Addendum #6

to
Spotsylvania County
IFB #19-25-TV

for
Thornburg WWTP Expansion and Upgrade
Contract No. 2 – General Construction
January 15, 2020

Addendum #6 to Invitation for Bid #19-25-TV is issued in accordance with the IFB Terms & Conditions and is intended to provide additional information and clarification to bidders.

Addendum #6 consists of four (4) items which are listed below, attached hereto and made a part hereof to IFB #19-25-TV.

Item 1 – REVISED BID FORM:

Revised Bid Form for Addendum #6 (attached) shall be used in lieu of previous Bid Forms posted.

Item 2 – QUESTIONS AND ANSWERS:

1. QUESTION: Size of ball drip valve on Siamese fire connection (C-502 detail).
   ANSWER: Ball drip valve shall be ½” x ½” MNPT.

2. QUESTION: Please provide more information on the staging area and temporary stockpile area referenced in addendum #5. How far away, how big and are there any special regulations to using the property?
   ANSWER: See attached map titled “Thornburg WWTP Upgrade - Construction Staging Area” for location and area details.

3. QUESTION: Please provide more information on the disposal site for excess soils referenced in addendum #5. What is Livingston? Are there dump fees? More details are needed.
   ANSWER: Livingston Landfill and Convenience Center is a County owned and operated landfill located at 6241 Massey Road Spotsylvania, VA 22551. Disposal and dump fees will be the contractor’s responsibility.

4. QUESTION: A question was asked about the size of the water meter shown on the civil drawings and the answer referenced sheet C-504. That sheet was revised in addendum #3 but it still does not show the size of the meter. What size meter is required? Also, please confirm the fees associated with purchasing the water meter are to be paid by the county.
   ANSWER: Water meter will be 6”. Fees associated with purchase of the water meter will be paid by the County.
5. QUESTION: Question #64 on addendum #5 does not answer if the contractor will have to pay for the water for leak testing. Please advise who will pay for the water.
   ANSWER: County will pay for the water associated with leak testing.

6. QUESTION: The architectural drawings reference spec section 87100 for door hardware schedule. Spec section 87100 does not include a schedule but instead references item ‘A’ for the schedule. I cannot find where Item A is included. Please advise and include Item A if necessary.
   ANSWER: Item A added via Addendum #6.

7. QUESTION: The following list of instruments are listed on E-108 and E-009, and noted on E-108 to be located on the PFAS structure. I cannot find them on E-201, I-201/202/203. Please advise their location.
   - AE/AIT-2213
   - AE/AIT-2216
   - AE/AIT-2223
   - AE/AIT-2226
   - FE/FIT-222
   ANSWER: These instruments (AE/AIT-2213, -2216, -2223, -2226) do not exist anymore. They were removed during final design.

8. QUESTION: FE-3451’s location is shown on the pfas structure on E-201 with the transmitter power feed from the headworks LV panel. FIT-3451 is shown to be in the mbr building on E-304. I-304 designates the control to be tied to the PCS in the mbr building. Please advise the orientation for this instruments design.
   ANSWER: FE-3051 (flow tube) is to be installed in the vault, while the FIT-3051 (transmitter) is to be remotely mounted in the mbr building, as shown on E-304. Control to be provided from PCS-1, as shown on the I-304 in the MBR building.

9. QUESTION: Addendum #3 deleted the UWS CP power feed from E-311 and E-312. Please confirm the UWS Control panel and motors are being deleted from this contract scope.
   ANSWER: There was no intent in Addendum #3 to delete the UWS CP and motors from Contract 2 scope.

10. QUESTION: The memorandum in addendum #5 says to revise specification section 462139.41 but that section was not included in the revised table of contents provided in addendum #4. Please advise which section 462139.41 is.
    ANSWER: Typo. Correct Spec is 43 21 39.41.

11. QUESTION: In Addendum 3, Supplement A – Statement of Special Inspections was referenced. It appears that Supplement A is not attached in 01 41 06. Can you tell me where I can find this in the documents or let me know if this is coming out in Addendum #5?
    ANSWER: Supplement A is located right after Specification 01 41 06 and before 01 45 00 in the Specification book.

12. QUESTION: Please confirm that when we price up the options, the value to be entered in the option
item on the bid form is the difference between the base and the option. For example if the Cast-In Place Tank (Base Bid) is $10,000, and the Precast Post Tension Tank (Option) is $15,000, the number we should enter is $5,000.

**ANSWER:** Yes, the value to be entered in the option item is the difference between the base and the option.

13. **QUESTION:** The specs call for the fire alarm to connect back to the existing system, is there an existing system or is all of this going to be new? The drawings make reference, sheet E-002, of the connection from the MBR/OPS building to the PCS building panel but I don’t see a layout for the PCS building. I am thinking that may be the existing building that they are referring too, please clarify.

**ANSWER:** References to existing fire alarm system connections may be disregarded. The “PCS Panel” on Drawing E-002 is Process Control System Panel PCS-1 as further detailed on Drawing I-701.

14. **QUESTION:** The following list of instruments are shown on E-314, but their location is not designated on E-304. Please advise their locations:

   a. FV-3-2053
   b. FV-3-3102
   c. FV-3-3103
   d. FV-3-301S
   e. FV-3-601S
   f. FV-3-6013
   g. FV-3-193A
   h. FV-3-193B
   i. FV-3-393A
   j. FV-3-393B
   k. ZS-4112
   l. ZS-4122
   m. AE-4113/TE-4114
   n. AE-4123/TE-412

**ANSWER:** Generally, all these valves are supplied by MBR manufacturer, to be installed in the MBR process lines, in the MBR building. Please refer to P&ID drawings on I-301, I-305, I-306 and I-401 for general locations.

15. **QUESTION:** PIT-2220 is shown on E-304, but is not on the Instrument schedule on E-314 or the I-drawings. Please confirm conduit, wire, and controller.

**ANSWER:** PIT-2220 is shown on I-203 and is located on the 10” low pressure air header. ¾”C with 1#16TSP

16. **QUESTION:** Please confirm that the following do not need control circuit wiring as shown on E-314:

   a. FV-3-1021
   b. FV-3-102S
   c. FV-3-1022
   d. FV-3-1023
   e. FCV-3411
   f. FCV-3421
   g. FCV-3441
h. FCV-3-193A/193B
i. FCV-3-393A/393B

**ANSWER:** The flow valves in question do need control circuits. Control circuits should be included as follows: ¾”C with 4#14 for FV-3-1021, FV-3-102S, FV-3-1022, FV-3-1023, FCV-3411, FCV-3421 and FCV-3421. FCV-3-193A/193B and FCV-3-393A/393B do not exist. These are FV-3-393A and FV-3-393A. FV-3-193B and FV-3-393B have been removed (refer to Addendum #4)

**17. QUESTION:** FIT-3461/FE-3461 is shown on E-304 and not mentioned anywhere else. Please advise.
**ANSWER:** FIT-3461 is shown on I-304, as the WAS flow meter.

**18. QUESTION:** PIT-3-3012 is shown on E-304 and not mentioned anywhere else. Please advise.
**ANSWER:** PIT-3-3012 is the same instrument shown on I-301 as PIT-3121. Relabel Instrument on I-301 to PIT-3-3012.

**19. QUESTION:** PSH-3231B is shown on E-304 and not mentioned anywhere else. Please advise.
**ANSWER:** PSH-3231B is the same instrument shown on I-301 as PSH-3-3012. Relabel Instrument on E-304 as PSH-3-3012.

**20. QUESTION:** Page 5 of the Bid Form lists the five items that sum into the Total Lump Sum Bid Brice at the bottom line. One of these items is the “Option – Precast (Lump Sum)” to construct the PFAS and Post Aeration structures as precast. The cost to construct these structures as cast-in-place concrete is already included in the “Total Price – Base (Lump Sum)”. By providing a separate total price for a precast option, the Bid Form is including the costs of these two structures twice (once in the Base Lump Sum and again under the Option – Precast item). (As also referenced in the answer in Addendum #5, Question 49.) Please clarify if that is the correct interpretation of the costs for these bid items and how they total to the Total Lump Sum Bid Price at the bottom of the Bid Form.
**ANSWER:** The Option price line item is the precast DIFFERENCE (add or deduct $) to the base scope of cast-in-place concrete.

**21. QUESTION:** Page 2 of the Bid Form contains an item 2 – “Deviations from IFB Specifications”, however there was no description of what the purpose of this item is and what is to be included here. Please provide information and details regarding this Item 2 – Deviations.
**ANSWER:** This is referenced in the IFB, Section I II, C on page 4 of the IFB. If there is an area within the specifications and/or the IFB that the Contractor has deviated from they are to state it here.

**22. QUESTION:** Page 6 of the Bid Form lists the Contingent Unit Price Items that also total onto Page 5 of the Bid Form to calculate the Total Lump Sum Bid Price. As asked in Addendum #5, Question 50, there is no Measurement and Payment section detailing each individual Contingent Unit Price Item. Without these descriptions, many assumptions will have to be made in pricing these unit prices. For example: Unit Price Item 13 – Miscellaneous Concrete (4,000 psi): Is this unit price only for the purchase of 100 cy? Or does this unit price also include the labor, materials, support, etc. to install the concrete also? Is this concrete for slab on grade pours or for elevated slabs? As you can see, there are many items and assumptions that could be included in each unit price. Without a detailed description, it is not known what should be included. Please provide additional information and details so these unit prices can be accurately priced by all bidders.
**ANSWER:** Enter a unit price for each of the stated assumed contingent quantities. There is no detailed
description of how or where these contingent items may be specifically applied. Each unit price should include the labor, materials, and support associated with installation of the contingent item.

23. **QUESTION:** Engineer’s response to Question #35 of Addendum #5 stated the 2” Utility Water shown on P-603 is within our scope of work and to refer to the civil drawings for continuation. Revised civil drawing C-108 does not show the 2” Utility Water running from Chemical Building to Solids Handling Building, please provide detail.  
**ANSWER:** Clarification made to 2” Utility Water Line which has been updated to 2” Non-Potable line. C-108 updated to show connection from CHM to SHB.

24. **QUESTION:** There is a call out above the 8 Stormtech SC-740 Chambers on the West side of the MBR building that states (12”-DI-RAS INV EL. 220.00”), but it does not point to any piping. It also appears the 12” RAS coming from the South side of PFAS reduces down to 8”. Please confirm that the 12” RAS reduces to 8” and there is no 12” RAS West of the MBR building.  
**ANSWER:** The 12” line reduces to an 8” right before the RAS Vault and upsizes to an 12” right after the RAS Vault.

25. **QUESTION:** Reference Specification Section 08 71 00 Door Hardware; Paragraph 3.7 states “Door Hardware Schedule (See Item ‘A’ Hardware Schedule)”, this schedule does not appear to be provided. Please provide or advise were we can find Item ‘A’ Hardware Schedule.  
**ANSWER:** Item A added via Addendum #6.

26. **QUESTION:** The following instruments are shown on E-512’s schedule but there is no location shown on the layout drawings. Please advise.  
   a. PIT-5110  
   b. LIT-5110  
   c. LSLL-5110  
   d. LSHH-5100  
   e. PSH-5111A  
   f. PSH-5111B  
   g. PSH-5121A  
   h. PSH-5121B  
   i. LIT-5132  
   j. FSL-5212  
**ANSWER:**  
   a. Old tag; revised to 5-0321  
   b. Old tag; revised to 5-0223  
   c. Old tag; revised to 5-0221  
   d. Old tag; revised to 5-0221  
   e. Old tag; revised to 5-322A  
   f. Old tag; revised to 5-321A  
   g. Old tag; revised to 5-322B  
   h. Old tag; revised to 5-321B  
   i. Old tag; revised to 5-603B  
   j. Old tag; revised to 5-0210
27. **QUESTION:** The following instruments are shown on E-512’s schedule but there is no power circuit designated and they are shown on the layout drawings.
   a. AIT-5110
   b. AE/AIT-5113
   c. AE/AIT-5114
   d. AIT-5131

   **ANSWER:**
   a. Old tag; revised to 5-0101 and needs power
   b. Old tag; revised to 5-0329 and needs power
   c. Old tag; revised to 5-0327 and needs power
   d. Old tag; revised to TIT-5-001B

28. **QUESTION:** Please advise why the following instruments are duplicated on E-512 and E-513 schedules:
   a. FSL-5250
   b. FE/FIT-5213
   c. FE/FIT-5251
   d. PSH-5311A/B
   e. PSH-5321A/B

   **ANSWER:** Typo if duplicated

29. **QUESTION:** LE/LIT-5402C are shown on E-504, but not shown on E-512. Please confirm this instrument is utilized and matches A/B’s configuration.

   **ANSWER:** Instrument is shown on I-503 as part of the Dumpster control strategy and is required.

30. **QUESTION:** Can you provide a specification for the FRP grating?

   **ANSWER:** Refer to FRP GRATING NOTES on drawing S-002, including Addendum 4 revisions. Addendum 4 revised drawing S-002 as follows:
   o DELETE FRP Grating Notes 6 and 7 and SUBSTITUTE THEREFORE the following notes:

   “6. RESIN SHALL CONFORM TO THE FOLLOWING:
   A. RESIN: VINYL ESTER
   B. FIRE RETARDENT
   C. CORROSION RESISTANT
   D. COLOR: DARK GRAY

   7. GRATING MANUFACTURER SHALL BE FIBERGRATE COMPOSITE STRUCTURES OR ENGINEER OF RECORD APPROVED EQUAL. REFER TO PLANS FOR ADDITIONAL GRATING INFORMATION.”

31. **QUESTION:** DWG E-108 mentions AIT-2216/2223/2226. They are not shown on DWG. E-105 Panel Schedule or DWG. E-201 Power Plan. Please advise.

   **ANSWER:** Instruments removed during Final Design.

32. **QUESTION:** Drawings M-203 & M-209 both show Coag piping to be 1” size while drawing M-205,
M-207 & M-208 all show Coag piping to be ½” size. Note 2 on drawing M-203 states that 1” Double Wall Containment Piping shall be used for the ½” Alkalinity & Coagulant piping. Coag piping is called out on Yard Piping drawing C-108 to be 3/8” PE in 2” PVC. Spec section 40 05 13, 2.9 specifies Double Wall Containment Piping to be Sch. 80 PVC Carrier Pipe inside Sch. 80 PVC Containment Pipe, Guardian Systems as manufactured by IPEX. Please clarify requirement for Chemical Piping and advise if Coag piping in Plug Flow Activated Sludge Building should be ½” Sch. 80 PVC Pipe inside 2” Sch. 80 PVC Pipe as manufactured by Guardian Systems by IPEX.

**ANSWER:** Correct, Coag piping should be ½” sch. 80 PVC Pipe inside 2” Sch 80 PVC Pipe as manufactured by Guardian Systems by IPEX.

33. **QUESTION:** Drawing M-203 shows the Carbon (Acetic Acid) piping to be 1” size PVC pipe. Drawings M-204 thru M-209 all show the Carbon (Acetic Acid) piping to be ½” size. Carbon (Acetic Acid) piping is called out on Yard Piping drawing C-108 to be 3/8” PE in 2” PVC. Spec section 40 05 13, 2.9 specifies Double Wall Containment Piping to be Sch. 80 PVC Carrier Pipe inside Sch. 80 PVC Containment Pipe, Guardian Systems as manufactured by IPEX. Please clarify requirement for Chemical Piping and advise if Carbon (Acetic Acid) piping in Plug Flow Activated Sludge Building should be ½” Sch. 80 PVC Pipe inside 2” Sch. 80 PVC Pipe as manufactured by Guardian Systems by IPEX or single wall Sch. 80 PVC Pipe & Fittings.

**ANSWER:** Correct, Carbon piping should be ½” sch. 80 PVC Pipe inside 2” Sch 80 PVC Pipe as manufactured by Guardian Systems by IPEX.

34. **QUESTION:** Please provide more detail for the 12”-DI-RAS to RAS Flow Meter to 8”-DI-RAS. Where does the 12”-DI-RAS reduce to 8”-DI-RAS? Where does the 8”-DI-RAS increase to 12”-DI-RAS (MBR)?

**ANSWER:** On the influent side of the RAS Flow Meter/ vault the 12” x 8” reducer is located just upstream of the bypass tee. On the effluent side of the RAS Flow Meter / vault the 8” x 12” reducer is located directly adjacent to where the 8” DI pipe leaves the vault.

35. **QUESTION:** Concrete Section 03300 2.6 B (concrete mixes) Item #5 Concrete Fill indicates “no admixtures are required” other than HRWR that may be added. However, Structural Concrete Note #22, on S-001, Item B. indicates Structural Fill is scheduled to include the Integral Waterproofing Admixture. Please advise if concrete fills require the crystalline waterproofing admixture.

**ANSWER:** Structural fill does not require integral waterproofing admixture. Refer to Addendum 6 Summary of Changes.

36. **QUESTION:** Specification 03300 prescribes usage requirements for Mix A, 4500psi w/CWP, as concrete in contact with water, wastewater and/or groundwater. However, S-001 Structural Concrete Note #22 provides a schedule of concrete indicating “Structure Concrete” to be 4500psi including the addition of the waterproofing admixture. The structural drawing note therefore indicates ALL structures concrete requires the addition of the crystalline waterproofing admixture and not just concrete in contact with water as indicated within 03300. The addition of CWP to ALL concrete greatly increases the cost of the work. Please clarify use requirements for the concrete waterproofing admixture.

**ANSWER:** Integral waterproofing admixture is not required in elevated slabs and beams in the MBR Building and the Solids Handling Building and slab on grade of the OPS Building. Integral waterproofing admixture is required in all other “Structure Concrete.” Refer to Addendum 6 Summary of Changes.
37. **QUESTION:** Concrete Section 03300 2.9 NON-METALIC FIBER REINFORCEMENT identifies multiple products for particular concrete elements. Section 03300 2.6 B schedules concrete mixes of which only Swept in Grout Topping and Concrete Fill indicate fiber reinforcement. Please confirm only mixes identified within the schedule of mixes or when specifically indicated on the drawings shall require fiber reinforcing.

**ANSWER:** Correct. Swept-in-Grout Topping, Concrete fill and locations specifically indicated on the drawings require fiber reinforcing.

38. **QUESTION:** Concrete Section 03300 3.7 REMOVING FORMS paragraph B indicates forms supporting suspended slabs and beams may be removed once the concrete has attained 75 percent of the 28 day design strength. However, 03300 3.3 REMOVING AND REUSING FORMS paragraph B indicates forms for suspended slabs and beams must be left in place until concrete has achieved the full design compressive strength. Please advise which criteria is required.

**ANSWER:** Forms can be removed once concrete has reached 100 percent of the 28-day design strength. Refer to Addendum 6 Summary of Changes.

39. **QUESTION:** Concrete Section 03300 3.10 FINISHES, GENERAL paragraph A indicates, in the last sentence, smooth rubbed finish is required on all interior formed surfaces including interior surfaces of tank walls. Please confirm that tank wall surfaces below normal water level require a rubbed finish.

**ANSWER:** Finishes shall be as specified.

40. **QUESTION:** Joints in Concrete Elements: Structural Concrete Note #9 on S-001 and 03300 both indicate that joints shall be located by the contractor based on details and spacing limitations sown on the contract drawings. The only spacing limitation we find is the wall schematic for Liquid Retaining Structure shown on S-004 that appears to limit vertical construction joints in walls at 30’ maximum. We are unable to locate a spacing limit for joints in foundation mats, slabs and suspended slabs. Please joints in walls are limited to 30’ maximum and provide criteria for maximum placement in horizontal elements.

**ANSWER:** Per Typical Slab and Wall Construction Joint Details on S-004 for liquid retaining and non-liquid retaining structures, typical maximum spacing between construction joints is 30 times the wall or slab thickness. Refer to typical details for additional information.

41. **QUESTION:** Slab Vapor Barrier: we find no specification for slab vapor barrier and note the drawings are silent on providing vapor barrier below slabs, that would normally receive vapor barrier, other than the Chemical Building which identifies (Note #7 S-602) the requirement for a 15mil vapor barrier below the Chemical Building slab. Please confirm this location, Chemical Building, is the only slab requiring vapor barrier.

**ANSWER:** As indicated on the drawings, vapor barriers are only required at the Chemical Building.

42. **QUESTION:** Drawing Sheet M-001 Note 3 refers to Specification 26 00 30 for heat trace schedule. We are unable to locate the schedule. Please advise.

**ANSWER:** Pipe Heat Trace Schedule is located on Drawing E-203.

43. **QUESTION:** Reference Details 1&4 on Drawing A-006; indicating a 7/8” metal liner panel over MRGWB. Please provide additional information and details on this 7/8” metal liner panel including
materials to be used, finishes, fastening methods, joint details, etc. Question 15 on Addendum 4 addressed this issue, but the added Specification Section 07 42 13 does not appear to include this metal liner panel.

**ANSWER:** Please refer to Specification Section 07 42 13 provided in Addendum #6.

**44. QUESTION:** Specification section 40 05 23.01. 1.1 Summary, A, states in the second sentence that solid wedge resilient seated valves shall be installed, unless otherwise specified.

Specification section 40 05 23.01. 2.2 Valve Construction, A, (1) states Solids Wedge AWWA C500 and (2) states Resilient seated AWWA C500.

Question: I assume this is standard should be AWWA C509 since that is a resilient seated standard.

**Drawing(s) Plug Flow Activated Sludge – drawings M201 through M209**

a. Do the 16” gate valves in the Activated Sludge require by-passes? I don’t see any notes dictating so.

b. The 16” & 10” gate valves in the Activated Sludge are shown with extension stems, floor stands and Hand wheels. Do the extension stems require enclosures, i.e. extended bonnets? Or are the extension stems bare.

c. What is the required construction material for the extension stems used with the 16” & 10” gate valves in the Activated Sludge? Carbon steel? 304 SS?

d. Do the 16” Gate Valves require Gearing as noted in Specification section 40 05 23.01, 2.3, A, Gearing, 1? Valves of this size don’t normally require Gearing.

e. Do the 16” & 10” gate valves in the Activated Sludge shown with extension stems, floor stands and Hand wheels require position indicators?

**ANSWER:**

a. A bypass is not required for the 16” gate valves in both PFAS tanks.

b. The extension stems do not require an enclosure.

c. Carbon steel is not acceptable for the extension stem. 316 SS or 304 SS is acceptable material for the extension stem.

d. Gearing is not required as mentioned in Specification section 40 05 23.01, 2.3, A, Gearing, 1.

e. Position indicators are required for the 16” and 10” gate valves.

**45. QUESTION:** Can confirmed drawings and specs be issued for bidding purposes? The majority of drawings and a significant amount of specs have been reissued through the addenda making it very difficult to determine what is current and what is old.

**ANSWER:** Conformed drawings and specs will not be re-issued before the end of Bid Phase.

**46. QUESTION:** There have been changes in the expected scope of work for E-Merge throughout the four addenda but a new quote from E-Merge has not been provided. Will they update the quote to account for all changes?

**ANSWER:** An updated quote from E-Merge had been provided as part of this Addendum #6.

**47. QUESTION:** Gates FV-1110, FV-1120, FV-1115 & FV-1125. These gates are located in the open channels of the headworks. On the gate schedule the gate plate height is 49” and the head condition is called out as 54”. Without an upper seal these gates cannot reach the head condition as called out. Please verify if gates are to seal on 4 side or 3 side with no upper seal. Please correct the head condition accordingly.
ANSWER: Head condition incorrectly called out in schedule, see corrected spec 35 20 16. No top seal needed.

48. QUESTION: Gate SUG-1 this gate is called out on the gate schedule with a self-contained frame, the drawing shows a non-self-contained frame with operating pedestal. Please verify if gate frame is to be a self-contained frame with the operator mounted atop the gate bench or a non-self-contained frame with wall bracket and operator pedestal.
ANSWER: Gate frame for SUG-1 is non-self-contained with operating pedestal.

49. QUESTION: Gates FV-3-2091, FV-3-2092 & FV-3-2093 these gates are called out on the gate schedule with a self-contained frame, the drawing shows a non-self-contained frame with operating pedestal. Please verify if gate frame is to be a self-contained frame with the operator mounted atop the gate bench or a non-self-contained frame with wall bracket and operator pedestal.
ANSWER: Self-Contained gate frame for all 3 gate frames is correct.

50. QUESTION: Gates FV-3-2091, FV-3-2092 & FV-3-2093 these gates are all shown with electric actuators on drawing M-301, only FV-3-2091 & FV-3-2092 are called out on the gate schedule as to have electric actuators. Please confirm if only two or all three of the MBR gates are to be provided with electric actuators.
ANSWER: All three MBR gates are Motorized and Self-Contained.

Item 3 – CLARIFICATIONS TO IFB #19-25-TV:

The International Mechanical Code calls for non-metallic duct to have a flame spread of 25 or less and smoke development of 50 or less on both the outside and inside surface.

Item 4 – REVISED TECHNICAL SPECIFICATIONS AND DRAWINGS:
Refer to attached Memorandum dated January 14, 2020 for a listing of and copies of Revised Technical Specifications and Drawings for IFB #19-25-TV for the Thornburg WWTP Expansion and Upgrade.

Bidder shall acknowledge receipt of this Addendum on the Bid Form.

Toni Vaughan
Senior Procurement Officer

January 15, 2020
Date
REVISED – Bid Form – Addendum #6
IFB #19-25-TV
Thornburg WWTP Expansion and Upgrade, Contract No. 2 – General Construction

In compliance with this Invitation for Bid, Addenda and to all the Terms and Conditions imposed therein and hereby incorporated by reference, the authorized undersigned offers and agrees to furnish the goods/services at the price(s) indicated on the Bid Form, in accordance with this Signed Bid Form.

The signer of this bid form must be an authorized officer of the company.
(Please include any documentation of authority. For example, resolution of the board of directors, articles of incorporation, etc.)

Name and Address of Firm:

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

Date: __________________________________________

By: ____________________________________________

(Signature In Ink)

Name: __________________________________________

(Please Print)

__________________________________________________________________________

Zip Code: ____________

E-mail: ______________________________________

EIN: ____________________________

Phone: (_____)____________________ Fax: (_____)____________________

If Corporation or LLC, list State of Incorporation or Corporation:

Contractors License Number: ____________________________

Commonwealth of Virginia State Corporation Commission Number: ____________________________

(ATTACH A COPY OF YOUR STATE CORPORATION COMMISSION CERTIFICATE AND A LIST OF OFFICERS)

D-U-N-S Number: ____________________________

The named party hereby submits a bid in response to this Spotsylvania County IFB to furnish construction services and materials as described in the Specification and bid form to this IFB. The entire Bid Form, including Response Statement, license certifications, and any supplemental materials required to be provided by the bidder pursuant to the terms and conditions of the IFB, constitute the entire bid submission.

The party hereby certifies that such bid is genuine and not collusive or sham; that said bidder has not colluded, conspired, connived or agreed, directly in directly, with any bidder or person, to put in a sham bid or to refrain from bidding, and has not in any manner, directly or indirectly, sought by agreement or collusion or communication or conference, with any person to fix the bid price or affiant or any bidder, or to fix any overhead, profit or cost element of said bid price, or of that of any other bidder, or to secure any advantage against Spotsylvania County or any person interested in the proposed contract.

The party submitting the forgoing bid acknowledges the provisions, terms and conditions of this IFB including all attachments and addenda, and agrees to be bound by those provisions, terms and conditions. Further, the party certifies that all information submitted in response to this IFB is correct and true.

Receipt of the following Addenda are acknowledged:

Addendum No. ____________, dated ____________

Addendum No. ____________, dated ____________

Addendum No. ____________, dated ____________

Addendum No. ____________, dated ____________

(RIGHT HERE)

(ATTACH A COPY OF YOUR STATE CORPORATION COMMISSION CERTIFICATE AND A LIST OF OFFICERS)

D-U-N-S Number: ____________________________

The named party hereby submits a bid in response to this Spotsylvania County IFB to furnish construction services and materials as described in the Specification and bid form to this IFB. The entire Bid Form, including Response Statement, license certifications, and any supplemental materials required to be provided by the bidder pursuant to the terms and conditions of the IFB, constitute the entire bid submission.

The party hereby certifies that such bid is genuine and not collusive or sham; that said bidder has not colluded, conspired, connived or agreed, directly in directly, with any bidder or person, to put in a sham bid or to refrain from bidding, and has not in any manner, directly or indirectly, sought by agreement or collusion or communication or conference, with any person to fix the bid price or affiant or any bidder, or to fix any overhead, profit or cost element of said bid price, or of that of any other bidder, or to secure any advantage against Spotsylvania County or any person interested in the proposed contract.

The party submitting the forgoing bid acknowledges the provisions, terms and conditions of this IFB including all attachments and addenda, and agrees to be bound by those provisions, terms and conditions. Further, the party certifies that all information submitted in response to this IFB is correct and true.

Receipt of the following Addenda are acknowledged:

Addendum No. ____________, dated ____________

Addendum No. ____________, dated ____________

Addendum No. ____________, dated ____________

Addendum No. ____________, dated ____________
Response Statement

This Response Form is to be completed by the Bidder to more specifically describe and define the proposed services. Any deviations from the IFB specifications shall be stated on this form or attached to this form.

1. Item Description

   Thornburg WWTP Expansion and Upgrade, Contract No. 2 – General Construction

2. Deviations from IFB Specifications

Sign here to confirm accuracy of Bid Form and conformity with provisions of IFB #19-25-TV

Signature:_______________________________ Name of Firm:_______________________________

(RETURN THIS FORM)
REvised – Bid Form – Addendum #6

Ifb #19-25-Tv

Thornburg Wwtp Expansion and Upgrade, Contract No. 2 – General Construction

A List of 3 References for Which the Contractor Has Provided Similar Work Over the Last 5 Years Similar in Scope to That Which Is Described Herein Shall Be Provided With the Bid Package. Spotsylvania County Cannot Be Listed as a Reference.

Please List References below:

Company Name: ___________________________
Address: __________________________________

Phone Number: ___________________________
Email Contact: ___________________________
Project Name: ___________________________
Location Address: _________________________

Additional Information: ____________________

Company Name: ___________________________
Address: __________________________________

Phone Number: ___________________________
Email Contact: ___________________________
Project Name: ___________________________
Location Address: _________________________

Additional Information: ____________________

Company Name: ___________________________
Address: __________________________________

Phone Number: ___________________________
Email Contact: ___________________________
Project Name: ___________________________
Location Address: _________________________

Additional Information: ____________________

Sign Here to Confirm Accuracy of Bid Form and Conformity With Provisions of Ifb #19-25-Tv

Signature: ___________________________ Name of Firm: ________________________________

(Return THIS FORM)
SUBCONTRACTOR IDENTIFICATION SHEET

Bidder proposes to use the following Subcontractors who will perform work on this project.

<table>
<thead>
<tr>
<th>Name of Firm, Address, and Contact Person By Subcontractor</th>
<th>Work to be Performed by Subcontractor</th>
<th>Value of work to be completed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sign here to confirm accuracy of Bid Form and conformity with provisions of IFB #19-25-TV

Signature:________________________________________ Name of Firm:________________________________________

(RETURN THIS FORM)
Provide construction services and materials to complete the Thornburg WWTP Expansion and Upgrade, Contract No. 2 – General Construction, project as described in the Spotsylvania County IFB #19-25-TV, Specifications and Construction Drawings.

<table>
<thead>
<tr>
<th>Description</th>
<th>Total Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL PRICE – BASE (LUMP SUM)</td>
<td></td>
</tr>
<tr>
<td>TOTAL PRICE – OPTION – DEWATERING (LUMP SUM)</td>
<td></td>
</tr>
<tr>
<td>TOTAL PRICE – OPTION – PRECAST (LUMP SUM)</td>
<td></td>
</tr>
<tr>
<td>TOTAL – CONTINGENT ITEMS</td>
<td></td>
</tr>
<tr>
<td>TOTAL – ALLOWANCE ITEMS</td>
<td>$1,321,730</td>
</tr>
<tr>
<td>TOTAL LUMP SUM BID PRICE – BASE, OPTIONS, CONTINGENT AND ALLOWANCE ITEMS</td>
<td></td>
</tr>
</tbody>
</table>

Sign here to confirm accuracy of Bid Form and conformity with provisions of IFB #19-25-TV

Signature:_________________________________________ Name of Firm:_________________________________________

(RETURN THIS FORM)
## Contingent Items

Contingent work is not identified on plans or in specifications, and not in Base or Option work. Bidder shall include the total cost entered below for the assigned quantities of units and totals (unit quantity x price per unit quantity in the Total Bid Price above, for additional work that may be directed by Owner or Engineer.

<table>
<thead>
<tr>
<th>Contingent Items</th>
<th>Quantity and Units</th>
<th>Price Per Unit Quantity</th>
<th>Total (Unit Qty x Price Per Unit Quantity)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – Sheeting and Shoring Left in Place</td>
<td>5,000 SF</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>2 – Excavation Below Subgrade</td>
<td>500 CY</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>3 – Test Pits</td>
<td>5 EA</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>4 – Erosion and Sediment Control, Silt Fencing</td>
<td>250 LF</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>5 – Concrete Sidewalk</td>
<td>100 SY</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>6 – Bituminous Paving</td>
<td>250 SY</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>7 – Miscellaneous Rock Removal</td>
<td>100 CY</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>8 – Select Fill – Type “A” (Crushed Gravel)</td>
<td>100 CY</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>9 – Select Fill – Type “E” (Run-of-Bank Gravel)</td>
<td>250 CY</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>10 – Select Fill – Type “F” (Run-of-Crusher Stone)</td>
<td>100 CY</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>11 – Miscellaneous Form Work</td>
<td>500 SF</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>12 – Miscellaneous Reinforcement</td>
<td>2,500 LBS</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>13 – Miscellaneous Concrete (4,000 psi) – Structural Slab</td>
<td>100 CY</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>Total – Contingent Items</td>
<td>--</td>
<td>--</td>
<td>$</td>
</tr>
</tbody>
</table>

Sign here to confirm accuracy of Bid Form and conformity with provisions of IFB #19-25-TV

Signature:________________________________________ Name of Firm:________________________________________

(RETURN THIS FORM)
Allowance Items

Bidder shall include the total cost entered below for the assigned allowance items in the Total Bid Price above.

<table>
<thead>
<tr>
<th>Allowance Items</th>
<th>Quantity and Units</th>
<th>Price Per Unit Quantity</th>
<th>Total (Unit Qty x Price Per Unit Quantity)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – Services Provided by E-Merge Systems, Inc.</td>
<td>--</td>
<td>--</td>
<td>$1,246,730</td>
</tr>
<tr>
<td>2 – Security System</td>
<td>--</td>
<td>--</td>
<td>$15,000</td>
</tr>
<tr>
<td>3 – Electric Utility Coordination</td>
<td>--</td>
<td>--</td>
<td>$60,000</td>
</tr>
<tr>
<td>Total – Allowance Items</td>
<td>--</td>
<td>--</td>
<td>$1,321,730</td>
</tr>
</tbody>
</table>

This project has the following schedule for completion after the Notice to Proceed has been issued:

Substantial Completion – 760 days   Final Completion – 820 days

Sign here to confirm accuracy of Bid Form and conformity with provisions of IFB #19-25-TV

Signature:_______________________________ Name of Firm:_______________________________

(RETURN THIS FORM)
The following equipment system information is not required to be submitted with the Bid Form, but shall be supplied within twenty-four (24) hours after requested by the Procurement Division.

Equipment System Write-Ins

1. Specifications Section 26 24 19 – Motor Control Centers (a portion of Total Price - Base)
   Manufacturer / Model: _____________________________

2. Specifications Section 26 29 23 – Variable-Frequency Motor Controllers (a portion of Total Price - Base)
   Manufacturer / Model: _____________________________

3. Specifications Section 26 32 13 – Diesel-Engine-Driven Generator Sets (a portion of Total Price - Base)
   Manufacturer / Model: _____________________________

4. Specifications Section 43 11 23.11 – Positive Displacement Blowers (a portion of Total Price - Base)
   Manufacturer / Model: _____________________________

5. Specifications Section 43 21 36.21 – Rotary Lobe Pumps (a portion of Total Price - Base)
   Manufacturer / Model: _____________________________

6. Specifications Section 43 21 39.11 – Dry-Pit Submersible Pumps (a portion of Total Price - Base)
   Manufacturer / Model: _____________________________

7. Specifications Section 43 21 39.11 – Submersible Non-Clog Centrifugal Pumps (a portion of Total Price - Base)
   Manufacturer / Model: _____________________________

8. Specifications Section 43 21 39.23 – Submersible Recirculator Chopper Pumps (a portion of Total Price - Base)
   Manufacturer / Model: _____________________________

9. Specifications Section 44 31 16 – Odor Control Equipment (a portion of Total Price - Base)
   Manufacturer / Model: _____________________________

10. Specifications Section 46 21 00 – Screening Equipment (a portion of Total Price - Base)
    Manufacturer / Model: _____________________________

11. Specifications Section 46 33 44 – Peristaltic Metering Pumps (a portion of Total Price - Base)
    Manufacturer / Model: _____________________________

12. Specifications Section 46 36 00 – Dry Chemical Feed Equipment (a portion of Total Price - Base)
    Manufacturer / Model: _____________________________
13. Specifications Section 46 41 23 – Submersible Mechanical Mixers (a portion of Total Price - Base)
Manufacturer / Model: _____________________________________________________________

14. Specifications Section 46 51 21 – Coarse Bubble Diffusers (a portion of Total Price - Base)
Manufacturer / Model: _____________________________________________________________

15. Specifications Section 46 51 33 – Flexible Membrane Disc Diffusers (a portion of Total Price - Base)
Manufacturer / Model: _____________________________________________________________

16. Specifications Section 46 66 23 – Closed-vessel Medium-press. UV Treatment Equipment (a portion of
Total Price - Base)
Manufacturer / Model: _____________________________________________________________

17. Specifications Section 46 51 33 – Flexible Membrane Disc Diffusers (a portion of Total Price - Base)
Manufacturer / Model: _____________________________________________________________

18. Specifications Section 46 33 33 – Liquid Polymer Blending and Feed Equipment (a portion of Total
Price - Option)
Manufacturer / Model: _____________________________________________________________

19. Specifications Section 46 71 36 – Centrifuge System (a portion of Total Price - Option)
Manufacturer / Model: _____________________________________________________________
Thornburg WWTP Upgrade - Construction Staging Area

Thornburg Wastewater Treatment Plant

Staging Area
(Temporary Construction Easement)
Approximate Area: 1 Acre
PROPOSAL FOR THORNBURG WWTP EXPANSION AND UPGRADE – SCADA PROPOSAL (DIV 40)

Prepared for

County of Spotsylvania DPU
600 Hudgins Road
Fredericksburg, VA 22408-4147

January 14, 2020, Rev 2.0

E-Merge Systems, Inc.
1314 East Cary Street
Richmond, VA 23219
(804) 344-3511
www.E-Mergesystems.com
Revision Notes:

July 31st, 2019 – Rev 1.0 Initial release

January 14th, 2019 – Rev 2.0 revised with the changes listed below; in addition, all changes pertaining to Rev 2.0 are highlighted in yellow throughout the remainder of this proposal.

The following additional instruments will be provided as per Addendums 2 & 4:

<table>
<thead>
<tr>
<th>Tag No.</th>
<th>Description</th>
<th>Manufacture</th>
<th>qty</th>
<th>Addendum</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIT/FE-5322</td>
<td>Flow - Transmitter/Sensor/Tube, Magnetic</td>
<td>Krohne</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>LIT/LE-5402C</td>
<td>Level - Transmitter/Sensor, Radar</td>
<td>Rosemount</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>DPSL-3108</td>
<td>Pressure - Switch, Differential</td>
<td>Dwyer</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>DPSL-3109</td>
<td>Pressure - Switch, Differential</td>
<td>Dwyer</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>YA/YI-3110A</td>
<td>Alarm – Horn/Strobe</td>
<td>Federal</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>YA/YI-3110B</td>
<td>Alarm – Horn/Strobe</td>
<td>Federal</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>DPSL-5358</td>
<td>Pressure - Switch, Differential</td>
<td>Dwyer</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>DPSL-5359</td>
<td>Pressure - Switch, Differential</td>
<td>Dwyer</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>YA/YI-5360A</td>
<td>Alarm – Horn/Strobe</td>
<td>Federal</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>YA/YI-5360B</td>
<td>Alarm – Horn/Strobe</td>
<td>Federal</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>DPSL-5367</td>
<td>Pressure - Switch, Differential</td>
<td>Dwyer</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>DPSL-5368</td>
<td>Pressure - Switch, Differential</td>
<td>Dwyer</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>DPSL-5369</td>
<td>Pressure - Switch, Differential</td>
<td>Dwyer</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>YA/YI-5370A</td>
<td>Alarm – Horn/Strobe</td>
<td>Federal</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>YA/YI-5370B</td>
<td>Alarm – Horn/Strobe</td>
<td>Federal</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>YA/YI-5370C</td>
<td>Alarm – Horn/Strobe</td>
<td>Federal</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

The following additional discrete input signals will be provided as per Addendum 4:

<table>
<thead>
<tr>
<th>Description</th>
<th>Signal</th>
<th>PLC Panel</th>
<th>Addendum</th>
</tr>
</thead>
<tbody>
<tr>
<td>PFAS blower 1 high discharge temp alarm</td>
<td>DI</td>
<td>PCS-1</td>
<td>4</td>
</tr>
<tr>
<td>PFAS blower 2 high discharge temp alarm</td>
<td>DI</td>
<td>PCS-1</td>
<td>4</td>
</tr>
<tr>
<td>PFAS blower 3 high discharge temp alarm</td>
<td>DI</td>
<td>PCS-1</td>
<td>4</td>
</tr>
<tr>
<td>PFAS blower 4 high discharge temp alarm</td>
<td>DI</td>
<td>PCS-1</td>
<td>4</td>
</tr>
<tr>
<td>Sludge storage blower 1 high discharge temp alarm</td>
<td>DI</td>
<td>PCS-2 RIO</td>
<td>4</td>
</tr>
<tr>
<td>Sludge storage blower 2 high discharge temp alarm</td>
<td>DI</td>
<td>PCS-2 RIO</td>
<td>4</td>
</tr>
</tbody>
</table>
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• Appendix A - Project Change Control Procedure
• Appendix B - Signature Document
1. **OVERVIEW**

E-Merge Systems is pleased to provide a proposal to Spotsylvania County for the upcoming Thornburg WWTP upgrade. E-Merge is providing a scalable “open” architecture controls/SCADA system that shall integrate well with the existing SCADA system deployed at other County water/wastewater facilities. This SCADA system is also designed with a vision to provide a common hardware/software platform across the County.

E-Merge shall provide the necessary services including SCADA/PLC system design and development, panel construction, implementation, programming, installation, on-site checkout, startup and training support.

2. **STATEMENT OF WORK**

This Statement of Work defines the scope of work to be accomplished by E-Merge Systems, Inc. (“E-Merge”). The tasks to be performed by E-Merge are defined. In addition, the responsibilities of others are listed.

Changes to this Statement of Work will be processed in accordance with the procedure described in Appendix A, “Project Change Control Procedure”. The investigation and the implementation of changes may result in modifications to the Estimated Schedule, Charges, or other terms of this Statement of Work.

The following are incorporated in and made part of this Statement of Work:

1. Appendix A, “Project Change Control Procedure”.

3. **Proposed Services**

3.1 **Project Management**

The objective of this task is to provide technical direction and maintain overall project communications as the County’s systems integrator with the OEM’s, GC and their electrical and mechanical sub-contractors. E-Merge will participate in routine progress and coordination meetings as required in project specification section 409800-1.6. E-Merge will assign a project manager to coordinate and schedule SCADA activities. Following activities will be carried out under this task:

1. Maintain overall communication with the GC for the controls and instrumentation aspects of this project.
2. Develop a project schedule and track project progress against the schedule. Take appropriate actions to keep the project on schedule.
3. Manage internal communication within the E-Merge project team so that all the team members are focused on their tasks.
3.2 **Submittal Engineering**

E-Merge will provide submittals as required in spec section 409800-1.7. The submittal engineering will comprise of following sub-tasks:

1. Provide submittals for all the E-Merge furnished hardware which may include control panels, PLC’s etc.
2. Provide submittals on all the instrumentation that will be furnished by E-Merge. This will comprise of both an instrument list and instrument datasheets.
3. Submit wiring and loop diagrams for all PLC I/O’s.
4. Provide software submittals for all E-Merge furnished software.
5. Provide submittals for control strategies. This submittal will comprise of a well-documented PLC program.
6. Submit the SCADA screens for approval.
7. Submit O&M manual for controls and instrumentation aspects of this project.
8. Submit final system documentation at the end of the project.

3.3 **SCADA Application Development**

E-Merge shall design, program, install and test the SCADA screens which will provide monitoring of the wastewater plant. Screens shall provide the operators a vehicle to monitor, control and diagnostic plant functions. This task shall include:

1. Create new graphic displays showing the new facilities and functions described in the project specifications.
2. The new displays will adhere to similar graphical standards previously developed and deployed at existing County water treatment facilities. The graphics developed for the Thornburg SCADA application are an evolution of the County’s current graphical standard.
3. Create new real-time and historical trend displays.
4. Create new real-time and historical alarm displays.

3.4 **PLC and Other Programming**

E-Merge will provide PLC programming services for the below listed PLCs. Programming for the PLCs and the systems that each monitor and control will be based on the process control descriptions provided in project specification section 409636. In addition, all necessary programing will be performed to allow for the integration of OEM vendor control systems.

1. Programming of PCS-1.
3. Programming of PCS-2 RIO.
3.5 **System Test**

E-Merge will prepare a Factory Acceptance Test (FAT) procedure. The FAT will verify the panel wiring and panel layout is in accordance with the approved drawings. The FAT will consist of testing the HMI application and its interface with PLCs. The objective will be to verify I/O mapping between the HMI application and E-Merge furnished PLCs. At the end of the FAT, E-Merge will prepare a FAT report for each control panel indicating the results of the factory witness test and any disposition determined by Engineer. The FAT will be conducted at E-Merge’s facilities.

3.6 **Installation Coordination and Startup**

We will coordinate with County/Engineer/GC/OEM at appropriate times for startup. E-Merge will completely debug the system; incorporate reasonable operator requests for changes and build operator/plant personnel confidence in the new system. This will consist of the following tasks:

1. Instrumentation - After instrumentation is installed, E-Merge shall verify the operation of instruments for desired operating ranges. E-Merge will configure/program the instruments that are provided by E-Merge.
2. PLC Panels - After the contractor has completed installation of all control panels, E-Merge shall power up the PLC panels, and checkout I/O signals.
3. Startup HMI application.
4. Test HMI application with real world I/O.
5. Test out logic for process controls.
6. Test alarming, trending and historical logging.

3.7 **Final Witness Testing**

As and when the control system has been installed and started up, E-Merge will schedule an acceptance test. Following will be tested:

1. Verify that all the hardware has been installed properly.
2. Verify HMI Screens.
3. Verify OIT Screens.
4. Verify PLC program.
5. Verify alarming, trending, historical logging, and reporting.

3.8 **Training**

E-Merge will provide the following training for this project:
1. **Operator Training** – This will be two two-day courses comprised of daily half-day (four hour) sessions for up to ten persons each on the use of Control and Information System to monitor and control the facility.

2. **Maintenance Training** – This will be a one-day course for at least six persons to familiarize maintenance personnel of the new control system.

3. **Instrument Training** – This will be a one-day course for at least five persons each in the calibration and preventive maintenance of the field instruments provided under this contract.

### 3.9 Operation and Maintenance Manual

E-Merge will generate O&M manuals for controls and instrumentation aspects of this project. The O&M manual shall consist of the basic two parts:

1. Manufacturer standard O&M manuals for all equipment and software furnished by E-Merge.
2. Custom O&M information describing the specific configuration of equipment and software, and the operation and maintenance requirements for this particular project.

### 4. Hardware and Software

Section 4 of this proposal outlines all hardware, software and instrumentation provided by E-Merge for this project.

#### 4.1 PLC Hardware

The following lists all major hardware components being provided for the four project SCADA panels: PCS-1, PCS-2, PCS-2 RIO and the chemical fill station panel.

1. **PCS-1**

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Manufacturer</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free standing NEMA12 enclosure</td>
<td>Hoffman</td>
<td>1</td>
</tr>
<tr>
<td>Enclosure back panel</td>
<td>Hoffman</td>
<td>1</td>
</tr>
<tr>
<td>Thermostat</td>
<td>Hoffman</td>
<td>1</td>
</tr>
<tr>
<td>Cooling fan</td>
<td>Hoffman</td>
<td>1</td>
</tr>
<tr>
<td>LED light 5 watt</td>
<td>Hoffman</td>
<td>1</td>
</tr>
<tr>
<td>7-Slot Chassis</td>
<td>Allen Bradley</td>
<td>2</td>
</tr>
<tr>
<td>17-Slot Chassis</td>
<td>Allen Bradley</td>
<td>2</td>
</tr>
<tr>
<td>Power Supply</td>
<td>Allen Bradley</td>
<td>4</td>
</tr>
<tr>
<td>Processor</td>
<td>Allen Bradley</td>
<td>2</td>
</tr>
<tr>
<td>Redundancy module</td>
<td>Allen Bradley</td>
<td>2</td>
</tr>
<tr>
<td>32 ch DI module</td>
<td>Allen Bradley</td>
<td>7*</td>
</tr>
<tr>
<td>36 pin screw clamp block (for DI, AI &amp; AO)</td>
<td>Allen Bradley</td>
<td>18*</td>
</tr>
<tr>
<td>16 ch DO module</td>
<td>Allen Bradley</td>
<td>4*</td>
</tr>
<tr>
<td>20 position nema screw clamp block</td>
<td>Allen Bradley</td>
<td>4*</td>
</tr>
<tr>
<td>8 ch AI module</td>
<td>Allen Bradley</td>
<td>8</td>
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<tr>
<td>8 ch AO module</td>
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<td>Qty.</td>
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<tr>
<td>Enet module</td>
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<tr>
<td>24VDC power supply</td>
<td>Phoenix Contact</td>
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<tr>
<td>24VDC power supply redundancy mod.</td>
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<tr>
<td>Duplex power receptacle</td>
<td>Phoenix Contact</td>
<td>1</td>
</tr>
<tr>
<td>Relay 24vdc coil</td>
<td>Phoenix Contact</td>
<td>16</td>
</tr>
<tr>
<td>Surge suppressor for AI/AO</td>
<td>Phoenix Contact</td>
<td>68</td>
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<tr>
<td>Base for surge suppressor</td>
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<td>Intrinsically safe barrier AI/AO</td>
<td>Pepperl+Fuchs</td>
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<td>Intrinsically safe barrier DI/DO</td>
<td>Pepperl+Fuchs</td>
<td>20</td>
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<td>Circuit breaker 1P, 15A</td>
<td>Square D</td>
<td>2</td>
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<tr>
<td>Circuit breaker 1P, 10A</td>
<td>Square D</td>
<td>1</td>
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<tr>
<td>Circuit breaker 1P, 5A</td>
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<tr>
<td>Circuit breaker 1P, 3A</td>
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</tr>
<tr>
<td>Circuit breaker 1P, 2A</td>
<td>Square D</td>
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</tr>
<tr>
<td>Circuit breaker 1P, 1A</td>
<td>Square D</td>
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<tr>
<td>UPS 1500VA</td>
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<tr>
<td>UPS network card</td>
<td>APC</td>
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</tr>
<tr>
<td>UPS bypass</td>
<td>APC</td>
<td>1</td>
</tr>
<tr>
<td>Network switch</td>
<td>Moxa</td>
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<tr>
<td>Fiber patch panel</td>
<td>DIN Space</td>
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*Quantity increased in Rev. 2.0*

2. **PCS-2**

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<tr>
<th>Item Description</th>
<th>Manufacturer</th>
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<td>Free standing NEMA12 enclosure</td>
<td>Hoffman</td>
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<td>Enclosure back panel</td>
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<tr>
<td>Thermostat</td>
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<td>Cooling fan</td>
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<td>LED light 5 watt</td>
<td>Hoffman</td>
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<tr>
<td>17-Slot Chassis</td>
<td>Allen Bradley</td>
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<tr>
<td>Power Supply</td>
<td>Allen Bradley</td>
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</tr>
<tr>
<td>Processor</td>
<td>Allen Bradley</td>
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<tr>
<td>32 ch DI module</td>
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<tr>
<td>36 pin screw clamp block (for DI, AI &amp; AO)</td>
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<td>8</td>
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<td>16 ch DO module</td>
<td>Allen Bradley</td>
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<tr>
<td>20 position nema screw clamp block</td>
<td>Allen Bradley</td>
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<tr>
<td>8 ch AI module</td>
<td>Allen Bradley</td>
<td>2</td>
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<tr>
<td>8 ch AO module</td>
<td>Allen Bradley</td>
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<tr>
<td>24VDC power supply</td>
<td>Phoenix Contact</td>
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<td>24VDC power supply redundancy mod.</td>
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<td>Duplex power receptacle</td>
<td>Phoenix Contact</td>
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<tr>
<td>Relay 24vdc coil</td>
<td>Phoenix Contact</td>
<td>16</td>
</tr>
<tr>
<td>Surge suppressor for AI/AO</td>
<td>Phoenix Contact</td>
<td>18</td>
</tr>
<tr>
<td>Base for surge suppressor</td>
<td>Phoenix Contact</td>
<td>18</td>
</tr>
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</table>
### Intrinsically safe barrier AI/AO
- Manufacturer: Pepperl+Fuchs | Quantity: 6

### Intrinsically safe barrier DI/DO
- Manufacturer: Pepperl+Fuchs | Quantity: 6

### Circuit breaker 1P, 15A
- Manufacturer: Square D | Quantity: 2

### Circuit breaker 1P, 10A
- Manufacturer: Square D | Quantity: 1

### Circuit breaker 1P, 5A
- Manufacturer: Square D | Quantity: 2

### Circuit breaker 1P, 3A
- Manufacturer: Square D | Quantity: 1

### Circuit breaker 1P, 2A
- Manufacturer: Square D | Quantity: 6

### Circuit breaker 1P, 1A
- Manufacturer: Square D | Quantity: 3

### UPS 1500VA
- Manufacturer: APC | Quantity: 1

### UPS network card
- Manufacturer: APC | Quantity: 1

### UPS bypass
- Manufacturer: APC | Quantity: 1

### Network switch
- Manufacturer: Moxa | Quantity: 1

### Fiber patch panel
- Manufacturer: DIN Space | Quantity: 1

### Panel Light
- Manufacturer: Hoffman | Quantity: 1

### Door Switch
- Manufacturer: Hoffman | Quantity: 1

### Thermistors
- Manufacturer: Hoffman | Quantity: 2

### Laptop Shelf
- Manufacturer: Hoffman | Quantity: 1

### Fan Filter Assembly
- Manufacturer: Hoffman | Quantity: 1

### PLC Processor
- Manufacturer: Allen Bradley | Quantity: 2

### Chassis
- Manufacturer: Allen Bradley | Quantity: 3

### Ethernet Communication Card
- Manufacturer: Allen Bradley | Quantity: 5

### Redundancy Module
- Manufacturer: Allen Bradley | Quantity: 2

### Redundancy Module Fiber Cable
- Manufacturer: Allen Bradley | Quantity: 1

### Discrete Input Module, 32 Pt, 24 VDC
- Manufacturer: Allen Bradley | Quantity: 2

### Discrete Output Module, 32 Pt, 24 VDC
- Manufacturer: Allen Bradley | Quantity: 1

### Analog Input Module, 6 Ch., 4-20 mA
- Manufacturer: Allen Bradley | Quantity: 2

### Analog Output Module, 6 Ch., 4-20 mA
- Manufacturer: Allen Bradley | Quantity: 2

### Power Supply
- Manufacturer: Allen Bradley | Quantity: 3

### Slot Filler
- Manufacturer: Allen Bradley | Quantity: 11

### Operator Interface, PanelView Plus 1000
- Manufacturer: Allen Bradley | Quantity: 1

### Main Power Surge Suppressor
- Manufacturer: Phoenix Contact | Quantity: 1

### Relays
- Manufacturer: Square D | Quantity: 16

### Analog Surge Suppressors
- Manufacturer: Phoenix Contact | Quantity: 24

### Circuit Breakers
- Manufacturer: Square D | Quantity: Lot

### Terminal Blocks
- Manufacturer: Phoenix Contact | Quantity: Lot

### 24 VDC PS, 5A
- Manufacturer: Phoenix Contact | Quantity: 2

### 24 VDC Redundancy Module
- Manufacturer: Phoenix Contact | Quantity: 1

#### 3. PCS-2 RIO

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Manufacturer</th>
<th>Qty.</th>
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</thead>
<tbody>
<tr>
<td>Wall mounted NEMA12 Enclosure</td>
<td>Hoffman</td>
<td>1</td>
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<tr>
<td>Enclosure back panel</td>
<td>Hoffman</td>
<td>1</td>
</tr>
<tr>
<td>LED light 5 watt</td>
<td>Hoffman</td>
<td>1</td>
</tr>
<tr>
<td>Enet card</td>
<td>Allen Bradley</td>
<td>2</td>
</tr>
<tr>
<td>32 ch DI module</td>
<td>Allen Bradley</td>
<td>4</td>
</tr>
</tbody>
</table>
**16 ch DO module** | **Allen Bradley** | **3**
--- | --- | ---
**8 ch AI module** | **Allen Bradley** | **3**
**8 ch AO module** | **Allen Bradley** | **2**
**Terminal base for DI** | **Allen Bradley** | **4**
**Terminal base for DO** | **Allen Bradley** | **3**
**Terminal base for AI/AO** | **Allen Bradley** | **5**
**24VDC power supply** | **Phoenix Contact** | **2**
**24VDC power supply redundancy mod.** | **Phoenix Contact** | **1**
**Duplex power receptacle** | **Phoenix Contact** | **16**
**Relay 24vdc coil** | **Phoenix Contact** | **1**
**Surge suppressor for AI/AO** | **Phoenix Contact** | **32**
**Base for surge suppressor** | **Phoenix Contact** | **32**
**Intrinsically safe barrier AI/AO** | **Pepperl+Fuchs** | **8**
**Intrinsically safe barrier DI/DO** | **Pepperl+Fuchs** | **8**
**Circuit breaker 1P, 15A** | **Square D** | **2**
**Circuit breaker 1P, 10A** | **Square D** | **1**
**Circuit breaker 1P, 5A** | **Square D** | **2**
**Circuit breaker 1P, 3A** | **Square D** | **1**
**Circuit breaker 1P, 2A** | **Square D** | **6**
**Circuit breaker 1P, 1A** | **Square D** | **3**
**UPS 1500VA** | **APC** | **1**
**UPS network card** | **APC** | **1**
**UPS bypass** | **APC** | **1**
**Network switch** | **Moxa** | **1**
**Fiber patch panel** | **DIN Space** | **1**

*Quantity increased in Rev. 2.0*

### 4. Chemical Fill Station Panel

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<tr>
<th>Item Description</th>
<th>Manufacturer</th>
<th>Qty.</th>
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<td>Stainless steel wall mount enclosure</td>
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<tr>
<td>Enclosure back panel</td>
<td>Hoffman</td>
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</tr>
<tr>
<td>Digital display (2 relays and 4-20ma out)</td>
<td>Precision Digital</td>
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</tr>
<tr>
<td>4-20 ma surge suppressor</td>
<td>Phoenix Contact</td>
<td>4</td>
</tr>
<tr>
<td>Base for surge suppressor</td>
<td>Phoenix Contact</td>
<td>4</td>
</tr>
<tr>
<td>Alarm strobe</td>
<td>Schnider Electric</td>
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<tr>
<td>Alarm horn</td>
<td>Edwards Signaling</td>
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<tr>
<td>Relay DPDT</td>
<td>Phoenix Contact</td>
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<tr>
<td>Time delay relay</td>
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<tr>
<td>Indicator lights</td>
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<tr>
<td>Condensation heater</td>
<td>Hoffman</td>
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<tr>
<td>Thermostat</td>
<td>Hoffman</td>
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## 4.2 Instrumentation

The following instrumentation will be provided by E-Merge. All other project instrumentation is provided by others:

<table>
<thead>
<tr>
<th>Tag No.</th>
<th>Description</th>
<th>Manufacturer</th>
<th>Qty.</th>
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<tr>
<td>FIT/FE-1101</td>
<td>Flow - Transmitter/Area Velocity Sensor</td>
<td>Hach</td>
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<td>FIT/FE-1103</td>
<td>Flow - Transmitter/Area Velocity Sensor</td>
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<td>LSH-1102</td>
<td>Level - Switch, Capacitance</td>
<td>Siemens</td>
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<td>UIT-1140</td>
<td>Gas - Monitor, Ch4</td>
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<td>YI/YA-1140</td>
<td>Gas - Alarm/Horn Strobe</td>
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<td>DPSH-1307</td>
<td>Gas - Supply Air No/Low Flow</td>
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<td>DPSH-1309</td>
<td>Gas - Exhaust Air No/Low Flow</td>
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<td>DPS-1310</td>
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<td>FIT/FE-2110</td>
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<td>Analysis - Sensor, Ph</td>
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<td>FSL-5250</td>
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<td>FIT/FE-5251</td>
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<td>PSH-5311A</td>
<td>Pressure - Switch, Gauge</td>
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<tr>
<td>PSH-5311B</td>
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<td>Ashcroft</td>
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<td>PSH-5321A</td>
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<td>PSH-5321B</td>
<td>Pressure - Switch, Gauge</td>
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<td>FIT/FE-5312</td>
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<td>LIT/LE-5402A</td>
<td>Level - Transmitter/Sensor, Radar</td>
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<tr>
<td>LIT/LE-5402B</td>
<td>Level - Transmitter/Sensor, Radar</td>
<td>Rosemount</td>
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<td>HSS-6404</td>
<td>E-Mergency Call-Out Button</td>
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<td>E-Mergency Call-Out Button</td>
<td>See Drawings</td>
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<td>YA-6103</td>
<td>Alarm - Fault</td>
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<tr>
<td>LSSL-6112</td>
<td>Level - Switch, Float</td>
<td>Flygt</td>
<td>1</td>
</tr>
<tr>
<td>LSHH-6112</td>
<td>Level - Switch, Float</td>
<td>Flygt</td>
<td>1</td>
</tr>
<tr>
<td>LIT/LE-6112</td>
<td>Level - Transmitter/Sensor, Ultrasonic</td>
<td>Pulsar</td>
<td>1</td>
</tr>
<tr>
<td>LSSL-6122</td>
<td>Level - Switch, Float</td>
<td>Flygt</td>
<td>1</td>
</tr>
<tr>
<td>LSHH-6122</td>
<td>Level - Switch, Float</td>
<td>Flygt</td>
<td>1</td>
</tr>
<tr>
<td>LIT/LE-6122</td>
<td>Level - Transmitter/Sensor, Ultrasonic</td>
<td>Pulsar</td>
<td>1</td>
</tr>
<tr>
<td>HSS-6204</td>
<td>E-Mergency Call-Out Button</td>
<td>See Drawings</td>
<td>1</td>
</tr>
<tr>
<td>LSH-6202</td>
<td>Level - Containment Float</td>
<td>Switch-Tek</td>
<td>1</td>
</tr>
<tr>
<td>YA-6203</td>
<td>Alarm - Fault</td>
<td>See Drawings</td>
<td>1</td>
</tr>
<tr>
<td>LSSL-6212</td>
<td>Level - Switch, Float</td>
<td>Flygt</td>
<td>1</td>
</tr>
<tr>
<td>LSHH-6212</td>
<td>Level - Switch, Float</td>
<td>Flygt</td>
<td>1</td>
</tr>
<tr>
<td>LIT/LE-6212</td>
<td>Level - Transmitter/Sensor, Ultrasonic</td>
<td>Pulsar</td>
<td>1</td>
</tr>
<tr>
<td>LSSL-6222</td>
<td>Level - Switch, Float</td>
<td>Flygt</td>
<td>1</td>
</tr>
<tr>
<td>LSHH-6222</td>
<td>Level - Switch, Float</td>
<td>Flygt</td>
<td>1</td>
</tr>
<tr>
<td>LIT/LE-6222</td>
<td>Level - Transmitter/Sensor, Ultrasonic</td>
<td>Pulsar</td>
<td>1</td>
</tr>
<tr>
<td>LSH-6233</td>
<td>Level - Switch, Leak</td>
<td>By Oem</td>
<td>1</td>
</tr>
<tr>
<td>HSS-6304</td>
<td>E-Mergency Call-Out Button</td>
<td>See Drawings</td>
<td>1</td>
</tr>
<tr>
<td>LSH-6302</td>
<td>Level - Containment Float</td>
<td>Switch-Tek</td>
<td>1</td>
</tr>
<tr>
<td>YA-6303</td>
<td>Alarm - Fault</td>
<td>See Drawings</td>
<td>1</td>
</tr>
<tr>
<td>HSS-7202</td>
<td>E-Mergency Call-Out Button</td>
<td>See Drawings</td>
<td>1</td>
</tr>
<tr>
<td>Magnetic Flowmeter</td>
<td>FIT-700</td>
<td>Krohne OR</td>
<td>1</td>
</tr>
<tr>
<td>Magnetic Flowmeter</td>
<td>FIT-800</td>
<td>Krohne OR</td>
<td>1</td>
</tr>
<tr>
<td>Magnetic Flowmeter</td>
<td>FIT-2201</td>
<td>Krohne OR</td>
<td>1</td>
</tr>
<tr>
<td>Magnetic Flowmeter</td>
<td>FIT-1</td>
<td>Krohne OR</td>
<td>1</td>
</tr>
<tr>
<td>Magnetic Flowmeter</td>
<td>FIT-2</td>
<td>Krohne OR</td>
<td>1</td>
</tr>
<tr>
<td>Magnetic Flowmeter</td>
<td>FIT-3</td>
<td>Krohne OR</td>
<td>1</td>
</tr>
<tr>
<td>Magnetic Flowmeter</td>
<td>FIT-4</td>
<td>Krohne OR</td>
<td>1</td>
</tr>
<tr>
<td>Magnetic Flowmeter</td>
<td>FIT-5</td>
<td>Krohne OR</td>
<td>1</td>
</tr>
</tbody>
</table>
### Magnetic Flowmeter
- **FIT-6** Krohne OR 1

### Pressure Transmitter
- **PIT-200** Rosemount OR 1

### pH Analyzer
- **AIT-200A** HACH OR Equal 1
- **AIT-2100A** HACH OR Equal 1

### Turbidity analyzer
- **AIT-702** HACH OR Equal 1
- **AIT-802** HACH OR Equal 1
- **AIT-200B** HACH OR Equal 1

### Particle Counters
- **AIT-901B** HACH OR Equal 1
- **AIT-2101B** HACH OR Equal 1

### Turbidity analyzer
- **FIT/FE-5322** Krohne 1
- **LIT/LE-5402C** Rosemount 1
- **DPSL-3108** Dwyer 1
- **DPSL-3109** Dwyer 1
- **YA/YI-3110A** Federal 1
- **YA/YI-3110B** Federal 1
- **DPSL-5358** Dwyer 1
- **DPSL-5359** Dwyer 1
- **YA/YI-5360A** Federal 1
- **YA/YI-5360B** Federal 1
- **DPSL-5367** Dwyer 1
- **DPSL-5368** Dwyer 1
- **DPSL-5369** Dwyer 1
- **YA/YI-5370A** Federal 1
- **YA/YI-5370B** Federal 1
- **YA/YI-5370C** Federal 1

*Manufacturers listed in the instrumentation schedule above are “or equal”*

**Instrument added in Rev. 2.0**

### Spares & Calibration Equipment

The following spare PLC hardware components and instrument testing/calibration hardware will be provided:

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Manufacturer</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-Slot Chassis</td>
<td>Allen Bradley</td>
<td>1</td>
</tr>
<tr>
<td>17-Slot Chassis</td>
<td>Allen Bradley</td>
<td>1</td>
</tr>
<tr>
<td>Power Supply</td>
<td>Allen Bradley</td>
<td>1</td>
</tr>
<tr>
<td>Processor</td>
<td>Allen Bradley</td>
<td>1</td>
</tr>
<tr>
<td>Redundancy module</td>
<td>Allen Bradley</td>
<td>1</td>
</tr>
<tr>
<td>32 ch DI module</td>
<td>Allen Bradley</td>
<td>2</td>
</tr>
<tr>
<td>16 ch DO module</td>
<td>Allen Bradley</td>
<td>2</td>
</tr>
<tr>
<td>8 ch AI module</td>
<td>Allen Bradley</td>
<td>2</td>
</tr>
</tbody>
</table>

*Manufacturers listed in the instrumentation schedule above are “or equal”*
### 4.4 SCADA Server/Front End Hardware

The following list the server/client PC components, UPS, and network equipment for the SCADA frontend:

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Manufacturer</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stratus Server - ztC Edge 110i</td>
<td>Stratus</td>
<td>1</td>
</tr>
<tr>
<td>Stratus Server - 5yr support</td>
<td>Stratus</td>
<td>1</td>
</tr>
<tr>
<td>Server Peripherals</td>
<td>Various</td>
<td>1</td>
</tr>
<tr>
<td>Server/rack UPS</td>
<td>APC</td>
<td>2</td>
</tr>
<tr>
<td>UPS network card</td>
<td>APC</td>
<td>1</td>
</tr>
<tr>
<td>Client PC</td>
<td>Dell</td>
<td>4</td>
</tr>
<tr>
<td>Client PC touch screen monitor for PCS-1 &amp; 2 Cabinets</td>
<td>Arista</td>
<td>2</td>
</tr>
<tr>
<td>Client PC peripherals</td>
<td>Various</td>
<td>2</td>
</tr>
<tr>
<td>Client PC UPS - for operations building clients only</td>
<td>APC</td>
<td>2</td>
</tr>
<tr>
<td>Network switch - Layer 3</td>
<td>Moxa</td>
<td>1</td>
</tr>
<tr>
<td>SFP SM 80km (for county fiber)</td>
<td>Moxa</td>
<td>2</td>
</tr>
<tr>
<td>SFP MM 1km (for local fiber)</td>
<td>Moxa</td>
<td>2</td>
</tr>
<tr>
<td>4G modem for Verizon private network</td>
<td>Cradlepoint</td>
<td>1</td>
</tr>
<tr>
<td>Antennas &amp; hardware for modem</td>
<td>Tessco</td>
<td>1</td>
</tr>
<tr>
<td>Equipment rack</td>
<td>Tripp Lite</td>
<td>1</td>
</tr>
<tr>
<td>Rack mount fiber patch panel</td>
<td>N/A</td>
<td>1</td>
</tr>
</tbody>
</table>

### 4.5 SCADA Software

The following lists all software provided:

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Manufacturer</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>FactoryTalk Site Edition Server - 250 display</td>
<td>Rockwell</td>
<td>1</td>
</tr>
</tbody>
</table>
4.6 Miscellaneous

A total of seventeen (17) Allen Bradley 1783-ETAP modules will be provided allowing for the below listed VFDs to be placed on each PLC’s device level ring:

- PFAS Blower 1 VFD
- PFAS Blower 2 VFD
- PFAS Blower 3 VFD
- Permeate Pump 1 VFD
- Permeate Pump 2 VFD
- Permeate Pump 3 VFD
- Permeate Pump 4 VFD
- RAS Pump 1 VFD
- RAS Pump 2 VFD
- RAS Pump 3 VFD
- RAS Pump 4 VFD
- Internal Recycle Pump 1 VFD
- Internal Recycle Pump 2 VFD
- Filtrate Pump 1 VFD
- Filtrate Pump 2 VFD
- Sludge Storage Blower VFD 1
- Sludge Storage Blower VFD 2
5. Assumptions/Other’s Responsibilities

1. Only above listed hardware, software and services are included in E-Merge’s scope. Any hardware, software or services beyond this proposal will be provided at extra cost.
2. This proposal is based on the Specs and Plans dated March 2019.
3. Contractor to verify that all the signals shown in specifications are available for SCADA system.
4. Provide E-Merge with one set of submittals from electrical contractor and other relevant OEM suppliers.
5. E-Merge is not supplying any concrete pads, external ground cables, ground rods, stilling wells, pipe stands, mounting hardware, etc.
6. Contractor to furnish all conduits, junction boxes, cables and wiring as required by the specifications. Contractor to install E-Merge supplied control panels in the field. Contractor to install and wire up E-Merge furnished SCADA panels.
7. Contractor to install all E-Merge furnished instruments and any associated transmitters/displays in the field. Contractor to furnish and install any accessories not specified in this proposal but required for instruments including but not limited to process taps, sensing lines, shut-off valves etc. Please see section 4.2 of this proposal which identifies E-Merge provided instrumentation.
8. Contractor to ensure that OEM’s control engineers are available for discussing PLC tag exchange between OEM PLC’s and SCADA.
9. 1783-ETAP modules listed in section 4.6 of this proposal are to be installed by others.
10. It is assumed that all VFDs listed in this proposal have an Ethernet interface for PLC communications.
11. All fiber optic cabling is provided, installed and terminated by others.

6. Cost Proposal

E-Merge section 3 “Proposed Services” and section 4 “Hardware and Software” shall be provided for a fixed price of $1,246,730.

This project is considered tax exempt and sales tax is not included in this price.

6.1 Terms and Conditions

- Payment Terms: Monthly invoicing as per an agreed upon SOV.
- For items not included in the scope of this proposal, additional services and support shall be provided at additional cost.
- For items not included in the scope of this proposal, additional services and support shall be provided via procedures described in "Project Change Control".
- Supplied equipment warranted free from defective materials and workmanship for a period of one year from date of installation.
- Invoices to be paid within 30 days of receipt. There shall be no retainage withheld.
- Prices do not include any amounts for changes in taxes, tariffs, or other similar charges that are enacted after the date of this proposal.
- This proposal is valid through April 30, 2020.
APPENDIX A. PROJECT CHANGE CONTROL PROCEDURE

The following provides a detailed process to follow if a change to this Statement of Work (SOW) is required.

- A Project Change Request (PCR) will be the vehicle for communicating change. The PCR must describe the change, the rationale for the change and the effect the change will have on the project.

- The designated Project Manager of the requesting party will review the proposed change and determine whether to submit the request to the other party.

- Both Project Managers will review the proposed change and approve it for further investigation or reject it. E-Merge will specify any charges for such investigation. If the investigation is authorized, the Project Managers will sign the PCR, which will constitute approval for the investigation charges. E-Merge will invoice GC for any such charges. The investigation will determine the effect that the implementation of the PCR will have on price, schedule and other terms and conditions of the Agreement.

- A written Change Authorization and/or Project Change Request (PCR) must be signed by both parties to authorize implementation of the investigated changes.
APPENDIX B. SIGNATURE DOCUMENT

Each of us agrees that the complete agreement between us about these Services consists of “Statement of Work”.

Accepted by: E-Merge Systems, Inc.  Accepted by: General Contractor

By ____________________________________________  By ____________________________________________

Andrew Jackson  ________________________________
Name (Type or Print)  ____________________________________________

1-14-2020  ____________________________________________
Date  ____________________________________________

E-Merge Systems, Inc.  ____________________________________________
3314 E Cary Street  ____________________________________________
Address  ____________________________________________

Richmond, VA 23219  ____________________________________________
City, State and Zip Code  ____________________________________________

City, State and Zip Code
Below is a list of the changes made to the Issued for Bid Design Documents for the Thornburg WWTP Expansion and Upgrade as part of Addendum 6.

**Revised Technical Specifications**

- Revised Specification Table of Contents
  - DELETE “Section 26 32 13 Diesel-Engine-Driven Generator Sets” and SUBSTITUTE THEREFORE “Section 26 32 13.01 Diesel-Engine-Driven Generator Sets-Installation”.

- Revised Specification 03 30 00
  - DELETE paragraph B of Specification 03 30 00 Cast-In-Place Concrete Part 3.7 Removing Forms (Dated February 2019) and SUBSTITUTE THEREFORE the following paragraph:
    
    Formwork supporting the weight of concrete, such as slabs and other structural elements, may be removed in less than 14 days but in no case until concrete has attained at least 100 percent of design minimum compressive strength at 28 days, unless otherwise noted. Determine representative compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

- DELETE Specification 07 42 13 Metal Wall Panels (Dated December 2019) and SUBSTITUTE THEREFORE Specification 07 42 13 Metal Wall Panels (Dated January 2020)

- ADD Item A Door Hardware Schedule to Specification Section 08 71 00.


- ADD Specification 26 32 13.01 Diesel-Engine Driven Generator Sets-Installation (attached to this addendum).


- DELETE Specification 43 21 36.21 Rotary Lobe Pumps (Dated February 2019) and SUBSTITUTE THEREFORE Specification 43 21 36.21 Rotary Lobe Pumps (Dated January 2020, Addendum No 6).

- Revised Specification 46 51 21
  - On Section 2.2 A.1. MBR Influent Channel Length DELETE “48.0” and SUBSTITUTE THEREFORE “41”.
  - On Section 2.2 A.1. Column/Channel – cubic feet DELETE “480” and SUBSTITUTE THEREFORE “410”.

TO: Julia Monat  
FROM: Casey Murray  
RE: Thornburg WWTP Addendum No. 6  
FILE: Docs/ Submittals  
DATE: January 14, 2020
Revised Drawings

- DELETE Drawing C-108 Yard Piping Plan (Rev No. 6, Dated January 2020) and SUBSTITUTE THEREFORE Drawing C-108 Yard Piping Plan (Rev No. 7, Dated January 2020) Attached to this Addendum #6.

- Revised Drawing S-001:
  - DELETE on Structural Concrete Notes Note 22 item B and SUBSTITUTE THEREFORE the following note:
    - B. STRUCTURAL FILL  4500  0.42  NO  F2,S0,W1,C1

- Revised Drawing S-001:
  - ADD to Structural Concrete Notes the following Note 23:
    - “23. INTEGRAL WATERPROOFING ADMIXTURE IS NOT REQUIRED IN ELEVATED SLABS AND BEAMS IN THE MBR BUILDING AND THE SOLIDS HANDLING BUILDING AND SLAB ON GRADE OF THE OPS BUILDING. INTEGRAL WATERPROOFING ADMIXTURE IS REQUIRED IN ALL OTHER ‘STRUCTURE CONCRETE.'”

- Revised Drawing S-603:
  - ADD to Floor Plan Notes the following Note 25:
    - “25. FRP FRAMING MANUFACTURER SHALL BE STRONGWELL EXTREN SERIES 625 (VINYL ESTER RESIN) OR ENGINEER OF RECORD APPROVED EQUAL. FRAMING RESIN SHALL CONFORM TO THE FOLLOWING:
      A. RESIN: VINYL ESTER
      B. FIRE RETARDENT
      C. CORROSION RESISTANT
      D. COLOR: BEIGE”

- Revised Drawing A-008:
  - DELETE Hardware Group Assignments for each door in its entirety.

- Revised Drawing A-009:
  - DELETE Hardware Group Assignments for each door in its entirety.

- Revised Drawing A-010:
  - DELETE Hardware Group Assignments for each door in its entirety.

- Revised Drawing A-011:
  - DELETE Hardware Group Assignments for each door in its entirety.

- Revised Drawings M-001:
  - From General Mechanical Notes Note 3, DELETE “See pipeline heat trace specification 26 00 30 for heat tracing schedule,” and SUBSTITUTE THEREFORE “See sheet E-201 for heat tracing schedule.”
Revised Drawing M-202:
- ADD 8" X 12" reducer on the left side (downstream) of the RAS Vault.
- In Zone 1 of PFAS Train 1 DELETE "1" AA " and SUBSTITUTE THEREFORE " ½" AA ".
- In Zone 2 of PFAS Train 1 DELETE "1" AA " and SUBSTITUTE THEREFORE " ½" AA ".
- In Zone 3 of PFAS Train 1 DELETE "1" AA " and SUBSTITUTE THEREFORE " ½" AA ".
- In Zone 4 of PFAS Train 1 DELETE "1" AA " and SUBSTITUTE THEREFORE " ½" AA ".
- In Zone 6 of PFAS Train 1 DELETE "1" AA " and SUBSTITUTE THEREFORE " ½" AA ".
- In Zone 7 of PFAS Train 1 DELETE "1" AA " and SUBSTITUTE THEREFORE " ½" AA ".
- In Zone 8 of PFAS Train 1 DELETE "1" AA " and SUBSTITUTE THEREFORE " ½" AA ".
- In Zone 2 of PFAS Train 2 DELETE "1" AA " and SUBSTITUTE THEREFORE " ½" AA ".
- In Zone 3 of PFAS Train 2 DELETE "1" AA " and SUBSTITUTE THEREFORE " ½" AA ".
- In Zone 4 of PFAS Train 2 DELETE "1" AA " and SUBSTITUTE THEREFORE " ½" AA ".
- In Zone 6 of PFAS Train 2 DELETE "1" AA " and SUBSTITUTE THEREFORE " ½" AA ".
- In Zone 7 of PFAS Train 2 DELETE "1" AA " and SUBSTITUTE THEREFORE " ½" AA ".
- In Zone 8 of PFAS Train 2 DELETE "1" AA " and SUBSTITUTE THEREFORE " ½" AA ".
- DELETE "1" PVC AA " and SUBSTITUTE THEREFORE " ½" PVC AA in 2" Carrier Pipe ".
- DELETE "1" PVC COAG " and SUBSTITUTE THEREFORE " ½" PVC COAG ".
- DELETE "1" PVC COAG " and SUBSTITUTE THEREFORE " ½" PVC COAG ".
- DELETE "1" PVC AA Refer to Civil Drawings for continuation, Heat trace and insulate above grade AA piping to 2’ below grade " and SUBSTITUTE THEREFORE " ½" PVC AA in 2" Carrier Pipe. Refer to Civil Drawings for continuation, heat trace and insulate above grade AA piping to 2’ below grade”.
- DELETE "1" PVC COAG Refer to Civil Drawings for continuation, Heat trace and insulate above grade AA piping to 2’ below grade. " and SUBSTITUTE THEREFORE " ½" PVC COAG in 2" Carrier Pipe. Refer to Civil Drawings for continuation, heat trace and insulate above grade AA piping to 2’ below grade”.

Revised Drawing M-203:
- DELETE "1" PVC AA "and SUBSTITUTE THEREFORE " ½" PVC AA ".
- DELETE "1" PVC COAG " and SUBSTITUTE THEREFORE " ½" PVC COAG ".
- DELETE "1" PVC COAG " and SUBSTITUTE THEREFORE " ½" PVC COAG ".
- DELETE "1" PVC AA Refer to Civil Drawings for continuation, Heat trace and insulate above grade AA piping to 2’ below grade " and SUBSTITUTE THEREFORE " ½" PVC AA in 2" Carrier Pipe. Refer to Civil Drawings for continuation, heat trace and insulate above grade AA piping to 2’ below grade”.
- DELETE "1" PVC COAG Refer to Civil Drawings for continuation, Heat trace and insulate above grade AA piping to 2’ below grade. " and SUBSTITUTE THEREFORE " ½" PVC COAG in 2" Carrier Pipe. Refer to Civil Drawings for continuation, heat trace and insulate above grade AA piping to 2’ below grade”.

Revised Drawing M-209:
- DELETE "1" COAG in double walled containment pipe, see yard piping for continuation, heat trace and insulate above grade AA piping to 2’ below grade “ and SUBSTITUTE THEREFORE “ ½” COAG in double walled containment pipe, see yard piping for continuation, heat trace and insulate above grade AA piping to 2’ below grade 

Revised Drawing M-502:
-
MEMORANDUM

- DELETE “1” flanged connection to SW, see plumbing drawings for continuation” and SUBSTITUTE THEREFORE “

- Revised Drawing E-102:
  - DELETE panelboard homerun designation “LV-HW-1/17” at instruments LDIT-1112, LDIT-1122, FIT-1101, FIT-1103 and UIT-1140 in the Electrical Room. Instruments LDIT-1112, LDIT-1122, FIT-1101, FIT-1103 and UIT-1140 shall be powered from circuit LV-HW-1/5 as also shown.

- Revised Drawing E-105:
  - ADD “UIT-1140” to the circuit description for circuit LV-HW-1/5.

- Revised Drawing E-108:
  - DELETE references to devices AE-2216, AIT-2216, AE-2223, AIT-2223, AE-2226 and AIT-2226.

- Revised Drawing E-302:
  - DELETE 42 KW UV System No. 1 with 100AF/80AT MCC circuit breaker and SUBSTITUTE THEREFORE 35 KW UV System No. 1 with 100AF/60AT MCC circuit breaker.
  - DELETE 21 KW UV System No. 2 with 100AF/40AT MCC circuit breaker and SUBSTITUTE THEREFORE 35 KW UV System No. 2 with 100AF/60AT MCC circuit breaker.

- Revised Drawing E-303:
  - ADD to Note 2 (Note 2 added by Addendum #3) for Switchgear Main -SWG-1 Elevation:
    “Utility metering transformers may be located in the utility’s pad mounted transformer and the switchgear utility metering transformer compartment deleted if acceptable to the utility.”

- Revised Drawing E-312:
  - DELETE for UV-1, Load: 42 KW, Circuit From Power Source To Controller: 1-1/2” conduit with 3-#2, 1-#6 ground, Circuit From Controller To Motor: 1-1/2” conduit with 3-#2, 1-#6 ground and SUBSTITUTE THEREFORE Load: 35 KW, Circuit From Power Source To Controller: 1” conduit with 3-#4, 1-#10 ground, Circuit From Controller To Motor: 1” conduit with 3-#4, 1-#10 ground.
  - DELETE for UV-2, Load: 21 KW, Circuit From Power Source To Controller: 1” conduit with 3-#6, 1-#8 ground, Circuit From Controller To Motor: 1” conduit with 3-#6, 1-#8 ground and SUBSTITUTE THEREFORE Load: 35 KW, Circuit From Power Source To Controller: 1” conduit with 3-#4, 1-#10 ground, Circuit From Controller To Motor: 1” conduit with 3-#4, 1-#10 ground.

- Revised Drawing I-101:
  - On the incoming utility line DELETE “3”-UW” and SUBSTITUTE THEREFORE “2”-UW”

- Revised Drawing I-201:
  - On the RAS line DELETE “16” RAS” and SUBSTITUTE THEREFORE “12” RAS “.

- Revised Drawing I-304:
  - Within RAS Meter Vault DELETE “14” FE-3451 “ and SUBSTITUTE THEREFORE “8” FE-3451”
  - DELETE “8” X 6” “ reducer within RAS Vault
- DELETE "8" X 6" " reducer within RAS Vault
- ADD " 8" X 12" " reducer on the downstream side of the RAS Vault after the vault bypass.
- DELETE " 8"-RAS " and SUBSTITUTE THEREFORE " 12"-RAS ".

- Revised Drawing I-603
  - ADD ¾" tepid water line connection to ½" Alk discharge to Headworks
  - ADD ¾" ball valve to ¾" tepid water line connection to ½" Alk discharge.

- Revised Drawing P-504
  - DELETE "Domestic water" from indicated call out and SUBSTITUTE THEREFORE "Non-Potable Water".

- Revised Drawing P-603
  - DELETE "Utility Water" from indicated call out and SUBSTITUTE THEREFORE "Non-Potable Water".
SECTION 07 42 13

METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concealed-fastener, lap-seam metal wall panels.
   2. Metal soffit panels.
   3. Metal Liner Panel

1.2 DEFINITION

A. Metal Wall Panel Assembly: Metal wall panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories necessary for a complete weathertight wall system.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Metal wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Delegated Design: Design metal wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of wall area when tested according to ASTM E 283 at the following test-pressure difference:
   1. Test-Pressure Difference: 1.57 lbf/sq. ft.

D. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:

E. Water Penetration under Dynamic Pressure: No evidence of water leakage when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq. ft. and not more than 12 lbf/sq. ft.
   1. Water Leakage: As defined according to AAMA 501.1.
   2. Water Leakage: Uncontrolled water infiltrating the system or appearing on system's normally exposed interior surfaces from sources other than
condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.

F. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:

1. Wind Loads: Determine loads based on the following minimum design wind pressures:
   a. Uniform pressure of 30 lbf/sq. ft., acting inward or outward.
   b. Uniform pressure as indicated on Drawings.

2. Deflection Limits: Metal wall panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/240 of the span.

G. 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, ambient; 180 deg F, material surfaces.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of wall panel and accessory.

B. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory-, shop- and field-assembled work.

1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
   a. Flashing and trim.
   b. Anchorage systems.

C. Samples for Initial Selection: For each type of metal wall panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.
2. Include manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each sealant exposed to view.

D. Delegated-Design Submittal: For metal wall panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Coordination Drawings: Exterior elevations drawn to scale and coordinating penetrations and wall-mounted items. Show the following:

1. Wall panels and attachments.
2. Stud framing.

F. Qualification Data: For Installer and testing agency.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

H. Field quality-control reports.

I. Maintenance Data: For metal wall panels to include in maintenance manuals.

J. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

C. Source Limitations: Obtain each type of metal wall panel from single source from single manufacturer.
1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.

B. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal wall panel for period of metal wall panel installation.

E. Protect foam-plastic insulation as follows:
   1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
   2. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
   3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.7 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal wall panel fabrication, and indicate measurements on Shop Drawings.

1.8 COORDINATION

A. Coordinate metal wall panel assemblies with rain drainage work, flashing, trim, and construction of girts, studs, soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall 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 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 wall 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 Hunter units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   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

2.1 PANEL MATERIALS

A. Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.

2. Surface: Smooth, flat finish.

3. Exposed Coil-Coated Finish:
   a. 3-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

4. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

B. Panel Sealants:
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 wide and 1/8 inch thick.

2. **Joint Sealant**: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal wall panels and remain weathertight; and as recommended in writing by metal wall panel manufacturer.

3. **Butyl-Rubber-Based, Solvent-Release Sealant**: ASTM C 1311.

### 2.2 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

**A. General**: Provide factory-formed metal wall panels designed to be field assembled 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, Concealed-Fastener Metal Wall Panels**: Formed with vertical panel edges and flat pan between panel edges; with flush joint between panels.

1. **Basis-of-Design Product**: Subject to compliance with requirements, provide Flush/Reveal Wall and Soffit Panel by PAC-CLAD Peterson Aluminum Corp. or comparable product by one of the following:
   a. Alcoa Architectural Products (USA).
   b. CENTRIA Architectural Systems.
   c. Fabral.
   d. Or approved equal.

2. **Material**: Zinc-coated (galvanized) steel sheet, 0.034-inch nominal thickness.
   a. Exterior Finish: 3-coat fluoropolymer
   b. Color: As selected by Architect from manufacturer's full range of colors including custom colors.

3. **Panel Coverage**: 12 inches.
4. **Panel Height**: 2.0 inch.
5. **Color**: As selected by Owner from manufacturers standard color range.

### 2.3 METAL SOFFIT PANELS

**A. General**: Provide factory-formed 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. Metal Soffit Panels: Match profile and material of metal wall panels.
   1. Finish: Match finish
   2. Color: As selected by Owner from manufacturers standard color range.

C. Flush-Profile Metal Soffit Panels: Perforated panels formed with vertical panel edges and flat pan between panel edges; with flush joint between panels.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Flush/Reveal Wall and Soffit Panel by PAC-CLAD Peterson Aluminum Corp. or comparable product by one of the following:
      a. Alcoa Architectural Products (USA).
      b. CENTRIA Architectural Systems.
      c. Fabral.
      d. Or approved equal.
   2. Material: Same material and finish as metal wall panels.
   4. Panel Height: 1.0 inch.
   5. Sealant: Factory applied within interlocking joint.

2.4 METAL LINER PANELS

A. General: Provide factory-formed metal liner panels designed for interior side walls and field assembled 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 a complete installation.

B. Metal Liner Panels: Solid panels formed with intermediate stiffening ribs symmetrically spaced between panel edges; with a flush joint between panels.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Alcoa Architectural Products (USA).
      b. CENTRIA Architectural Systems.
      c. Fabral.
      d. MBCI; a division of NCI Building Systems, L.P.
      e. Or approved equal.
   2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation;
structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
   a. Nominal Thickness: 0.022 inch.
   c. Color: As selected by Owner from manufacturer's full range.
   d. Panel Coverage: 12 inches.
   e. Seam Profile: Flush.

2.5 ACCESSORIES
   A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.
      1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal wall 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 thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

   B. Flashing and Trim: Formed from 0.018-inch minimum thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.

   C. 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 wide and 1/8 inch thick.
      2. Joint Sealant: ASTM C 920; 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.
2.6 FABRICATION

A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, 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. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, and that will minimize noise from movements within panel assembly.

E. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the 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.


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 nonexpansion but movable joints in metal to accommodate elastomeric sealant 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 by metal wall panel manufacturer.

   a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.7 GENERAL FINISH REQUIREMENTS

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: 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

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of work.

1. Examine wall 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 wall panel manufacturer.

2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.

3. Verify that weather-resistant sheathing paper has been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

4. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Framing: Inspect existing framing and replace members which are deteriorated with similar in kind. Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorages according to ASTM C 754 and metal wall panel manufacturer's written recommendations.

1. Soffit Framing: Wire-tie[ or clip] furring channels to supports[, as required to comply with requirements for assemblies indicated].

3.3 METAL WALL PANEL INSTALLATION

A. General: Install metal wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor metal wall panels and other
components of the Work securely in place, with provisions for thermal and structural movement.

1. Commence metal wall panel installation and install minimum of [300 sq. ft.] in presence of factory-authorized representative.

2. Shim or otherwise plumb substrates receiving metal wall panels.

3. Flash and seal metal wall panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.

4. Install screw fasteners in predrilled holes.

5. Locate and space fastenings in uniform vertical and horizontal alignment.

6. Install flashing and trim as metal wall panel work proceeds.

7. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.

8. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete and elsewhere as indicated or, if not indicated, as necessary for waterproofing.

9. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.

10. Provide weathertight escutcheons for pipe and conduit penetrating exterior walls.

B. Fasteners:

1. Steel Wall Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal wall panel manufacturer.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.

1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

E. Lap-Seam Metal Wall Panels: Fasten metal wall panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.

2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal wall 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.

5. Provide sealant tape at lapped joints of metal wall panels and between panels and protruding equipment, vents, and accessories.

6. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps; on side laps of nesting-type panels; on side laps of corrugated nesting-type, ribbed, or fluted panels; and elsewhere as needed to make panels weathertight.

7. At panel splices, nest panels with minimum 6-inch end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.

F. Zee Clips: Provide Zee clips of size indicated or, if not indicated, as required to act as standoff from subgirt for thickness of insulation indicated. Attach to subgirts with fasteners.

Metal Liner Panels: Install panels on interior side of subgirt with flush appearance on the inside.

3.4 METAL SOFFIT PANEL INSTALLATION

A. In addition to complying with requirements of "Metal Wall Panel Installation, General" Article, install metal soffit panels to comply with the requirements of this article.

B. Metal Soffit Panels: Provide metal soffit panels full width of soffits. Install panels perpendicular to support framing.

1. Flash and seal panels with weather closures where metal soffit panels meet walls and at perimeter of all openings.
3.5 ACCESSORY INSTALLATION

A. General: 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 wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. 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 excessive oil canning, 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 result in 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 with no joints allowed within 24 inches 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 deep, filled with mastic sealant (concealed within joints).

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect and test completed metal wall panel installation, including accessories.

B. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.

C. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.

B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
C. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.
# Section 08710 - Item 'A' Hardware Schedule

**THORNBURG WWTP EXPANSION UPGRADE**  
**PROJECT NO. 5842.70035**

<table>
<thead>
<tr>
<th>Num.</th>
<th>Item Description</th>
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**APPLIES TO DOORS: HW 101, MBR 101A, SHB 202, CB 104, 105**

| **Hardware Group # 2** | | | | | |
| 1 | Hinges | 3 pr | FFB179NRP 4 1/2" x 4 1/2" | US32D | STLY |
| 2 | Panic / Push Bar | 2 | FL2203 x V4903 | 626 | Best |
| 3 | Kick Plate | 4 | 12"H x W (Width of Door - 2") | US26D | Burns |
| 4 | Closer | 1 | D-4551 - CS | Alum. | STLY |
| 5 | Astragal | 2 | 600DKB (Set) | Alum. | NGP |
| 6 | Sweep | 1 | 600A | Alum. | NGP |
| 7 | Threshold | 1 | 8429 | Alum. | NGP |
| 8 | Door Gasketing | 3 | 131 NA | Alum. | NGP |

**APPLIES TO DOORS: HW 102, MBR 101, 102, 103, 104, SHB 101, 102, 103, CB 101, 102, 103**

| **Hardware Group # 3** | | | | | |
| 1 | Hinges | 1-1/2 pr | FFB179NRP 4 1/2" x 4 1/2" | US32D | STLY |
| 2 | Panic / Push Bar | 1 | FL2103 x 4903 | 626 | Best |
| 3 | Kick Plate | 2 | 12"H x W (Width of Door - 2") | US26D | Burns |
| 4 | Closer | 1 | D-4551 - CS | Alum. | STLY |
| 5 | Door Bottom Seal | 1 | 420 NA | Alum. | NGP |
| 7 | Door Gasketing | 3 | 131 NA | Alum. | NGP |

**APPLIES TO DOORS: MBR 104A**
### Section 08710 - Item 'A' Hardware Schedule

**THORNBURG WWTP EXPANSION UPGRADE**  
**PROJECT NO. 5842.70035**

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APPLIES TO DOORS: OPS 109, 110

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APPLIES TO DOORS: OPS 112

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APPLIES TO DOORS: OPS 105
SECTION 26 32 13.01
DIESEL-ENGINE-DRIVEN GENERATOR SETS - INSTALLATION

PART 1 - GENERAL

1.1 SUMMARY

A. Install diesel engine driven generator set for legally required standby service, as shown on the Drawings and as specified herein.
B. Generator shall be furnished by the Owner. Shop drawings and proposed delivery schedule to be provided by Owner for coordination. Owner to provide temporary off-site storage if required.

1.2 EQUIPMENT DESCRIPTION

A. This Section includes installation of a packaged diesel engine driven generator set with the following components and accessories:
1. Engine
2. Generator
3. Generator set control panel
4. Engine starting battery with charger
5. Engine coolant heater
6. Engine exhaust silencer
7. Exhaust piping external to engine
8. Sub-base fuel tank
9. Fuel oil return cooler
10. Fuel piping external to engine
11. Weatherproof enclosure
12. Access platform and stair
13. Remote annunciator
14. Remote stop switch

1.3 DEFINITIONS

A. In addition to the definitions in Division “Electrical” Section "Electrical", the following definitions apply to this Section:
1. EPSS: emergency power supply system (NFPA 110 definition)
2. Equipment Supplier: Owner selected manufacturer, or manufacturer’s representative, of the diesel-engine-driven generator set.
3. Generator: commonly used term for a rotating three phase brushless alternator with 60Hz output voltage
4. Generator set: a complete assembly of engine and generator set components capable of generating electricity
5. Legally Required Standby Systems: refer to NEC Section 701 for definition
1.4 QUALIFICATIONS

A. Testing Firm Qualifications: An independent firm, with experience and capability to conduct specified tests, and is a member company of NETA or is an NRTL as defined by OSHA in 19 CFR 1910.7, acceptable to the AHJ.

B. Testing Firm's Field Supervisor Qualifications: person currently certified by NETA or NICET to supervise on-site testing specified in Part 3.

1.5 SUBMITTALS

A. Submittals shall conform to the General Provisions.

B. Layout Drawing
   1. Scale drawing showing generator location on the site and its relationship to adjacent structures and features.

C. Concrete Pad Detail
   1. Scale drawing with plan and section views of pad showing dimensions, reinforcing, openings, subbase material and other proposed features.

D. Test Reports
   1. Acceptance test reports in accordance with NFPA 110 and as specified.

E. Manufacturer's Field Reports
   1. Inspection of equipment installation (prior to energization and startup)
   2. Acceptance test report

1.6 HANDLING, STORAGE AND DELIVERY

A. The timing of installation and required storage of the equipment shall be coordinated with the County, Engineer and Equipment Supplier in accordance with the project schedule. There is limited storage space available at the construction site and the Equipment Supplier may be required to ship to a storage site in the local vicinity as designated by the Owner.

B. The Contractor shall provide all loading, transportation and unloading to facilitate relocation of the equipment from the storage site to the construction site if necessary, and for placing the equipment in its permanent location.

C. Provide rigging, handling, temporary storage, protection and unpacking in accordance with the Equipment Supplier’s requirements.

D. Equipment damaged by handling, storage or installation by the Contractor, shall be repaired or replaced by the Contractor as directed by the Owner.

1.7 COORDINATION

A. Obtain all installation manuals, instructions and other information from the Owner and Equipment Supplier as necessary to provide proper handling, storage and installation.

B. Coordinate layout and installation of generator set with switchgear, remote starting controls, remote monitoring equipment and the work of other trades.

C. Coordinate wiring stub-up locations, necessary concrete pad openings and points of connection for grounding electrode conductors with the equipment as furnished.
D. Generator pad size shown on the Drawings is approximate. Coordinate size of concrete pad with generator dimensions (including access platform) to provide 6 inches minimum setback all around. Cast anchor bolt inserts in accordance with Equipment Supplier’s requirements.

E. Coordinate with the Equipment Supplier regarding scheduling of manufacturer’s field services.

F. Coordinate with the Equipment Supplier’s factory-authorized representative to ensure installation is in accordance with the Equipment Supplier’s requirements.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SERVICES OF CONTRACTOR

A. Installation – Receive generator from the Owner and provide installation as specified herein.

B. Start-up Assistance - Assist factory-authorized representative with inspecting, adjusting and start-up of the installed generator. Services of the factory-authorized representative will be provided by the Equipment Supplier.

C. Acceptance Testing – Provide tests, inspections and reporting as specified herein.

3.2 INSTALLATION PREREQUISITES

A. Examine areas related to installation, concrete pad and other conditions, with the Equipment Supplier’s representative present, to confirm compliance with installation requirements.

B. Examine roughing-in of conduit and grounding connections. Verify alignment with points of connections on the generator before generator set installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 CONCRETE PAD

A. Concrete pad materials and installation requirements shall be as indicated on the Drawings and as specified in Division “Concrete” Section "Cast-in-Place Concrete”.

3.4 TRANSPORTATION, STORAGE AND HANDLING

A. Transport, store, and handle generator set and accessories in accordance with Equipment Supplier’s instructions.

3.5 INSTALLATION

A. Comply with Equipment Supplier’s instructions and with NFPA 110.

B. Install generator set level on concrete pad.

1. Vibration Isolation: Mount generator set on restrained spring isolators furnished with generator.
C. Provide field assembly of access platform and other generator components shipped loose from the manufacturer.

D. Install generator to provide access for periodic maintenance without removing connections or accessories.

E. Provide all field wiring for power, grounding, control and monitoring circuits as indicated on the Drawings.
   1. Provide control wiring between the Automatic Transfer Controls in MAIN-SWG-1A/1B and the SCADA system to report that the generator is running, system transferred to standby power, and to report that utility power is restored. This shall be to initiate the appropriate sequencing of Process-Mechanical and HVAC equipment when operating on standby power and to initiate normal operation when loads are returned to utility power.

3.6 ELECTRICAL CONNECTIONS

A. Ground equipment in accordance with the Division “Electrical” Section “Grounding and Bonding for Electrical Systems”.

B. Provide conductor connections in accordance with Division “Electrical” Section “Low-Voltage Electrical Power Conductors and Cables”.

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.7 IDENTIFICATION

A. Provide warning signs and wiring identification in accordance with the Division “Electrical” Section "Identification for Electrical Systems”.

3.8 MANUFACTURER'S FIELD SERVICES

A. Manufacturer's Field Service: The Owner’s Equipment Supplier will provide the services of a factory-authorized representative to inspect, program, adjust and start-up the installed generator including:
   1. Assist the Contractor with defining Equipment Supplier’s requirements for installation.
   2. Provide engine coolant and lubricants.
   3. Inspect the completed installation and certify compliance with Equipment Supplier’s requirements.
   4. Provide on-site testing in accordance with NFPA 110.
   5. Assist with acceptance testing provided by the Contractor and Contractor’s testing firm.

3.9 ACCEPTANCE TESTING

A. The Contractor shall provide an independent testing firm to perform the following field acceptance tests and inspections:
1. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specifications INSPECTION AND TEST PROCEDURES 7.15.2 and 7.22.1 (except for vibration baseline test). Certify compliance with test parameters.

2. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
   a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
   b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
   c. Verify acceptance of charge for each element of the battery after discharge.
   d. Verify that measurements are within manufacturer's specifications.

3. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.

4. System Integrity Tests: Methodically verify proper installation, connection, and integrity of the generator before and during operation.

5. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases. Verify that performance is as specified.

6. Harmonic-Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.

7. Noise Level Tests: Measure A-weighted level of noise emanating from generator set installation, including engine exhaust and cooling-air intake and discharge, at four locations on the property line, and compare measured levels with required values.

B. Coordinate generator tests with tests for transfer equipment and perform the tests concurrently as necessary to confirm proper operation of both the generator and transfer equipment.

C. Test instruments shall have been calibrated within the last 12 months, traceable to standards of the National Institute for Standards and Technology, and adequate for making positive observation of test results. Make calibration records available for examination on request.

D. Leak Test: Inspect for fluid leaks prior to, during and after operation. Inspect for air and exhaust leaks during operation.

E. Operational Test: After electrical circuitry has been energized, start loads to confirm proper motor rotation and generator operation.

F. Test controls and safeties.

G. Malfunctioning components damaged by the Contractor during handling, storage or installation shall be repaired or replaced as directed by the Owner and shall be retested as specified above.

H. Report results of tests and inspections in writing. Record settings of adjustable parameters. Include measured insulation resistances, time delays, and other values and observations.

I. Fuel for testing shall be provided by the Contractor. Fuel tank shall be filled by the Contractor at the completion of testing.

* * * * *
SECTION 35 20 16.1

STAINLESS STEEL HYDRAULIC GATES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes stainless steel gates, including sluice, slide, weir, and stop gates, complete with all appurtenances, as indicated in accordance with the Contract Documents.

1.2 RELATED SECTIONS

A. Related Sections include the following:

1. Division 9
   a. Section 09 96 00 High Performance Coatings

2. Division 40
   a. Section 40 92 13.13 Electrically-Operated Primary Control Valves

1.3 SUBMITTALS

A. Shop Drawings

1. Submit the following in accordance with Section 01 33 00 Submittal Procedure:

2. Submit shop drawings in accordance with the requirements of Special Conditions.

3. Submit layout and coordination drawings in accordance with the requirements of Special Condition which indicate general assembly, components, materials of construction, dimensions, weights, clearances, blower support requirements, and methods of installation and assembly.

4. Provide manufacturer’s literature, including general assembly and disassembly of equipment for repair; and control drawings with list of materials, wiring diagrams, spare parts list, special tools list, and service connections.

5. Provide manufacturer’s handling, storage and detailed installation instructions, including equipment support, connection and alignment requirements, and startup instructions (if applicable).

6. Provide manufacturer’s certification of equipment compliance with the requirements of the Procurement Documents.

7. In addition to the requirements noted in the special conditions. Compliance Statement: With each submittal, include a Compliance Statement listing each
Specification Section, and Part 1, 2, and 3 Sub-Sections, stating, paragraph-by-
paragraph, compliance with the Specification, each minor nonconformity that is
within the intent of the Specification, and proposed nonconformities. Provide
short description of minor nonconformities, and detailed explanation of other
nonconformities.

B. Motor-Operated Gates

1. Submittals for motor-operated gates shall include electric actuator information
as specified in the Submittals Section 40 92 13.13 Electrically-Operated Primary
Control Valves. Submittal of the electric actuator shop drawings under a
separate cover shall not be permitted.

C. Product Data

1. Catalog information and cuts.

2. Suggested spare parts list with current price information.

3. List of special tools required for checking, testing, parts replacement, and
maintenance. Special tools are those which have been specially designed or
adapted for use on parts of the equipment, and which are not customarily and
routinely carried by maintenance mechanics.

4. List of special tools furnished with the equipment.

5. Submit a coordination list that identifies each gate. The coordination list shall
include project specific information such as tag numbers, gate type, size, and
application.

D. Test Reports

1. Test Reports

2. Investigation reports

3. Daily checklists

4. Final acceptance test and operational test procedure

E. Certificates

1. The gate manufacturer shall submit written certification with the submittal of
motor-operated gates that:

   a. The electric actuator supplied with the gate has been coordinated with
      the gate operating requirements.
b. The gate manufacturer has reviewed the electric actuator shop drawings, and the shop drawings have been coordinated with the gates so as to provide a completely functional and operational system.

2. Submit Manufacturer’s Certificate of proper installation.

F. Manufacturer’s Instructions

1. Complete manufacturer's specifications, including materials description and lubricant requirements.
2. Special handling instructions.
3. Requirements for storage and protection prior to installation.
4. Manufacturer's installation recommendations.
5. Requirements for routine maintenance required prior to startup.

G. Operation and Maintenance Data

1. Submit Operation and Maintenance Manuals in accordance with Section 01 78 23.00 18 Operation And Maintenance Data

H. Closeout Submittals

1. As-built Drawings

1.4 QUALITY ASSURANCE

A. Gates shall be the product of a single manufacturer.

B. All materials furnished under this Section shall be furnished by manufacturers who have at least five years’ experience in the design, production, assembly, and field service of units of like type, size, and materials.

C. References

Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:

1. American National Standards Institute (ANSI)
2. American Water Works Association (AWWA)
3. American Welding Society (AWS)
5. American Society of Mechanical Engineers (ASME)
6. National Electrical Code (NEC)
8. National Fire Protection Association (NFPA)
9. Occupational Safety and Health Act (OSHA)
D. Welding shall be performed in accordance with AWS standards.

E. Gates and operators shall be furnished with all necessary parts and accessories; and shall be fabricated, assembled and placed in proper operating condition in accordance with installation instructions and recommendations of the equipment manufacturer.

1.5 EQUIPMENT IDENTIFICATION

A. Equipment covered under this specification are identified as provided below in Section 2.6 SCHEDULE

1.6 DELIVERY, STORAGE, AND HANDLING

A. Materials and equipment shall be boxed, crated or otherwise completely enclosed and protected during shipment, handling, and storage. Such boxes, crates or protection shall be clearly labeled with manufacturer's name, brand or model designation, type or grade and color.

B. Protect materials and equipment from exposure to the elements and keep dry at all times. Handle and store to prevent damage in accordance with manufacturer's recommendations.

C. Material and equipment damaged by handling and storage shall be repaired or replaced by the Contractor as directed by the Engineer.

1.8 WARRANTY

A. Gates and appurtenances shall be provided with manufacturer’s warranty of not less than one (1) year from date of final acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND SYSTEM SUPPLIERS

A. Stainless Steel Gates are the design basis for this Project. Acceptable manufacturers are as follows:

1. RW Gate Company
2. WACO Products Inc.
3. Whipps, Inc
4. Or approved equal

2.2 DESIGN CRITERIA

A. Gates shall be designed for the indicated seating and unseating heads.

B. Gates shall conform to the requirements of AWWA C561, applicable to discs and frames with a safety factor of 5 with regard to tensile, compressive and shear strength.

C. All gates shall meet the allowable leakage specified herein according to gate type.
D. Materials of construction shall be suitable for the environment.

E. Sluice Gates

1. Gates shall be substantially watertight under the design head conditions. Under the design head, seating or unseating, as specified, the leakage shall not exceed 0.1 U.S. gallon per minute per foot (1.24 l/min per meter) of seating perimeter.

2. The sluice gates shall be designed to withstand the design head shown in the schedule.

3. The gate’s sealing system should have been tested through a cycle test in an abrasive environment and should show that the leakage requirements are still obtained after 25,000 cycles with a minimum deterioration.

F. Slide Gate

1. Gates shall be substantially watertight under the design head conditions. Leakage shall not exceed 0.10 U.S. gallon per minute per foot seal periphery under the design seating head and unseating head.

2. The slide gates shall be designed to withstand the maximum design head (maximum design head shall be taken as the height of the slide unless otherwise shown in the schedule).

3. The gate’s sealing system should have been tested through a cycle test in an abrasive environment and should show that the leakage requirements are still obtained after 25,000 cycles with a minimum deterioration.

G. Weir Gates

1. Gates shall be substantially watertight under the design head conditions. Leakage shall not exceed 0.10 U.S. gallon per minute per foot seal periphery under the design seating head and unseating head.

2. The weir gates shall be designed to withstand the maximum design head (maximum design head shall be taken as the height of the slide unless otherwise shown in the schedule).

3. The gate’s sealing system should have been tested through a cycle test in an abrasive environment and should show that the leakage requirements are still obtained after 25,000 cycles with a minimum deterioration.

H. Stop Gates

1. Gates shall be substantially watertight under the design head conditions. Leakage shall not exceed 0.10 U.S. gallon per minute per foot seal periphery under the design seating head and unseating head.

2. The stop gates shall be designed to withstand the maximum design head (maximum design head shall be taken as the height of the slide unless otherwise shown in the schedule).
3. The gate’s sealing system should have been tested through a cycle test in an abrasive environment and should show that the leakage requirements are still obtained after 25,000 cycles with a minimum deterioration.

2.3 MATERIALS AND CONSTRUCTION

A. Slides and Frames shall be 316L stainless steel.

B. Sluice Gates
   1. Gates shall be either self-contained or non self-contained of the rising stem, non-rising or telescopic stem configuration as indicated on the gate schedule.
   2. The wall thimble shall be stainless steel and supplied by the gate manufacturer. Refer to the gate schedule for type and applicable locations. Material thickness should be according to the manufacturer's recommendations and be of sufficient resistance to handle the operating forces.
   3. The gate frame shall be constructed of structural members or formed plate welded to form a rigid one-piece frame. The frame shall be of the flange back design suitable for mounting on a concrete wall (CW), concrete wall with extra-wide flange (CWX), round manhole (RM), round manhole with extra-wide flange (RMX), a wall thimble (WT), or a standard flange (SF). The guide slot shall be made of UHMWPE (ultra high molecular weight polyethylene).
   4. The frame configuration shall be of the flush-bottom type and shall allow the replacement of the top and side seals without removing the gate frame from the concrete or wall thimble.
   5. The slide shall consist of a flat plate reinforced with formed plates or structural members to limit its deflection to 1/720 of the gate's span under the design head.
   6. The guides shall be made of UHMWPE (ultra high molecular weight polyethylene) and shall be of such length as to retain and support at least two thirds (2/3) of the vertical height of the slide in the fully open position.
   7. Side and top seals shall be made of UHMWPE (ultra high molecular weight polyethylene) of the self-adjusting type or fully adjustable J bulb seal type. A continuous compression cord shall ensure contact between the UHMWPE guide and the gate in all positions. The sealing system shall maintain efficient sealing in any position of the slide and allow the water to flow only in the opened part of the gate.
   8. The bottom seal shall be made of resilient neoprene, EPDM, or approved equal, set into the bottom member of the frame and shall form a flush-bottom.

C. Slide Gates
   1. Gates shall be either self-contained or non self-contained of the rising stem, non-
rising or telescopic stem configuration as indicated on the gate schedule.

2. The gate frame shall be constructed of structural members or formed plate. The frame shall be suitable for mounting on a concrete wall (CW) at the end of a channel, embedded inside a channel (FE), mounted on the channel surface (EC), or mounted to a standard flange (SF). The guide slot shall be of UHMWPE (ultra high molecular weight polyethylene). The frame configuration shall be of the flush-bottom type.

3. The slide shall consist of a flat plate reinforced with formed plates or structural members to limit its deflection to 1/720 of the gate's span under the design head.

4. The guides shall be made of UHMWPE (ultra high molecular weight polyethylene) and shall be of such length as to retain and support at least two thirds (2/3) of the vertical height of the slide in the fully open position.

5. Side and top seals shall be made of UHMWPE (ultra high molecular weight polyethylene) of the self-adjusting type or fully adjustable J bulb seal type. A continuous compression cord shall ensure contact between the UHMWPE guide and the gate in all positions. The sealing system shall maintain efficient sealing in any position of the slide and allow the water to flow only in the opened part of the gate.

6. Seals shall maintain the specified leakage rate in both seating and unseating conditions. The bottom seal shall be made of resilient neoprene, EPDM, or approved equal; set into the bottom member of the frame and shall form a flush-bottom.

D. Weir Gates

1. Gates shall be either self-contained or non self-contained of the rising stem, non-rising or telescopic stem configuration as indicated on the gate schedule.

2. The gate frame shall be constructed of structural members or formed plate welded to form a rigid one-piece frame. The frame shall be of the flange back design, suitable for mounting on a concrete wall (CW). The guide slot shall be made of UHMWPE (ultra high molecular weight polyethylene).

3. The slide shall consist of a flat plate reinforced with formed plates or structural members to limit its deflection to 1/720 of the gate's span under the design head.

4. The guides shall be made of UHMWPE (ultra high molecular weight polyethylene) and shall be of such length as to retain and support at least two thirds (2/3) of the vertical height of the slide in the fully open position.

5. The bottom and side seals shall be made of UHMWPE (ultra high molecular weight polyethylene) of the self-adjusting type or fully adjustable J bulb seal type. A continuous compression cord shall ensure contact between the UHMWPE guide and the gate in all positions. The sealing system shall maintain efficient sealing in any position of the slide and let the water flow only in the open part of the gate.
6. Seals shall maintain the specified leakage rate in both seating and unseating conditions.

E. Stop Gates

1. Stop gate Frame is to be fabricated from minimum ¼” thickness 316L stainless steel. Designed to resist loads imposed by the design head upon the stop plate and into the frame.

2. Guide frames built out of plate or structural shapes shall not be acceptable.

3. The frame shall have factory welded mitered corners where the side and invert frames meet.

4. Embedded and end-of-wall mount frames shall be designed to allow for a flush bottom installation.

5. Flush bottom frames will incorporate a countersunk invert seat or flush neoprene invert seal as indicated. Formed concrete inverts and stop plate mounted seals shall not be acceptable.

6. Except as otherwise indicated by this specification, all stop gates and frames will be designed and manufactured to meet or exceed all design criteria of AWWA Standard C513, most current edition, defining head and loading calculations, structural strength, deflection requirements, and material specifications including minimum dimensions.

7. Structural components shall have a minimum design safety factor of 5 with regard to ultimate tensile, compressive, and shear strength.

8. The stop plates are to be fabricated from minimum ¼” thickness 316L Stainless steel plate and shapes reinforced as required to meet the engineer’s specified design head. Deflection under full design head will be no more than 1/360 of the span width of the gate. Stop gates will be fabricated so that gate plates will be interchangeable for all channels of equal width the same frame type.

9. Stop gates equal to or under 3 feet in width shall have single hand slots or handles as specified for lifting purposes. Gate plates wider than 3 feet in width shall incorporate dual slots or handles. Where drawings do not indicate otherwise, slots shall be provided. All slots shall have welded pipe handholds on the upper side of the slot for ease of lifting unless otherwise indicated.

10. Embedded frames shall be grouted in place within a blockout or embedded at the time of the channel concrete pour. Embedded frame extrusions shall have a minimum weight of 1 ½ lbs per foot. Frames shall have a factory applied coating of bituminous paint on all surfaces to be in contact with concrete or grout.

11. Wall mounted frames shall be designed for grouted or gasketed installation as indicated. Gasket-type frames require that Installer/Contractor field verify channel dimensions, wall alignment and wall surface conditions for suitability with gasket use prior to start of submittal drawings. End of wall mount and
intra-channel surface mount frames shall have a minimum extrusion weight of 2 pounds per foot.

12. Frames shall have a factory applied coating of bituminous paint on all surfaces to be in contact with concrete or grout.

13. All guide frames shall incorporate ultra-high molecular weight polyethylene (UHMW) bearing bars on both sides of the stop plate to reduce friction and wear between the plate and frame. Bearing bars shall be held within the guide frame by integral dovetail retaining slots in the guide extrusion. Bearing bars glued or mechanically fastened to the frame or plate shall not be acceptable.

F. Stems

1. Stems and extensions shall be entirely of Type 316 Stainless steel.

2. The sections of extension stems shall be joined together by solid couplings, threaded and keyed to the stems. All couplings of the same size shall be interchangeable.

3. Stems shall be furnished with adjustable, bronze bushed stem guides, spaced as necessary to maintain a slenderness ratio L/R of less than 200.

4. Stems shall be of ample cross section to prevent distortion and shall have stub acme threads.

5. Stems shall be designed to withstand tensile and compressive loads that occur under maximum operating conditions. Design for compressive loading shall meet AISC code where K=1 with a minimum safety factor of 2 to 1.

6. Stems shall be cold rolled with a double start stub acme thread and a finish of 32 microns or less.

7. Stem shall be fixed to the disc by a threaded and keyed assembly into a lifting nut, attached to the disc in a lifting bracket which is bolted to the disc.

8. Gates and stems shall be threaded for opening in direction scheduled herein.

2.4 ACCESSORIES

A. Manual Gate Operators

1. Gates shall be provided with manual operators of the handwheel type, with drill nut attachment. Operators shall be rising-stem with clear plastic cover with graduated gate position indicators.

2. Provide gearing as necessary to coordinate manual operator with space available at gate installation location.

3. Operators shall be sized to start the gate moving under maximum head pressure with a pull of not more than 40 pounds.

4. Provide indication of “OPEN” and arrow indicating direction of operator rotation.
to open gate.

5. The lifting mechanism shall be capable of withstanding, without damage, an effort of up to 200 pounds.

6. Provide manual operator with anti-friction brass or roller bearings.

7. Provide lubrication fittings for grease lubrication of bearings.

8. Provide floor stand for gate operators for open-frame gates.

B. Motor Operators

1. Motorized gate operators and positioners shall meet applicable requirements of the Section 40 92 13.13 ELECTRICALLY-OPERATED PRIMARY CONTROL VALVES.

C. Anchor Bolts and Hardware

2. All necessary attaching bolts, anchor bolts, mounting and assembly hardware shall be of Type 316 stainless steel and shall be furnished by the gate manufacturer.

2.6 SCHEDULE

A. Base Bid

Provide stainless steel gates as indicated in the Contract Documents and scheduled below as part of the base bid. Operators are motor powered or manual handwheel as noted in the schedule.

<table>
<thead>
<tr>
<th>Tag No.</th>
<th>Style</th>
<th>Description</th>
<th>Gate Frame Mounting</th>
<th>Opening Direction</th>
<th>Dimension W x H/Dia.</th>
<th>Operator Mounting</th>
<th>Head Conditions</th>
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<td>Embedded In-Channel And Bottom, Self-Contained</td>
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*For these gates, frame shall extend up flush with operating level finished floor. Gate operator shall be mounted on a floor stand on the top of the frame.*

**PART 3 - EXECUTION**

**3.1 INSTALLATION**
A. Install equipment and accessories in accordance with manufacturer’s instructions and recommendations and in conformance with the Contract Documents.

B. Prepare concrete mounting surfaces for installation of gates.

3.2 PAINTING

A. With the exception of those parts and components customarily furnished unpainted, all non-stainless steel metal surfaces shall be shop prepared and coated with rust inhibitive shop paint. Shop paint shall be fully compatible with the field paint specified.

B. Machined surfaces shall be protected against damage and corrosion by other means.

C. Perform field painting in accordance with the Section 09 96 00 HIGH PERFORMANCE COATINGS.

3.3 FIELD TESTING

A. After installation, the Contractor shall operate all gates to show they operate without binding or strain.

B. Any deficiencies shall be corrected at the Contractor's expense.

C. Gates shall be tested under active operating conditions for a minimum of two (2) hours.

1. Ensure leakage rate past seated gate does not exceed 0.10 gpm/ft of wetted perimeter.

2. Verify proper operation of gate operators.
   a. Unseat seated gate and run full-open.
   b. Fully seat open gate.
   c. Perform cycle a minimum of five (5) times.

3. Verify the following for each gate:
   a. Gate deflection is less than specified.
   b. Stem deflection is less than specified.
   c. Gate warpage/crowning is less than specified.

D. Defective components shall be replaced or repaired and retested at no additional cost to the Owner.

*****
SECTION 43 21 36.21

ROTARY LOBE PUMPS

PART 1 GENERAL

1.1 SUMMARY
A. This Section includes requirements for rotary lobe pumps and appurtenances to be furnished for the Solids Handling Building. The rotary lobe pumps included in this section shall be utilized for removal of thickened sludge from the thickened sludge storage tank and transfer to a truck for hauling, or to the centrifuge for dewatering, complete as specified herein and as shown in the Reference Drawings.

1.2 QUALITY ASSURANCE
A. All equipment in this Section shall be furnished by or through a single manufacturer. Pumps shall be fabricated, assembled, erected and placed in proper operating condition in full conformity with the drawings, specifications, engineering data, instructions and recommendations of the equipment manufacturer.

B. The manufacturers shall be experienced in the design and construction of equipment for this purpose, and shall have furnished such equipment and can prove that it has performed successfully for a period of not less than five (5) years.

C. Warranty

1. All equipment supplied under this Contract shall be warranted by the Manufacturer to meet the specifications herein for a period of two (2) years after delivery and acceptance by the Owner.

2. For work taken under beneficial occupancy prior to issuance of a Certificate to Operate, the two-year warranty period shall commence on the date of beneficial occupancy of that work, unless noted otherwise on the Notice of Beneficial Occupancy. Otherwise, the two-year warranty period shall commence with the date of Substantial Completion, as determined by the Owner, for all work accepted as substantially complete. Items of work which are uncompleted as of the date of Substantial Completion, or which subsequently become defective, shall be warranted for two-years from the date of their respective completion or correction.

3. Under this warranty and without limitation of any other obligation imposed by law or agreement and without limitation of any other right or remedy of the Owner pursuant to law or agreement, the Manufacturer agrees to promptly repair, replace or otherwise make good to the Owner's satisfaction, and at the Manufacturer’s expense, any and all items of work of the contract which fail to perform in accordance with the Contract Documents, and also to make good any direct damage caused by such failure.
4. This warranty shall be a part of the Manufacturer’s obligations under this Contract. The Contractor shall warrant that, unless otherwise specified, all materials and equipment under the contract shall be new, in first class condition, and in accordance with the contract documents. The Contractor further warrants that all workmanship shall be of the highest quality and in accordance with contract documents and shall be performed by persons qualified at their respective trades. Services not conforming to these warranties shall be considered defective. This warranty of materials and workmanship is separate and independent from and in addition to any of the Contractor’s other guarantees or obligations in any resulting contract.

1.3 RELATED SECTIONS

A. Related Sections include the following:

1. Section 09 99 00 – FIELD PAINTING
2. Section 26 00 20 – ELECTRIC MOTORS
3. Section 26 09 20 – PACKAGED SYSTEM CONTROL PANELS
4. Section 26 29 23 – VARIABLE-FREQUENCY MOTOR CONTROLLERS
5. Section 40 05 13 – COMMON WORK RESULTS FOR PROCESS PIPING
6. Section 40 95 13 – PROCESS CONTROL PANELS AND HARDWARE
7. Section 46 71 36 – CENTRIFUGE SYSTEM

1.4 SUBMITTALS

A. Submit shop drawings in accordance with the requirements of specification 01 33 00 submittal procedures.

B. In addition to submittals specified elsewhere, submit the following:

1. Performance data curves showing head, capacity, horsepower demand, pump efficiency, and pump speed. Indicate separately the head, capacity, horsepower demand, min. and max. operating speed and overall efficiency at the operating capacity.

2. Catalog data on pumps, motors, drives and all appurtenances.

3. Certified pump curves showing head, capacity, horsepower demand, pump efficiency, and pump speed. Indicate separately the head, capacity, horsepower demand, min. and max. operating speed and overall efficiency at the operating capacity.

4. Installation drawings for pumps, drives and bases.

5. Suggested spare parts list with current price information.

6. List of special tools required for checking, testing, parts replacement, and maintenance. (Special tools are those which have been specially designed or adapted for use on parts of the equipment, and which are not customarily and routinely carried by maintenance mechanics.)
7. List of materials and supplies furnished with the equipment.

8. Requirements for storage and protection prior to installation.

9. Requirements for routine maintenance.

10. Motor submittals shall include manufacturer’s catalog information, motor drawings and operating characteristics, nameplate data and efficiency characteristics, and maximum starts per hour. Wiring diagrams shall be provided showing power and control wiring terminal connections including wiring identification and color coding. Junction box sizing for power and control wiring connections shall be provided. Information shall indicate compliance with requirements specified in Section 26 00 20 ELECTRIC MOTORS.

13. The pump manufacturer shall review the VFD submittal, and provide written verification that the selected VFD meets the minimum operating and interface requirements for each pump.

14. Manufacturer's installation recommendations and instructions for the pumps.

15. Submit Manufacturer’s certification that all materials furnished are in compliance with the applicable requirements of this Specification.

16. Submit Manufacturer’s Certificate of proper installation.

17. Compliance Statement: With each submittal, include a Compliance Statement listing each Specification Section, and Part 1, 2, and 3 Sub-Sections, stating, paragraph-by-paragraph, compliance with the Specification, each minor nonconformity that is within the intent of the Specification, and proposed nonconformities. Provide short description of minor nonconformities, and detailed explanation of other nonconformities.

C. Submit operations and maintenance manuals in accordance with 01 33 00 Submittal Procedures and 01 78 23 Operation and Maintenance Data.

PART 2 PRODUCTS

2.1 EQUIPMENT MANUFACTURERS

A. The project design is based on Vogelsang USA as listed in this Section.

B. If any other manufacturer listed in this Section, or substitution, is proposed by the Contractor for the Work covered in this Section, it shall be the responsibility of the Contractor to perform any required redesign and coordination associated with, but not limited to, mechanical equipment layout, electrical wiring, conduit and controls, and structural/architectural work, at no additional cost to the Contract.

B. No substitution of the listed manufacturer(s) will be allowed without prior approval by the Engineer.
C. Acceptable manufacturers:
   1. Borger, LLC
   2. Vogelsang USA
   3. Swaby Lobeline
   4. or Equal

2.2 PERFORMANCE REQUIREMENTS

A. Pumps shall be of the horizontal, positive displacement rotary lobe type. Pumps shall be heavy duty, designed for thickened sludge up to 3% solids. Pumps shall be capable of a 10:1 flow range, and capable of running dry without damage to pump. Unit shall be provided complete with pump, motor, and pump base.

1. Sludge Transfer Pumps
   No. of pumps 2 (one duty, one spare)
   Primary Duty Point 165 gpm
   Secondary Duty Point (Minimum Flow) 37 gpm
   Differential Pressure 25 psi (57.8 TDH)
   Design Percent Solids 3%
   Maximum HP at Duty Condition 7.5 HP
   Suction and Discharge Flange Size 6 inch ANSI Class 150
   Pump Operating Speed RPM 274 RPM
   Drive Type Variable Speed
   Hazardous Location No
   Electric Service 460 volt, 60 Hz, 3 ph

2.3 MATERIALS AND CONSTRUCTION

A. General

1. Rotary lobe pumps shall consist of a pair of counter rotating rotors. Rotor configuration shall be per manufacturer’s recommendation for the pumping application.

2. Gears shall be synchronized such that lobes rotate without any contact under maximum duty conditions.

3. The pump heads shall be designed to permit all wetted parts to be easily removed or cleaned in place without disassembly of the pump unit or piping.

4. Pumps and drive motors shall be provided on a common galvanized steel baseplate complete with necessary couplings, guards, and mounting hardware.
5. The pumping units shall be capable of running dry, with no fluid in the pumping chamber.

B. Pump Casing and Front Cover

1. The pump casing and front cover shall be constructed of gray cast iron, with a minimum Brinell hardness of 230. The front cover shall permit removal of the rotors without disturbing piping, bearings and mechanical seals.

2. The cover shall be protected with a reversible wear plate with a Brinell hardness of 550.

C. Rotors

1. Rotors shall be of the tri-lobe form and shall be Viton or EPDM.

2. Rotors shall be designed to form precise clearances allowing no contact between rotors or pump casing.

D. Shafts

1. Shafts shall be stainless steel adequately sized to withstand full torque at the peak duty point specified.

2. Shafts shall be non-wetted. The rotor/shaft connection shall be lubricated with hydraulic oil from a separate chamber.

E. Gear Case and Bearings

1. Bearings and timing gear shall be located in a common oil filled cast iron gear case, fitted with a filler/breather plug, a level sightglass and a drain plug.

2. Bearing life to be designed for bearing life rating of 100,000 hours at design conditions.

F. Mechanical Seals

1. The pumps shall be fitted with split face type mechanical seals with silicon carbide seal faces.

2. The seals shall be operating in an oil-filled intermediate chamber.

H. Pump Accessories

1. The pump manufacturer shall provide the following pump accessories for each pump:
   a. inlet and outlet pump protection high pressure switches
   b. inlet and outlet pressure gauges
   c. outlet drain connection (3/4 in.)
2.4 DRIVES

A. Drive Coupling

1. The connection between pump and the motor shall be direct drive type.

2. A flexible coupling shall be provided on the shaft connection between the driving and driven shaft (pump and the motor). Coupling shall be supplied with elastomer element suitable to protect drive shafts from angular misalignment and parallel offset and to assure optimum shafts performance. Coupling shall be dual hub, split sleeve with bolt through type. No lubrication shall be required for any part of the coupling.

3. Coupling shall be easily replaced without moving the hubs or connected equipment. Coupling inspection shall be performed without disassembling the unit.

4. Coupling elements shall be able to withstand temperature range from –40 to 150 F without affecting its performance.

5. Coupling shall be suitable for pump speed and torque created on the shaft and shall be designed to accommodate for torque loading variation during operation of the equipment. Type and model number shall be as recommended per coupling manufacturer.

6. Coupling shall be Rexnord “Omega” type.

2.5 ACCESSORIES

A. Gauge Connections

1. Provide tapped and plugged suction and discharge gauge connections on the pump nozzles or flanges. Where this is not possible, Contractor shall provide gauge connections on the immediately adjacent piping.

B. Pressure Switches and Gages

1. The pump manufacturer shall provide pressure gauge and pressure switch assemblies, for sensing of pump suction and discharge pressures, as scheduled below.

2. Each assembly shall include a pressure switch, a pressure gauge, isolation ball valves for each switch and gauge, and brass or Type 316 stainless steel piping and fittings for connection to an annular pressure sensor element, and the sensor element. Inlet isolation rings installed on the suction side of the pump shall have compound gages.

3. The annular pressure sensor element shall provide means for indirect sensing of the process fluid pressure. Isolation rings shall be designed to permit pressure measurement on slurries and other hard-to-handle fluids without
clogging or compromising gauge function. Isolation ring shall consist of a metal ring with an elastomer inner tube filled with silicone instrument oil. Sensors shall fit inside the bolt circle of 150# ANSI flanges (or shall be provided with appropriate spacers for 300# or 600# flanges). Face to face length of the sensor shall conform to specification MSS-SP67. Sensor shall be flow through design with flexible rubber sleeve around full circumference.

4. The sensor shall be vacuum filled and permanently sealed at the factory with a modular seal consisting of a rubber membrane and needle fitting to allow removal and replacement of pressure instruments without compromising the vacuum fill. The needle fitting shall have both 1/4" NPT(F) thread and 1/2 NPT(M) threads. The pressure isolator shall be capable of operating under pressure with all instruments removed with no loss of fill fluid, without isolating valves. Pressure instruments shall be attached to the isolator with a hand tightened lock ring. It shall be possible to remove or attach pressure instruments to the isolator without requiring the use of any tools. The pressure sensor shall be permanently filled with high viscosity silicone instrument oil to damp out surges or pressure spikes without a separate snubber.

5. All pressure instruments attached to the sensor shall be rigidly supported by a post at least 0.875 inches diameter welded directly to the isolator.

6. All connections shall be 1/2" NPT as a minimum. 1/4" NPT fittings are not acceptable. The sensor ring shall not have a fill plug that can be inadvertently removed with the resultant loss of fill fluid. In order to minimize potential leak paths, where two instruments are attached to one isolator ring the instruments shall be interconnected with a 1-piece goal-post consisting of a cast 316-stainless steel manifold with ½” NPT connection points.

7. Max rated operating pressure: 1,000 psig

8. Isolator Ring Materials of Construction:
   a) Body: Carbon steel
   b) End Plates: Acetal Homo Polymer (Alt: UHMW-PE, 316-Stainless steel)
   c) Sleeve: Buna-N (Alt: EPDM, Viton)
   d) Fill Fluid: Silicone instrument oil
   e) Fasteners: 316-Stainless steel

9. Pressure switches shall be as manufactured by ASCO, Mercoid or equal.

10. The switch circuit shall be contact arrangement, rated at 4 amps for 120 VAC power. Pressure switches shall have adjustable pressure set points and adjustable pressure reset points. Suction pressure switches shall automatically reset upon increasing pressure; discharge pressure switches shall automatically reset upon decreasing pressure.

11. Pressure switches shall be housed in a NEMA 4X enclosure for non-hazardous locations unless otherwise indicated below. Pressure switches
shall be housed in a NEMA 4X and NEMA 7 rated for installation in a Class 1 Division 1 Group D hazardous location where indicated below.

12. Provide gauges in accordance with the requirements of the Section entitled “Pressure Gauges,” including shutoff cock and pulsation dampener accessories (diaphragm seal not required if annular pressure sensor element provided as required).

13. Pressure switch and gages shall be provided for the suction and discharge of all rotary lobe pumps.

14. Schedule:

<table>
<thead>
<tr>
<th>Tag No.</th>
<th>Service</th>
<th>Pump Design PSI</th>
<th>Decreasing Pressure Setpoint</th>
<th>Increasing Pressure Setpoint</th>
<th>Reference (Notes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSL-5311A</td>
<td>Centrifuge Feed (Thickened Sludge)</td>
<td>50</td>
<td>-5 in Hg</td>
<td>0 PSI</td>
<td></td>
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<tr>
<td>PSH-5311B</td>
<td>Centrifuge Feed (Thickened Sludge)</td>
<td>50</td>
<td>55 PSI</td>
<td>60 PSI</td>
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<tr>
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<td>50</td>
<td>55 PSI</td>
<td>60 PSI</td>
<td></td>
</tr>
</tbody>
</table>

2.5 SHOP PAINTING

A. With the exception of those parts and components customarily furnished unpainted, all metal surfaces shall be shop prepared and coated with rust inhibitive shop paint. Shop paint shall be fully compatible with the field paint specified. Machined surfaces shall be protected against damage and corrosion by other means.

B. Surface preparation and application of the shop paint coating shall be as specified in Section 09 99 00 FIELD PAINTING.

2.6 SPARE PARTS

A. Spare parts for the pumping equipment as listed below shall be provided in the quantities listed for each pump.

1. One (1) set of cartridge mechanical seals and o-rings for each pump

2. One (1) Set of lobes and o-rings for each pump

3. One (1) set of all special tools required for normal operation and maintenance

4. One (1) set of belts for pump

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Rotary Lobe Pumps
B. Packaging and Labeling

Spare parts listed to be furnished shall be packed in wooden boxes, labeled with the manufacturer's name, address and telephone number; local representative's name, address and telephone number; name of equipment the parts are for and list of parts contained therein.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install pumps and accessories in accordance with the configuration shown on the Contract Drawings.

B. Prior to grouting, pump and pump motor base plates shall be leveled with metal shims in accordance with Hydraulic Institute Standards. Wedges will not be allowed.

C. The baseplates shall be grouted after initial fitting and alignment but before final bolting of connecting piping. The Contractor shall maintain alignment of pumping unit components. No stresses shall be transmitted to the pump flanges. After final alignments and bolting, pump connections shall be tested for applied stresses by loosening the flange bolts. If any movement or opening of the joints is observed, piping shall be adjusted to proper fit.

D. All bearings shall be lubricated according to the manufacturer's instructions and all adjustments made to suite anticipated operating conditions.

3.2 FIELD TESTING AND INITIAL OPERATION

A. Field testing of each of pumping equipment specified herein shall be performed in accordance with the Contract Documents as follows:

1. Pre-test Checkout

   a. Pump Alignment

      1) Before pedestal is grouted check that pump column assembly is absolutely horizontal.

      2) Check for piping stresses after final alignment and bolting. Loosen flange bolts and measure pipe deflection or movement due to forcing of pipe into position. If pipe movement occurs, realign piping. Grout pumps.

   b. Rotate pump by hand to determine free rotation with motor leads disconnected.

   c. Demonstrate that each unit:

      1) Has been properly installed
      2) Is in proper alignment.
      3) Has been properly connected.
4) Has no visual defects.
5) Has no mechanical defects.

B. Final acceptance will be dependent upon the satisfactory operation and performance after installation.

3.3 MANUFACTURER’S FIELD SERVICE

A. Provide manufacturer's services at the jobsite for the minimum hours listed below, travel time excluded:

1. 16 hours for installation assistance, inspection, and certification of installation (minimum two visits)
2. 8 hours for performance testing
2. 4 hours for operational training (minimum 1 session)

B. Above services shall be provided by the manufacturer's qualified factory-trained service staff.

* * * * *
SECTION 43 21 39.01
DRY-PIT SUBMERSIBLE PUMPS

PART 1 GENERAL

1.1 SUMMARY

A. Work specified in this Section includes but is not limited to the following:
   1. Furnish all labor, materials, equipment and appurtenances required to provide vertical non-clog centrifugal submersible pumps in dry-pit-mode and appurtenances for the pumping of raw wastewater as specified herein and as shown on the Contract Drawings.
   2. All equipment and components furnished under this Section shall be the latest, most current design and production.

B. Equipment covered under this specification is identified as follows:
   RAS Pump No. 1
   RAS Pump No. 2
   RAS Pump No. 3
   RAS Pump No. 4

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specifications, apply to this Section.

1.3 RELATED SECTIONS

B. Section 01 33 00 SUBMITTALS
F. Section 01 78 23 OPERATIONS AND MAINTENANCE DATA
E. Section 01 79 00 DEMONSTRATION AND TRAINING
G. Section 01 91 13 GENERAL COMMISSIONING REQUIREMENTS
H. Section 09 99 00 FIELD PAINTING
I. Section 26 00 20 COMMON MOTOR REQUIREMENTS
J. Section 26 26 29 13.06 REDUCED VOLTAGE SOLID STATE STARTERS
K. Section 43 08 20.11 TESTS ON PUMPING EQUIPMENT

1.4 REFERENCES

A. American Society for Testing and Materials (ASTM)
B. American Iron and Steel Institute (AISI)
C. Mine Safety and Health Administration (MSHA)
D. National Electrical Code (NEC)
E. Insulated Cable Engineers Association (ICEA)

1.5 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00 SUBMITTAL PROCEDURES. Submit the following items at the same time under one cover:

1. Performance data curves showing head, capacity, horsepower demand, pump efficiency, and net positive suction head required over the entire operating range of the pump at both the minimum and rated speed.

2. Catalog data on pumps, motors, drives and all appurtenances.

3. Certified pump curves showing head, capacity, horsepower demand, pump efficiency, and net positive suction head required over the entire operating range of the pump at both minimum and rated speed.

4. Installation or placing drawings for equipment, drives and bases.

5. Suggested spare parts list with current price information.

6. List of special tools required for checking, testing, parts replacement, and maintenance. (Special tools are those which have been specially designed or adapted for use on parts of the equipment, and which are not customarily and routinely carried by maintenance mechanics.)

7. List of materials and supplies furnished with the equipment.

8. Requirements for storage, maintenance and protection prior to installation.

9. Motor submittals shall include manufacturer’s catalog information, motor drawings and operating characteristics, nameplate data and efficiency characteristics, and maximum starts per hour and demonstrate compliance with the Section 26 00 20 ELECTRIC MOTORS. Wiring diagrams shall be provided showing power and control wiring terminal connections including wiring identification and color coding. Junction box sizing for power and control wiring connections shall be provided.

B. Manufacturer’s installation recommendations and instructions for the equipment specified.

C. Address and contact information for the manufacturer’s factory authorized service center that is closest to the worksite.

D. Submit Operation and Maintenance Manuals in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

E. Submit Manufacturer’s certification that all materials furnished are in compliance with the applicable requirements of this Specification.
F. Submit Manufacturer’s Certificate of proper installation.

1.6 QUALITY ASSURANCE

A. All equipment in this Section shall be furnished by or through a single supplier. The contractor shall be responsible for the design, coordination and proper operation of the entire system. Pumps shall be fabricated, assembled, erected and placed in proper operating condition in full conformity with the drawings, specifications, engineering data, instructions and recommendations of the equipment manufacturer.

B. The manufacturers shall be experienced in the design and construction of equipment for this purpose, and shall have furnished such equipment and can prove that it has performed successfully for a period of not less than five (5) years.

1.7 DELIVERY, STORAGE, AND HANDLING

A. After testing and before dismantling pumping equipment for shipment, all wiring and mechanical connections shall be match-marked or tagged to ensure proper field assembly

B. Materials and equipment shall be boxed, crated or otherwise completely enclosed and protected during shipment, handling, and storage. Such boxes, crates or protection shall be clearly labeled with manufacturer's name, brand or model designation, and type or grade. Complete packing lists and bills for material shall be included with each shipment. Each item of equipment shall be tagged or marked with the same identification number or mark as shown on the packing lists and bills of material

C. Protect materials and equipment from exposure to the elements and keep dry at all times. Handle, maintain and store to prevent damage and in accordance with manufacturer's recommendations.

D. Materials and equipment damaged by handling, maintenance and storage shall be repaired or replaced by the Contractor as directed by the Owner.

E. Pumps shall be protected against corrosion during storage and prior to being placed in operation. Machined surfaces shall be flushed with heavy, non-corrosive oil, and bearings shall be lubricated. Contractor shall inspect the stored pump weekly, shall manually rotate or slide all moving parts, and shall renew the lubrication in accordance with manufacturer’s recommendations. Before the pump is put into operation, it shall be cleaned.

1.8 WARRANTY

A. The pump manufacturer shall warrant the pumps being supplied to the Owner for a period of not less than five (5) years with a non-prorated warranty following the requirements identified in the Sections entitled “Operation and Maintenance Data,” “Demonstration and Training,” and “General Commissioning Requirements.” Warranty shall cover defects in materials and workmanship. The manufacturer shall replace parts which become defective, at no additional cost to the Contract.

B. The pump manufacturer shall submit three copies of the warranties to the Owner prior to the equipment installation.
PART 2 PRODUCTS

2.1 MANUFACTURERS
   A. The project design is based on Flygt pump model number DP N150-3850.
   B. If any manufacturer other than those listed in this Section is proposed by the Contractor for the Work covered in this Section, it shall be the responsibility of the Contractor to perform any required redesign and coordination associated with, but not limited to, mechanical equipment layout, electrical wiring, conduit and controls, and structural/architectural work, at no additional cost to the Contract.
   C. No substitution of the listed manufacturer(s) will be allowed without prior approval by the Owner, in accordance with the requirements outlined on the Bid Form.
   D. Acceptable Manufacturers:
      1. Flygt model number: DP N150-3850
      2. KSB
      3. Or approved equal.

2.2 PERFORMANCE REQUIREMENTS
   A. Pumps shall be capable of operating in a continuous non submerged condition in vertical position in a dry-pit installation.
   B. Pump shall be of submersible construction and will continue to operate within the specified duty points should the pumps be submerged in a flood condition.

2.3 PUMP SCHEDULE
   A. Dry-Pit Submersible Pumps
      No. of pumps 4
      Type Dry-pit submersible, non-clog
      Pump configuration Vertical, centrifugal
      Impeller Semi-open, non-clog
      Maximum rated speed 1422 RPM
      Design Capacity 1301 gpm @ 9.2 ft
      Motor characteristics 460V / 3 Phase / 50/60 Hz / 1.15 SF
      Maximum horsepower 5.5 HP
      Drive Variable Speed
      Suction Elbow Port 8-inch
      Discharge Port 6-inch
2.4 MATERIALS AND CONSTRUCTION

A. Pump Construction
   1. Major pump components shall be of gray cast iron, ASTM A 48, Class 35B, with smooth surfaces devoid of blow holes or other casting irregularities.

   2. All exposed nuts or bolts shall be AISI type 316 stainless steel. All metal surfaces coming into contact with the pumped media, other than stainless steel, shall be protected by an approved sewage resistant factory applied spray coating. Equipment shall be shop finish coated.

   3. Where water tight sealing is required, O-rings made of Viton, or Nitrile shall be used. All mating surfaces where water tight sealing is required shall be such that sealing is accomplished by metal to metal contact between machined surfaces, resulting in a controlled compression of O-rings without the requirement of a specific torque limit to affect the seal. Rectangular gaskets, elliptical "O"-rings, grease, or other devices shall not be used.

   4. Pump volute(s) shall be single-piece non-concentric design with smooth passages large enough to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified.

B. Wearing Rings
   1. The impeller shall be provided with an AISI 329 duplex stainless steel or 316LSS wear ring which is drive fitted to the suction eye of the impeller.

   2. The casing shall be provided with an AISI 304 stainless steel wear ring which is drive fitted to the bottom suction inlet.

   3. The volute wear ring Brinell Hardness Number (BHN) shall exceed the impeller wear ring hardness by at least 50 BHN.

C. Impeller
   1. Pump impellers shall be of the solids handling non-clog type. The impeller vane shall be smooth, finished throughout, and shall be free from sharp edges.

   2. The impeller shall be of Hard-Iron™ (ASTM A-532 (Alloy III A) 25% chrome cast iron), dynamically balanced, semi-open, multi-vane, back swept, screw-shaped, non-clog design. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The leading edges of the impeller shall be hardened to Rc 60 and shall be capable of handling solids, fibrous materials, heavy sludge and other matter normally found in wastewater. The screw shape of the impeller inlet shall provide an inducing effect for the handling of up to 5% sludge and wastewater. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw. The impeller shall be locked to the shaft, held by an impeller bolt and shall be coated with alkyd resin primer.

   3. The impeller(s) shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in raw wastewater.
4. Impeller(s) shall be key driven and securely held to the shaft by a streamlined impeller washer and bolt assembly specifically designed to reduce friction in the suction eye of the impeller. The arrangement shall be such that the impeller cannot unscrew or be loosened by torque from either forward or reverse rotation. Designs based on threaded connection between pump shaft and impeller will not be considered.

5. The impeller shall be capable of passing a 3 inch solid non-deformable sphere through the bottom inlet and out between the two shrouds. Designs which cannot pass a sphere through the impeller or rely on deforming, cutting or chopping solid materials shall not be acceptable.

E. Bearings

1. The pump shaft shall rotate on at least three grease-lubricated bearings. The upper bearing, provided for radial forces, shall be a single roller bearing. The lower bearings shall consist of at least one roller bearing for radial forces and one or two angular contact ball bearings for axial thrust.

2. The minimum L10 bearing life shall be 50,000 hours as defined by the Anti-Friction Bearing Manufacturers Association, at conditions of operation.

F. Mechanical Seal

1. Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The lower seal shall be independent of the impeller hub. The seals shall operate in a lubricant reservoir that hydro-dynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one rotating corrosion resistant tungsten-carbide or silicon-carbide seal ring. The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall be a leakage-free seal. The upper seal shall contain one stationary and one positively driven rotating corrosion resistant tungsten-carbide or silicon-carbide seal ring.

2. Each seal interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment and shall be capable of operating in either clockwise or counter clockwise direction of rotation without damage or loss of seal.

3. Conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces shall not be allowed. No system requiring a pressure differential to offset pressure and to affect sealing shall be used.

4. Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. The motor shall be able to operate continuously while non-submerged without damage while pumping under load.

G. Submersible Motors
1. The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be insulated by the trickle impregnation method using Class H monomer-free polyester resin resulting in a winding fill factor of at least 95%.

2. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable.

3. The motor shall be designed for continuous duty handling pumped media of 40°C (104°F) and capable of no less than 30 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of cast aluminum. Thermal switches set to open at 125°C (260°F) shall be embedded in the stator end coils to monitor the temperature of each phase winding. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the control panel.

4. The motor and the pump shall be produced by the same manufacturer.

5. Each pump shall be furnished with a squirrel cage, induction motor enclosed in a watertight housing.

6. The motor shall be suitable for wet pit or dry pit installation under full load conditions. The motors shall be capable of installation in either the wet pit or dry pit installation without adding or removing any items to the motor’s interior or exterior. Motors shall be capable of supplying the maximum rated horsepower and rpm specified by the pump manufacturer and shall be capable of withstanding all forces that may be imposed during the course of normal operation.

7. Motors shall be capable of up to 30 starts per hour at an ambient temperature of 40°C.

8. Motors shall be capable of uninterrupted operation with a voltage drop of 10%.

9. The power cables entering the motor housing shall connect to individual terminal pins, which separates the incoming service from the pump motor.

10. The motor shall be fitted with at least two lifting eyes or heavy duty lifting bail capable of supporting the entire weight of the pump and motor.

11. Cold-type thermistors or bimetallic thermal switches shall be furnished to control the winding temperature in the motor. The stator shall be equipped with a set of thermistors or bimetallic thermal switches, one per phase. Thermistors or bimetallic thermal switches shall open automatically and de energize the motor when its temperature exceeds a preset limit as recommended by the manufacturer.

12. A moisture sensor shall be mounted in the stator housing to signal if there is water intrusion.
13. A Mini-CAS II, 120VAC module, or approved equal, shall be provided as part of the Protective Devices specified in section I installed in the control panel to monitor temperature and leakage in the motor.

14. The use of wire nuts or crimp-type connectors is not acceptable.

H. Power and Control Cables

1. The power cable shall be sized according to the NEC and ICEA standards and shall be furnished in lengths to run un-spliced from the pump to the pump control panel as shown on the Contract Drawings and as specified herein. Cables shall terminate with conductor sleeves that bundle the entire group of strands of each phase to improve termination at the pump control panel. The sleeves shall be provided to confirm that all strands of each conductor are terminated properly. Termination shall be coordinated with the connection to the Pump Control Panel.

2. Power and control cables under common sheathing shall be terminated at common junction box.

3. Cables shall be of the "NSSHOU" type and shall be approved by the MSHA for use in hazardous locations and shall conform to industry standards for loads, resistance under submersion against sewage, and be of stranded construction. The cables shall enter the pump through a heavy duty entry assembly which shall be provided with an external clamp assembly to protect against tension once secured providing a strain relief function as part of standard construction.

4. The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of dual cylindrical elastomer grommets, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter. The grommets shall be compressed by the cable entry unit, thus providing a strain relief function. The assembly shall provide ease of changing the cable when necessary using the same entry seal. The cable entry junction chamber and motor shall be sealed from each other, which shall isolate the stator housing from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered equal.

5. The motor horsepower shall be adequate so that the pump is non-overloading throughout the entire pump performance curve from shut off through run out.

I. Protective Devices

1. All stators shall incorporate three thermal switches, connected in series, to provide over temperature protection of the motor winding. Should high temperature occur, the thermal switches shall open, stop the motor and activate an alarm.

2. One leakage sensor shall be provided to detect water intrusion into the stator chamber and junction chamber. When activated, the switch will stop the motor and activate an alarm.

3. The pump motors will be equipped with (3) klixons (or approved equal) – (1) embedded per phase winding, and the FLS Leakage Sensor. The thermal switch in the stator will reset automatically, however, in order to provide proper motor protection, the thermal switches must be connected to the motor starter via an
J. Nameplate

1. Each pump shall be supplied with a stainless steel nameplate listing the following data as a minimum:

   1) Manufacturer and Model Number
   2) Serial Number
   3) Rated Horsepower
   4) Insulation Class
   5) Voltage and Amperage at Full Load
   6) Full Load Speed
   7) Head and GPM Rating
   8) Impeller Code/Size
   9) Service Factor
  10) Frequency
  11) Full Load Current at Nameplate Voltage

2.5 PUMP SUPPORT BASE AND SUCTION PIPING

A. Components

1. Anchor bolts shall be embedded in the concrete to attach / secure the four corners of the steel base transition plate to the concrete (Construction by contractor). Anchor bolts shall be sized by the pump manufacturer and shall be embedded in the concrete in accordance with the pump manufacturer’s recommendations. The pump shall be bolted or anchored for wet sewage conditions requiring the use of 316 stainless steel bolts and hardware. Expansion/wedge style anchors will not be acceptable.

2. The pump base plate shall be 12 mm thick A36 structural steel with epoxy coating to avoid vibrations due to flexibility. The base plate shall be machined at the pump suction interface and at the concrete pier interface. The plate shall be bored / drilled to match the suction connection of the pump and shall have 11/16 inch (minimum) anchor bolt holes drilled at each of the corners. (Base plate by pump manufacturer)

3. Suction spool piece - constructed of ASTM A48 Class 30B or higher cast iron as shown in the contract drawings. The suction spool piece shall be a custom fabrication to fit the installation location and accomplish the piping connection between the pump and the suction elbow. It shall be designed to provide equal flow distribution to the impeller eye. Surface preparation and coating application
shall be in accordance with manufacturer’s instructions. Contractor to provide appropriate connection piece.

5. Hardware - The suction elbow shall be supplied with all attachment hardware necessary to connect the upper elbow flange to the suction of the pump. The hardware shall be AISI 304 stainless steel. (Hardware by pump manufacturer)

B. Construction

1. The pump shall be supported by the 12 mm (minimum) thick base plate. The base plate shall be anchored at four corners to the top of the concrete. Contractor shall ensure that the base plate makes complete contact with the supporting concrete and there are no air gaps at these interfaces. The suction spool piece shall be secured to the underside of the base plate and to the suction elbow, secured to the station suction piping.

2.6 SPARE PARTS

A. The manufacturer shall furnish one set of the following spare parts:

1. One (1) Spring Washer
2. One (1) Retaining Ring
3. One (1) O-Ring Kit
4. One (1) upper bearing
5. One (1) Lower Bearing
6. One (1) Mechanical Seal (contains inner and outer seal)
7. One (1) Sticker

B. A written description of each spare part and the storage recommendation shall be provided as directed by the Owner.

2.7 SHOP PAINTING

A. With the exception of those parts and components customarily furnished unpainted, all metal surfaces shall be shop prepared and shop finish coated with rust inhibitive shop paint. Shop paint shall be fully compatible with the field paint specified. Machined surfaces shall be protected against damage and corrosion by other means.

B. Surface preparation and application of the shop paint coating shall be as specified in Section 09 99 00 FIELD PAINTING.

2.8 SOURCE QUALITY CONTROL

A. Perform shop testing in accordance with the requirements of the Section entitled “Tests on Pumping Equipment”.
PART 3 EXECUTION

3.1 INSTALLATION

A. Install pumps and accessories in accordance with the configuration shown on the Contract Drawings.

B. Prior to grouting, pump and pump motor base plates shall be leveled with metal shims in accordance with Hydraulic Institute Standards. Wedges will not be allowed.

C. The baseplates shall be grouted after initial fitting and alignment but before final bolting of connecting piping. The Contractor shall maintain alignment of pumping unit components. No stresses shall be transmitted to the pump flanges. After final alignments and bolting, pump connections shall be tested for applied stresses by loosening the flange bolts. If any movement or opening of the joints is observed, piping shall be adjusted to proper fit.

D. All bearings shall be lubricated according to the manufacturer's instructions and all adjustments made to suite anticipated operating conditions.

E. Field Painting

1. Field painting shall be in accordance with the Section entitled “09 99 00 FIELD PAINTING”.

3.2 FIELD QUALITY CONTROL

A. Field Testing of each of the pumping equipment specified herein shall be performed in accordance with the Contract Documents as follows:

1. Pre-test Checkout

a. Pump Alignment

1) Before Pedestal is grouted, check that pump column assembly is absolutely vertical.

2) Check for piping stresses after final alignment and bolting. Loosen flange bolts and measure pipe deflection or movement due to forcing of pipe into position. If pipe movement occurs, realign piping. Grout pumps.

b. Rotate pump by hand to determine free rotation with motor leads disconnected.

c. Demonstrate that each unit:

1) Has been properly installed

2) Is in proper alignment

3) Has been properly connected

4) Has no visual defects

5) Has no mechanical defects
d. Furnish Manufacturer's Certificate of Installation.

2. Performance Tests
   a. Perform pump running tests in accordance with the Section entitled “Tests on Pumping Equipment.”

B. Manufacturer’s Field Service will be provided at the jobsite designated by the Owner in accordance with Section 01 79 00 DEMONSTRATION AND TRAINING.
   1. Each jobsite visit shall be scheduled separately with minimum seven (7) calendar days’ notice prior to each visit. The service visit for operational training shall be scheduled in coordination with the Owner operations staff and shall be at such times as requested by the Owner. Video recording of the training sessions shall be provided by pump manufacturer.
   2. Above services shall be provided by the manufacturer's qualified factory-trained service staff.

PART 4 MEASUREMENT AND PAYMENT

4.1 MEASUREMENT
   A. Work will not be measured separately for payment.

4.2 PAYMENT
   A. Payment for dry-pit submersible pumps will be made at the Contract lump-sum price, which price and payment include all labor, materials, tools, fees, equipment and incidentals needed to complete work specified.

* * * * *

January 2020
Dry-Pit Submersible Pumps
Addendum No. 6