a complete aeration system below the air main connection. As an alternative to a flanged connection, the diffuser manufacturer may coordinator with the contractor to provide a plain end stainless steel dropleg. The diffuser manufacturer shall be responsible for providing any required transition coupling for joining the stainless steel dropleg and the CPVC dropleg
2. Dropleg material shall be Type 304 stainless steel.
3. Transition to Schedule 40 CPVC shall occur 2 feet above the basin floor. If the CPVC to stainless connection is flanged, gasket between the flanges shall be suitable for a near wall temperature of 250 degrees F.

B. CPVC Air Manifold:
1. Perpendicular to air distribution headers, same nominal pipe size as Dropleg.
2. Connect air manifold to distribution headers at common pipe centerline. Manifold shall act as drainline.
3. Fabricate with minimum 4-inch diameter fixed threaded union of flanged joint connections to each air distribution header to prevent rotation and blow apart.
4. Fabricate manifolds in section up to 30 feet in length.

5. Construct from Schedule 40 CPVC. Piping, pipe joints, and supports shall be provided for long term exposure to 125 degrees F mean-wall temperature.

C. Distribution Headers:
   1. Minimum 3-inch Schedule 40 CPVC or equivalent wall thickness.
   2. Fabricate in sections up to a maximum of 20 feet in length, with fixed joints or expansion joints as required.
   3. Fabricate with diffuser element holders factory solvent welded to crown of header or with holed drilled for saddle mounted diffusers to be installed in the field. Attach diffuser elements to distribution headers to resist a dead load of 200 lbs applied vertically to the outer edge of the diffuser holder.
   4. Distribution headers shall be grouped, as necessary, to allow easy access for maintenance.
   5. Maximum spacing between distribution headers shall be as required by the manufacturer to maintain mixing and aeration.

D. Include an expansion/contraction system consisting of fixed joints and guide type supports. Fixed joints shall be positive-locking, anti-rotational flanged or threaded couplings. Longitudinal movement of piping shall be accommodated by sliding through non-gripping guide type supports.

2.06 FLEXIBLE MEMBRANE DIFFUSER ASSEMBLIES:

A. Diffusers type shall be non-clog medium bubble or low pressure type, suitable for intermittent or constant operation in sludge with up to 2.0% total solids.

B. Air diffusers shall be of the non-clog membrane disc or tube type with a flexible perforated air release membrane.
   1. Tube Membranes: Tube membranes shall provide a maximum of 380 in^2 of porous surface area each
      a. Diffuser tube shall be Schedule 40 CPVC and difuser membrane shall be EPDM
      b. Connection to air piping header shall be by saddle connection with stainless steel hardware.
   2. Disc Membranes: Maximum disc diameter shall be 9 inches. Hold down assembly shall consist of a threaded retainer ring with O-ring gasket assembly. Systems requiring multiple screws or bolts with a flange and gasket assemblies are not acceptable. Single through-bolt assemblies are not acceptable.
      a. CPVC Diffuser Element Holders:
         (1) Provide support plate to form an air plenum under the diffuser and support for the membrane when the air is off.
         (2) Mechanism to attach diffuser element to element holder.
         (3) Provide complete peripheral edge support for membrane diffuser.
         (4) Each diffuser element holder shall have an airflow control orifice.
         (5) Design distributors and holders to resist a dead load of 200 lbs applied vertically to the outer edge of the diffuser holder.
      b. Retaining Device:
         (1) Securely hold and seal diffuser element to element holder.
         (2) Diffuser Assembly and retaining device shall prevent air escape at diffuser element sealing gasket interface.
         (3) Design retainer ring threads with minimum cross section of 1/8 inch and allow for one complete turn to engage threads.

C. Backflow preventer assembly to prevent liquid from passing into aeration header. Diffusers shall require no special tools for attaching diffusers to diffuser connectors. If special tools are required, manufacturer shall provide the necessary tools to complete install.

D. Membrane: Ethylene propylene diene monomer (EPDM) suitable for application to continuous aeration of waste activated sludge without significant increase in headloss.
   1. Add carbon black to the material for resistance to ultraviolet light
   2. Replaceable without use of any special tools.
   3. Exterior surface shall be smooth to restrict biological film growth.
   4. Inflate during aeration and deflate when airflow is discontinued, further restricting biological film growth.
   5. Suitable for "Bumping" type cleaning.
   6. After 1 year of continuous operation without basin dewatering or diffuser cleaning, the pressure drop through the diffuser shall be measured at a flow rate of 1.0 cfm per diffuser. If the pressure has increased more than 0.5 psi compared to the pressure drop of a new diffuser membrane, then the basin shall be dewatered, and the diffusers cleaned. If the pressure of the diffusers is still greater than 0.5 psi over that of a new diffuser, then he manufacturer shall provide replacement membranes at no extra cost.
   7. Membrane Longevity:
      a. Longevity of the proposed membrane diffusers shall have been demonstrated in at least three full-scale municipal installations operating continuously for a minimum of three years.
      b. Test reports, prepared by an independent testing agency, shall confirm membrane longevity through compliance with the maximum allowed percent (plus or minus) change in each membrane property indicated. Tests conducted in-house by the Supplier shall not be acceptable. Data for a minimum of three diffusers from each installation shall be provided.

Property	Maximum Percent Change
Durometer	5%
Weight	5%
Permanent Set	0.5%

2.07 SUPPORTS AND ANCHOR BOLTS:

A. Fabricate from glass fiber reinforced polypropylene (GFPP) or Type 304 stainless steel, ASTM A240. Use Type 304L stainless steel for welded parts, ASTM A240.
   1. Support spacing to be limited to a maximum of 8 feet.
   2. Design all supports to allow for thermal expansion and contraction forces over a temperature range of 125° F (mean wall) and to minimize stress build up in the piping system.
   3. Design supports to be adjustable without removing the air distribution header from the support.
   4. Manifold Support – 6-inch diameter and larger
      a. Design supports to include hold down guide straps, support structure and anchor bolts.
      b. Design guide straps with a 2 inch minimum width to eliminate point load on manifold and minimize binding.
      c. Design support for a total of 4 inch vertical adjustment for leveling of manifold.
      d. Attach supports to tank floor with stainless steel anchor bolts.
   5. Air Distributor and Manifold Supports – 3 and 4-inch diameter

a. Provide guide and fixed type supports to allow expansion/contraction.
b. Design supports to include hold down straps, support structure and anchor bolt.
c. Design support for a total of 3 inch vertical adjustment for leveling air distribution headers within ¼ inch of a common plane.
d. Guide support
   (1) Guide straps to have 1 1/2-inch wide top and bottom contoured bearing surface with chamfered edges to minimize binding and resistance to movement of air distributor under full buoyant uplift load.
   (2) Design strap with 1/8 inch clearance around distributor so strap is self-limiting and cannot be over tightened.
e. Fixed supports
   (1) Fixed straps to have 1 1/2 inch wide top and bottom contoured bearing surface with punched burrs to positively grip the air distributor when tightened.
   (2) Design strap to be self-limiting to prevent stressing the distributor if the clamp is overtightened.

B. Anchor Bolts:
   1. Attach supports to basin with Type 304 stainless steel anchor bolts. Provide a chemical bond adhesive anchor bolt system.

2.08 DRAINLINE, SUMP, AND PURGE:

A. CPVC System: To drain entire submerged aeration piping system. The grid shall have an integral sump built into the air manifold header.
B. Sump:
   1. Bottom elevation shall be lower than invert of air distribution headers.
   2. Connect to a 1-inch diameter CPVC purge line extending from sump invert elevation to a point approximately 3-ft, 6-in above holding tank platform and terminate with a stainless steel ball valve.

2.09 HEADER JOINTS:

A. Special Flanged Joints or Between Section of Air Distribution Header:
   1. Connect air distribution header sections with threaded union or flange joints to prevent blow apart and rotation.
   2. Flanged Joints for Stainless Steel Piping: Face ring-follower flange type with through-bolts, capable of transmitting longitudinal forces caused by expansion and contraction in air distribution header.
B. Fixed Joints for CPVC Piping: Spigot section solvent welded to one end of a Distribution Header, a threaded socket section welded to mating distribution Header, and O-ring gasket and a threaded screw-on retainer ring.

2.10 APPURTENANCES:

A. Couplings: Van Stone type flanges ASTM A182 Type 304 stainless steel drill 150-pound ANSI B16.5 standard.
B. Face Rings: Stainless steel, ASTM A240, Type 304L, inside diameter (ID) drilled 1/16-inch larger than pipe outside diameter (OD).
C. Gaskets: Neoprene, 45 to 55 durometer; locate at expansion joints and couplings to form an airtight connection at 20 psig minimum.

D. Miscellaneous: Nuts, bolts, washers, and other nonwelded parts: Type 304 stainless steel, ASTM A240. Threaded assemblies shall be chemically treated or lubricated prior to assembly to prevent galling.
E. Anchors: Type 304 stainless steel expansion anchors (1/2 inch by 4-1/2 inches), unless otherwise indicated or specified.

2.11 SPARE PARTS AND SPECIAL TOOLS:
A. At a minimum, furnish, tag, and box for shipment and storage spare parts and special tools summarized below:
1. Diffuser Assemblies 3% of original quantity.
2. Joint Assemblies: six (6).
3. Couplings: six (6).

PART 3 - EXECUTION

3.01 INSTALLATION:
A. Install in accordance with these specifications and in accordance to manufacturer's instructions.
B. Diffusers shall be installed level as per manufacturer's recommendation or as specified, whichever is more stringent.

3.02 FIELD QUALITY CONTROL:
A. Level Test: The Thin Sludge Holding Tanks shall be flooded with non-potable water to the tops of the diffusers. The level of the diffusers shall then be checked to ensure that they are at the same elevation with plus or minus 0.125-inch. The elevations of the diffuser assemblies shall be adjusted as necessary.
B. Uniformity and Leakage Tests: The Thin Sludge Tanks shall be flooded to a depth of approximately 1-foot above the tops of the diffusers. Process air shall be supplied to the header in the tank. The surface of the water above the diffusers shall then be visually inspected for leaks and to ensure that airflow is uniformly distributed across the tank. Any leaks or non-uniformity discovered shall be repaired to full satisfaction of the Engineer.
C. Performance Test:
1. Perform under actual or approved simulated operating conditions. Airflow shall be as measured by plant instrumentation.
2. Test for a continuous 3-hour period without malfunction.
3. Adjust, realign, or modify units and retest if necessary.
4. Test as follows:
a. Pressure Test: Measure air pressure immediately upstream of elbow located at top of each dropleg, and at maximum airflows and submergences stated in paragraph 2.02.
b. Mixing Test (refer to paragraph 2.04):
(1) Perform at airflows stated in paragraph 2.02.
(2) Select three vertical lines and two depths in the sludge holding tank.
(3) Take three samples at each of two depths along each vertical line using Van Dorn sampler.
(4) Independent testing laboratory approved by Engineer will perform residue test on each Sample. Mean value of total residue for three samples at each depth will be used to determine conformance with requirements.

(5) All testing and sampling shall conform to procedures established in latest edition of Standard Methods for Examination of Water and Wastewater.

3.03 MANUFACTURER'S SERVICES:

A. As specified in Division 1 and as follows:

B. The equipment suppliers shall furnish the services of a factory-trained representative on site for a period of no less than three days (two visits). The representative shall inspect, adjust, calibrate and place into operation the system, then train Owner operating personnel in its use for a minimum of two sessions, two hours each. If additional services are required to produce a fully operational system, they shall be provided at no cost to the Owner.

C. After installation and after all equipment and components are in operable condition, a field mechanical and electrical performance test shall be performed in the presence of the Engineer.
   1. Each piece of equipment shall be tested for normal start, stop, and emergency stop cycles.
   2. Each piece of equipment shall be field tested and the equipment calibrated to demonstrate to the Engineer that all equipment will satisfactorily perform the functions and criteria specified.
   3. Furnish test forms and procedures for field testing and provide all test apparatus required at no additional cost to the Owner.
   4. Follow testing procedures recommended by the equipment manufacturer and approved by the Engineer.
   5. The equipment supplier shall modify or replace any equipment necessary to obtain satisfactory performance.

D. All labor, materials, and test apparatus necessary for conducting the above tests shall be furnished by the Contractor at no additional cost to the Owner, unless stated otherwise.

3.04 MANUFACTURER'S CERTIFICATE(S):

A. Provide manufacturer's certificate(s) in accordance with Division 1.

END OF SECTION 46 51 21

SECTION 46 53 60 – GRANULAR SLUDGE BIOLOGICAL TREATMENT SYSTEM

PART 1 - GENERAL

1.01 SUMMARY:

A. This section contains the requirements to furnish the design and equipment for a Granular Sludge Biological Treatment System (Treatment System) for the treatment of domestic wastewater. This section also specifies the overall performance requirements of the supplied Treatment System and includes the procurement, installation and operation of the biological treatment system and related services from the Equipment Supplier in accordance with the information contained herein. The Supplier will be responsible for the confirmation of the design of the bioreactors and provide a performance warranty of the biological process to meet permit requirements.

B. Description of Overall Treatment Process:

1. The system is for use in treating wastewater at the Todd Creek Wastewater Treatment Plant (TCWWTP).
2. Raw wastewater enters the treatment process at the existing influent screening structure, which includes an automatically cleaned, 1/4-inch-spaced mechanical bar screen. Screened effluent is discharged into a new influent wet well and subsequently pumped to the new wastewater treatment plant site. Influent wastewater passes through 1/4-inch automatically cleaned perforated plate screens and a stacked tray grit removal system. Screened and degritted influent flows into a header that serves the Treatment System. The Treatment System consists of four AGS Basins operated in parallel, with influent fed to one reactor at a time. The Equipment Supplier shall provide all non-concrete tank internals, pumps, instrumentation, and automatic valves required for complete operation of the treatment system.
3. Each basin in the Treatment System shall be capable of operating independently of all other basins including influent flow, effluent discharge, sludge withdrawal, and water level correction withdrawal, as outlined in these Specifications and on the Contract Drawings. The basins shall be synchronized to prevent sludge withdrawal from simultaneously occurring in more than one basin.

C. Requirements and materials not specified herein shall be selected by the Equipment Supplier for specified performance requirements and environmental conditions based on standard practice. The Equipment Supplier shall provide the required major equipment components, including but not limited to:

1. Biological process design calculations to assure the Treatment System can meet all performance requirements listed in this specification. Any process equipment provided by Others shall be recommended and approved by the Equipment Supplier for use as a single point of responsibility of the performance guarantee.
2. All motor-actuated and/or automatic valves required for a complete functional system:
    a. Influent header motor-actuated plug valves for each reactor (1 duty / 1 standby for each basin, 8 total).
    b. Air header motor-actuated air flow control valves (1 per basin, 4 total).
    c. Small air supply motor-actuated valves (2 per basin, 8 total).
    d. Sludge withdrawal and water level correction motor-actuated plug valves for each reactor (2 per basin, 8 total).
    e. Motor-actuated plug valves for influent to each of two (2) Sludge Buffer Tanks (2 total).
3. All internal reactor piping and connections as coordinated with Design Engineer.
4. Fine bubble diffuser grids for each AGS Basin, including drop leg to top of reactor wall.

5. Sludge / liquid withdrawal piping grid for each AGS Basin with any required air piping connections to top of reactor wall.
6. Effluent overflow weir launder system for each AGS Basin.
7. Five (5) positive displacement blowers in a 4 duty / 1 standby configuration.
8. Intake silencers for installation interior of the Blower Building for each blower provided.
9. Intake filter / silencer assemblies for installation exterior of the Blower Building for each blower provided.
10. Pumps for sludge processing system:
    a. Three (3) Sludge Pumps.
    b. Three (3) Supernatant Pumps.
11. Two (2) Water Level Correction (WLC) Pumps.
12. Furnish a complete operations and instrumentation package to control the Treatment System. The package shall consist of the following at a minimum:
    a. Furnish packaged equipment and devices with instrumentation and controls as specified.
    b. Furnish all instruments, meters, gauges, switches, controllers, thermometers, indicators, and transmitters as required for a complete system.
    c. Furnish instrumentation as required to properly monitor and control the equipment supplied by this Contract in a fully automatic mode. Include instrumentation for all equipment operation including startup, normal and shutdown modes.
    d. Design, shop install, and test all skid-mounted instruments.
    e. Furnish all materials for complete installation of shipped-loose instrumentation. Coordinate the physical arrangement and mechanical connections with equipment and structures furnished in this Section with the Design Engineer.
    f. Furnish and program a Programmable Logic Controller and Operator Interface Terminal (OIT) as specified for proper control and operation of the system. Design and factory acceptance test the complete main control panel.
    g. Provide controls integration for the complete system.

D. Work by Others:
1. Concrete Treatment System Basins.
    a. Four (4) AGS Basins, including concrete center effluent trough.
    b. Two (2) Sludge Buffer Tanks.
    c. One (1) Water Level Correction Tank.
2. Utility corridor with influent, sludge, and water level correction piping and appurtenances as required, including the following components.
    a. Influent check valves.
    b. Influent flow meters.
    c. Influent wastewater TSS instrument.
3. Utility corridor for pumping systems including the following components:
    a. Check valves.
    b. Sludge, supernatant, and WLC flow meters.
4. Air piping between blowers and reactor, up to the top of interior basin wall.
5. Sludge and WLC piping exterior of the AGS Basins.
6. All manually-operated valves shall be provided by Contractor.
7. Motor control centers, motor starters, and variable frequency drives shall be provided by the Contractor for all equipment without integral control equipment.
8. Configuration of the plant control system network.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 01
B. Section 01433 – Manufacturers Field Services
C. Section 01664 - Training
D. Section 01757 – Commissioning
E. Section 09 90 00 – Protective Coatings.
F. Section 33 11 00 – Pressure Piping.
G. Section 33 12 16 – Utility Valves and Accessories.
H. Section 40 66 00 – Process Control Networks.
I. Section 40 67 00 – Process Control Panels and Hardware.
J. Section 40 70 00 – Instrumentation For Process Systems.
K. Section 43 11 33 – Positive Displacement Blowers.
L. Section 46 05 13 – Common Motor Requirements for Water and Wastewater Equipment.

1.03 EXCEPTIONS TO WORK SPECIFIED ELSWHERE:

A. Aqua Aerobics International standard training, commissioning, and startup services shall take precedent over Div 1.

1.04 REFERENCES:

A. Applicable Standards:
   1. American National Standards Institute (ANSI).
   2. American Water Works Association (AWWA).
   3. National Sanitation Foundation (NSF).

1.05 SUBMITTALS:

A. Furnish submittals in accordance with SECTION 01300 - SUBMITTALS.
B. Initial Design Deliverables shall be submitted according to the schedule provided in the Bid Form.
   1. Biological design information on the following at a minimum:
      a. Process Flow Diagram.
      b. Tank Configuration and Volumes.
      c. Equipment Confirmation and Sizing.
      d. Sludge, WLC withdrawal rates.
      e. Sludge, supernatant, and WLC design flow ranges.
      f. Oxygen Demand.
      g. Sludge Production.
      h. SRT/HRT.
      i. BioWin Model demonstrating treatment at maximum month design loading.
   2. Assembly and installation drawings including arrangement, layout, and dimensions of all basin/tank internal components. Provide plan elevation views of all major components and subsystems, detailing orientation of equipment, piping, fittings, and valves (including valve actuators) and necessary supports for the equipment.
   3. Three-dimensional models of all equipment. Electronic copies of all models shall be provided in Revit Version 2024 or compatible alternative.
   4. P&ID drawings clearly identifying the termination points for piping connections, and electrical connections on the P&ID drawings where interfacing of the Treatment System supplied equipment and Contractor supplied equipment and/or piping exists.

5. Complete Bill of Materials including quantity, manufacturer, and custom tag number referenced to the P&IDs. The custom tags shall be developed by the Design Engineer and Owner. The Equipment Supplier shall not create their own tagging system.
    a. Equipment Supplier shall provide literature and Engineering data and specifications including dimensions, materials, size, and weight of major components.
6. Hydraulic calculations for reactor influent distribution grids and sludge/WLC withdrawal grids across the range of anticipated flows in tabular form.
7. Detailed design specifications, design criteria, and design calculations for pumps, blowers, and other ancillary equipment.
8. Basin dimensional requirements.
9. Anchorage requirements and details for all supplied mechanical equipment, influent distribution grids, sludge/WLC withdrawal grids, and effluent lauders.
10. Detailed control package summary including detailed control equipment cabinets layouts, associated cabinet wiring diagrams, I/O lists, alarms, control loops, and integration of associated ancillary equipment.
11. Detailed Control Narrative describing how the Treatment System operation works. The control narrative should describe the operation of the system in various operating modes including Hand and Auto.

C. Shop Drawings:
1. Provide setting drawings, templates for the installation of anchor bolts and other anchorage systems.
2. Final P&IDs, General Arrangement Drawings.
3. Complete power and control wiring diagrams and schematics with all field revisions.
4. Bill of Materials with Quantities for major electrical and control components like PLCs, OITs, Ethernet Switches etc.
5. Product Data: Submit the following for each type of product specified and included as minimum:
    a. Data sheets for all control panel components furnished.
6. PLC Control Panels: Provide the following as minimum:
    a. Fabrication drawings, front elevation, wiring diagrams, and bills of material for control panels.
    b. Electrical connection diagrams showing termination locations for all field wiring. External connection diagrams shall indicate cable number and wire color for field cables terminated at the panel.
    c. Engraving schedule and physical dimensions for nameplates.
    d. Provide heat dissipation calculations for all panels containing programmable logic controllers. Include calculation for ventilation fans if required.
7. Operator Interface Terminal (OIT) touch screen layouts (for each screen) subject to Owner and Engineer approval.
8. Testing Protocol. Submit to the Contractor and Owner, the Treatment System testing protocol as indicated below.
9. I/O list for SI programming of client SCADA system.
10. Final PLC program copy with complete documentation to be submitted after startup and acceptance of the system. The program shall be provided with the final O&M materials and stored on flash media.

D. Quality Control Submittals
1. Equipment Supplier’s Certificate of Proper Installation
2. Special shipping, storage and protection, and handling instructions for all components.
3. Equipment Supplier’s written/printed installation instructions.

4. Routine maintenance requirements prior to plant startup.
5. Two (2) hard copies and one (1) electronic copies of the Operation and Maintenance Manuals for the Treatment System and all associated equipment O&M Manuals. The Manuals shall include complete operations and maintenance manuals, maintenance procedures, spare parts lists, and field procedures according to SECTION 01300 – SUBMITTALS.
6. The Equipment Supplier's instructions for the handling, long and short-term storage, installation, maintenance, and cleaning of all provided equipment.
7. Maintenance procedures spare parts lists, and field procedures.

1.06 SITE CONDITIONS:

A. All Equipment provided as part of this system shall be rated for the temperature, seismic and elevations as specified in Section 01810 – Project Design Criteria and its appendices.

1.07 SYSTEM WARRANTIES:

A. A Process Performance Warranty shall be provided by Equipment Supplier for the Treatment System per the requirements outlined in Section 2.02 Treatment System Design Criteria, Section 3.03 Performance Test and Section 3.04 Monitored Test Period. This warranty shall include the required effluent values for BOD, TSS, TN, NH_3-N, and TP. The Process Performance Warranty shall be based on demonstrating the specified performance during a 60-day Performance Test, and maintenance of performance through the Monitored Test Period. The warranty shall include a protocol for provisions to make process adjustments, replace equipment and make any other modifications necessary to maintain plant performance through the warranty period.
   1. Equipment Supplier shall furnish a two-year, non-prorated, Process Performance Warranty. Required effluent values for BOD, TSS, TN, NH_3-N, and TP shall be met as long as Influent Wastewater Quality is maintained at or below the values listed in Section 2.02.
   2. The two-year warranty shall commence after the Performance Test has been successfully completed. The Equipment Supplier shall retroactively set the beginning of the warranty period at the date with which the process met and maintained the effluent requirements, up to a maximum of 60 days prior to the end of the Performance Test.

B. Equipment Supplier shall furnish a two-year, non-prorated, materials and workmanship warranty for all components comprising the Treatment System unless otherwise noted. Warranty shall be for two (2) years from the date of successful completion of commissioning activities as described in Section 3.02.

PART 2 - PRODUCTS

2.01 ACCEPTABLE TREATMENT SYSTEMS:

A. Aerated Granular Sludge (AGS) treatment system package, as provided by Aqua Nereda / Aqua Aerobics Systems, Inc.

2.02 TREATMENT SYSTEM DESIGN CRITERIA:

A. The Equipment Supplier shall provide the biological system design calculations to assure the Treatment System can meet all performance requirements listed in this specification.

B. Treatment System shall provide biological phosphorus removal without incorporation of a chemical phosphorus removal system.

C. The Treatment System shall be designed to remove phosphorus, biological oxygen demand, ammonia, and total nitrogen at a maximum month flow of 7.96 MGD. The biological system shall meet the following design criteria:
   1. Design Conditions:
      a. Average Day Flow (ADF): 4.59 MGD
      b. Maximum Month Flow (MMF): 7.96 MGD
      c. Peak Day Flow (PDF): 12.3 MGD
      d. Minimum Temperature: 10°C
      e. pH: 6.5-8.5
      f. Site Elevation: 915 ft
   2. Influent Wastewater Characteristics:

	Average Day	**Maximum Month**	**Peak Day**
BOD_5, lbs/d	7,200	13,300	16,800
TSS, lbs/d	7,600	15,400	23,500
TKN, lbs/d	1,600	2,230	3,180
TP, lbs/d	270	380	540

   3. Effluent Wastewater Quality Requirements:

Parameter, Units	**30-Day Avg**	**7-Day Avg**	**Daily Max**
pH, su	-	-	6.0-9.0
BOD_5, mg/L	15	15	-
TSS, mg/L	20	30	-
Oil and Grease, mg/L	10	-	15
Ammonia, mg/L	1.8 (Jan) 1.8 (Feb) 1.8 (Mar) 1.4 (Apr) 1.2 (May) 0.6 (June) 0.4 (July) 0.6 (Aug) 0.7 (Sept) 1.3 (Oct) 1.8 (Nov) 1.8 (Dec)	-	8.4 (Jan) 8.4 (Feb) 8.4 (Mar) 6.9 (Apr) 8.4 (May) 6.9 (June) 6.9 (July) 8.4 (Aug) 6.9 (Sept) 6.9 (Oct) 8.4 (Nov) 8.4 (Dec)
Total Phosphorus, mg/L	1.0	-	-
Total Nitrogen, mg/L	8.0	-	-

D. Include biological design information on the following, at a minimum:
   1. Process flow diagram.
   2. Tank configuration and volumes.
   3. Sludge and WLC withdrawal flows.
   4. Oxygen demand.
   5. Sludge production.
   6. SRT/HRT.

E. Treatment System shall be designed for four (4) AGS Basins, each with the dimensions below:

1. Reactor Width: 75 feet
2. Reactor Length: 80 feet
3. Maximum Sidewater Depth: 22 feet
4. Aeration Sidewater Depth: 21 feet
5. Top of Reactor Wall: 24 feet

F. Treatment System sludge processing system shall be designed for two (2) Sludge Buffer Tanks, each with the dimensions below:
1. Reactor Width: 20 feet
2. Reactor Length: 28 feet
3. Maximum Sidewater Depth: 14.2 feet
4. Top of Reactor Wall: 24 feet

G. Treatment System water level correction system shall be designed for one (1) WLC Tank with the dimensions below:
1. Reactor Width: 20 feet
2. Reactor Length: 20 feet
3. Maximum Sidewater Depth: 14.4 feet
4. Top of Reactor Wall: 24 feet

2.03 AERATION EQUIPMENT:

A. Equipment Supplier shall design aeration control system based on a common air discharge header with modulating control valves at each basin to balance air between basins as needed to meet process performance demands. A control system with blowers dedicated to individual basins shall not be acceptable.

B. Butterfly valves for air service:
1. All butterfly valves shall be provided with stainless steel disc, and FKM valve seat. All internal materials must be compatible with the highest anticipated blower discharge temperature and 25 degrees F safety factor.
2. Equipment Supplier shall provide four (4) electrically operated, modulating service butterfly valves for controlling airflow to each basin.
   a. Valves shall be 10-inch with lug-style or flanged connections.
   b. Electric motor actuators shall be 460V, 3ph, 60Hz service.
   c. Actuators shall include motor winding protection, integral disconnect switch (NEMA 4X), manual override and limit switch feedback to allow monitoring of valve position and whether valve is open or closed.
   d. Actuators shall include local controls, including push buttons for opening / closing, selector switches for placing actuator in hand or remote, and indicator lights to identify if valve is open / closed and if the valve is in a fault mode.
   e. Modulating electric motor actuator shall include the following control signals, at minimum:
      (1) Discrete outputs:
         (a) Dry contacts rated 5A, 120Vac.
         (b) Signals:
            i) Open limit switch.
            ii) Closed limit switch.
            iii) In-Remote status.
      (2) Discrete inputs:
            i) Open/Close.
      (3) Analog output:
         (a) 4-20mA range.

i) Position control.
ii) Position feedback.

3. Equipment Supplier shall provide eight (8) electrically operated, open/close service butterfly valves for use with the air supply at each basin.
   a. Valves shall be 4-inch with lug-style or flanged connection.
   b. Electric motor actuators shall be 460V, 3ph, 60Hz service.
   c. Actuators shall include motor winding protection, integral disconnect switch, manual override and limit switch feedback to allow determination whether valve is open or closed.
   d. Actuators shall include local controls, including push buttons for opening / closing, selector switches for placing actuator in hand or remote, and indicator lights to identify if valve is open / closed and if the valve is in a fault mode.
   e. Open/close electric motor actuator shall include the following control signals, at minimum:
      (1) Discrete outputs:
         (a) Dry contacts rated 5A, 120Vac.
         (b) Signals:
            i) Open limit switch.
            ii) Closed limit switch.
            iii) In-Remote status.
      (2) Discrete inputs:
            i) Open/Close.

C. Aeration Blowers:
   1. Equipment supplier shall provide blowers sized to accommodate projected peak day loadings into the WWTP, as indicated in Section 2.02C.1. The blowers shall be provided with a 4 Duty / 1 Standby arrangement. Other blower arrangements shall be subject to Design Engineer Approval.
   2. Aeration Blowers shall be positive displacement type and shall be as specified in Section 43 11 33 Positive Displacement Blowers.

D. Aeration Blower Intake Filter / Silencer Assemblies:
   1. Equipment supplier shall provide five (5) intake filter / silencer assemblies, as specified in Section 43 11 33 under Series 400 Blowers.

E. Aeration Blower Intake Silencer Assemblies:
   1. Equipment supplier shall provide five (5) intake silencer assemblies, as specificed in Section 43 11 33 under Series 400 Blowers.
   2. Equipment supplier shall coordinate connections to blower piping with Design Engineer.

F. Air Flowmeter:
   1. Function: Continuously measure, indicate, and transmit signals proportional to air flow being supplied to each AGS Basin. Each air flow meter shall be integrated with the Equipment Supplier PLC for monitoring, data recording, and process control.
   2. Provide one (1) air flowmeter for each AGS Basin as specified in Section 2.11.

2.04 AGS BASIN, SLUDGE BUFFER TANK, AND WLC TANK INTERNALS

A. Treatment System shall be provided with tank internals required for a complete system. All piping connections shall be within 48 inches of reactor wall, and shall be coordinated with Design Engineer.

B. Fixed Fine Bubble Diffuser System:
   1. Equipment Supplier shall provide a complete fine bubble membrane diffuser system for each AGS Basin, with flanged dropleg connection located at the top of the reactor wall

for transition to contractor provided piping. Equipment Supplier shall provide dropleg connection for each independent diffuser grid provided.

2. Dropleg shall be minimum SCH10 304L stainless steel with 150# flange connection at top of dropleg.
3. Provide a manifold for connection to the air distribution headers. Fabricate maximum 30 feet long manifolds with threaded union or flanged joints to connect manifold sections and to connect to the air distribution headers to prevent rotation and blow apart. Fabricate manifolds of Schedule 40 CPVC conforming to ASTM D1784, D1785 and D2466. Design piping, pipe joints and supports to resist expansion/contraction thrust forces of the air distribution headers over a temperature range of 250°F. CPVC components to be produced from CPVC compound with a minimum tensile strength of 7000 psi. Design manifolds to withstand 180° F mean wall temperature. CPVC components shall have minimum 1.5 percent titanium dioxide to minimize ultraviolet light degradation. Factory solvent weld all CPVC joints and diffuser holders.
4. Fabricate maximum 24 feet long air distribution headers with diffuser holders factory solvent welded to the crown of the pipe for positive air seal and strength. Fabricate minimum 4-inch diameter air distribution headers conforming to ASTM D3915 and D3034. Connect air distribution header sections with threaded union or flange joints to prevent blow apart and rotation. Design joints with mating halves factory solvent welded to the ends of the air distribution header. Design threaded union joints with spigot and socket ends joined with a threaded ring and sealed with an O-ring gasket. Design union joints with threads of a minimum of 0.013 square inches to provide adequate strength of the socket and retainer ring. Design flange joints with an angle face ring, follower flange with 150 lb drilling and stainless-steel hardware. Diffuser holders shall have a continuous contact area of 13 square inches minimum to ensure structural integrity. Air distribution headers and diffuser holders to resist a dead load of 200 lbs applied vertically to the outer edge of the diffuser holder. Provide end caps at the end of each air distribution header.
5. Provide complete pipe support system for entire manifold and header assembly, including dropleg connections along reactor wall. Support spacing to be limited to a maximum of 8 feet. Design all supports to allow for thermal expansion and contraction forces over a temperature range of 125° F and to minimize stress build up in the piping system. Design supports shall be adjustable without removing the air distribution header from the support. Design supports shall include hold down guide straps, support structure and two anchor bolts. Design guide straps with a 2-inch minimum width to eliminate point load on manifold and minimize binding. Design support for a total of 4-inch vertical adjustment for leveling of manifold within ¼ inch of a common plane.
6. Provide guide and fixed type supports for air distributors and manifolds to allow expansion/contraction. Design supports to include hold down straps, support structure, locating plate and single anchor bolt. To prevent improper installation, the locating plate shall be able to be installed in either of two directions relative to the support. Design support for a total of 3-inch vertical adjustment for leveling air distribution headers within 1/4-inch of a common plane. Guide straps shall have 1 1/2-inch wide top and bottom contoured bearing surface with chamfered edges to minimize binding and resistance to movement of air distributor under full buoyant uplift load. Design strap with 1/8-inch clearance around distributor so strap is self-limiting and cannot be over tightened.
7. All supports shall be 304 stainless steel construction.

8. Provide diffuser assemblies including diffuser, holder, retaining ring, and air flow control orifice. Incorporate integral check valve into the membrane diffuser.
    a. Test diffuser using primary sampling criteria outlined in Military Standard 105E. Manufacture circular membrane diffuser with integral O-ring of EPDM synthetic rubber compound with precision die formed slits. Add carbon black to the material for resistance to ultraviolet light. Design diffuser as one piece injection molded part with a minimum thickness of 0.080 inches for 9 inch diameter unit. Extractable oil content shall not exceed 10%. Limit the maximum tensile strength of the diffuser to 10 psi when operating at 2.4 SCFM/sq. ft. of material.
    b. Visual Uniformity: Observe diffusers for uniform air distribution across the active surface of the diffuser at 1.0 SCFM/diffuser and 2 inches submergence. Active surface shall be defined as the perforated horizontal projected area of the diffuser. Factory test diffusers for a dynamic wet pressure (DWP) of 12 inches ± 20% water column @ 1.0 SCFM/diffuser and 2 inches submergence.

C. Influent Distribution System:
1. Equipment Supplier shall provide one (1) influent distribution system for each AGS Basin. System shall consist of PVC and HDPE components.
2. Complete support system shall be provided, including anchors. All support components shall be of 304 stainless-steel construction.
3. Influent distribution system shall connect to 36” flange provided by Contractor. Connection shall be internal to the tank and within 48 inches of interior wall as shown in the CONTRACT DRAWINGS.

D. Solids / WLC Waste Assembly:
1. Equipment Supplier shall provide one (1) HDPE withdrawal manifold for each AGS Basin to facilitate removal of sludge and WLC during applicable operational cycles.
2. Complete support system shall be provided, including anchors. All support components shall be of 304 stainless steel construction.
3. Solids / WLC waste assembly shall connect to 24” flange provided by Contractor. Connection shall be internal to the tank and within 24 inches of interior wall as shown in the Contract Drawings.

E. Effluent Weir Assembly:
1. Furnish one (1) effluent weir system for each AGS Basin, consisting of maximum eight (8) finger weirs to be installed between basin exterior concrete walls and center concrete effluent trough.
2. Effluent weirs shall be 304 stainless steel.
3. Complete support system shall be provided, inlcuding anchors. All support compoenents shall be of 304 stainless steel construction.

F. Solids Buffer Tank Sludge Withdrawal Assembly:
1. Furnish one (1) solids withdrawal assembly for each Sludge Buffer Tank.
2. Manifold shall be of PVC and HDPE construction and shall be provided with 10” flanged connection internal to each tank for connection to Contractor piping connection.
3. Supply all required supports and anchors. Supports and anchors shall be 304 stainless steel construction.

G. Tank internals shall be installed by Contractor per Equipment Supplier instructions and guidelines.

2.05 UTILITY CORRIDOR VALVES:

A. Influent Header Control Valves:

1. Equipment Supplier shall provide two (2) electronically actuated 30-inch plug valves for each AGS Basin (total of 8 valves). The valves shall be intended for use in 1 Duty / 1 Standby service.
2. Valve construction shall conform to Section 33 12 16 – Utility Valves and Accessories.
3. Electric motor actuators shall be 460V, 3ph, 60Hz service.
4. Actuators shall include motor winding protection, integral disconnect switch (NEMA 4X), manual override and limit switch feedback to allow monitoring of valve position and whether valve is open or closed.
5. Actuators shall include local controls, including push buttons for opening / closing, selector switches for placing actuator in hand or remote, and indicator lights to identify if valve is open / closed and if the valve is in a fault mode.
6. Open/close electric motor actuator shall include the following control signals, at minimum:
    a. Discrete outputs:
        (1) Dry contacts rated 5A, 120Vac.
        (2) Signals:
            (a) Open limit switch.
            (b) Closed limit switch.
            (c) In-Remote status.
    b. Discrete inputs:
            (a) Open/Close.

B. Sludge and WLC Modulating Control Valves
1. Equipment supplier shall provide two (2) electronically actuated 20-inch plug valves for each AGS Basin (total of 8 valves). The valves shall be intended for modulating service.
2. Equipment Supplier shall provide two (2) electronically actuated 20-inch plug valves to serve the Sludge Buffer Tanks. The valves shall be intended for open / close service.
3. Valve construction shall conform to Section 33 12 16 – Utility Valves and Accessories.
4. Electric motor actuators shall be 460V, 3ph, 60Hz service.
5. Actuators shall include motor winding protection, integral disconnect switch (NEMA 4X), manual override and limit switch feedback to allow monitoring of valve position and whether valve is open or closed.
6. Actuators shall include local controls, including push buttons for opening / closing, selector switches for placing actuator in hand or remote, and indicator lights to identify if valve is open / closed and if the valve is in a fault mode.
7. Modulating electric motor actuators shall include the following control signals, at minimum:
    a. Discrete outputs:
        (1) Dry contacts rated 5A, 120Vac.
        (2) Signals:
            (a) Open limit switch.
            (b) Closed limit switch.
            (c) In-Remote status.
    b. Discrete inputs:
            (a) Open/Close.
    c. Analog output:
        (1) 4-20mA range.
            (a) Position control.
            (b) Position feedback.

2.06 HORIZONTAL END-SUCTION CENTRIFUGAL PUMPS:

A. Equipment supplier shall furnish the following horizontal end-suction centrifugal pumps for sludge, supernatant, and WLC service.

B. All pumps shall be manufactured by Gorman Rupp.

C. Materials of Construction:

1. Construct motor housing, pump casing, and major pump components of cast iron conforming to ASTM A48.
2. Casing:
   a. Designed to withstand a hydrostatic pressure of 150% of the shutoff head.
   b. Single-stage, single-suction, volute type.
   c. Provide flanged hand hole for inspection of casing interior.
   d. Inside face contoured to match volute.
   e. Bolted to casing.
   f. Provide with rigid mounting assembly to support motor weight, assure proper pump and motor alignment, and dampen vibration within the specific tolerance.
   g. Provide flanged suction and discharge flanges to match the connecting pipe flanges.
   h. Provided with casing vent and drain connections
3. Impeller:
   a. Open design with smooth water passages to prevent clogging.
   b. Balanced statically and dynamically to eliminate vibration and minimize hydraulic end thrust.
   c. Castings shall not have been repaired by plugging, welding, or other means.
   d. Securely fitted and keyed or screwed to the shaft
4. Shaft:
   a. Ample diameter to assure first critical speed will occur at not less than 150% of rated pump speed.
   b. Provide shaft with sleeves designed to prevent water leakage between shaft and sleeves. Adequately anchor sleeves to the shaft to prevent rotation relative to shaft.
   c. Completely encase shaft along its entire length within the pump by the impeller and sleeves.
   d. Proportioned to transmit all loads and torque without deflection or twisting.
5. Bearings:
   a. Bearings shall be permanently lubricated.
   b. Inboard bearings shall be roller, while outboard bearings may be ball or roller.
   c. Designed for all radial and thrust loads imposed by hydraulically unbalanced impellers.
   d. Have provisions for shaft and casing expansion movement.
   e. Designed for a minimum L-10 life of 100,000-hour minimum in accordance with ABMA standards.
6. Shaft Seals:
   a. Pump shall have a single self-contained mechanical seal.
7. Drive Coupling:
   a. Provide adequate spacer length to allow removal of end suction pump internals or mechanical seal from horizontal split-case pumps without disturbing casing.
   b. Rigidly fastened to the base plate. Guard shall be arranged to allow ease of disassembly or removal for access to the coupling.
   c. Prevent any thrust from being transmitted to the drive motor shaft under any operating condition.
   d. Rated for at least 150% of drive motor horsepower.

8. Base Plate:
   a. Provide each pumping unit with a separate base plate.
   b. Provide for rigid anchoring of pump, motor, coupling guard including all blocks and leveling plates.
   c. Have a raised drip lip around the perimeter with a threaded drain connection.
   d. Provide all necessary bolting to attach all components to the base plate.
   e. Cast-iron or steel base plates shall be designed rigid enough for no grout, but shall be suitable for field grouting under the entire plate.
9. Motors:
   a. Shall be in accordance with Section 46 05 13 and herein.
   b. All motors shall be of single-speed, premium-efficient, squirrel cage induction design.
   c. All motors shall be rated for 480V, 3-phase, 60-Hz operation with the service factor of 1.15. RPM rating shall be as required.
   d. Designed for operation with variable frequency drive.
   e. Provide two normally closed temperature switches embedded in each phase winding for high temperature protection. Switches shall be rated for use with 120Vac.
   f. Provide factory installed, maintenance free, circumferential, conductive micro fiber shaft grounding ring to discharge shaft currents to ground.
   g. Rated horsepower as required at 40° C ambient with Class F insulation.
   h. Comply with the applicable provision of NEMA with a minimum B-10 bearing life of 100,000 hours.
10. Materials:
   a. The materials specified below indicate a standard of quality. Substitutions may be made or recommended by Supplier upon approval of Purchaser, if deemed necessary due to quality of fluid being pumped, start-up system flushing chemical additives, or other reasons.
      (1) Base Plate: ASTM A36 structural steel or ASTM A48 cast iron.
      (2) Casing: Cast iron, cast steel, or ductile iron.
      (3) Impeller: ASTM A395 or ASTM A536 cast-ductile iron.
      (4) Shaft: AISI 1045 carbon steel or ASTM A322 Grade 4140.
      (5) Shaft Sleeve: ASTM A276 Type 416 Condition A.

D. Sludge Pumps:
1. Description of Service: Sludge pumps shall be used to transfer thickened sludge layer from Sludge Buffer Tanks to the Thin Sludge Tanks (provided by Others). Pumps shall be provided with one unit dedicated to each of two (2) Sludge Buffer Tanks, with a third pump available as a standby unit.
2. Number of Units: 3 Pumps (2 Duty / 1 Standby).
3. Design Capacity, each:
   a. Flow: 185 gpm.

E. Total Dynamic Head: 42.3 feet.
1. Maximum Motor Size: 7.5 HP.

F. Supernatant Pumps:
1. Description of Service: Supernatant pumps shall be used to transfer supernatant layer from Sludge Buffer Tanks following withdrawal of the thickened sludge layer. Supernatant shall be pumped to the AGS Influent Header (provided by Others). Pumps shall be provided with one unit dedicated to each of two (2) Sludge Buffer Tanks, with a third pump available as a standby unit.
2. Number of Units: 3 Pumps (2 Duty / 1 Standby).

3. Design Capacity, each:
   a. Flow: 740 gpm.
   b. Total Dynamic Head: 30 feet.
4. Maximum Motor Size: 15 HP.

G. WLC Pumps:
1. Description of Service: WLC pumps shall be used to transfer liquid from the WLC tank. WLC liquid shall be pumped to the AGS Influent Header (provided by Others). Pumps shall be provided in a 1 Duty / 1 Standby configuration.
2. Number of Units: 2 Pumps (1 Duty / 1 Standby).
3. Design Capacity, each:
   a. Flow: 485 gpm.
   b. Total Dynamic Head: 30 feet.
4. Maximum Motor Size: 15 HP.

2.07 ELECTRICAL:

A. Electrical material and equipment shall have UL listing wherever standards have been established by that agency.
B. Complete electrical assembly shall meet all requirements of the National Electrical Code, the National Electrical Manufactures Association (NEMA), the National Fire Protection Association (NFPA), all applicable state and local codes.
C. Three phase, 480V, 60 Hz power will be available for all Treatment System equipment, except instruments.
D. Unless specifically noted otherwise, all the power distribution equipment including the motor control center, variable frequency drives, motor starters and panelboards etc. for the Treatment System equipment shall be provided by Others.

2.08 PROCESS CONTROL PANEL:

A. Provide and program a Programmable Logic Controller (PLC) based system with an operator interface to control the operation of the Treatment System including all ancillary equipment as specified in this section.
B. Programmable Logic Controllers (PLC):
1. Refer to Section 40 67 00 – Process Control Panels and Hardware for all requirements of the AGS control system PLC.
2. Provide Allen-Bradley ControlLogix series PLC hardware as specified and required for application.
3. The PLC shall communicate with the Plant Control System over an EtherNet/IP communications network.
4. The PLC shall each include spare parts as well as memory sufficient to implement all application software plus 100% spare capacity as minimum.
5. The PLC should be capable of communicating and controlling the following treatment processes at the minimum in addition to the Treatment System.
   a. All automatic valves that are associated with the Treatment System.
   b. Aeration Blowers.
   c. Sludge Pumps.
   d. Supernatant Pumps.
   e. WLC Pumps.
   f. Instrumentation, sampling pumps, and sampling panels, as required.

C. PLC I/O:

1. Refer to the I/O List at the end of this Section for a list of I/O required to be provided for the AGS control system.
2. Refer to Section 40 67 00 for requirements of PLC input and output modules for the consumption of all AGS PLC I/O.

D. Main Control Panel (AGS-MCP-001):
1. Provide a Main Control Panel (MCP) to house the PLC and associated control panel components that conform to Section 40 67 00 – Process Control Panels and Hardware.
   a. The MCP shall operate from a 120 VAC, single phase, 60Hz power supply.
   b. MCP shall be NEMA 12 rated cabinet located in a dedicated electrical room in the Blower Building.
   c. Motor and valve controls shall be a combination of hardwired control and network controls via the plant control system connection. The communications shall be by EtherNet/IP protocols. Refer to plans and schematics for specific control cabling and communication requirements.
2. Provide and configure an Operator Interface Terminal (OIT) installed within the door of the Main Control Panel. The OIT shall be as specified in Section 40 67 00 – Process Control Panels and Hardware.
3. Provide and configure a panel mount managed Ethernet switch within the main control panel for connection of the Plant Control System and all applicable AGS equipment. The network switch shall be as specified in Section 40 66 00 Process Control Networks.
4. Spare Parts: In addition to the general spare parts defined by Section 40 70 00, the following shall be provided specifically for the supplied main control panel PLC.
   a. One spare ControlLogix PLC processor as specified in Section 40 67 00.
   b. One spare I/O module of each type used.

E. Process Control
1. Unless otherwise specified, all equipment shall be capable of being controlled at the OIT and local controls including push buttons and pilot devices with the following functionality as minimum:
   a. For each Aeration Blower:
      (1) Manual/Auto.
      (2) Start/Stop.
      (3) Alarm reset.
      (4) Speed adjustment.
   b. For each Pump:
      (1) Manual/Auto.
      (2) Start/Stop.
      (3) Alarm reset.
      (4) Speed adjustment.
   c. For each Motor-Actuated Valve:
      (1) Manual/Auto.
      (2) Open/Close.
      (3) Alarm reset.
      (4) Position adjustment (for modulating valves).
2. The PLC shall be capable of receiving initial run-time values for existing and proposed equipment. Initial run-time shall not automatically be assumed to be zero.
3. Unless otherwise specified, all flows and equipment run-times shall be totalized in the PLC and displayed on the HMI for current day, prior day, weekly, monthly, and annual totals.

F. HMI Screen Development:

1. Refer to Section 40 61 96 - Process Control Software Programming and Reports for requirements of HMI operator screen development.
2. HMI screens shall be developed for control interface and monitoring of AGS systems and related equipment.
3. The AGS System Supplier shall coordinate with the Systems Integrator to establish HMI development standards to ensure the HMI screens developed by the AGS supplier and the System Integrator share the same typical graphics, faceplates, and function blocks to meet the project standards.
4. The AGS System Supplier shall develop and provide a complete set of HMI screens with all system application files to the Systems Integrator. The screens shall be integrated into the Plant Control System HMI screen set.
5. The AGS System Supplier shall provide the necessary coordination with the Systems Integrator to ensure a fully functional application. Refer to Part 3 of this Section for minimum coordination requirements with the Systems Integrator.

2.09 AQUANEREDA SERVER:

A. Provide a Process System Server for monitoring, calculations, and modification of control system parameters.
B. The server shall communicate control system updates to the main control panel PLC over the Ethernet network.
C. The servers shall be rack mount design and provided with sliding rack rails. The server shall be installed in the plant control system network rack (by others). The server shall include the following as minimum.
   1. The processor shall be an Intel® Xeon E2334, 3.4GHz, 8MB Cache or greater.
   2. Provide 132.0 Gigabytes (minimum) of registered UDIMM.
   3. Provide a minimum of two fully rated power supplies for redundant operation.
   4. Provide with dual on-board 10/100/1000 Base-T network interface card. The dual NIC card shall be configurable to serve as a primary and secondary fail-over.
   5. Provide Dell Power Edge R250 Server or approved equal.
D. The graphics card shall be integrated with a minimum of 16 MB of video memory.
E. Disk Drives:
   1. Provide two (2) 1TB SATA Drives, 7200 rpm, 6Gbps, 3.5”.
   2. Provide C22, RAID 1 for S140 SATA.
F. Operating System and Software:
   1. Provide Microsoft Windows Server 2022 with five client access licenses (CAL’s) as necessary. Provide and install the latest service packs and patches available that are compatible with the supplied control software.
   2. The servers shall have a clean install of the operating system and hardware drivers. Non-essential applications, such as manufacturer provided trial software and utilities, shall not be loaded on the system.
   3. Provide Remote Desktop Services (RDS) client access licenses (CAL’s) as required.
   4. Provide one copy of the latest version of Microsoft Office Professional for each server.

2.10 DESCRIPTION OF OPERATIONS:

A. Equipment Supplier shall provide any additional automatic valves and instrumentation as required to provide a complete, functional system. Any additional items shall be coordinated with the Design Engineer and Contractor to be incorporated into this Section and Contract Drawings, including Process & Instrumentation Diagrams.

B. Equipment Supplier shall tag all provided equipment as specified herein, and as shown on the Contract Drawings and Section 40 70 00. Any additional items required by Equipment Supplier shall be coordinated with Design Engineer to develop appropriate tagging.

C. System Components and Functions:
   1. Equipment denoted with "*" symbols is to be provided by the Contractor / System Integrator. Refer to Section 40 61 96 and Section 40 70 00 for additional requirements.
   2. AGS Main Control Panel AGS-MCP-001.
      a. Equipment Supplier provided control panel for control of the Treatment System containing a PLC, operator interface, and other ancillaries necessary for control of the equipment.
   3. AGS Nereda Controller AGS-SVR-001.
      a. Equipment Supplier provided software-based controller running on a host server located in the Blower Building Electrical Room network rack.
   4. AGS Influent Header:
      a. *Influent Header Analytical Transmitter AGS-AIT-001 for the following*:
         (1) *Analytical element AGS-AE-001 for measuring influent total suspended solids*.
   5. AGS Basins:
      a. AGS Basin No. 1:
         (1) Basin No. 1 Influent Valve A AGS-VLV-101:
            (a) Motor actuated valve with open/close service.
         (2) Basin No. 1 Influent Valve B AGS-VLV-103:
            (a) Motor actuated valve with open/close service.
         (3) *Basin No. 1 Influent Flow Meter Transmitter AGS-FIT-101 for monitoring the following*:
            (a) *Basin No. 1 Influent Flow Meter AGS-FE-101*:
               i) Magnetic flow meter for measuring influent flow into the basin.
         (4) Basin No. 1 Thermal Mass Flow Meter AGS-FIT-101:
            (a) Measures process air flow to Basin No. 1.
         (5) Basin No. 1 Aeration Header Air Valve AGS-VLV-105 :
            (a) Motor actuated valve with modulating service.
         (6) Basin No. 1 Air Valve AGS-VLV-108:
            (a) Motor actuated valve with open/close service.
         (7) Basin No. 1 Air Valve AGS-VLV-109:
            (a) Motor actuated valve with open/close service.
         (8) Basin No. 1 Sludge Withdrawal Valve AGS-VLV-110:
            (a) Motor actuated valve with modulating service.
         (9) Basin No. 1 WLC Withdrawal Valve AGS-VLV-111:
            (a) Motor actuated valve with modulating service.
         (10) Basin No. 1 Level Indicating Transmitter AGS-LIT-101:
            (a) Submersible pressure transducers for measuring basin water level.
         (11) Basin No. 1 Analytical Transmitter AGS-AIT-110:
            (a) Transmitter/controller for monitoring the following basin probes:
               i) Analytical element AGS-AE-111 for measuring Ammonium (NH_4^+).
         (12) Basin No. 1 Analytical Transmitter AGS-AIT-120:
            (a) Transmitter/controller for monitoring the following basin probes:
               i) Analytical element AGS-AE-121 for measuring pH/Temperature.

ii) Analytical element AGS-AE-122 for measuring dissolved oxygen (DO).
iii) Analytical element AGS-AE-123 for measuring total suspended solids (TSS).
iv) Analytical element AGS-AE-124 for measuring oxidation-reduction potential (ORP).

b. AGS Basin No. 2:
(1) Basin No. 2 Influent Valve A AGS-VLV-201:
(a) Motor actuated valve with open/close service.
(2) Basin No. 2 Influent Valve B AGS-VLV-203:
(a) Motor actuated valve with open/close service.
(3) *Basin No. 2 Influent Flow Meter Transmitter AGS-FIT-201 for monitoring the following*:
(a) *Basin No. 2 Influent Flow Meter AGS-FE-201*:
i) Magnetic flow meter for measuring influent flow into the basin.
(4) Basin No. 2 Thermal Mass Flow Meter AGS-FIT-201:
(a) Measures process air flow to Basin No. 2.
(5) Basin No. 2 Aeration Header Air Valve AGS-VLV-205:
(a) Motor actuated valve with modulating service.
(6) Basin No. 2 Air Valve AGS-VLV-208:
(a) Motor actuated valve with open/close service.
(7) Basin No. 2 Air Valve AGS-VLV-209:
(a) Motor actuated valve with open/close service.
(8) Basin No. 2 Sludge Withdrawal Valve AGS-VLV-210:
(a) Motor actuated valve with modulating service.
(9) Basin No. 2 WLC Withdrawal Valve AGS-VLV-211:
(a) Motor actuated valve with modulating service.
(10) Basin No. 2 Level Indicating Transmitter AGS-LIT-201:
(a) Submersible pressure transducers for measuring basin water level.
(11) Basin No. 2 Analytical Transmitter AGS-AIT-210:
(a) Transmitter/controller for monitoring the following basin probes:
i) Analytical element AGS-AE-211 for measuring NH_4^+.
(12) Basin No. 2 Analytical Transmitter AGS-AIT-220:
(a) Transmitter/controller for monitoring the following basin probes:
i) Analytical element AGS-AE-221 for measuring pH/Temperature.
ii) Analytical element AGS-AE-222 for measuring DO.
iii) Analytical element AGS-AE-223 for measuring TSS.
iv) Analytical element AGS-AE-224 for measuring ORP.

c. AGS Basin No. 3:
(1) Basin No. 3 Influent Valve A AGS-VLV-301:
(a) Motor actuated valve with open/close service.
(2) Basin No. 3 Influent Valve B AGS-VLV-303:
(a) Motor actuated valve with open/close service.
(3) *Basin No. 3 Influent Flow Meter Transmitter AGS-FIT-301 for monitoring the following*:
(a) *Basin No. 3 Influent Flow Meter AGS-FE-301*:
i) Magnetic flow meter for measuring influent flow into the basin.
(4) Basin No. 3 Thermal Mass Flow Meter AGS-FIT-301:
(a) Measures process air flow to Basin No. 3.

(5) Basin No. 3 Aeration Header Air Valve AGS-VLV-305:
(a) Motor actuated valve with modulating service.
(6) Basin No. 3 Air Valve AGS-VLV-308:
(a) Motor actuated valve with open/close service.
(7) Basin No. 3 Air Valve AGS-VLV-309:
(a) Motor actuated valve with open/close service.
(8) Basin No. 3 Sludge Withdrawal Valve AGS-VLV-310:
(a) Motor actuated valve with modulating service.
(9) Basin No. 3 WLC Withdrawal Valve AGS-VLV-311:
(a) Motor actuated valve with modulating service.
(10) Basin No. 3 Level Indicating Transmitter AGS-LIT-301:
(a) Submersible pressure transducers for measuring basin water level.
(11) Basin No. 3 Analytical Transmitter AGS-AIT-310:
(a) Transmitter/controller for monitoring the following basin probes:
i) Analytical element AGS-AE-311 for measuring NH_4^+.
(12) Basin No. 3 Analytical Transmitter AGS-AIT-320:
(a) Transmitter/controller for monitoring the following basin probes:
i) Analytical element AGS-AE-321 for measuring pH/Temperature.
ii) Analytical element AGS-AE-322 for measuring DO.
iii) Analytical element AGS-AE-323 for measuring TSS.
iv) Analytical element AGS-AE-324 for measuring ORP.

d. AGS Basin No. 4:
(1) Basin No. 4 Influent Valve A AGS-VLV-401:
(a) Motor actuated valve with open/close service.
(2) Basin No. 4 Influent Valve B AGS-VLV-403:
(a) Motor actuated valve with open/close service.
(3) *Basin No. 4 Influent Flow Meter Transmitter AGS-FIT-401 for monitoring the following*:
(a) *Basin No. 4 Influent Flow Meter AGS-FE-401*:
i) Magnetic flow meter for measuring influent flow into the basin
(4) Basin No. 4 Thermal Mass Flow Meter AGS-FIT-401:
(a) Measures process air flow to Basin No. 4.
(5) Basin No. 4 Aeration Header Air Valve AGS-VLV-405 :
(a) Motor actuated valve with modulating service.
(6) Basin No. 4 Air Valve AGS-VLV-408:
(a) Motor actuated valve with open/close service.
(7) Basin No. 4 Air Valve AGS-VLV-409:
(a) Motor actuated valve with open/close service.
(8) Basin No. 4 Sludge Withdrawal Valve AGS-VLV-410:
(a) Motor actuated valve with modulating service.
(9) Basin No. 4 WLC Withdrawal Valve AGS-VLV-411:
(a) Motor actuated valve with modulating service.
(10) Basin No. 4 Level Indicating Transmitter AGS-LIT-401:
(a) Submersible pressure transducers for measuring basin water level.
(11) Basin No. 4 Analytical Transmitter AGS-AIT-410:
(a) Transmitter/controller for monitoring the following basin probes:
i) Analytical element AGS-AE-411 for measuring NH_4^+.
(12) Basin No. 4 Analytical Transmitter AGS-AIT-420:
(a) Transmitter/controller for monitoring the following basin probes:

i) Analytical element AGS-AE-421 for measuring pH/Temperature.
ii) Analytical element AGS-AE-422 for measuring DO.
iii) Analytical element AGS-AE-423 for measuring TSS.
iv) Analytical element AGS-AE-424 for measuring ORP.

e. The AGS Basins receive and treat influent wastewater. The basins include Equipment Supplier provided instrumentation and all required tank internals for a complete functional system.

6. Sludge Buffer Tanks:
   a. Sludge Buffer Tank No. 1:
      (1) Waste Sludge Header Valve AGS-VLV-511
         (a) Motor actuated valve with open/close service.
      (2) Sludge Buffer Tank No. 1 Level Transmitter AGS-LIT-510.
         (a) Submersible pressure transducers for measuring the Sludge Buffer Tank level.
      (3) Sludge Buffer Tank No. 1 Level Switches AGS-LSLL-510, AGS-LSL-510, and AGS-LSH-510.
         (a) Float level switches for tank level alarms and automatic shutoff of the Sludge Pumps and Supernatant Pumps in REMOTE AUTO.
   b. Sludge Buffer Tank No. 2:
      (1) Waste Sludge Header Valve AGS-VLV-521
         (a) Motor actuated valve with open/close service.
      (2) Sludge Buffer Tank No. 1 Level Transmitter AGS-LIT-520.
         (a) Submersible pressure transducers for measuring the Sludge Buffer Tank level.
      (3) Sludge Buffer Tank No. 1 Level Switches AGS-LSLL-520, AGS-LSL-520, and AGS-LSH-520.
         (a) Float level switches for tank level alarms and automatic shutoff of the Sludge Pumps and Supernatant Pumps in REMOTE AUTO.
   c. Sludge is wasted from the AGS Basins to the Sludge Buffer Tanks for gravity thickening and subsequent pumping of sludge and supernatant.
7. Supernatant Pumps:
   a. Supernatant Pump No. 1 AGS-PMP-610:
      (1) Horizontal centrifugal pump controlled by a VFD (by Others).
      (2) Associated with Sludge Buffer Tank No. 1.
   b. Supernatant Pump No. 2 AGS-PMP-620:
      (1) Horizontal centrifugal pump controlled by a VFD (by Others).
      (2) Associated with Sludge Buffer Tank No. 1 or Sludge Buffer Tank No. 2, dependent on position of manual pump valves and Operator selection at the Equipment Supplier HMI.
   c. Supernatant Pump No. 3 AGS-PMP-630:
      (1) Horizontal centrifugal pump controlled by a VFD (by Others).
      (2) Associated with Sludge Buffer Tank No. 2.
   d. *Supernatant Flow Transmitter AGS-FIT-601 for monitoring the following*:
      (1) *Supernatant Flow Meter AGS-FE-701*:
         (a) Magnetic flow meter for measuring supernatant flow from Sludge Buffer Tanks.
   e. Supernatant Pumps transfer supernatant from the Sludge Buffer Tanks to the AGS Influent Header after the sludge layer has been discharged to the Solids Processing Building.

8. Sludge Pumps:
    a. Sludge Pump No. 1 AGS-PMP-710:
        (1) Horizontal centrifugal pump controlled by a VFD (by Others).
        (2) Associated with Sludge Buffer Tank No. 1.
    b. Sludge Pump No. 2 AGS-PMP-720:
        (1) Horizontal centrifugal pump controlled by a VFD (by Others).
        (2) Associated with Sludge Buffer Tank No. 1 or Sludge Buffer Tank No. 2, dependent on position of manual pump valves and Operator selection at the Equipment Supplier HMI.
    c. Sludge Pump No. 3 AGS-PMP-730:
        (1) Horizontal centrifugal pump controlled by a VFD (by Others).
        (2) Associated with Sludge Buffer Tank No. 2.
    d. Sludge discharge header Analytical Transmitter AGS-AIT-701 for monitoring the following probes:
        (1) Sludge discharge header Analytical Element AGS-AE-701 for measuring TSS.
    e. *Sludge Flow Transmitter AGS-FIT-701 for monitoring the following*:
        (1) *Sludge Flow Meter AGS-FE-701*.
            (a) Magnetic flow meter for measuring waste sludge flow from Sludge Buffer Tanks.
    f. Sludge Pumps transfer thickened sludge from the Sludge Buffer Tanks to the Solids Processing Building.
9. Water Level Correction (WLC) Tank:
    a. WLC Tank Level Transmitter AGS-LIT-801.
        (1) Submersible pressure transducers for measuring the WLC Tank level.
    b. WLC Tank Level Switches AGS-LSLL-801, AGS-LSL-801, and AGS-LSH-801.
        (1) Float level switches for tank level alarms and low water cutoff of the WLC Pumps.
    c. WLC is transferred from the AGS Basins to the WLC Tank for reprocessing through the Treatment System.
10. WLC Pumps:
    a. WLC Pump No. 1 AGS-PMP-810:
        (1) Horizontal centrifugal pump controlled by a VFD (by Others).
    b. WLC Pump No. 2 AGS-PMP-820:
        (1) Horizontal centrifugal pump controlled by a VFD (by Others).
    c. *WLC Return Flow Transmitter AGS-FIT-801 for monitoring the following*:
        (1) *WLC Return Flow Meter AGS-FE-801*:
            (a) Magnetic flow meter for measuring WLC return from WLC Tank.
    d. WLC Pumps transfer liquid from the WLC Tank to the AGS Influent Header.
11. Aeration Blowers:
    a. Aeration Blower No. 1 AGS-BLOW-910.
        (1) Rotary lobe blower package controlled by a VFD (by Others).
    b. Aeration Blower No. 2 AGS BLOW-920.
        (1) Rotary lobe blower controlled by a VFD (by Others).
    c. Aeration Blower No. 3 AGS-BLOW-930.
        (1) Rotary lobe blower controlled by a VFD (by Others).
    d. Aeration Blower No. 4 AGS-BLOW-940.
        (1) Rotary lobe blower controlled by a VFD (by Others).
    e. Aeration Blower No. 5 AGS-BLOW-950.

(1) Rotary lobe blower controlled by a VFD (by Others).

f. Aeration Header Pressure Transmitter AGS-PIT-901:

(1) Pressure transmitter used for monitoring common aeration header pressure.

D. Description of Operation:

1. Equipment Supplier shall provide complete control system for integrating all process equipment, instrumentation, and required control sequences for complete operation of the Treatment System. The following descriptions of operation are not intended to be complete. Equipment Supplier shall incorporate functionality described herein and coordinate with Design Engineer on any items that conflict with ability of Equipment Supplier control system to perform properly.

2. AGS Basin Feed System:

a. Equipment Supplier shall develop operating sequences for controlling AGS Basin Influent Valves based on influent conditions and historical treatment performance.

b. When transitioning influent feed to a subsequent AGS Basin, the programming shall not allow the previous AGS Basin Influent Valve to close until the current AGS Basin valve is confirmed. For example, if the control system is transitioning between AGS Basin No. 1 and AGS Basin No. 2, the following sequence shall be considered:

(1) AGS Basin No. 2 Influent Valve A AGS-VLV-201 shall be called to open. Once confirmed open, AGS Basin No. 1 Influent Valve A AGS-VLV-101 shall be called to close.

c. AGS Influent Valve Automatic Rotation

(1) The two (2) AGS Influent Valves associated with each AGS Basin shall be programmed in a Duty and Standby configuration.

(2) The Duty valve shall be automatically opened and closed as needed per the Equipment Supplier's control requirements.

(3) The Duty valve shall operate as the control valve for an adjustable number of hours prior to automatic alternation of the Influent Valves. The timer shall be adjustable by the operator and initially set at 168 hours.

(4) The Influent Valves shall be rotated automatically by the Equipment Supplier control system. Manual rotation of the Influent Valves shall also be available to the plant operator at the Equipment Supplier operator workstation.

(a) When the rotation timer elapses, the control system shall queue the rotation of the valves and perform the transition during the next influent cycle when both valves are in the open position. At the end of that cycle, the previous Standby valve shall transition to the Duty valve and close as required.

(5) The Standby valve shall be maintained open at all times during normal operation.

3. AGS Basin Cycle Times:

a. Equipment Supplier shall develop operating sequence for controlling all cycle times, including fill/draw phase, react phase (including aerated and non-aerated operation, as necessary), and settle / decant phase.

b. Equipment Supplier shall provide operator adjustable setpoints for process inputs, including DO, ORP, pH, TSS or other parameters that are assocaited with automatic control of air flow, cycle time, or settling time.

4. AGS Basin Air Flow Control and Blower Control:

a. Equipment Supplier shall include air flow control process for a common aeration header serving all reactors. Each reactor shall utilize the dedicated modulating Aeration Header Valve to deliver air as needed.
b. Blower Control:
    (1) Equipment Supplier shall provide complete control system for managing air flow to the AGS Basins.
    (2) The Aeration Blowers shall be capable of being controlled at the associated blower VFD or remotely by the Equipment Supplier control system when the LOCAL/OFF/REMOTE switch is in REMOTE.
    (3) Local Control:
        (a) When the blowers are in LOCAL control, starting, stopping, and speed adjustment shall be controlled at the associated VFD.
    (4) Remote Control:
        (a) When the blowers are in REMOTE control, starting, stopping, and speed adjustment shall be controlled from the Equipment Supplier main control panel (AGS-MCP-001) PLC.
        (b) When a run command associated with the blower is communicated to the VFD, the corresponding blower shall start and run. When a stop command associated with the pump is communicated to the VFD, the corresponding pump shall stop.
        (c) HMI screens shall be developed to allow the operators to select from the following modes of operation:
        (d) Remote Manual Control Mode:
            i) Starting and stopper of each of the blowers is initiated by the operator at the MCP OIT.
            ii) The operator shall set the speed as a percentage of full speed for each of the VFD controlled blowers.
        (e) Remote Automatic Control Mode:
            i) The control system shall automatically start, stop, and adjust the speed of the blowers based on DO, ORP, pH, ammonium, or other parameters as required by the Equipment Supplier to maintain process performance.
            ii) The blowers shall be configured in a four (4) Duty and one (1) Standby configuration. At Equipment Supplier's discretion, the blowers may be programmed to allow all five (5) blowers to operate simultaneously if recommended for process performance.
            iii) The blowers shall be rotated automatically by the control system. All available blowers shall be assigned a sequential priority. After each blower stop cycle, the stopped blower shall automatically be moved to the last priority assignment, with remaining blowers moving up one priority assignment.

5. AGS Water Level Correction (WLC) and Sludge Withdrawal:
    a. Equipment Supplier shall provide programming to automatically open/close/modulate the WLC and sludge withdrawal automatic valves as needed during the settling phase of the biological process.
    b. Valve percent open setpoints shall be developed by Equipment Supplier during commissioning and startup.
6. Sludge Pump Control:

a. Equipment Supplier shall provide complete control system for managing sludge withdrawal from the Sludge Buffer Tanks. All Sludge Pumps are configured to pump into a shared discharge header. Flow monitoring is available on the shared discharge header only.
b. The sludge pumping system is provided with one (1) common TSS analytical element installed on the common sludge discharge header.
c. The pumps shall be capable of being controlled at the associated pump VFD or remotely by the Equipment Supplier control system when the LOCAL/OFF/REMOTE switch is in REMOTE.
d. Local Control:
    (1) When the pumps are in LOCAL control, starting, stopping, and speed adjustment shall be controlled at the associated VFD.
e. Remote Control:
    (1) When the pumps are in REMOTE control, starting, stopping, and speed adjustment shall be controlled from the Equipment Supplier main control panel (AGS-MCP-001) PLC.
    (2) When a run command associated with the pump is communicated to the VFD, the corresponding pump shall start and run. When a stop command associated with the pump is communicated to the VFD, the corresponding pump shall stop.
    (3) HMI screens shall be developed to allow the operators to select from the following modes of operation:
    (4) Remote Manual Control Mode:
        (a) Starting and stopper of each of the pumps is initiated by the operator at the MCP OIT.
        (b) The operator shall set the speed as a percentage of full speed for each of the VFD controlled pumps.
    (5) Remote Automatic Control Mode:
        (a) The control system shall automatically start, stop, and adjust the speed of the pumps based on tank level, total suspended solids, and/or sludge discharge flow.
        (b) No more than one (1) pump shall be called to run at a time.
        (c) Sludge Pumps shall be shut off if low low level is reached in the associated Sludge Buffer Tank. Sludge Pump No. 2 shall shut off only if the tank it is assigned to reaches low low level.
    (6) Sludge Pump No. 2 (AGS-PMP-720) operation:
        (a) The HMI screen shall allow the operator to select the Sludge Buffer Tank with which the pump is associated. The allowable assignments shall be as previously defined in the System Components and Functions section above.
            i) A warning pop-up shall be programmed to ensure the operator has confirmed the manual valve changes for the selected pump assignment. The pop-up shall read as follows:
                a) "Warning: Pump assignment change requires operator confirmation of manual valve positions for intended usage! Are valve positions correct (YES) (NO)?"
                b) If "YES" is selected the assignment change shall be executed. If "NO" is selected the assignment change shall be ignored and remain unchanged.

(b) When two (2) pumps are assigned to one (1) Sludge Buffer Tank, the following automatical controls shall be additionally applicable to other automatic operations:
i) The two (2) pumps shall be programmed in a Duty and Standby Configuration.
ii) The pumps shall be rotated automatically by the control system or manually by the operator. Selections shall be made available on the OIT for enabling and disabling this function.
a) If automatic rotation is enabled, the pumps shall rotate Duty and Standby assignment ater each pump stop cycle.
b) If automatic rotation is disabled, the pumps shall rotate Duty and Standby assignment manually by the operator.

7. Supernatant Pump Control:
a. Equipment Supplier shall provide complete control system for managing supernatant withdrawal from the Sludge Buffer Tanks. All Supernatant Pumps are configured to pump into a shared discharge header. Flow monitoring is available on the shared discharge header only.
b. The pumps shall be capable of being controlled at the associated pump VFD or remotely by the Equipment Supplier control system when the LOCAL/OFF/REMOTE switch is in REMOTE.
c. Local Control:
(1) When the pumps are in LOCAL control, starting, stopping, and speed adjustment shall be controlled at the associated VFD.
d. Remote Control:
(1) When the pumps are in REMOTE control, starting, stopping, and speed adjustment shall be controlled from the Equipment Supplier main control panel (AGS-MCP-001) PLC.
(2) When a run command associated with the pump is communicated to the VFD, the corresponding pump shall start and run. When a stop command associated with the pump is communicated to the VFD, the corresponding pump shall stop.
(3) HMI screens shall be developed to allow the operators to select from the following modes of operation:
(4) Remote Manual Control Mode:
(a) Starting and stopping of each of the pumps is initiated by the operator at the MCP OIT.
(b) The operator shall set the speed as a percentage of full speed for each of the VFD controlled pumps.
(5) Remote Automatic Control Mode:
(a) The control system shall automatically start, stop, and adjust the speed of the pumps based on tank level, and/or supernatant discharge flow.
(b) No more than one (1) pump shall be called to run at a time.
(c) Supernatant Pumps shall be shut off if low low level is reached in the associated Sludge Buffer Tank. Supernatant Pump No. 2 shall shut off only if the tank it is assigned to reaches low low level.
(6) Supernatant Pump No. 2 (AGS-PMP-620) operation:
(a) The HMI screen shall allow the operator to select the Sludge Buffer Tank with which the pump is associated. The allowable assignments

shall be as previously defined in the System Components and Functions section above.

i) A warning pop-up shall be programmed to ensure the operator has confirmed the manual valve changes for the selected pump assignment. The pop-up shall read as follows:
   a) "Warning: Pump assignment change requires operator confirmation of manual valve positions for intended usage! Are valve positions correct (YES) (NO)?"
   b) If "YES" is selected the assignment change shall be executed. If "NO" is selected the assignment change shall be ignored and remain unchanged.

(b) When two (2) pumps are assigned to one (1) Sludge Buffer Tank, the following automatical controls shall be additionally applicable to other automatic operations:
   i) The two (2) pumps shall be programmed in a Duty and Standby Configuration.
   ii) The pumps shall be rotated autoatically by the control system or manually by the operator. Selections shall be made available on the OIT for enabling and disabling this function.
      a) If automatic rotation is enabled, the pumps shall rotate Duty and Standby assignment ater each pump stop cycle.
      b) If automatic rotation is disabled, the pumps shall rotate Duty and Standby assignment manually by the operator.

8. WLC Pump Control:
   a. Equipment Supplier shall provide complete control system for managing liquid withdrawal from the WLC Tank. All WLC Pumps are configured to pump into a shared discharge header. Flow monitoring is available on the shared discharge header only.
   b. The pumps shall be capable of being controlled at the associated pump VFD or remotely by the Equipment Supplier control system when the LOCAL/OFF/REMOTE switch is in REMOTE.
   c. Level switches associated with the WLC Tank will be incorporated into an external low water cutoff (LWCO) system to shut the WLC Pumps off if the low low level is reached.
   d. Local Control:
      (1) When the pumps are in LOCAL control, starting, stopping, and speed adjustment shall be controlled at the associated VFD.
   e. Remote Control:
      (1) When the pumps are in REMOTE control, starting, stopping, and speed adjustment shall be controlled from the Equipment Supplier main control panel (AGS-MCP-001) PLC.
      (2) When a run command associated with the pump is communicated to the VFD, the corresponding pump shall start and run. When a stop command associated with the pump is communicated to the VFD, the corresponding pump shall stop.
      (3) HMI screens shall be developed to allow the operators to select from the following modes of operation:
      (4) Remote Manual Control Mode:

(a) Starting and stopping of each of the pumps is initiated by the operator at the MCP OIT.
(b) The operator shall set the speed as a percentage of full speed for each of the VFD controlled pumps.

(5) Remote Automatic Control Mode:
(a) The control system shall automatically start, stop, and adjust the speed of the pumps based on tank level, and/or discharge flow.
(b) No more than one (1) pump shall be called to run at a time.
(c) The two (2) pumps shall be programmed in a Duty and Standby configuration.
i) The pumps shall be rotated autoatically by the control system or manually by the operator. Selections shall be made available on the OIT for enabling and disabling this function.
a) If automatic rotation is enabled, the pumps shall rotate Duty and Standby assignment ater each pump stop cycle.
b) If automatic rotation is disabled, the pumps shall rotate Duty and Standby assignment manually by the operator.

E. Setpoints and Ranges:
1. For air flow meters, level transmitters, and all analytical devices, Equipment Supplier shall provide a display of instrument range with measurement on HMI screens.

F. System Upsets and Procedures for Recovery:
1. If an abnormal system condition is detected, the control system shall alarm the operator via the operator workstation. Abnormal system conditions shall be as recommended by the Equipment Supplier and the following as minimum:
a. Analytical instrument measurement is out of normal operating range.
b. High level for each basin.
c. Low level for each basin.
d. Reverse flow.
e. Pump, valve, or blower failure.
2. System in Remote Automatic control mode:
a. If a low level is detected by either sludge buffer or water level correction basin level transmitter while the basin is in service, all associated pumps shall be called to stop pumping. The associated pumps shall be allowed to run when the level rises above the pump run setpoint.
b. If a low-low level is detected by either sludge buffer or water level correction basin level switch while the basin is in service, all associated pumps shall be called to stop pumping. The associated pumps shall be allowed to run if the level switch returns to normal state and the alarm is cleared at the operator workstation.
c. In the event a Duty pump becomes unavailable, fails to start, or drops off-line, the Standby pump in the starting sequence shall be automatically selected to operate as the lead pump.
d. In the event an influent valve fails or becomes unavailable, the available valve shall close and the reactor operation shall stop. The AGS control system shall alarm the operator via the operator workstation. The reactor shall be allowed to resume automatic operation after the operator has acknowledged the following message: “Has the malfunctioning influent valve been manually opened and locked out?” If the operator selects “Yes”, the available valve shall be selected as duty and the reactor processes shall restart. If the operator selects “No”, the reactor shall remain out of operation.

3. Unless otherwise specified, all equipment shall automatically restart after a power failure utilizing adjustable start delay timers in PLC control logic. Unless otherwise specified, all PLC control strategies shall be based upon automatic restart after a power failure and shall return to a normal control mode upon restoration of power. Monitoring of power failure shall be through the plant control system network communications.
    a. If operating prior to the power failure in automatic mode, the Aeration Blowers shall be sequentially restarted by the AGS control system. No more than one blower shall be started simultaneously. Operator adjustable time delays shall be programmed between the enabling of each blower to operate.

2.11 INSTRUMENTATION:

A. All instrumentation shall be as specified in Section 40 70 00. Provide instruments as specified herein and as shown on the AGS Instrument List provided as an Appendix to this Section.
B. All analytical instrumentation shall be manufactured by Hach, unless otherwise specified.
C. Temperature/pH Transmitter:
    1. Function: Continuously, measure, indicate, and transmit water temperature and pH of AGS Basin. Each temperature/pH transmitter shall be integrated with the Equipment Supplier PLC for monitoring, data recording, and process control.
    2. Provide one temperature / differential pH transmitter for each AGS Basin. The probe shall use two measuring electrodes to compare the process value to a stable internal reference. The sensor shall have a built-in preamplifier, and include an integral temperature sensor. The pH sensor shall automatically compensate measured values for changes in temperature.
    3. Temperature/pH instrument shall be provided with pole mount assembly and handrail support attachments. Equipment Suppler shall provide complete mounting and support assembly.
D. Dissolved Oxygen Transmitter:
    1. Function: Continuously, measure, indicate, and transmit dissolved oxygen (DO) concentration of AGS Basin. Each DO transmitter shall be integrated with the Equipment Supplier PLC for monitoring, data recording, and process control.
    2. DO probe shall be a continuous-reading probe utilizing luminescent sensor technology, and shall provide electrolyte-free operation without requiring sample conditioning.
    3. DO probe shall be provided with pole mount assembly and handrail support attachments. Equipment Suppler shall provide complete mounting and support assembly.
E. Level Transmitters/Switches:
    1. Function: Continuously measure, indicate, and transmit the level of water in each AGS Basin, Sludge Buffer Tank, and WLC Tank.
    2. Provide one (1) submersible pressure transducer for each reactor, sludge buffer basin, and water level correction basin as indicated. The transducers shall provide continuous level monitoring for each location
    3. Provide the transducers and accessories as follows:
        a. Transducer body shall be constructed of stainless steel.
        b. Loop-powered, 4-20mA signal output.
        c. Transducer model shall be Keller Levelrat or Engineer-approved equal.
        d. Provide a local display indicator within a NEMA 4X 304 SST enclosure as a complete and pre-wired assembly.
        e. Provide moisture-excluding bellows supplied loose for installation in the display indicator enclosure. The Contractor shall install the bellows in the enclosure per manufacturer recommendations.

f. All mounting and support materials shall be 304 stainless steel.
g. Equipment Supplier shall provide complete mounting and support assembly per recommendations, unless otherwise indicated. The Contractor shall be responsible for installing the mounting and support assembly per manufacturer recommendations, Specifications, and Contract Drawings.

4. Provide level switches as follows and as indicated:.
   a. One (1) level switch for each reactor.
   b. Three (3) level switches for each sludge buffer basin.
   c. Four (4) level switches for each water level correction basin.
   d. Level switch shall be float-type as specified in Section 40 70 00. Provide with the indicated mounting brackets and weight kits for locations indicated. Suspending float switches from support masts shall not be allowed.

F. Oxidation-Reduction Potential Transmitter:
   1. Function: Continuously measure, indicate, and transmit the ORP of the liquid in the AGS Basins. Each ORP transmitter shall be integrated with the Equipment Supplier PLC for monitoring, data recording, and process control.
   2. Provide one ORP probe per AGS Basin.
   3. ORP probe shall use two measuring electrodes to compare the process value to a stable internal reference. The sensor shall have a built-in preamplifier, and include an integral temperature sensor.
   4. ORP probe shall be provided with pole mount assembly and handrail support attachments. Equipment Suppler shall provide complete mounting and support assembly.

G. Ammonium Probe:
   1. Function: Continuously measure, indicate, and transmit the ammonia concentration of the liquid in the AGS Basins. Each nitrate probe shall be integrated with the Equipment Supplier PLC for monitoring, data recording, and process control.
   2. Provide one Ammonium Analyzer per basin.
   3. Ammonium probe shall be model HC-200NH, as manufactured by Horiba Process & Environmental.
   4. Ammonium probe shall be provided with pole mount assembly and handrail support. Equipment Supplier shall provide complete mounting and support assembly.

H. Orthophosphate Analyzer
   1. Function: Provide routine measurement, indication, and transmittance of orthophosphate concentration of the liquid in a common AGS effluent location. Each orthophosphate analyzer shall be integrated with the Equipment Supplier PLC for monitoring, data recording, and process control.
   2. Provide one Orthophosphate Analyzer to be installed in the UV Disinfection influent channel.
   3. The analyzer shall be an Phosphax sc Orthophosphate Analyzer, as manufactured by Hach. The analyzer shall include an ASA UV-resistant, lockable housing, rated to IP55. It shall feature automatic cleaning and calibration, and adjustable extensive self-diagnostics.
   4. Furnish one (1) Hach Filtrax sampling system to be installed for use with the Phosphax analyzer. The sampling system shall consist of a IP55 rated control unit with 120V power supply, submersible module holder and sample delivery hose. Sample hose shall be heated type that is powered from the control unit enclosure. Unit shall be provided with minimum 20 feet of heated suction tubing and 60 feet of heated discharge tubing.

I. Total Suspended Solids Probe:

1. Function: Provide routine measurement, indication, and transmittance of total suspended solids in each AGS Reactor and the discharge of the sludge pumping system. Each total solids probe shall be integrated with the Equipment Supplier PLC for monitoring, data recording, and process control.
2. Provide four (4) immersion-style total solids probes to be installed in AGS Basins No. 1 through No. 4, and one (1) pipe insertion-style total solids probe to be installed on the sludge discharge line.
3. The immersion-stype probes shall be Hach model TSS EX1 sc sensor. The insertion style probe shall be Hach model Solitax sc with wiper.
4. Each immersion-style probe shall be provided with pole mounting kit to be field mounted.
5. Each pipe-insertion-style probe shall be provided with installation armature and isolation valve to allow removal of probe from service. Equipment Supplier shall coordinate installation detail with Contractor.

J. Universal Controller Probe Modules:
1. AGS Basins:
   a. One (1) Hach SC1000 Multi-Parameter Universal Controller Probe Module shall be provided for each AGS Basin. The probe module shall receive input from each Hach instrument sensor provided in each basin.
   b. Each module shall be provided with a Hach SC1000 Display module provided in an IP65 enclosure.
2. Sludge Pumping:
   a. One (1) Hach SC4500 Universal Controller Probe Module shall be provided for use with the Solitax sc inline probe adajcent to the Sludge Pumps.
3. Effluent Sampling:
   a. One (1) Hach SC4500 Universal Controller Probe Module shall be provided for use with the Phosphax analyzer mounted in the UV Disinfection Building.
   b. Provide all required accessories for connection of Phosphax instrument to SC4500 Controller, including power junction box.
4. An analog output (4-20mA) card in the probe module shall provide analytical instrumentation signals to the PLC. Quantity of analog outputs per module shall be as required by the instrument and I/O lists. The probe module shall be provided in IP65 enclosure with corrosion resistant finish. Probe module shall include internal 125 VAC power supply and EEPROM memory back-up.

K. Universal Controller Probe Modules – Horiba:
1. One (1) Horiba HD-200NH transmitter shall be provided for each AGS Reactor Basin. The probe module shall receive input from each Horiba instrument sensor.

L. Air Flow Meter:
1. Function: Continuously measure, indicate, and transmit signals proportional to air flow being supplied to each AGS Basin. Each air flow meter shall be integrated with the Equipment Supplier PLC for monitoring, data recording, and process control.
2. Provide one (1) air flowmeter for each AGS Basin.
3. Air flow meter shall be thermal dispersion type, with 1/2-inch compression fitting fabricated of stainless steel and appropriate for pipe insertion into a 14” SCH STD carbon steel pipe. Equipment Supplier shall coordinate appropriate length of insertion probe with Contractor to ensure flow meter manufacturer requirements are met.
4. Each air flow meter shall be provided with integral transmitter. Refer to Contract Drawings for location of meter and transmitter.

a. Power supply to the transmitter shall be rated for 120Vac, single phase, 60Hz operation.

5. All cable fittings required for a complete installation to the transmitter shall be supplied.
6. Aeration piping design includes 24-feet of unobstructed straight pipe run upstream of flow meter and 12-feet of unobstructed straight pipe run downstream of flow meter. Flow conditioners shall not be used unless approved by Design Engineer.
7. Air flowmeter shall be Model ST51A as fabricated by Fluid Components International.
8. Air flowmeter shall be configured to allow mounting to sidewall of 14-inch aeration pipe.

2.12 SPECIAL TOOLS AND SPARE PARTS:

A. Provide the following spare parts at a minimum:
1. Refer to Section 43 11 13 for blower spare parts requirements.
2. Spare diffuser assemblies totaling a minimum of 3% of installed diffuser count.
3. Minimum ten (10) diffuser grid joint assemblies and couplings.
4. One (1) crimping tool.
5. One set of new and unused special tools required for installation, operation, and maintenance.
6. Provide electric motor actuator manufacturer recommended shelf spare parts to limit downtime following actuator failure.
7. One complete set of reagents/chemicals, calibration sets, and spare parts as specified for individual equipment items or instruments.
8. Provide one (1) spare, fully-programmed, and operation-ready PLC controller such that a malfunctioning controller may be replaced in-place and the AGS system will immediately resume operation.
9. Provide at least one (1) spare for each piece of PLC Equipment provided, including but not limited to:
   a. Power supply.
   b. Communications interface module.
10. Provide spare I/O cards in quantities corresponding to 10% (rounded up) of the total quantity of each type of card provided. At least one (1) spare shall be provided for each type of I/O card.
11. Two spare LED indicating lamps for each type and color used.
12. Two spare indicating light assemblies.
13. Provide ten (10) spare fuses of each type used including those used in power supplies, processor, and I/O cards.
14. Ethernet Switches: Provide one (1) spare of each type of switch used.

B. Provide a list of critical recommended and maintenance parts with pricing.
C. Provide prices for all replaceable parts associated with the Treatment System.
D. Guarantee availability of appropriate spare parts as listed above for a period no less than 20 years. If the company or product line no longer exists, the Supplier shall make provisions such that the Treatment System shall continue to operate at the spcified conditions using comparable equipment or products.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. The installing Contractor shall install the Treatment System in strict accordance with Equipment Supplier's instructions and recommendations. Equipment Supplier shall provide written instructions with their submittal on installation requirements.
B. The Equipment Supplier shall provide to the Purchaser a listing of Goods that require protection. Special storage, protection, and handling instructions shall be provided.
C. The Equipment Supplier shall supply all necessary control system addresses, control logic, and OIT screens in order for the Owner's System Integrator to program the plant control system operator screens, database, trends, reports, and alarms, as applicable.
D. Equipment Supplier shall provide a Certificate of Proper Installation to the Owner following installation to certify that the system (inclusive of all equipment specified herein) has been installed correctly.
E. Equipment Supplier shall coordinate exchange of information to the Owner's System Integrator to allow for integration of Treatment System into client SCADA system.

3.02 COMMISSIONING:

A. Refer to SECTION 01757 for additional commissioning requirements.
B. Once written Certification of Proper Installation has been issued, the Equipment Supplier shall coordinate with the Purchaser to perform functional testing of the Treatment System. It will be the responsibility of the Equipment Supplier to coordinate with the Contractor and Owner to arrange the times for testing and startup activities.
C. The Equipment Supplier shall check all valves, controls, and other devices to ensure they are functional and ready for performance testing.
D. The Equipment Supplier shall field calibrate all instruments and be responsible for integration with the Equipment Supplier software programming.
E. Commissioning shall not be considered complete until influent wastewater has been processed through the Treatment System and all equipment and instrumentation has been verified to be working properly.
F. The Equipment Supplier shall complete all commissoning to the satisfaction of the Contractor and Owner prior to commencing the Performance Test.
G. The purpose of commissioning shall be to demonstrate the effectiveness of the following AGS system components and features:
    1. Automatic flow control of the Treatment System, including proper transition between AGS Basins.
    2. Start and stop of air system, and modulation of air flow control valves to maintain operational parameters.
    3. Monitoring of operating data as allowed by Owner.
    4. All control functions.
    5. Operation of all monitoring instruments.
    6. Operation of all associated pumping systems for the sludge blend tank and water level correction tank.

3.03 PERFORMANCE TEST:

A. Following completion of commissioning, the installing Contractor shall conduct the Performance Test (PT) with supervision assistance provided by the Equipment Supplier.
B. Successful completion of the PT shall constitute Initial Acceptance and commence warranty.

C. The Equipment Supplier shall provide the IPT Report within 7 days of completion of the test period.
D. To perform the test, the Equipment Supplier shall assist with operation of the system continuously over a sixty (60) calendar day test period, and collect and summarize data to demonstrate that the system meets the performance test requirements as specified in the warranty.
E. Water quality sampling shall be completed by the Contractor for the PT period.
F. In all cases, compliance with the requirements of this specification shall be determined for each calendar day, and to successfully pass the test, the Treatment System must comply with the requirements for each of the 60 calendar days of the PT.
G. Successful completion of the PT shall be defined as 60 continuous calendar days of operation without a major failure in the system and demonstration that the Treatment System meets all performance requirements established herein. A major failure in the system is one that interrupts system operation for more than 1 hour.
H. If the Treatment System fails to successfully complete the PT, the Equipment Supplier shall have the option of repeating the test over a second 60-day period. All water quality testing during a second, or subsequent PT period shall be the responsibility of the Equipment Supplier. If the system fails to successfully complete the PT during the second test period, the Equipment Supplier shall prepare a written plan for modifying or supplementing the system to meet all test requirements. The Equipment Supplier shall submit the written plan within 7 calendar days after the second unsuccessful test period ends.
I. During the PT, the Owner shall have the option of collecting samples for independent analyses to confirm measurements and analyses conducted by the Equipment Supplier. The Contractor and Owner shall have the option of witnessing all testing performed by the Equipment Supplier. The Equipment Supplier shall notify the Contractor a minimum of two weeks in advance of testing.

3.04 MONITORED TEST PERIOD (MTP):

A. Compliance with the requirements for treatment capacity, and Treatment system effluent water quality use shall be determined during the Monitored Test Period (MTP).
B. The MTP shall begin immediately after successful completion of the PT.
C. Duration shall be 180 calendar days.
D. The Owner shall operate the plant during the MTP; however, the Equipment Supplier shall be allowed to provide onsite or remote assistance.
E. The Equipment Supplier is responsible for monitoring the operating conditions and performance during the MTP. The Owner shall be responsible for providing the Equipment Supplier access to plant data under agreed upon authorized window times. Additionally, the Owner shall be responsible for providing water quality testing data and transfer of logged process data to the Equipment Supplier.
F. The Equipment Supplier shall summarize the data at the end of the MTP and report the results in writing to the Contractor and Owner. The report shall include a narrative description, tables and graphs of influent and effluent water quality parameters, air flow, and flow rates for all monitored liquid streams to document the performance of the system. The Equipment Supplier shall submit the report within 30 days following the end of the MTP.
G. The Treatment System shall exhibit development of granulation by the end of the MTP. To be considered a granular sludge, ninety (90) percent of the sludge shall have a particle size greater than 200 um.

H. The Contractor and Owner may conduct their own monitoring and record-keeping during the MTP. Any monitoring and record-keeping data shall be provided to the Equipment Supplier if requested.

I. The following parameters shall be evaluated during the MTP to determine compliance with the Equipment Suppliers stated performance in the Bidding Documents and submittals. Penalties that shall be owed to the Owner by the Equipment Supplier are as described below.

1. Effluent Water Quality and Treatment Capacity: If the system fails to comply with the requirements for effluent water quality and treatment capacity as shown in Section 2.02 Biological System Design Criteria, the Equipment Supplier shall provide to the Purchaser a written plan of modifications to the Treatment System (such as repairing damaged components, replacing seals, complete replacement of components, etc.) to achieve compliance with the requirements. Upon implementation of the plan of modifications, the MTP shall recommence in its entirety.

3.05 ONSITE SERVICES:

A. The Equipment Supplier shall furnish qualified field personnel to observe and guide the installation, testing and placement of the Treatment System into successful operation. Trips in excess of those described below, which are required for placement of the Treatment System into successful operation shall be at Equipment Supplier's sole expense. The field personnel shall demonstrate experience with installation, start-up, and operation of Treatment Systems of comparable size, application, and complexity.

B. Equipment Supplier's Representative: In addition to the time necessary to complete the requirements established elsewhere within these Specifications, the Equipment Supplier's Representative shall also provide onsite services at times designated by the Owner, for the minimum person-days listed below. Equipment Supplier shall account for travel time outside of these days in their Proposal. The Equipment Supplier's Representative shall be a qualified individual who has previously provided onsite services for the installation, testing, and startup of identical unit processes at a minimum of one wastewater treatment plant of similar size.

1. Electrical/I&C
   a. 4 trips, 16 days. Includes 1 float trip.
   b. Approx. 3.5 days per reactor, 1 day for SB/WLC
   c. Includes:
      (1) Electrical/I&C checkout – aeration system, valves, instrumentation
   d. Electrical/I&C checkout – controller/PLC installation, wiring, phase checks
   e. Manufacture Standard SAT – Site Acceptance Testing – controller and PLC final checkout
2. Mechanical
   a. 4 trips, 16 days. Includes 1 float trip.
   b. Approx. 3.5 days per reactor, 1 day for SB/WLC
   c. Includes:
      (1) Mechanical checkout, dry – basin internal piping, aeration system, valves
      (2) Mechanical checkout – instrumentation
      (3) Mechanical checkout – clean water submerged
3. Process
   a. 4 trips, 16 days. Includes 1 float trip.
   b. Approx. 3.5 days per reactor, 1 day for SB/WLC
      (1) Includes:
      (2) Process startup, checkout
      (3) Process training, sampling, classroom & field instruction

(4) Seeding – oversight, process optimization

3.06 COORDINATION WITH THE SYSTEM INTEGRATOR:

1. The HMI screens associated with the AGS system shall be developed by the AGS System supplier.
2. The AGS System supplier shall coordinate with the System Integrator to establish HMI development standards to ensure the HMI screens developed by the AGS supplier and the System Integrator share the same typical graphics, faceplates, and function blocks to meet the project standards.
3. The System Integrator and AGS supplier shall work together to ensure required control and monitoring signals are communicated correctly between the AGS PLC and the plant PLCs.
4. The AGS system "AquaNereda Controller" shall be supplied by the AGS System Supplier in the form of a rack mounted host server. The server shall be installed and connected to the network by the SI. The AGS supplier shall be responsible for programming and configuration of the server. Coordination shall be provided for this work as required.
5. The System Integrator shall work with the AGS system supplier to establish communication with the aeration drive VFDs.
6. As a minimum the AGS system supplier and System Integrator shall participate in three web conferences setup by the System Integrator and attended by the Engineer to determine programming standards, verify proper application of the standards and coordinate communicated signals.
    a. The first web conference shall occur a minimum of one month prior to the System Integrator or AGS system supplier starting system development and shall serve to discuss development standards and develop an action item list for information needed to properly develop the systems.
    b. The second web conference shall occur one week prior to the AGS system supplier starting system development and shall serve as the meeting to communicate development standards to all parties.
    c. The third web conference shall occur after the oxidation system supplier has completed their initial screen development and PLC program and shall serve as a review meeting to verify that proper standards have been followed and proper points are being communicated.
    d. Follow up conferences shall occur as required during development and after initial development is completed to ensure the agreed to standards are being followed, discuss progress, verify communicated points and address any outstanding communication questions.

3.07 TREATMENT SYSTEM TRAINING:

A. Refer to SECTION 01664 for additional training requirements.
B. Training for the AGS system will take place at Aqua-Aerobic Systems, Inc. (AASI) in Loves Park, IL.
C. On-site training will take place at the Four Rivers Sanitation Authority (FRSA) in Rockford, IL.
D. Training sessions at AASI and FRSA will not conform to the format and content requirements specified in SECTION 01664 and must be approved by the Owner.
E. The Equipment Supplier shall furnish the services of qualified field personnel for 10 person-days to formally instruct the Owner's personnel on proper operation, installation, sampling,

cleaning, maintenance, and troubleshooting for the Treatment System. Time spent with the Owner's personnel during the functional testing and PT does not count toward the training requirements. The training provided by the Equipment Supplier shall be recorded by the Contractor (provide 2 DVD copies and 2 thumb drives containing video files) for further use by the Owner. Equipment Supplier shall cover the following topics at a minimum:

1. Process Overview
    a. Provide introductory training on Treatment System including:
        (1) Definitions.
        (2) Advantages.
        (3) Limitations.
        (4) Required pretreatment.
    b. Discuss the performance criteria, including treatment capacity, and water quality.
    c. Provide a detailed overview of the entire process and the purpose of each process component.
    d. Describe independent processes in detail.
2. Equipment and System Controls:
    a. OIT:
        (1) Provide training on the features and use of each OIT.
        (2) Summarize and demonstrate features provided on each control screen.
    b. Integration with plant controls:
        (1) Discuss fail-safe features, alarms, and integration of the Treatment System with other process equipment.
        (2) Discuss integration with the remainder of plant controls. The Purchaser can assist with this portion of the training.
    c. Local control:
        (1) Demonstrate/discuss use of local controls for each component.
    d. Instrumentation maintenance/calibration:
        (1) Provide "hands-on" training and discuss maintenance requirements as defined in the O&M manual for each unique instrument provided as part of this Procurement Agreement Document.
        (2) Demonstrate calibration of each type of instrument.
        (3) Review/identify documentation provided in O&M manuals
3. Operation:
    a. System Startup/Shutdown Procedures:
        (1) Discuss startup of the Treatment System and level of automation.
        (2) Provide detailed procedures for inspection during and after startup.
        (3) Discuss appropriate shutdown procedures.
        (4) Discuss automated shutdown procedures.
    b. Normal operation:
        (1) Provide detailed sample control screens demonstrating 'normal operation', and displaying the position of each valve during normal operation.
        (2) Discuss operational activities that must be conducted during normal operation to ensure proper operation of the system.
    c. Manual operation:
        (1) Describe/demonstrate operation of any components equipped with manual features.
    d. Typical Treatment Cycle:
        (1) Describe purpose of each treatment cycle.
        (2) Discuss process variables and monitoring aspects of each cycle.

(3) Conduct field observation of all system transitions.

4. Monitoring/Troubleshooting:
   a. Describe methods of troubleshooting process equipment.
   b. Discuss parameters considered critical when troubleshooting problems.
5. Inspection Procedures/Maintenance:
   a. Review inspection procedures for critical components
   b. Review routine maintenance requirements for the entire Treatment System and ancillary components.
6. Proper record keeping:
   a. Discuss the importance of record keeping.
   b. Discuss critical parameters to be monitored and recorded.
   c. Provide sample forms.
7. Interpretation of data relative to operation:
   a. Discuss methods for interpreting data and identifying operational problems based on recorded data. This shall include (but not be limited to) changes in the following parameters:
      (1) Sludge granule size.
      (2) Effluent total solids.
8. Discuss any deficiencies identified during PT.
9. Provide contact information (including the toll-free number) where Owner's personnel can obtain assistance with operation/maintenance issues that may arise.

3.08 LONG-TERM OPERATIONS ASSISTANCE:

A. Equipment Supplier shall provide monitoring and remote operations support for a period of one (1) year after successful commissioning of the Treatment System, at no cost to the Owner.

END OF SECTION 46 53 60

SECTION 46 66 00 – ULTRAVIOLET LIGHT DISINFECTION EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section includes the supply, delivery, installation, and commissioning of the inclined, open-channel low-pressure/low-intensity Ultraviolet (UV) Disinfection System as specified herein. Contractor shall supply all equipment, materials, and labor required for the installation and operation of the UV Disinfection System. Systems utilizing horizontal or vertical lamp configurations are unacceptable.

B. Related Work Specified Elsewhere.
   1. General Requirements: Division 1.
   2. Protective Coatings: Section 09 90 00.
   3. Process Control Panels and Hardware: Section 40 67 00.
   4. Electrical: Division 26.

1.02 REFERENCES:

A. Application Standards:
   1. American Welding Society (AWS):
      a. D1.1 – Structural Welding Code – Steel.
   2. American Society for Testing and Materials (ASTM):
      a. A743 – Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion-Resistant, for General Application.
      b. A276 – Stainless Steel Bars and Shapes.
   3. Insulated Cable Engineers Association (ICEA).
   4. Institute of Electrical and Electronics Engineers (IEEE).
      a. Publication 587.
   5. National Fire Protection Association (NFPA)
      a. NFPA 70: National Electrical Code
   6. National Electrical Manufacturers Association (NEMA).
   7. Underwriters Laboratories Inc. (UL).

1.03 SUBMITTALS:

A. Submit in accordance with Division 1.

B. Technical Submittal includes, but not limited to, the following:
   1. All submittal data shall be labeled in English units. All Drawings shall be drawn to scale, and text shall be in English.
   2. Submit drawings for the UV Disinfection System equipment and accessory equipment including principal dimensions and locations of fittings, electrical connections, electrical equipment, control panels, and remote monitoring equipment.
   3. Technical description of equipment.
   4. Plan and section drawings of proposed system with projected headloss at all specified flows. Headloss shall be represented based on a fixed weir level control. The resulting water level elevations at the fixed weir, downstream of the last UV bank, and upstream of first UV bank shall be clearly shown.
   5. Hydraulic calculations demonstrating compliance with the required hydraulic characteristics.
   6. All structural loads imparted onto the structure.
   7. Anchor bolt design calculations sealed by a Professional Engineer licensed in the state of Missouri.

8. Recommended spare parts list including guaranteed unit costs for five (5) years. The unit costs shall be the same for each year.
9. Material Safety Data Sheet (MSDS) for cleaning chemicals.
10. Submit calculations and Certified Testing Laboratory results indicating the UV Disinfection System can provide the design UV dose at the maximum design flow rate, specified lamp age, and specified UV lamp output. The bioassay shall be signed and sealed by a Missouri licensed Professional Engineer with relevant experience. Calculation package shall include, but not be limited to:
    a. Bioassay report summary
    b. Bioassay validated design UV dose
    c. Reactor retention time
    d. End of lamp life factor, including supporting documentation
    e. Quartz sleeve fouling factor, including supporting documentation
11. Certification of the UV-C output at 254 nm for the proposed lamp. The certification shall be performed by an independent testing laboratory and also certified by the lamp manufacturer. The certification shall include a graph indicating lamp output from 0 to 12,000 hours of operation.
12. Control schematics and wiring diagrams for power, control, and instrumentation that clearly indicate factory and field wiring requirements. All field wiring shall terminate on terminal blocks clearly marked with identification matching control schematics.
13. System control center, power distribution centers, and ballast enclosure elevation drawings showing construction and placement of operator interface devices and other elements.
14. Electric power requirements, wiring diagrams, schematics and datasheets for all electrical equipment and devices.
15. Panel layout including dimensions, bill of materials, and catalog data sheets. Provide power and control wiring diagrams and schematics to clearly show factor and field wiring.
16. Touch screen layouts (for each screen) subject to Engineer approval.
17. Control wiring diagram showing wiring into and out of the control panel and terminal landing points.
18. Functional description of internal and external instrumentation and controls to be supplied including list of parameters monitored, controlled, and alarmed.
19. Submit certification that proposed UV disinfection system will meet the specified *E. Coli* limits and UV dosage requirement(s).

C. Quality Assurance Submittal includes, but not limited to, the following:
1. Submit contact names, addresses, and telephone numbers of at least five (5) similar municipal wastewater installations having a capacity of 12.3 MGD or greater and that have been in operation for at least two (2) years. The systems shall be the same as those specified in Paragraph 2.02.A.
2. Submit maximum electrical demand (kW) for the proposed system at all current conditions and design conditions for 65% UVT, appropriate end of lamp life factor, and appropriate quartz sleeve transparency reduction factor. The appropriate end of lamp life factor and appropriate quartz sleeve transparency reduction factor in accordance with this specification.
3. Performance/disinfection guarantee including terms and conditions of the guarantee (see Article 1.06).
4. A statement indicating the Manufacturers understanding of the bonding and warranty requirements (see Article 1.06).

D. Operation and Maintenance Manual includes, but not limited to, the following:

1. Special shipping, storage, protection, and handling instructions including dimensions of each container or package shipped.
2. Recommended unloading method at project site including implement (e.g., forklift, etc.) and maximum container or package weight.
3. Manufacturer's printed installation instructions.

E. Certifications
1. Field performance test procedures.
2. Submit complete, signed report of results of field inspection, operation, adjustments, and tests. Include the Manufacturer's certificate that the equipment is ready for permanent operation and that nothing in installation will affect Manufacturer's warranty in any manner or render warranty null and void.

1.04 DELIVERY, STORAGE, AND HANDLING MATERIALS:

A. Equipment shall be shipped pre-assembled to the degree that is practicable.
B. Manufacturer shall provide storage instructions indicating specific requirements to ensure there is no damage to or deterioration of components.

1.05 QUALITY ASSURANCE:

A. All items of equipment specified herein shall be furnished by one Manufacturer. This Manufacturer shall have the responsibility of providing the equipment, accessories, installation supervision, and testing services required to provide a functioning system.
B. Like items of equipment provided hereunder shall be the end products of one Manufacturer to achieve standardization for appearance, operation, maintenance, spare parts, and Manufacturer's service.
C. Products used in the Work of this Section shall be produced by the Manufacturer regularly engaged in the manufacture of inclined, open-channel, UV light disinfection systems for municipal wastewater of at least 12.3 MGD for a minimum of five (5) years and with a history of successful installations.

1.06 WARRANTY AND PERFORMANCE/DISINFECTION GUARANTEE:

A. Warranty:
1. The lamps shall have a 100% replacement term (including materials and shipping) of 8,760 operational hours. This warranty is required regardless of whether it is the manufacturer's standard.
2. The manufacturer shall warrant that all Equipment shall be free of defects caused by faulty material or workmanship and shall replace those parts for at least a period of one (1) year from the date of start-up.
3. In the event that the equipment fails to perform as specified, the manufacturer shall promptly repair or replace the defective equipment at no additional cost to the Owner.
4. Multiple warranties for individual components not shall not be acceptable, unless specified otherwise.

B. Performance/Disinfection Guarantee:
1. The Manufacturer shall guarantee that the proposed UV disinfection system will produce an effluent that meets or exceeds the requirements of this specification regardless of the *E. Coli* concentration entering the disinfection process. The effluent quality exiting the UV system must be equal to or better than the specification requirements. The guarantee shall be applicable for a duration of twenty (20) years from the date of startup as long as the wastewater flow and quality remain in the range(s) specified in Paragraph 2.03.

2. In the event that the equipment is not meeting the guaranteed performance requirements specified, alter the equipment to meet the guaranteed performance requirements. All costs associated with modifications shall be done by the Manufacturer. Upon modifying the equipment, the performance verification tests must be repeated. All costs associated with the retesting, including Engineer's cost, shall be borne by the Manufacturer.
3. If the equipment has not demonstrated compliance with performance requirements stated herein within 150 days following start-up of the equipment, the manufacturer shall replace all equipment and ancillary devices specified with the affected equipment (including costs for demolition, removal, and installation of new equipment). Replaced equipment will be returned to, and be the property of the manufacturer. All costs associated with the modifications will be the responsibility of the manufacturer.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. The following Manufacturers are acceptable and the minimum equipment requirements that are allowed to meet the specified performance include:
   1. Trojan Technologies, Inc., UVSigna.
   2. Wedeco, Duron.
   3. Engineer-approved equal.

B. Since the Manufacturer is ultimately responsible for meeting the specified performance requirements, if based on historic performance and testing, the Manufacturer requires additional equipment than the minimum specified to meet the performance requirements, then the Manufacturer shall be required to propose and bid such additional equipment. In no case shall the Manufacturer propose and bid less than the minimum equipment specified.

C. By listing a specific Manufacturer, the Owner and Engineer do not unconditionally accept that the minimum equipment specified is capable of achieving the performance requirements specified. The Manufacturer is responsible for bidding, supplying, and demonstrating the equipment required to meet the performance requirements.

2.02 GENERAL REQUIREMENTS

A. The UV Disinfection System shall inactivate E. coli in the treatment plant effluent by irradiation with UV light.

B. The UV Disinfection System shall include all equipment shown on the Contract Drawings and as specified herein. The system shall include, but not be limited to, the following equipment:
   1. UV germicidal lamps and electronic ballasts.
   2. UV transmitting sleeves.
   3. UV lamp enclosures (banks or modules).
   4. UV intensity monitor(s).
   5. Low level probe(s).
   6. Power distribution enclosure(s).
   7. UV Disinfection System control center(s).
   8. On-line UVT analyzer.
   9. Lifting Device (if required).
   10. All items necessary for complete assembly.
   11. All appurtenances and safety devices required for proper operation.
   12. Spare parts as required for the complete installation and operation of the system.

2.03 DESIGN REQUIREMENTS (EFF-UV -1, EFF-UV-2, EFF-UV-3, EFF-UV-4):

A. Each channel (Channel 1 = EFF-UV-1, EFF-UV-2) (Channel 2 = EFF-UV-3, EFF-UV-4) shall be sized for the following Design Flow Conditions:
   1. Design Flow Conditions:
      a. Average Daily Flow: 4.6 MGD (with two total banks in service).
      b. Maximum Month Flow: 8.0 MGD (with two total banks in service).
      c. Peak Hourly Flow: 12.3 MGD (with four total banks in service).
      d. Future Peak Hourly Flow: 30.0 MGD (with two channels in service, no redundant banks).

B. Design Water Quality:
   1. Total Suspended Solids: ≤30 mg/L.
   2. BOD_5: ≤30 mg/L.
   3. UVT @ 254 nm: ≥65%.
   4. Effluent Temperature Range: 40 to 80ºF.

C. Design Effluent Quality:
   1. Active *E.Coli*:
      a. < 1,030 / 100 mL (Weekly Geometric Average: October – April)
      b. < 206 / 100 mL (Monthly Geometric Average: April – October)

D. Minimum Equipment Requirements:
   1. Number of Channels: 2
   2. Number of Banks per Channel: 2

E. Water Level Control:
   1. Type: suppressed (finger) weir to be provided by UV system Manufacturer.

F. Design Approach:
   1. The delivered UV dose of the system shall be >30 mJ/cm^2 as measured in the effluent with a maximum UV transmission of 65%.
   2. An independent, third-party bioassay shall be used to verify that for the design UVT and peak flow per lamp, the UV system will deliver the target dosage.
      a. The Manufacturer shall submit supporting independent third-party documentation consistent with one of the following protocols:
         (1) National Water Research Institute's Ultraviolet Disinfection Guidelines for Drinking Water and Water Reuse (May 2003)
         (2) NSF International, the Public Health and Safety Company, 40CFR35.6450 Environmental Technology Verification Protocol
         (3) USEPA Design Manual: Municipal Wastewater Disinfection, EPA/625/1-86/021 (1986).
         (4) USEPA Ultraviolet Disinfection Guidance Manual for the Final Long Term 2 Enhanced Surface Water Treatment Rule, 815-R-06-007.
      b. Design end of lamp life factors and quartz sleeve fouling factors shall be verified by an independent, third testing organization using current protocols issued or approved by the National Water Research institute.
   3. The headloss through the channels with all restrictions factored shall be equal to or less than 0.5 feet at 12.3 MGD. The headloss includes channel baffles, UV banks or modules (including lamps and framework), any other equipment or restrictions, which may be required. The headloss does not include the water level variation associated with the water level control device (i.e., weir).

2.04 MATERIALS:

A. All metal components in contact with the effluent shall be Type 304 or 316 stainless steel.
B. All wiring exposed to UV light shall be Teflon or Polyurethane coated.

C. All material exposed to UV light shall be Type 316 stainless steel, Type 214 quartz, Teflon, Polyurethane, or Viton.

2.05 UV LAMPS:

A. Lamps shall be low-pressure mercury amalgam donated, low intensity type.
B. Low pressure-low intensity UV lamps and systems with no variation capability of the UV energy shall not be permitted.
C. Skin temperature of the UV lamp shall not exceed 130° C.
D. The filament shall be clamped design, significantly rugged to withstand shock and vibration.
E. Lamp life shall be guaranteed for a minimum of 8,760 hours at full power.
F. Electrical connection shall be at one end through a PTFE connector.
G. Lamp bases shall be of a metal and ceramic construction resistant to UV and ozone.
H. Maximum allowable lamp output after 100-hour burn in period (subject to certification by independent testing laboratory):
    1. 1000 watts.
    2. Lamp output shall be average maximum and not peak maximum.
    3. Lamp output shall not fluctuate more than 3% due to water temperature variations between 40-80ºF.

2.06 LAMP SLEEVES:

A. Lamp sleeves shall be Type 214 clear fused quartz circular tubing as manufactured by General Electric or equal.
B. Lamp sleeves shall be rated for a minimum UV transmission of 90 percent and shall not be subject to solarization over the useful life.

2.07 LAMP END SEAL AND LAMP HOLDER:

A. The open end of the lamp sleeve shall be sealed by means of a protective retainer cup designed with dual O-rings to seal and hold the sleeves in parallel alignment. The retainers shall remain in place to protect the quartz sleeve ends against accidental damage without impeding the removal and replacement of the UV lamps.
B. The lamp socket shall be centered against the inside of the quartz sleeve and shall be retained by a cap nut with a ribbed surface providing a positive handgrip for tightening/loosening without the need for any tools. The lamp and socket assembly shall be sealed independently from the quartz sleeve.
C. The lamp mounting and lamp connectors shall permit individual connection or removal under all of the following conditions.
    1. Lamp cable only, with UV lamp and quartz sleeve remaining in place.
    2. Lamp cable and UV lamp with quartz sleeve remaining in place.
    3. Lamp cable, UV lamp, and quartz sleeve.

2.08 LAMP ARRAY CONFIGURATION:

A. The lamp array configuration will be in a staggered inclined arrangement.
B. The single array pattern shall be continuous and symmetrical throughout the reactor.
C. The system shall be designed for complete immersion of the UV lamps including both electrodes and the full length of the lamp tube in the effluent. Both lamp electrodes shall operate at the same temperature and be cooled by the effluent.
D. To maximize performance and ensure safety, bank light locks will be used in each bank to prevent potential short circuiting over the top of the lamps.

E. For any UV inclined system that does not contain UV bank mechanical features to prevent short circuiting, the system shall be supplied with one additional UV bank to compensate for short-circuiting over the top of the lamps.

2.09 ULRAVIOLET LAMP MODULES OR BANKS:

A. Each UV bank shall consist of rows of UV lamps integrated into a 316 stainless steel frame with 316 stainless steel cover shields over the UV radiation area.
B. Each lamp shall be enclosed in its individual quartz sleeve, with the lamp end sealed by O-rings.
C. The ends of the lamp sleeve shall not protrude beyond the stainless-steel frame of the UV bank.
D. The UV bank or module shall be connected to the power distribution center by means of a multi-conductor cable with modular repairable quick disconnect for ease of removal.
E. Each UV bank or module shall be equipped with an automatic wiping and cleaning system. Cleaning shall take place while the bank or module remains in service.
F. The UV banks or modules shall be designed such that operating personnel at the plant can change the lamps and quartz sleeves without requiring special tools.
G. All lamp to ballast cables shall be provided by the UV manufacturer. All terminations shall be coordinated with the Contractor.

2.10 CLEANING SYSTEM:

A. An automatic wiping system shall be furnished. Wiping frequency shall have an adjustable number of strokes and an adjustable timer interval. Cleaning cycles shall be able to be initiated both automatically and manually. The wiping system shall be PLC controlled and fully automatic unattended operation. The cleaning system shall maintain uniform wiping tension and cleaning over complete wiping length of the quartz sleeve. The manufacturer shall guarantee performance of the cleaning system.
B. The wiped length of the quartz sleeve shall be no less than the complete arc length of the lamp.
C. The wiper blade brush or other cleaning device in contact with the quartz sleeve shall be non-metallic and shall not damage or scratch the quartz sleeve in any way.
D. All equipment necessary to power the mechanical wipers shall be provided by the manufacturer (i.e., hydraulic pumps, air compressors, air receivers, controls, etc.). This equipment shall include a NEMA 4X enclosure or be installed in the manufacturer-provided climate-controlled enclosure, and all air or hydraulic lines necessary to connect to the cleaning system. The maximum distance of the equipment from the cleaning system shall be 50 feet.
E. The automatic wiping system shall be equipped with a chemical feed system as designed by Manufacturer for cleaning if required.

2.11 WATER LEVEL CONTROL:

A. The Manufacturer will provide and install a fixed weir level control device (see contract drawings) to maintain water level in the channels.
B. One low-level sensor shall be included for each UV channel, provided by the Manufacturer. The level sensor shall be point level, conductivity type. Refer to Section 40 70 00 for requirements.
C. If the level sensor detects a low water level in any mode of operation, then all associated lamps shall be extinguished, and the operator shall be alarmed via HMI indication and I/O annunciation.

2.12 ELECTRICAL:

A. Electrical supply to UV system shall be as follows:
   1. Main control panel: 120Vac, 1 phase, 60Hz.
      a. SCCR: 22 kA.
   2. All other equipment: 480 volts, 3 phase, 3 wire.
      a. SCCR: 65 kA.

B. The power distribution panels shall have a single input circuit breaker rated at 480V, 3 phase.
   1. Circuit breakers shall be supplied with an external operator that allows system de-energization without having to open the panel.

C. Main control panel and components shall conform to Section 40 67 00. Provide a main input circuit breaker supplied with an external operator that allows system de-energization without having to open the panel.

D. The power distribution panels and control panel shall have Surge Protection Devices as specified in Section 40 67 00 – Process Control Panels and Hardware.

E. The UV disinfection system shall be supplied with all required power distribution and ballast panels, control panel and shall include all components for the power distribution, protection, regulation, control and monitoring.
   1. Manufacturer shall provide power distribution and control power transformers if required to provide a fully operational system.

F. The ballasts shall be electronic microprocessor controlled, high power factor type (0.95 or higher) designed for ease of maintenance and shall include the following features.
   1. Ability of automatic re-start attempts three times before giving a lamp failure indication to the monitoring system.
   2. Variable power settings adjustable manually or by means of the UV system PLC. Each bank shall have the ability to vary power output with a minimum range of 60% to 100%.
   3. Total harmonic current distortion shall not exceed 10% and total harmonic voltage distortion shall not exceed 5% measured at input terminals to UV system.

G. Provide electrical demand (kW) transducer to measure system output power. The UV system PLC shall monitor the demand and transmit to the Plant Control System.

H. Provide electrical enclosure in accordance with Section 40 67 00. NEMA ratings shall be as follows:
   1. NEMA 12 - System Control Center.
   2. NEMA 4X Stainless Steel - Hydraulic System Centers, and Power Distribution Centers.

I. If external ballasts are used, the Manufacturer shall provide a climate-controlled enclosure, including climate controls (i.e., temperature, humidity), in the equipment package as specified. Refer to Section 40 67 00 for requirements.

J. The Manufacturers equipment package shall include all electrical equipment necessary to convert the available power to the necessary voltage to operate the system (i.e., autotransformers).

K. Provide all required power, control, and instrumentation cables from the power distribution panel to each associated lamp bank and hydraulic system center.

2.13 UV DOSAGE CONTROL:

A. UV system input flow rate will be provided to the UV control system by the Plant Control System via the Ethernet network.

B. A submersible UV sensor shall continuously sense the UV intensity produced in each bank of UV lamp modules and shall only sense the germicidal portion of the light emitted by the UV lamps as measured at 254 nm. Sensors whose sensitivity to other wavelengths amounts to more than 5% of the total sensitivity shall not be allowed.

C. The UV disinfection system shall utilize the UV sensor and/or UVT analyzer output in conjunction with the UV system input flow rate to automatically control the UV system based on the applied UV dose.
D. The average UV dose shall be calculated using bioassay based on one of the approved third-party bioassay's method and be continuously displayed. Input data for calculation of UV dose shall include transmissivity, lamp fouling, lamp aging, and flow rate.
E. The UV intensity monitoring system shall be field or factory calibrated.
F. The sensor shall be automatically cleaned at the same frequency as the lamp sleeves.
G. Systems that utilize UVT for dose pacing shall include a continuous on-line UVT unit monitor to continuously and automatically track the transmissibility of the effluent at the 254 nm germicidal wavelength.
    1. Manually entering UVT values for dose pacing is unacceptable.
    2. The UVT unit shall include an automatic calibration sequence using 100% distilled water.
    3. The unit shall measure from 0 to 100% with an accuracy of ±1%.
    4. The UVT monitor shall be housed in a NEMA 4X enclosure.
H. The UV Control System shall modulate the lamp output in response to the effluent UV transmission.
I. UV Control System: The UV control panel shall contain all components for a fully functional system. All control panel components shall be completely factory wired. Control panel components and construction shall meet the requirements of Section 40 67 00 – Process Control Panels and Hardware or as listed below.
J. Control panels shall be PLC-based.
    1. PLC shall be Allen-Bradley CompactLogix as specified for vendor-supplied packaged control panels in Section 40 67 00.
K. The control panel shall contain an OIT for local control.
    1. Provide Allen-Bradley PanelView Plus 7 series as specified in Section 40 67 00. All manufacturer supplied graphics and applications shall be developed with FactoryTalk View Machine Edition.
    2. Operator interface shall be menu driven with automatic fault message windows appearing upon alarm conditions.
    3. The screens developed shall conform to ISA 101 "high performance" standards. High use of color and animation graphics will not be accepted.
L. Provide I/O surge suppressors for all I/O points to and from the control panel. See Section 40 67 00 for all requirements.
M. The UV control system shall include the necessary PLC I/O modules for all required equipment, including but limited to:
    1. Influent slide gate actuator for each channel
        a. Discrete Outputs:
            (1) Open
            (2) Close
        b. Discrete Inputs:
            (1) Opened
            (2) Closed
            (3) In-Remote
            (4) Common Alarm
    2. UV transmittance 4-20mA analog input

N. A System Inhibit signal shall be provided to each main control panel from the Plant Control System. The signals shall be communicated via the Ethernet/IP network. If an inhibit signal is received, all associated system equipment shall be prevented from running.

O. Effluent flow signal shall be provided to each main control panel from the Plant Control System. The signals shall be communicated via the Ethernet/IP network.

P. The UV control system shall communicate with the plant PLC via an Ethernet/IP network, all controller I/O shall be accessible via the Ethernet network to the Plant Control System, including but limited to:
   1. Bank Status
   2. Module Status (if required)
   3. Lamp Status
   4. UV Intensity/Transmissivity
   5. UV Dose
   6. Minor alarms, to indicate to plant operators that maintenance attention is required:
      a. Low UV intensity warning.
      b. Individual lamp failure.
      c. Low UV transmittance.
   7. Major alarms, to indicate an extreme alarm condition in which the disinfection performance may be jeopardized:
      a. Remote wiper system inoperable or inhibited (malfunctioned or blocked).
      b. Multiple lamp failure.
      c. Module or bank failure:
         (1) When a current leakage to ground occurs, or excess current draw.
         (2) If a module or bank is unplugged without first being placed in the OFF position.
      d. Low UV intensity.
      e. Low UV transmittance (for UVT dose pacing systems).
      f. Low UV dose.
   8. Run time of each bank shall be monitored and displayed.
   9. Start/stop cycle per bank shall be monitored and displayed.
   10. The system shall be capable of being placed in manual, auto, or off.
   11. Alarms shall identify the affected lamps by an address system and shall specify the lamp (i.e., Lamp No. ##). Individual lamp status shall be displayed on the operator interface.
   12. The following signals will be calculated at the plant PLC based on other inputs:
      a. Low UV Intensity/Transmissivity Alarm
      b. Low UV Intensity/Transmissivity Warning
      c. Low UV Dose

Q. The panel manufacturer shall provide a data/memory map to the project's systems integrator which includes all produced tags and coordinated IP addresses as required in order to enable communication between the control panel and the communication network.
   1. The manufacturer shall be responsible for programming and verifying the IP Addresses, Subnet, and Default Gateways, when applicable, for all devices on the network.
   2. The network IP addresses shall be defined and provided by the Systems Integrator based on the Ethernet Network TCP/IP Addresses provided later. Contractor to coordinate between Systems Integrator and Manufacturer accordingly.

R. The System Control Center shall cycle banks for equal wear and timed off to minimize bank cycling.

2.14 SPARE PARTS:

1. The following spare parts and safety equipment shall be furnished:
   a. 5% UV lamps.
   b. 5% ballasts.
   c. 5% lamp sleeves.
   d. 5% lamp sealing rings.
   e. 100% wiper housings and wiper rings.
   f. Forty (40) gallons of recommended cleaning solution (if required).
   g. Two face shields shall be provided to block UV light wavelength between 200 nm and 400 nm.
   h. Two pairs of gloves for handling UV lamps and sleeves.

B. The Manufacturer shall provide a lamp disposal program that includes accepting spent lamps at no cost to Owner. Owner shall pay for shipping costs for return of lamps to the Manufacturer.

2.15 ANCHOR BOLT ASSEMBLY:

A. Complete anchor bolt assembly (studs, nuts, washers, etc.) to be designed by the manufacturer and provided by the Contractor. Anchor material shall be 316 SST. Anchor size and embedment shall be clearly shown on the equipment drawings.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. The Contractor shall install equipment in conformance with the Manufacturer's written instructions.

B. The Contractor shall accurately place anchor bolts using templates furnished by the Manufacturer.

C. The Contractor shall coordinate and arrange with Manufacturer an appropriate time to verify and accept proper installation. Manufacturer shall provide certificate of proper installation to Contractor, Owner, and Engineer prior to performance testing.

3.02 FIELD QUALITY CONTROL:

A. Installation Check:
   1. The Manufacturer shall provide the services of a factory field engineer to initially check installation of the equipment, make electrical control panel modifications as necessary, and to place the equipment in service.
   2. The field engineer shall also be responsible for instructing operating personnel as to proper operational process and maintenance procedures.

B. Mechanical Startup Tests:
   1. After equipment is completely installed and the qualified representative of the Manufacturer has checked the installation and found it to be in accordance with the Manufacturer’s recommendations, a field mechanical startup test shall be performed by the Contractor with the assistance of the Manufacturer’s field representative. The Owner and Engineer will observe all tests. The date for the start of testing shall be set in mutual agreement with the Owner.
   2. All equipment shall be calibrated in the presence of the Engineer before and after the tests. Contractor and equipment manufacturer shall provide any information requested by the Engineer.
   3. All labor, materials, and test apparatus necessary for conducting the field acceptance test shall be furnished by Manufacturer at no additional cost.

3.03 PERFORMANCE AND DESIGN VERIFICATION:

A. Performance testing shall be conducted during startup at the project site to verify performance of the UV disinfection system and ensure compliance with this specification.
   1. At a minimum, the testing shall include a measurement of UV dose and influent/effluent *E. Coli* counts. The testing shall be at a minimum frequency of once every two hours for a duration of three days. All testing shall be completed during an eight-hour day shift.
   2. The Manufacturer is responsible for all costs associated with performance and design verifications with the exception of providing flow to the UV system, which will be provided by the Contractor.
   3. In the event the UV disinfection system does not meet the design criteria specified, the Manufacturer shall provide, at no cost, all equipment necessary to ensure compliance with this specification.

3.04 MANUFACTURER'S SERVICES:

A. Refer to Division 1.
B. The equipment shall be started by a manufacturer's representative, who shall certify to the Engineer that all equipment is properly installed and the plant operator has been instructed concerning proper operation and maintenance. Operator training shall include all items contained in the operation and maintenance manual.
C. Manufacturer's Authorized Representative: Present at work site or classroom designated by the Owner, for the minimum person-days listed below, travel time excluded.
   a. Two (2) person-days for installation assistance, inspection, and certification of installation.
   b. Two (2) person-days for testing.
   c. One (1) person-days for pre-startup classroom or job site training. Training shall include, at a minimum, proper operation, proper maintenance, troubleshooting, handling/disposal of lamps, safety, and calibration of instrumentation. The session shall also be attended by the local equipment manufacturer's representative.

END OF SECTION 46 66 00

SECTION 46 71 33 – ROTARY DRUM THICKENER EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY:

A. This Section covers design calculations, process guarantee, labor, materials, equipment, and incidentals required for delivery to the project site ready for installation, testing and startup for two (2) complete rotary drum thickener systems, with components and accessories, as specified herein.

B. The equipment package shall include:
   1. Two complete rotary drum thickeners (RDTs) with motors, drives, flocculation tanks, spare parts, sludge hoppers, and special tools.
   2. Each complete RDT package shall include a dedicated main control panel and a remote OIT control panel.
   3. Any additional equipment accessories not specified but that are required to achieve the minimum specified performance.

C. The RDT system will be served by three (3) Thin Sludge Pumps. Pump No. 1 will be dedicated to RDT No. 1, and Pump No. 3 will be dedicated to RDT No. 2. Pump No. 2 will be a swing pump capable of feeding either RDT. Thin sludge will be transferred from aerated Thin Sludge Storage Tanks. The RDT will be located in the Solids Processing Building. Construction materials shall be as specified and as required for corrosion resistance.

D. The specified equipment furnished under this section shall be fabricated, assembled, and tested in full conformity with the Specifications, engineering data, instructions and recommendations of the equipment Manufacturer.

E. Related Work Elsewhere:
   1. Painting and Coating: Section 09 90 00.
   2. Pressure Piping: Section 33 11 00.
   3. Process Control Panels and Hardware: Section 40 67 00.
   4. Instrumentation for Process Systems Section 40 70 00.
   5. Progressive Cavity Pumps Section 43 23 57.
   6. Rotary Lobe Pumps: Section 43 23 58.
   7. Common Motor Requirements for Water and Wastewater Equipment: Section 46 05 13.
   8. Polymer Preparation and Feed System: Section 46 33 33.

1.02 REFERENCES:

A. American Society for Testing and Materials (ASTM):
   1. ASTM A36 - Standard Specifications for Structural Steel.
   2. ASTM A48 – Standard Specifications for Gray Iron Castings.
   3. ASTM A120 – Standard Specification for Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless, for Ordinary Uses.
   4. ASTM A123 – Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   5. ASTM A167 - Standard Specifications for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
   6. ASTM A395 – Ferritic Ductile Iron Pressure Retaining Castings for Use at Elevated Temperatures.
   7. ASTM A500 – Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
   8. ASTM A536 – Ductile Iron Castings.
   9. ASTM D349 – Standard Test Methods for Laminated Round Rods Used for Electrical Insulation.

B. American National Standards Institute (ANSI):

1. ANSI B16.1 – Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800.

C. The Society for Protective Coatings (SSPC):
1. SSPC SP-10 – Near White Blast Cleaning.

D. National Electrical Manufacturers Association (NEMA):
1. NEMA MG-1 – Motors and Generators.
2. NEMA – Control Panel Enclosures.

E. American Welding Society (AWS).
F. American Gear Manufacturers Association (AGMA).
G. American Federation of Bearing Manufacturers Association (AFBMA).
H. Underwriters Laboratory (UL).
I. American Institute of Steel Construction (AISC).
J. Standard Methods for the Examination of Water and Wastewater.

1.03 SUBMITTALS:

A. Submit in accordance with Division 1.
B. All submittal data shall be labeled in English units. All Drawings shall be drawn to scale, and text shall be in English.
C. Submit contact names, addresses, and telephone numbers of at least two (2) similar municipal wastewater installations that have been in operation in North America for at least two (2) years. Referenced installations shall have RDT specifically designed for municipal thickening of waste activated sludge only (no primary or blended sludge).
D. Submit copies of process performance testing requirements and performance guarantee.
E. Manufacturer shall provide a statement indicating the Manufacturer's understanding of the warranty requirements.
F. Submittals shall include, but not limited to, the following:
1. Dimensional layout for RDT, flocculation tank, sludge hopper, bypass system components, and electrical components, including control panels.
2. Manufacturer's specifications.
3. Rated capacity for all components under anticipated operating conditions. Manufacturers that submit a RDT rated capacity not adequate per design requirements will not be accepted.
4. Fabrication and erection drawings.
5. Detailed equipment drawings.
6. Detailed equipment foundation drawing sealed by Missouri Licensed Engineer.
7. Parts listing.
8. Protective coating systems.
9. Electrical schematic control diagrams, wiring diagrams.
a. All diagrams shall be complete and have uniquely numbered terminals, wires and devices.
b. Control wiring diagram showing wiring terminations for all external connections.
c. External connection diagrams between plant and vendor control panels.
10. Process and instrumentation diagrams (P&IDs).
11. Control panel layout with devices and nameplates shown.
12. Motor nameplate data.
13. Performance Testing Program.
14. Operating weight of unit and load distribution.
15. Past performance test on sludge type being dewatered, that shows unit meeting performance requirement of this specification.
16. Bearing life calculations based on design load sealed by Missouri Licensed Engineer.

17. Catalog cut sheets for all electrical devices which completely indicate all electrical ratings.
18. Electronic and paper copy of the PLC operating program, control screens and complete documentation for approval and Owner's use in installation and integration with the plant control system.
19. Submit a complete list of all PLC I/O addresses used. Each address shall have description that completely identifies what the corresponding address represents, (i.e. "Drum Drive Speed") and what the status of this address corresponds to.
20. Written work plan for field erection.
21. Refer to Section 40 67 00 for additional submittal requirements pertaining to control panels.
22. Refer to Section 46 05 13 for additional submittal requirements pertaining to motors.

G. Operation and Maintenance Manuals.
   1. The manuals shall be prepared specifically for this installation and shall include all required catalog cuts, drawings, equipment lists, descriptions, and other information that is required to instruct operation and maintenance personnel unfamiliar with such equipment.
   2. Special shipping, storage, protection, and handling instructions including dimensions of each container or package shipped.
   3. Recommended unloading method at project site including implement (e.g., forklift, etc.) and maximum container or package weight.
   4. Manufacturer’s printed installation instructions.
   5. Descriptions of system components.
   6. Overview of RDT design that meet these Specifications, including, but not limited to:
      a. Feed capacity.
      b. Acceptable loading conditions.
      c. Design flow and total solids for thickener feed, filtrate, and thickened solids under design operating conditions.
      d. Typical polymer feed rates.
      e. Wash water supply requirements.
   7. Specific instructions for typical laboratory procedures for operation control testing or references to published sources of such instructions.
   8. Descriptions of process control systems.

H. Manufacturer’s Certificate of Proper Installation in accordance with Section 01757 - Commissioning.

I. Submit complete, signed report of results of field inspection, operation, adjustments, and tests. Include the Manufacturer’s certificate that, as a result of Manufacturer’s inspection(s), the Manufacturer’s equipment has been found to be ready for permanent operation and is installed in accordance with the Manufacturer’s instructions.

1.04 QUALITY ASSURANCE:

A. All items of equipment specified herein shall be furnished by one Manufacturer. This Manufacturer shall have the responsibility of providing the equipment, accessories, installation supervision, and testing services required to provide a functioning system.

B. Like items of equipment provided hereunder shall be the end products of one Manufacturer in order to achieve standardization for appearance, operation, maintenance, spare parts, and manufacturer's service.

1.05 DELIVERY:

A. Equipment shall be shipped pre-assembled to the degree that is practicable.

B. Manufacturer shall provide storage instructions indicating specific requirements to ensure there is no damage to or deterioration of components.

1.06 PERFORMANCE GUARANTEE:

A. Provide a written guarantee that the thickener shall meet the specified operating requirements described in PART 2.

B. The ability of the equipment to accomplish the results stipulated shall be determined by a performance testing program using laboratory tests by standard laboratory procedures as outlined in the latest edition of Standard Methods.

C. Performance testing program shall be as described in PART 3.

1.07 WARRANTY:

A. The manufacturer shall warrant that all Equipment shall be free of defects caused by faulty material or workmanship and shall replace those parts for at least a period of one (1) year from the date of start-up.

B. Multiple warranties for individual components shall not be acceptable.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

A. Materials, equipment, and accessories specified in this section shall be products of, or provided by:

1. FKC.
2. Parkson.
3. Andritz
4. JWC.

2.02 GENERAL:

A. The RDT shall thicken sludge by means of a rotating wedge-wire or perforated drum. The rotary drum thickener shall continuously receive and thicken sludge, passing filtrate through the openings in the drum. The thickened sludge shall be conveyed towards the discharge end of the drum. Thickened sludge will discharge at the end of the drum and be directed to an attached sludge hopper. The sludge hopper discharge shall consist of a 6-inch flanged connection.

B. Each rotary drum thickener shall be a complete thickening unit consisting of, but not limited to:

1. A structural frame, support structure.
2. A flocculation tank with variable speed mixer.
3. A thickening drum with variable speed drive.
4. An automatic drum wash system.
5. A drainage system.
6. Main Control Panel with PLC and OIT.
7. Remote Mounted OIT Control Panel.
8. All appurtenances required for the operation of the unit.

C. Primary control for the rotary drum thickner, and polymer preparation and metering system shall be through the rotary drum thickener control system. The RDT Control System will have

the ability to control all elements of the thickening process including: the Thin Sludge Pumps, flocculation tank, rotary drum thickener, polymer feed system, and wash water system.

1. The RDT Control System will interface with the polymer system local control panel for feed start/stop, system fail, metering pump feed rate, and polymer pacing rate via an Ethernet/IP communication link

D. All equipment shall be furnished by the manufacturer of the rotary drum thickener. The manufacturer shall provide a standard design, modified as necessary to meet the specifications herein.

E. The rotary drum thickener manufacturer shall be responsible for the proper operation and integration of all equipment provided under this Section.

F. The thickener shall be designed for disassembly of all components, including removal of rollers, and to provide accessibility for lubrication, inspection, mechanical adjustment, replacement of parts, and all other maintenance activities.

2.03 DESIGN AND PERFORMANCE CRITERIA:

A. Sludge Characteristics:

1. The wastewater treatment plant includes influent screening by 6 mm perforated plate screens, grit removal, and granular activated sludge biological treatment. Sludge from the biological treatment system is stored in the aerated Thin Sludge Holding Tanks prior to thickening.
    a. The rotary drum thickener system will be designed to receive waste sludge from the Thin Sludge Holding Tanks, with a total solids concentration between 0.5-2.0% wt.

B. Design Criteria:

1. Feed Sludge (Thin Sludge):
    a. Design Solids Loading: 1250 dry lbs/hr.
    b. Expected Feed Solids: 0.5-2.0%.
    c. Maximum Hydraulic Loading: 250 gpm.
    d. Minimum Thickener Solids Recovery: 95%.
    e. Minimum Thickened Solids Concentration: 5%.
2. Maximum Polymer Consumption: 14 lbs/dry ton solids based on 100% active product. Polymer consumption shall be determined by the quotient of the actual weight of polymer used/dry ton solids divided by the published % active product and the specific gravity of the emulsion.
3. Thickener Solids Recovery:
    a. Minimum 95% solids recovery with feed solids between 0.5-1.0% total solids.
    b. Minimum 97% solids recovery with feed solids between 1.0-2.0% total solids.
    c. Minimum 98% solids recovery with feed solids greater than 2.0% total solids.
4. Thickener shall be able to operate at a feed solids concentration up to 3.5% total solids at a reduced hydraulic loading rate.

2.04 MATERIALS OF CONSTRUCTION:

A. Materials used during manufacture of the RDT equipment shall be on the highest quality used in general commercial practice. Material shall be free from all defects and imperfections that may affect serviceability of the finished product. Used equipment, material, or parts will not be allowed.

B. Structural steel support members supplied by the rotary drum thickener manufacturer shall be 304L stainless steel.

C. Materials used shall conform to ASTM standards where such standards exist. Materials used shall be selected based on their continuous and successful use under similar service conditions.

D. Structural frames, plates, and shapes shall have a minimum thickness of 1/4-inch, unless otherwise specified. Bolts shall have a minimum diameter of 5/16-inch.
E. All wetted components, including, but not limited to, frames, flocculation tank, thickener cover, drain pans/trays, drain piping, wash piping, wash shower header and nozzles, and discharge hopper shall be fabricated of Type 304L stainless steel, or be of other, engineer-approved acceptable corrosion-resistant material.
F. All fasteners, pins, anchor bolts, washers and other hardware shall be Type 304L stainless steel.

2.05 SLUDGE CONDITIONING:

A. General:
1. The rotary drum thickener shall be furnished with a sludge conditioning system, designed to efficiently mix polymer with thickener feed sludge and to adequately condition the sludge for optimum thickener performance.
2. Sludge conditioning shall be initiated by injection of polymer through an injection ring located directly upstream of flocculation tank on the sludge feed piping. An additional polymer feed injection point is provided around 20-25-ft upstream of the flocculation tank. Sludge conditioning shall be completed in the flocculation tank upstream of the rotary drum thickener.
3. The manufacturer shall supply the polymer injection ring loose for installation by Contractor.
4. All wetted parts of the sludge conditioning system shall be constructed of 304L stainless steel.
   a. Aluminum shall not be acceptable.
5. All parts requiring regular maintenance, operational adjustment, lubrication or cleaning shall be readily accessible.
6. Components associated with polymer injection ring shall be hydrostatically tested by the manufacturer at the factory. Any components that associated with the polymer injection ring that exhibit leaking or decreases in pressure under field testing shall be repaired or replaced by the rotary drum thickener manufacturer at no additional cost to the Owner. Repaired systems shall be retested.

B. Polymer Injection Ring:
1. The injection ring shall have four separate injection points located 90 degress from each other for injection of polymer solution into the sludge feed piping.

C. Polymer Manifold:
1. The polymer manifold shall split the polymer feed line into four distinct injection lines for connection to the polymer injection ring.

D. Flocculation Tank:
1. The flocculation tank shall be constructed of 304L stainless steel throughout. The flocculation tank shall be self-supporting and shall have furnished stainless steel supports as required. The final dimensions of the concrete pad shall be coordinated during shop drawing review.
2. The flocculation tank will be designed for a hydraulic retention time of one (1) minute or greater under the design conditions specified herein.
3. The flocculation tank shall be equipped with a 6-inch flanged inlet connection located at or near the bottom of the tank, and a 6-inch outlet connection between the flocculation tank and rotary drum thickener. Final elevation of the inlet and oulet connection shall be coordinated during Submittal review.

4. The flocculation tank shall be supplied with a double vertical, flat blade impeller, mechanical mixer.
5. The mixer shall be equipped with a drive motor in accordance with Section 46 05 13.
   a. Provide two normally closed temperature switches embedded in each phase winding for high temperature protection. A high temperature detection shall be interlocked to prevent the VFD from powering the motor.
   b. Provide motor shaft grounding ring to discharge shaft currents to ground.
6. The mixer motor speed shall be adjustable with a manufacturer supplied VFD.
7. The top of the flocculation tank shall be covered with a removable, hinged access cover to allow regular inspection and maintenance. The access cover shall be facing south. Refer to drawings for orientation of floc tank.
8. Provide a point level switch with 2" NPT connection on tank lid for detection of high tank level. Manufacturer shall provide necessary equipment and recommendations for install to prevent false high level readings from splashing of liquid. Refer to Section 40 70 00 for other point level instrument requirements.Flocculation tank shall be connected to the rotary drum thickener in a manner that allows foul air to flow with the sludge to the hopper.

E. Thickener Distribution:
   1. The thickener inlet shall be designed to evenly distribute flow to the rotary drum thickener. Rods or bars that will trap stringy material shall not be used.

2.06 ROTARY DRUM THICKENER:

A. Main Structural Frame:
   1. The main structural frame shall be of electrical weld construction fabricated of 304 stainless steel structural members of sufficient design to support all components and accessories.
   2. The stainless steel frame shall be designed in accordance with the AISC Manual of Steel Construction, 15th Edition, ANSI/AISC 360-16, and AISC Design Guide 27 – Structural Stainless Steel, as applicable. Frame shall be designed for the loading from the equpiment under all possible opreations states, and for loadign as specified in ASCE 7-16.
   3. The structural frame shall be designed for installation on multiple 304L stainless steel legs anchored to a grout leveling pad with anchor bolts. The final dimensions of the stainless-steel support legs shall be coordinated during shop drawing review.
   4. Base frame disassembly shall not be required for removal of the drum or other mechanical components.
   5. No disassembled component, excluding the thickener frame, shall weigh more than 6,000 pounds. Lifting lugs shall be provided as necessary, but shall not restrict maintenance access points for the thickener.

B. Spray Shields/Cover:
   1. The drum shall be fully enclosed by removable spray shields located along each side of the thickener and a removable cover shall be mounted on the top. The cover hood shall be fabricated with handles to allow manual removal.
   2. The spray shields shall be designed to contain any fugitive spray and minimize mist emissions.
   3. The spray shields and cover shall be constructed of 304L stainless steel, with minimum 14-gauge thickness. Inspection doors shall be provided with neoprene seals around all openings to provide a water-tight fit. The thickener enclosure shall be equipped with a 6-inch diameter, flanged port on top of the cover to accommodate a future vent connection. A 6-inch blind flange and neoprene gasket shall be provided.

4. Manually removable doors or covers shall be equipped with handles and fastened with wing nuts, or another fastening system that allows for operator removal without special tools. If special tools are required for removal, manufacturer shall provide tools required for removal of doors or covers.

C. Rotary Drum System:
1. The drum shall be fabricated with a filter screen on the drum support structure, which rotates horizontally around a center feed assembly. The filter screen shall consist of stainless steel woven-wire mesh, wedge wire, or other filter material selected on the basis of porosity or percent openness, the opening size, and wire diameter used in the weaving process. The wire mesh, wedge wire, or other filter material shall be selected on the basis of maximizing flow and producing a high-quality filtrate.
2. The filter screen shall be changed from the drum support structure with simple tools. If special tools are required, manufacturer shall provide tools for complete disassembly of filter screen.
3. The rotary drum structure shall be constructed of 304L stainless steel.
4. The rotary system shall be equipped with internal mechanisms to influence shear, water release, and drainage rate independent of flow.
5. The inside of the drum shall have a series of angled flights welded to the interior to transport solids through the length of the drum.
6. Trunnion wheels, if required, shall be constructed of high-density polymer with an aluminum hub and dual-sealed, press fit steel tapered roller bearings. The bearings shall be lubricated by means of an external grease zerk and internal grease cavity located in the trunnion wheel shafts. The bearings shall remain sealed on the outer face with lubrication seals. Grease relief ports shall be provided to the exterior unit to confirm that proper lubrication of the bearing has been achieved.
7. The trunnion wheels shall be removable without the need for the drum to be removed from the unit. Cantilevered trunnion wheels shall not be allowed.
8. The drum may be constructed with a structural shaft along the centerline of the drum supported by pillow blocks and bearings on either end of the machine outside the process environment. The center shaft design shall not require internal trunnion wheels.
9. The rotary drum shall be equipped with a drive motor in accordance with Section 46 05 13.
    a. Provide two normally closed temperature switches embedded in each phase winding for high temperature protection. A high temperature shall prevent the VFD from powering the motor.
    b. Provide motor shaft grounding ring to discharge shaft currents to ground.
10. The rotary drum motor speed shall be adjustable with a manufacturer-supplied VFD.

D. Thickened Sludge Discharge Hopper:
1. Thickener manufacturer shall provide fully removable thickened sludge discharge hopper.
2. The thickened sludge hopper shall be constructed of minimum 14 gauge 304L stainless steel.
3. The structural design of the hopper, connections to the rotary drum thickener,and/or its floor supports shall be designed in accordance with the requirements for structural steel.
4. The hopper shall be designed to be supported off the rotary drum thickener frame, or with floor supports. At design conditions, the weight of the hopper and its contents shall not be transferred to the connected thickened sludge piping or pumps.

5. Hopper interior and exterior surfaces shall be smooth and free of sharp edges and burrs. All welds shall be ground smooth.
6. The discharge end of the thickener shall be supplied with covers which prevent splashing of thickened sludge outside of the hopper. The covers shall be hinged and gasketed to allow observation and inspection of the thickened sludge discharge.
7. The sludge discharge hopper shall be designed and fabricated by the thickener manufacturer. The discharge hopper shall be constructed with one (1) 6-inch diameter flanged connection at the bottom of the hopper to connect to the suction piping for thickened sludge pumps. The flanged connection at the bottom hopper shall be at an elevation approxiamtely 32 inches from finished floor. Final elevation shall be coordinated during Submittal review.
8. The discharge hopper shall be sized to provide adequate working volume for operating thickened sludge pumps without running dry.
9. At the top of discharge hopper, a conductive type point level switch for high sludge levels shall be provided. Manufacturer shall provide necessary equipment and recommendations for install to prevent false high level readings from splashing of sludge. During startup and commissioning, the switch on each hopper shall be field verified to function. Refer to Section 40 70 00 for other point level instrument requirements.
10. Thickener manufacturer shall provide one (1) minimum 2-inch flanged connections on discharge hopper for mouting of a hydrostatic pressure transducers. Manufacturer shall provide pressure transducer in accordance with requirements of Section 40 70 00.
11. Thickener manufacture shall provide one (1) 1 ½-inch NPT connection for a wash water connection on the discharge hopper.
12. Discharge hopper shall be designed to allow near-complete drainage through bottom flanged connections.
13. The final sizing and dimensions of the thickened sludge discharge hopper shall be coordinated during shop drawing submittal review.

E. Drum Wash System:
1. The washing system shall be designed to utilize:
    a. Process water (wastewater treatment plant effluent), supplied at a minimum pressure of 50 psig and maximum pressure of 75 psig.
    b. If wash water system requires a pressure greater than 75 psig, a booster pump shall be provided with the RDT system.
2. If necessary, design and supply for Contractor installation, a pressure reducing valve and 40 mesh strainer system.
    a. Pressure reducing valve shall be capable of reducing maximum potable water or plant service process water pressure to required pressure.
    b. Strainer shall be oversized to accommodate the flow equivalent to twice the normally required wash water flow. Strainer shall be easy to remove for inspection and maintenance cleaning.
3. The spray tube and nozzle assembly shall be readily removable.
4. Nozzle spacing and spray pattern shall be such that the spray patterns from adjacent nozzles overlap one another at the drum surface.
5. Wash water supply to the drum and sludge hopper shall each be automatically controlled with a dedicated manufacturer-supplied solenoid valve.
    a. Solenoid valve shall have minimum NEMA Type 4X enclosure, 120 VAC operation, and minimum Class F coil insulation.
    b. Solenoid valve shall be furnished with manual/bypass operators.

6. Spray header shall be fitted with stainless steel pressure gauge, liquid filled type with a 1/4-inch NPT back connection, 2-1/2 inches dial scaled at 0/160 psi.
7. Washing system shall include an adjustable flow or pressure switch that shall relay an alarm if the solenoid valves on the the wash water system fails and water can no longer be supplied to the spray header or sluge hopper.
8. All structrual components of the wash system shall be constructed of 304L stainless steel.

F. Filtrate Drainage:
1. A drainage pan shall be designed and attached to the structural frame underneath all elements of the rotary drum system and supporting frame. The pan shall be accessible for cleaning.
2. The drainage pan shall be constructed of 304L stailess steel. Drainage piping shall be corrosion resistant and rigidly secured to the frame.
3. Drainage pan shall be of adequate thickeness and have suitable reinforcement to not allow bending, creasing, or tearing from water loads during design conditions and from removing from the frame for service or access.
4. Delivery of collected filtrate water shall be by gravity through one 8-inch flanged pipe stub. Provide a 1-inch flange stub on the bottom of the filtrate drain pipe connection for sampling purposes.

G. Zero Speed Detection:
1. The rotary drive shall be provided with a zero-motion detector. In the event that movement is not detected, an alarm shall be relayed from the zero-motion detector.
2. The zero-motion detector shall be calibrated to operate between the minimum and maximum recommended speeds of the rotary drum system.

2.07 ROTARY DRUM THICKENER CONTROL PANELS:

A. Main Control Panel:
1. Two (2) main control panels shall be furnished in accordance with Section 40 67 00.
   a. Panel mounted combination main disconnect switch and circuit breaker shall be accessible without opening the door.
2. The control panels shall adhere to the following specifications:
   (1) Enclosure Rating: NEMA 12, painted steel, ventilated.
   (2) Voltage: 480 Volt.
   (3) Phase: 3 Phase.
   (4) Frequency: 60 Hz.
   (5) SCCR: 65 kA.
   (6) Mounting: Free Standing or Floor Mounted.
   (7) Logic: PLC.
3. Each Control panel shall contain all timers, starters, VFDs, switches, indicator lights, and other components necessary to operate the following equipment:
   (1) One (1) Flocculation Tank Mixer Motor.
   (2) One (1) RDT Drum Drive Motor.
   (3) One (1) Drum Wash System.
   (4) One (1) Hopper Flush Water System.
4. The point level switch control relays shall be installed within the associated main control panel.
5. Control panel shall be PLC based.
   a. PLC shall be Allen-Bradley CompactLogix according to Section 40 67 00.
6. The main control panel shall contain a door mounted OIT for local control.
   a. OIT shall be Allen-Bradley Panel View. Refer to Section 40 67 00.

b. All manufacturer supplied graphics and applications shall be developed with FactoryTalk View Machine Edition.
c. The screens developed shall utilize a "High Performance" design conforming to ISA 101.01 – Human Machine Interfaces for Process Automation Systems to provide situational awareness to the operator. HMI design and associated color schemes shall conform to those listed in Section 40 61 96 – 3.02 HMI STANDARDS AND SCREEN DEVELOPMENT.
d. In addition to controlling the Manufacturers equipment the supplied PLC and OIT shall be used for interfacing specified I/O with the Plant Control System screens.
(1) Coordinate with the Systems Integrator for exchange of the necessary I/O.
e. The RDT supplier shall provide a copy of the supplied OIT screens for use in the plant control system operator screens.
(1) Manufacturer shall provide the necessary coordination with the Systems Integrator to ensure a fully functional application for use in remote monitoring.

7. The RDT control panel PLC shall communicate with the plant control system PLC via an Ethernet/IP network, all controller I/O shall be accessible via the Ethernet network to the Plant Control System.
8. The control panel shall be supplied with a 480-120V control power transformer to provide power to 120V devices in the panel.
9. The control panel shall include provisions for connection of one (1) 120Vac, 20-Amp field supplied circuit and the internal derived 120Vac circuit from the specified 480V-120V CPT. The CPT derived circuit shall be used as "House" power for lights, fans, receptacles, etc. The field connected circuit shall be derived from the centralized UPS system and shall power all PLC, network, OIT, and control system related loads within the control panel.
10. The following devices shall also be provided in the control panel door at minimum.
a. Push-to-test Power On indicating light.
b. System Emergency Stop push button.

B. The control panel shall be supplied with applicable control relays and time delay relays with a minimum one extra normally closed and one extra normally opened contact is provided for each relay.

C. Remote OIT Enclosure:
1. Each RDT shall be supplied with a remote OIT enclosure for local control of the RDT equipment. The enclosure shall include the following as minimum:
a. Operator interface terminal mounted to the face of the enclosure.
b. Door mounted push-to-test control power indicating light.
c. Emergency stop push button.
d. Additional physical interfaces may be provided as recommended by the manufacturer.
e. Provide with the necessary 120Vac main circuit breaker, Power Supply, Terminal Blocks, OIT, and other internally mounted accessories as required.
f. Enclosure and all externally-mounted accessories shall be rated NEMA 4X SST. Refer to Section 40 67 00 - Process Control Panels and Hardware for enclosure requirements.

D. RDT System OIT:
2. All local operator interface with the rotary drum thickener shall be accomplished via an operator interface panel mounted in the face of the RDT Main Control Panel in

accordance with Section 40 67 00. Each RDT shall be provided with a Remote OIT Enclosure that can access the same functionality.

3. As a minimum, the following control functions shall be accessible via the OIT interface:
   a. System:
      (1) Alarm silence and reset.
      (2) Hand/Off/Auto selector switch.
      (3) Auto Start and Stop buttons.
      (4) System reset push button.
      (5) Emergency stopped indication.
      (6) Elapsed time meter.
   b. Washdown/Wash water System:
      (1) Hand/Off/Auto selector switch.
      (2) Cycle on indication.
      (3) Start and Stop (open) buttons.
      (4) Valve open indication.
      (5) Failure indication.
      (6) Low pressure alarm.
   c. Hopper water flush system:
      (1) Hand/Off/Auto selector switch.
      (2) Cycle on indication.
      (3) Start and Stop (open) buttons.
      (4) Valve open indication.
      (5) Failure indication.
   d. Rotary drum thickener:
      (1) Hand/Off/Auto selector switch.
      (2) Start and Stop buttons.
      (3) Speed adjustment.
      (4) Speed indication.
      (5) Thickener ready indicator.
   e. Flocculation tank:
      (1) Hand/Off/Auto selector switch.
      (2) Start and Stop buttons.
      (3) Running indication.
      (4) Speed adjustment.
      (5) Speed indication.
      (6) Alarm/failure indication.
   f. Polymer system:
      (1) Pump No. 1 selection.
      (2) Pump No. 2 selection.
      (3) Hand/Off/Auto selector switch.
      (4) Start and Stop push buttons.
      (5) Running indication.
      (6) Speed adjustment.
      (7) Speed indication (0-100%).
      (8) Alarm/failure.

E. The following I/O points will be read/write from others to the RDT control panel via an Ethernet/IP communication link. Each point shall be changeable via the OIT.
   a. Thickened Sludge Pumps:
      (1) Thickened Sludge Pump Remote Manual Start (Discrete).

(2) Thickened Sludge Pump Remote Auto Start (Discrete).
(3) Thickened Sludge Pump Off (Discrete).
(4) Thickened Sludge Pump Speed Control (Analog, 0-100%).

F. The following signal inputs will be provided by the RDT control panel to others via an Ethernet/IP communication link.
   a. System:
      (1) Emergency stopped indication (Discrete).
      (2) System failure (Discrete).
      (3) System Running In-Auto (Discrete).
   b. Washdown/Wash water System:
      (1) Low pressure alarm (Discrete).
   c. Discharge Hopper:
      (1) Level (Analog, 4-20mA)
      (2) High level alarm (Discrete).
   d. Rotary drum thickener:
      (1) In-Auto indication (Discrete).
      (2) Running indication (Discrete).
      (3) Common alarm (Discrete).
      (4) Zero speed alarm (Discrete).
      (5) Speed indication (Analog, 0-100%).
   e. Flocculation tank:
      (1) In-Auto indication (Discrete).
      (2) Running indication (Discrete).
      (3) Common alarm (Discrete).
      (4) High level alarm (Discrete).
      (5) Speed indication (Analog, 0-100%).
   f. Thin Sludge Feed:
      (1) Thin Sludge Pump Start/Stop (Discrete).
      (2) Thin Sludge Pump Speed Control (Analog, 0-100%).
   g. Polymer System:
      (1) Feed Pump No. 1 Start/Stop (Discrete).
      (2) Feed Pump No. 1 Speed Control (Analog, 0-100%).
      (3) Feed Pump No. 2 Start/Stop (Discrete).
      (4) Feed Pump No. 2 Speed Control (Analog, 0-100%).

G. The following signal inputs will be provided by others to the RDT control panel via an Ethernet/IP communication link.
   a. System:
      (1) System Inhibit.
         (a) Discrete signal which prevents all associated system equipment from running.
   b. Polymer system:
      (1) Feed pump run status.
      (2) Feed pump failure.
      (3) Feed pump in "AUTO" mode.
      (4) Feed pump motor overload.
   c. Thin Sludge Feed:
      (1) Thin Sludge Pump run status.
      (2) Thin Sludge Pump speed indication (0-100%).
      (3) Thin Sludge Pump failure.

(4) Thin Sludge Pump in "AUTO" mode.
(5) Thin Sludge Flow.
(6) Thin Sludge TS Concentration.

d. Thickened Sludge Feed:
(1) Thickened Sludge Pump run status.
(2) Thickened Sludge Pump speed indication (0-100%).
(3) Thickened Sludge Pump failure.
(4) Thickened Sludge Pump in "REMOTE" mode.
(5) Thickened Sludge Flow.
(6) Thickened Sludge TS Concentration.

H. The panel manufacturer shall provide a data/memory map to the project's systems integrator which includes all produced tags and coordinated IP addresses as required in order to enable communication between the control panel and the communication network.
1. The manufacturer shall be responsible for coordinating, programming, and verifying the IP Addresses, Subnet, and Default Gateways, when applicable, for all devices on the network.
2. The network IP addresses shall be defined based on the Ethernet Network TCP/IP addresses provided by the Systems Integrator.

2.08 RDT CONTROL SYSTEM DESCRIPTION OF OPERATION:

A. Each RDT control panel shall include a control system capable of independent operation.
B. Each rotary drum thickening system and associated components shall be started and stopped at the HMI by Hand/Off/Auto operation selection.
C. In general, each piece of equipment is provided with a Hand / Off / Auto switch. To operate the system from the Thickener HMI, all equipment should be placed in "AUTO". During normal operation, the switches will be left in the Auto position. There is a light indication for each item if it is running.
D. HAND Mode:
1. When any RDT equipment is in HAND control, starting and stopping of motors, the speed of motors, and opening and closing of valves shall be manually controlled at the control panel HMI.
E. AUTO Mode:
1. The following equipment shall be confirmed to be In-Auto before initiating the AUTO operation sequence:
a. Flocculation Tank Mixer Drive
b. Rotary Drum Thickener Drive
c. Wash Water Solenoid Valves
2. The following equipment shall be confirmed to be remotely available via the Plant Control System before initiating the AUTO operation sequence:
a. Thin Sludge Pumps
b. Polymer Feed System
c. Thickened Sludge Pumps
3. The rotary drum thickening control system AUTO mode shall be initiated at manufacturer control panel HMI.
4. Once the start sequence is activated, the Thin Sludge Pumps, Polymer Feed System, and the Flocculation Tank shall start.
a. The manufacturer provided PLC shall send a start command to Thin Sludge Pumps with the pump speed input selected via the PCS.

b. The manufacturer PLC shall send a start command the flocculation tank mixer. The flocculation tank speed is based on the user defined setpoint at the RDT control panel HMI.

c. The polymer feed system shall receive control signals from the RDT control panel via the PCS to initiate pump start and pump speed. The pump speed will be based on the user defined setpoint as a ratio of the sludge flow.

(1) When "Polymer Pacing Mode" is selected, the polymer pump speed shall be determined by the following equations to be included in the PLC:

(a) $$Neat\ Polymer\ Flow\ Rate\ (0-5gph) = Polymer\ Ratio\ \left(\frac{lbs\ active\ polymer}{DT\ of\ WAS}\right) * \frac{1DT}{2000\ lbs} * Influent\ Flow\ (gpm) * \frac{60\ minutes}{hour} * \frac{Influent\ Total\ Solids\ \left(\frac{mg}{L}\right)}{119826\ (conversion\ factor)} * \frac{1}{Specific\ Gravity * 8.34\frac{lbs}{gal}} * \frac{1}{Active\ Polymer\ Content\ (\%)}$$

(b) $$Polymer\ Pump\ Speed\ from\ RDT\ Control\ Panel\ (0\%-100\%) = \frac{Calculated\ Neat\ Polymer\ Flow\ Rate}{Pump\ Capacity\ at\ 100\%}$$

(c) $$Dilution\ Water\ Flow\ Rate\ (gpm) = Neat\ Polymer\ (gph) * \frac{1}{\%\ Polymer\ Diltuion} * \frac{1\ hr}{60\ minutes}$$

(2) In "Polymer Pacing Mode", the feed flow and total solids inputs into the control loops shall be relayed by 4-20 mA signals from the PCS to the RDT control system. There shall be an option in the RDT control system to manually input a total solids value (0-80,000 mg/L) for control rather than a communicated value from the PCS.

d. The rotary drum thickener shall start with the Thin Sludge Pumps, Polymer System, and Flocculation Tank. The speed of the thickener will be based on the user defined speed setpoint at the RDT control panel HMI.

e. The Thickened Sludge Pumps shall have the option to be operated independently from the rest of the system and shall operate based on level in the hopper. These pumps shall vary their speed to maintain the volume of solids in the discharge hopper based on the operator level setpoint.

f. The solenoid valve controlling wash water for rotary drum thickener shall open when the thickening is running.

5. The operator interface display shall have a readout of the following but not limited to:
   a. Neat Polymer feed rate (0-5 gph)
   b. % Speed of the rated capacity of the polymer feed pumps (0%-100%)
   c. Recommended dilution water flowrate for polymer feed system(gpm).
6. The submenu in the PLC shall have the following inputs but not limited to and shall be adjustable at the RDT control panel HMI:
   a. Active polymer ratio (0-14 lbs of active polymer / dry ton of solids)
   b. Polymer specific gravity (1.00-1.20)
   c. Active polymer content (0%-100%)
   d. Dilution water % (0-1%)
7. The rotary drum thickening control system and associated equipment shall have three options for shutdown, all of which are operator selected.
   a. Manual Shut-Off
      (1) The system shall stop when the "System Stop" is selected at the RDT control panel HMI.

b. Timed Shut-Off
   (1) The system shall stop after an operation timer has elapsed. Timer shall be adjustable from 0-24 hrs.
c. Totalized Flow Shut-Off
   (1) The system shall stop after an operator-adjustable, totalized thin sludge flow set point has been reached.

8. The normal shutdown sequence shall stop the sludge pump, polymer system and flocculation tank. The rotary drum thickener shall run for the additional time manually inputted and adjusted at the RDT control panel HMI (Thickener Shut-down Delay) and then set to off. The wash water solenoid valve for the rotary drum thickener shall automatically close when the thickener is off but shall remain on during the system clean out delay shutdown sequence. The thickened pump will continue to run until the volume in the hopper reaches the desired hopper level setpoint.
   a. When "Flush Mode" is enabled, the solenoid valve supplying wash water to the sludge hopper shall open after Thickener Shut-down Delay timer has elapsed.
   b. The solenoid valve shall close after an adjustable Flush Mode wash water timer has elapsed.

2.09 PAINTING:

A. All steel surfaces, excluding the structural frame and those specified to be stainless steel or galvanized, shall be completely painted in the shop with the protective coating normally recommended by the manufacturer for the service intended.
B. Provide field touch-up paint kit for each manufacturers coating system used.

2.10 SPARE PARTS:

A. Manufacturer shall provide a complete parts list, showing current price and anticipated delivery time for each part. Prices shall be held firm for at least one year after the date of equipment startup.
B. The manufacturer shall furnish recommended spare parts and special tools required to minimize rotary drum thickener system downtime. All tools and spare parts shall be packaged and labeled as to be clearly identified for their intended purpose and as labeled as spare parts.
C. One set (each) of any other parts recommended by manufacturer.
D. If specials tools are required for the service and maintenance of any component furnished by the rotary drum thickener system manufacturer, one complete set of special tools shall be provided.
E. All spare parts shall be in waterproof packages suitable for export service labeled with the description and parts number. Each item or set of parts expected to be installed at one time shall be individually packaged.
F. Furnish all required lubricants along with a maintenance schedule showing the required maintenance and frequency of maintenance for the first year of operation, including standard oils and grease, break-in lubricants, special lubricants, and required containers, pumps, hand pumps, or other devices necessary to store and apply the lubricants.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. The rotary drum thickener and accessory equipment as specified herein shall be installed as recommended by the manufacturer. Any additional power, piping or accessories recommended

by the thickener manufacturer shall be provided by the Contractor and shall be the responsibility of the Contractor.

B. Equipment delivered to the site in advance of installation shall be stored in accordance with the manufacturer's requirements and in accordance with the requirements of Division 1.

C. Factory representative shall be present when rotary drum thickener are initially moved into the Sludge Process Building and shall provide a written certificate of no machine damage upon completion of the move. The manufacturer shall coordinate all PLC programming with the installing contractor for verification and checkout of all I/O addressing prior to equipment startup.

3.02 PERFORMANCE TESTING:

A. After installation and prior to performance testing, the rotary drum thickeners shall be completely tested functionally in both AUTOMATIC and HAND modes. Included in the testing shall be a complete test of the PLC and interlock functions.

B. Performance tests shall be run to ensure that each rotary drum thickener perform as specified for peak loading conditions.

C. Performance testing shall be conducted to simulate peak solids and hydraulic loading, as permitted by field conditions. The rotary drum thickener shall be run at the maximum hydraulic loading rate as specified in this specification.

D. Performance testing shall establish the peak hydraulic flow rate, up to the rated capacity of the feed pumps, through the rotary drum thickener without degrading the thickener performance.

E. During the testing period, the rotary drum thickener shall be operated by the Owner's personnel under the direction of the supplier's field representative.

F. Performance testing shall include selection of optimal polymer and determination of optimal polymer dosing rate.

G. Testing period shall begin only after the manufacturer's field representative has instructed the Owner's personnel on equipment operation and the field representative confirms that these personnel are qualified to operate the equipment.

H. Testing period shall begin after the rotary drum thickener is in full operation.

I. Performance Testing:

1. Testing program shall consist of tests taken during a consecutive two-day period of operation. Duration of test each day shall be four hours.
    a. Samples shall be grab samples taken hourly during working day.
    b. Locations of where samples are to be taken shall be determined by the Engineer at the beginning of the testing program.
2. Laboratory tests shall be done by an Engineer-approved independent testing laboratory. Engineer shall receive a copy of laboratory test results direct from laboratory.
3. Laboratory tests shall be those required to determine if the design requirements specified in PARTS 2 and 3 are met.
4. Solids concentrations shall be based on total solids.
5. Chemicals and power supplied by Owner. Any other costs associated with the performance testing will be the responsibility of the Contractor.

J. Submit four copies of a written report of the results to the Engineer within 10 days after completion of the testing program. Report shall include all data required to calculate unit performance.

K. If the results of the performance tests are unsatisfactory, the Contractor shall make the necessary modifications to comply with the requirements at no additional cost to the Owner. After the modifications are made, the performance tests shall be repeated at no

additional cost to the Owner up to three times in order to meet performance requirements. If the results of the performance tests are unsatisfactory after three trials the Owner may at his option keep all or part of the performance withholding.

L. If the equipment fails to meet the requirements of the performance tests, the Contractor may, at his option, install equipment of another manufacturer in order to meet the performance tests. Any equipment changes and additional performance testing shall be done at no additional cost to the Owner.

M. Unsatisfactory performance shall be determined by Engineer based on written report and laboratory data of performance testing, for minimum thickened solids concentration, minimum solids recovery and polymer requirements as specified in PART 2.

N. Compliance with the performance requirements of these specifications will not relieve the Contractor from his responsibilities to supply a rotary drum thickener with the structural, mechanical and operational characteristics specified.

3.03 MANUFACTURER'S FIELD SERVICE:

A. Field service shall be provided by experienced representatives of the equipment supplier.

B. Services are to be provided:

1. As required during installation to ensure proper installation of the equipment. To include, but not be limited to, four (4) 8-hour days.
2. As required to ensure proper start-up to include but not limited to two (2) 8-hour days.
3. During the full length of the performance testing period.
4. Training of Owner's personnel in operation and maintenance of equipment shall be prior to performance testing and shall be a minimum of one (1) 8-hour day.

END OF SECTION 46 71 33