Union County
North Carolina

Crooked Creek WWTP Influent Pump Station, Headworks
and Equalization Tank Improvements Project
IFB No. 2016-029

******************************************************************************
ADDENDUM NO. 2

ISSUE DATE: FEBRUARY 8, 2016

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Bidders on this project are hereby notified that this Addendum shall be attached to and made a
part of the above named Contract Documents.

The following items add to, modify, and clarify the Contract Documents and shall have the full
force and effect of the original Documents. Bids shall conform to those items and the cost
change, if any, of these items shall be included in this Bid Price. This Addendum shall be
acknowledged by the Bidder on Page 1 of the Bid Form, C-410.
IN THE SPECIFICATIONS

Section C-410, Bid Form
1. Remove Section C-410 in its entirety (including attachments A and B) and replace with the revised Section C-410 attached.

Section 01014, Construction Sequence and Maintenance of Plant Operations during Construction
1. Page 01014-3, paragraph 1.02.F.2 add the following sentence to the end of the paragraph:

   “Bypass pumping of the existing 21-inch gravity sewer system shall be able to accommodate a peak flow of 7.0 mgd with a duty/standby arrangement.”

Section 01025, Measurement and Payment
1. Remove Section 01025 in its entirety and replace with the revised Section 01025 attached.

Section 01310, Construction Scheduling
1. Page 01310-1, paragraph 2.01.A, add the following sentence to the end of the paragraph:

   “The Contractor is allowed to use Microsoft Project as long as all scheduling documents and requirements of this Section are provided.”

Section 02213, Controlled Blasting and Rock and Boulder Excavation
1. Page 02213-5, delete paragraph 1.05.D.6 in its entirety.

Section 02616, Valves, Ductile Iron Pipe and Fittings
1. Page 02616-7, paragraph 2.03.B add the following sentence to the end of the paragraph:

   “Alternatively, stainless steel locking teeth integral to the joint gasket will be allowed for pipe 12-inches in diameter and smaller for ductile iron pipe restrained joints and fittings. Alternative restrained joint system shall be Field Lok by U.S. Pipe and Foundry, Fast Grip Gaskets or Field Flex-Ring by American Cast Iron Pipe Company, or approved equal.”

Section 02640, Valves, Hydrants and Appurtenances
1. Page 02640-8, paragraph 2.04.A after the words “cast iron” add the words “or epoxy-coated steel”.
2. Page 02640-8, paragraph 2.04.A after the name “Clow” add “, Smith-Blair”.

Section 03180, Concrete Coatings
1. Page 03180-4, paragraph 2.01.A after the words “ITW Futura Coatings, St. Louis, MO,” add the words “, Sewpercoat (1” minimum thickness) as manufactured by Kerneos Inc., Chesapeake, VA”.

Section 11282, Slide Gates
1. Remove Section 11282 in its entirety and replace with the revised Section 11282 attached.
Section 11285, Sluice Gates
1. Delete Section 11285 in its entirety.

Section 11300, Jet Aeration and Mixing System
1. Page 11300-3, paragraph 1.03.B, ninth sentence, delete the words “with modeling wastewater tanks”.
2. Page 11300-5, paragraph 1.05.G, third sentence, delete the words “with modeling wastewater tanks” and replace with the words “CFD modeling”.
3. Page 11300-10, paragraph 2.02.F.2, first sentence, delete the words “75 psi” and replace with “100 psi”.
4. Page 11300-10, paragraph 2.02.F.3 under Schedule of Pipe Wall Thicknesses for 24-inch diameter pipe delete the words “0.31” and replace with “0.36”.
5. Page 11300-11, paragraph 2.02.H.1, fourth sentence, delete the words “75 psi” and replace with “100 psi”.
6. Page 11300-22, delete paragraph 3.03 Field Testing in its entirety and replace with the following:

“3.03 FIELD TESTING

A. Blowers

1. Each of the blowers and appurtenances, including baseplate and silencers, shall be assembled at the manufacturer's production facility and tested by the blower manufacturer. Tests shall include a performance test under full load conditions and at the performance conditions specified. A performance test report shall be provided. The test method shall be per ASME PTC9 or similar, internationally recognized standard such as ISO or DIN. For blowers 8 inch gear diameter and smaller, certified PTC9 test report shall be for one test method per ASTM PTC9 paragraph 4.52. Equipment will have been run for ample time to allow for thermal adjustment before data can be taken. Test shall include ambient conditions, flow, bhp, slip, inlet and outlet temperature and motor efficiency. Slip test only shall not be acceptable.

2. After installation of all equipment has been completed and as soon as conditions permit, conduct an acceptance test under actual operating conditions to determine the operation is satisfactory and free from excessive vibration. The test shall consist of a minimum of 4 hours operation of each blower with readings taken and recorded at 30-minute intervals. Variable or multiple speed units shall be tested over the full range of the specified operating speeds.

3. Noise and vibration tests shall be conducted to ensure that the equipment noise level conforms to this Section. Each blower package shall be tested, with one unit running, in accordance with ISO 2151. Certified dBA noise level test results demonstrating compliance with specified noise levels shall be submitted to the Engineer.

4. To verify air flow is within the specified range, perform a flow test to confirm that the blower performance or "inefficiency" is within the manufacturer's stated tolerance.
a. Immediately correct or replace all defects or defective equipment revealed or noted during the field tests, at no additional cost to the Owner, and repeat tests until specified results are obtained. Contractor to provide all labor, piping, equipment, flow meters, test gauges, vibration testing equipment and materials for conducting tests.

b. Equipment that is unable to meet all the requirements specified to the satisfaction of the Engineer shall be removed and replaced with equipment that complies with all the requirements at no additional cost to the Owner.

B. Factory Pump Tests

1. Non-witnessed factory testing in accordance with the standards of the Hydraulic Institute shall be required for all pumps prior to shipment from the manufacturer. Non-witnessed factory tests shall be conducted by a licensed professional engineer with test results signed by the licensed professional engineer.

2. Certified pump performance curves shall be submitted, including head, capacity, brake horsepower, and pump efficiency for each pump supplied. Certified data shall be provided to verify the NPSH required by the pumps at the primary operating as required by the jet mix manufacturer.

3. All pumps shall be tested at full speed and complete staging through the specified range of flow, and head/capacity/efficiency curves plotted at maximum output speed. During each test, the pump shall be run at each head condition for sufficient time to accurately determine discharge, head, power input, and efficiency.

4. If any pump tested fails to meet any specification requirement it will be modified until it meets all specification requirements. If any pump tested fails to meet the requirements of the jet mix manufacturer at any of required flow or head conditions and all reasonable attempts to correct the inefficiency are unsuccessful, the pump(s) shall be replaced with unit(s) that meet the specified requirements.

C. Field Motor Tests:

1. The Contractor shall megger each motor winding before energizing the motor, and, if insulation resistance is found to be low, shall notify the Engineer and shall not energize the motor.

2. The Contractor shall check all motors for correct clearances and alignment and for correct lubrication in accordance with manufacturer’s instructions. The contractor shall check direction of rotation of all motors and reverse connections if necessary.

3. Vibration measurements shall be performed on the pumps by a qualified independent testing company. The pumps shall be tested at startup and after six months of operation. The vibration testing shall be performed at the middle and minimum tank liquid levels. The vibration frequency shall be measured in accordance with Hydraulic Institute Standards and shall not exceed maximum values for Hydraulic Institute Standards current at the time of bidding. Failure of the vibration tests shall be cause for the Contractor to take whatever means
necessary to correct the installation such that the vibration values are reduced to those above specified.

a) The Engineer shall be notified at least ten days in advance of the actual test dates. A qualified representative of the equipment supplier shall direct the tests, analyze data and certify the equipment performance during the tests. The Engineer shall observe all tests. Pump alignment and vibration testing, but the specified independent testing company, shall be completed only after the pumps are installed and aligned by the Contractor.

4. The Contractor shall meet all the testing requirements of Division 16.

D. Field Alarm System Testing:

1. Check each alarm and detection device for proper operation.

E. After all the equipment has been completely installed, and the installation approved by the manufacturer's representative the equipment shall be tested under the supervision of the manufacturer's factory representative. Two tests shall be performed- a functional test with water and a performance test with wastewater.

F. Prior to conducting the functional test, in the presence of the Engineer, make a thorough inspection of the inside of the tank to determine that all trash, debris, sand and extraneous material has been removed and the tank is ready to receive water. Testing will not be allowed until the tank is clean to the satisfaction of the Engineer. Prior to testing, conduct field tests on all equipment, inspecting for proper alignment, noisy operation, and proper connection, and satisfactory operation. The system supplier's authorized representative shall inspect the completed installation and provide written certification to the Engineer that the system has been installed in accordance with the contract requirements and is ready for operation.

1. The functional test shall comprise operating the mixing system using chlorinated secondary effluent or potable water beginning at the lowest water level up to the highest water level and back down to the lowest water level. The flow equalization tank shall be pumped out by the Contractor after the test and the interior piping, supports, and mixers are checked for structural integrity. If the system is satisfactory to the Engineer, the tank will be considered ready for startup in accordance with all other startup restrictions specified in Division 1.”

Section 11320, Mechanically-Induced Vortex Grit Removal System (Base Bid)

1. Page 11320-16, delete paragraph 2.10.G in its entirety.

Section 11321, Non-Mechanically-Induced Vortex Grit Removal System (Alternate Bid)

1. Page 11321-10, delete paragraph 2.06.D.5 in its entirety.

Section 11332, Screenings Washing and Compacting Equipment

1. Page 11332-9, after paragraph 2.03.C add the following paragraph:

“D. Heat Tracing
1. An insulated heat tracing system shall be provided per Section 15250 and 15257 for the washwater piping and manifold, and the discharge piping from the equipment.”

Section 11335, Multiple Rake Bar Screen
1. Page 11335-15, paragraph 2.03.J.1, after the first sentence add the following sentence:

“The discharge chute shall be also be heat traced, insulated and jacketed with a system that is easily removable and able to be reinstalled.”

Section 13205, Wire Wrapped Prestressed Concrete Tanks
1. Page 13250-4, paragraph 1.05.B, delete the second sentence in its entirety and replace with the following sentence:

“The Prestressed Concrete Tank Contractor shall have had at least 5 years of experience in this specialty and shall have built, completely in the company’s own name, in the past 5 years no fewer than 5 prestressed composite tanks of comparable size demonstrating satisfactory service with Type II or Type III wall construction.”

Section 13305, Instrumentation & Controls – Control Narratives
1. Page 13305-3, paragraph 2.01.A, third sentence, delete the words “sluice gates (SLU-1000-1 and SLU-1000-2)” and replace with the words “slide gates (SG-1000-1 and SG-1000-2)”.

2. Page 13305-3, paragraph 2.01.A, fourth sentence, delete the words “sluice gates” and replace with the words “slide gates”.

3. Page 13305-3, paragraph 2.01.A, fourth sentence, delete the words “Sluice Gate No. 1” and replace with the words “Slide Gate No. 1”.

4. Page 13305-3, paragraph 2.01.A, fourth sentence, delete the words “Sluice Gate No. 2” and replace with the words “Slide Gate No. 2”.

5. Page 13305-3, paragraph 2.01.A, fifth sentence, delete the words “Sluice Gate No. 2” and replace with the words “Slide Gate No. 2”.

6. Page 13305-9, paragraph 2.03.D, delete the first sentence of the fourth paragraph in its entirety and replace with the following sentence:

“The booster pump shall have a high discharge pressure switch (PSH-1420) installed as a pump protection.”

Section 13350, Vendor PLC Hardware and Software
1. Add the attached Specification 13350, Vendor PLC Hardware and Software.

Section 15100, Valves
1. Page 15100-19, paragraph 2.06.A, after the words “M&H Valve;” add the words “Milliken Valve Company”.

2. Page 15100-20, paragraph 2.07.A.2, after the word “Val-matic” add the words “Milliken Valve Company”.
Section 16216, Diesel Engine Driven Generator

1. Page 16216-9, paragraph 2.01. A sentence 1, after the words “Cummins,” add the words “Generac Industrial Power,”.

IN THE DRAWINGS

M-2

1. Top Plan, on the Combustible Gas Detector Detail Call Out, delete the words “I-9” and replace with the words “I-10”.

M-6

2. Add the following Note 3:

“3. 24”x18” RED TEE and 18”x90° BEND on screenings effluent pipe may be replaced with a 24”x24” TEE and a 24”x18” RED 90° BEND.”

M-7

1. Add the following Note 4:

“4. 24”x18” RED TEE and 18”x90° BEND on screenings effluent pipe may be replaced with a 24”x24” TEE and a 24”x18” RED 90° BEND.”

M-8

1. Add the following sentence to Note 6:

“Where pipes pass vertically through concrete walkway, extend width of walkway to provide 30-inches of clearance. Top elevation of concrete walkway shall be 644.75.”

2. On Section 1, Jet Mix Pump, add a 24” HFAC between the tank wall and the plug valve on the recirculation pipe and jet mix pipe for each jet mix pump (results in 4 additional 24” HFAC).

M-9

1. On Section 4, replace all references to “FRP” on the 14” Inlet Piping with “DI”.

2. On Section 5, replace all references to “FRP” on the 12” Overflow Piping with “DI”.

3. On Note 8, after the words “FRP” add the words “except as otherwise noted”.

M-10

1. On Section 2, Equalization Diversion Control Valve Vault, delete the words “18” Oxidation Ditch Influent – DI” on the downstream pipe label (right side of detail) and replace with “16” Oxidation Ditch Influent –DI”.

M-11

1. Remove sheet M-11 in its entirety and replace with sheet M-11 attached.

I-4

1. Delete the labels “SLU-1000-1 Sluice Gate No. 1” and SLU-1000-2 Sluice Gate No. 2” and replace with “SG-1000-1 Slide Gate No. 1” and SG-1000-2 Slide Gate No. 2”.
I-7
1. Remove sheet I-7 in its entirety and replace with sheet I-7 attached.

I-9
1. On Detail C and Detail D, delete the label “4” Flange” and replace with “4” Flange – DI”.

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END OF ADDENDUM NO. 2

Attachments:

1. Responses to Questions Received to Date, dated February 8, 2106
2. Specification Section 0410, Bid Form with Attachments, dated February 2016
6. Drawing M-11, Influent Diversion Box Plan and Sections
Crooked Creek WWTP Influent Pump Station, Headworks and EQ Tank Improvements Project
Responses to Questions Received To Date

DATE: February 8, 2016

I. Questions from the Prebid Meeting

1. Q: What is the bypass pumping capacity?
   A: See Addendum No. 2 for clarification.

2. Q: Can the EQ tank be cast-in-place construction?
   A: This method of construction was considered, but we have elected not to allow this option on this project.

3. Q: Can rock excavation be broken down into two separate bid items for structure rock and trench rock?
   A: Yes, the bid form was updated accordingly in Addendum No. 2. Additionally, the limitation on rock blasting for gravity sewer and yard piping was removed under Addendum No. 2, but all Contractors shall note that blasting operations must not damage adjacent structures or utilities and the Contractor is completely responsible for all damages resulting from the blasting operations.

II. Questions from Wharton-Smith

1. Q: According to Note #7 on C-7, all pipe shall be restrained joints (TR FLEX- according to spec 02616-7) except gravity swr and according to spec 02616-8 Sanitary Sewer is to be P401. I interpret that as everything is TR FLEX, p401.
   A: All buried, underground yard piping to is to be restrained joint including drain lines. The exception is the new influent gravity sewer as stated in Note 7 on C-7. All sanitary sewer piping is to be lined as stated in Specification 02616-2.05.

2. Q: Under the Yard Piping page (C-7), plans show 18x16 tap slv/vlv. But on the detail for Equalization Diversion Control VV (M-10) shows the incoming line to be 18” DIP…. Which contradicts the 18x16 tap slv/vlv??? Also when you exit that Equalization Diversion Control VV (M-10) detail shows 16” DIP… Which contradicts the 18” mj90 on C-7 (point no.2)
   A: Per Section 2 on Sheet M-10, the pipe leaving the EQ Diversion Control Valve vault shall be 16” DI. The label on downstream pipe was incorrect and revised in Addendum No. 2.

3. Q: 4” Relocated Wtr Main around Headworks - 4” Tyton DIP with mega lugs acceptable (no run is longer than 20ft)
   A: Per Specification 02616 paragraph 2.03.D, Mega-Lug joint glands are acceptable.
III. Questions from Vulcan

1. Q: Section 11335, Paragraph 2.03.J requires heat tracing on the bar screen, however we did not see the same requirement for the washing press specified in Section 11332. Please verify whether either or both pieces of equipment require heat tracing.

   A: See Addendum No. 2 for clarification.

2. Q: Please verify that the PLC that is required for the bar screen/washing press panel needs to meet the requirements of Section 13330. This Section requires PLC components to be manufactured by Data Flow Systems, with no alternate. Will alternates be accepted (i.e. Allen-Bradley)?

   A: Per Addendum No. 2, Specification 13350, Vendor PLC Hardware and Software, was added to the Contract Documents to clarify this issue.

IV. Questions from Precon Corp.

1. Q: Please indicate how far from the tank wall the power lines are located. We also request additional information on the voltage of the lines and what the power company requirement is for safe working distance from these lines.

   A: OHE is located approximately 32 feet from the outside wall of tank on the eastern side and approximately 56 feet on the northern side. The exact voltage of the existing power lines is not known. The power lines are owned by Union Power.

2. Q: Suggest adding mechanical fitting at 24” jet mix pipes (inside and outside) and 24 recirculation pipe (outside) to allow for wall movement and expansion/contraction.

   A: See Addendum No. 2 for clarification.

3. Q: Suggest widening the tank walkway at the pipe penetrations and water cannons.

   A: See Addendum No. 2 for clarification.

4. Q: Please confirm walkway elevation is 642.25.

   A: See Addendum No. 2 for clarification.

5. Q: Please confirm there are no interior or exterior ladders. Exterior staircase only.

   A: There are interior ladders as shown on Drawing M-8 and as required in Specification 13205.

6. Q: Please confirm there is no interior coating required for the tank wall or floor.

   A: There is no interior coating required for tank wall or floor.
V. Questions WesTech

1. Q: The description in section 11320 is typical and the most economical option. This panel uses motor starters and control relays in place of the more expensive PLC’s and VFDs noted in sections 11332 and 11335. PLCs may be utilized at an MCC but would be redundant in the panels for each piece of equipment. PLCs and VFDs are required as specified in 11332 and 11335 for the screening and compacting equipment.

A: Control panels for the grit removal system can utilize hard wired logic with timers and relays or PLCs as long as the control functionality is achieved. VFDs and Motor Starters shall be supplied to meet the needs of the controlled equipment. PLCs and VFDs are required as specified for the screening and washing equipment.

2. Q: Specification 13330 notes that PLCs would be PLC033’s by “Data Flow Systems”- when we provide PLCs we typically use Allen Bradley as a manufacturer.

A: Specification 13350 is being added by Addendum No. 2 to apply to PLCs in vendor local control panels.

3. Q: Section 11335 outlines a stainless steel local control panel which is more expensive than the aluminum local control panels mentioned in 11335.

A: All control panels are specified to be stainless steel in Section 11320 and in Section 11335. The only item for the Grit System that is specified to be aluminum is for the NEMA7 local control station which is not a control panel but is an operator interface that consists of an E-stop push button and two selector switches.

4. Q: Section 11335 shows separate level transmitters for the upstream and downstream transducers. Two transducers can be controlled using a single HydroRanger 200 transmitter.

A: Assuming that the HydroRanger 200 can display the upstream and downstream levels in addition to the differential level, the single transmitter can be used.

VI. Questions M.B. Kahn

1. Q: Will Restraint gaskets would be allowed for RJ pipe?

A: Yes, see Addendum No. 2 for additional information.

VII. Questions from Hydro International

1. Q: Section 11321.1.08.A indicates the warranty is to be for a period of 1 year, commencing as outlined in the GC and Division 1. It is not clear in the GC or Division 1 when the warranty is to start. Can you confirm?

A: Per Section 01740, Contractor and Manufacturer warranties begin on the date of Substantial Completion unless the Certificate of Substantial Completion designates a different commencement date for portions of the work.
2. Q: Section 11321.2.06.D adds an e-stop pull cord and a bagging device. The e-stop cord can be readily accommodated but we would not recommend a grit bagging system. The dewatered grit will be quite heavy and we have not found a suitable bagging system that can effectively hold grit or be supported off the Grit Snail.

A: The e-stop is required but the bagging system is being removed per Addendum No. 2.

3. Q: The grit testing language is a little contradictory. Section 11321.1.03.A.8 indicates that Hydro is to provide the testing plan in our submittal but section 3.02 indicates the testing company is to provide the protocol?

A: The testing protocol listed in 11321-1.03.A.8 is the testing protocol from the independent testing company that should be submitted by the Contractor.

4. Q: Our interpretation of drawing E-9 is that within 18 inches above or 10 feet around any of the equipment will be rated as Class 1, Div 2. This is seemingly reinforced by the NEMA 7 callout for the Heat Trace Junction Box attached to the underflow piping. If that is the case the following items would need to be upgraded to XP standards:

- Plug Valve Actuator on Grit King
- Grit Snail Motor (XPFC in lieu of TENV)
- Grit King and Grit Snail Solenoid Valves

The Control Panel is also concerning as it is within 10 feet of the Grit King, in previous correspondence we confirmed it was to be NEMA 4X but if that area is Class 1, Div 2 then we would need to add an air purge system or upgrade to NEMA 7.

A: If the Grit King is an enclosed unit, then the area surrounding it is not classified. The envelope around the screening structure must be considered though. The area located within 10 feet of the screening structure walls horizontally and 18-inches above the ground is Class 1, Div 2.

VIII. Questions from State Utilities

1. Q: Plan sheet M-2 has several 4” flanged floor pipes shown for Level Sensors and Float Switches; what materials are these floor pipes to be made of, ductile iron or stainless steel?

A: 4” flanged pipes may be ductile iron. See Addendum No. 2 for clarification.

2. Q: Plan sheet M-2 calls for a Combustible Gas Detector Detail I on I-9; we cannot find this detail … if overlooked I apologize?

A: This detail can be found on sheet I-10. See Addendum No. 2 for clarification.

3. Q: Specification section 01310 – Construction Scheduling calls for us to utilize Oracle-Primavera Contractor or P6 Professional Project Management Software for the CPM
scheduling for this project; can Microsoft Project be considered for this use. It is easier to use, less expensive and generates the same results?

A: See Addendum No. 2 for clarification. The Contractor is allowed to use Microsoft Project as long as all scheduling documents required by Section 01310 can be provided.

5. Q: Details 4 and 5 on Plan Sheet M-9; this inlet and overflow piping is usually ductile iron, I think the Jet Aeration equipment supplier will not include this piping (they have not in the past)?

A: See Addendum No. 2 for clarification.

6. Q: Plan sheets M-4 thru M-7 shows the alternate Non-Mechanically Induced Vortex Grit equipment; please show us the base bid Mechanically Induced Vortex Grit equipment with two (2) grit pumps so our pipe and valve suppliers can include the proper pipe/valves for the base bid.

A: Drawings for the base bid mechanically induced vortex grit system are not available. Per notes included on sheets M-4 through M-7, the Contractor is responsible for modifying the equipment, piping, supports, and appurtenance layouts as necessary to accommodate a Mechanically Induced Grit Removal System within a similar footprint as the alternate design detailed on the drawings. Drawings showing these modifications shall be prepared, signed and sealed by a Professional Engineer and shall be submitted for Engineer review.

7. Q: Plan sheet M-8 and detail C on sheet M-9; no 6” check valve is shown in the wash down booster pump detail, it is shown on the instrumentation drawing I-7, however valve suppliers (contractors) sometimes do not look there as they do their takeoff.

A: There is no check valve on the booster pump piping. See Addendum No. 2 for clarification.

8. Q: Plan sheet M-8; no valves are shown in the stainless steel blower piping, please clarify that there are valves required as shown on instrumentation drawing I-7, again valve suppliers (contractors) sometimes do not look there as they do their takeoff.

A: There are no valves on the blower piping. See Addendum No. 2 for clarification.

9. Q: Does the 14” MJ Plug Valve on the 14” EQ influent shown on drawing C7 and C8 need an electric actuator with an extended bonnet? Drawing I-7 on the P&ID shows the 14” MJ Plug Valve with an electric actuator and tagged as CV-1405. Not sure if these are the same valves, but they look to be. Please advise.

A: Correct, these are the same valves; therefore, the plug valve shall be provided with an electric actuator and extended bonnet.
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ARTICLE 1 – BID RECIPIENT

1.01 This Bid is submitted to:

UNION COUNTY
500 N. Main Street, Suite 709
Monroe, North Carolina 28112

1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2 – BIDDER’S ACKNOWLEDGEMENTS

2.01 Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for 60 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

ARTICLE 3 – BIDDER’S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents that:

A. Bidder has examined and carefully studied the Bidding Documents, and any data and reference items identified in the Bidding Documents, and hereby acknowledges receipt of the following Addenda:

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B. Bidder has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfied itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

C. Bidder is familiar with and has satisfied itself as to all Laws and Regulations that may affect cost, progress, and performance of the Work.

D. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings.

E. Bidder has considered the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and any Site-
related reports and drawings identified in the Bidding Documents, with respect to the
effect of such information, observations, and documents on (1) the cost, progress, and
performance of the Work; (2) the means, methods, techniques, sequences, and
procedures of construction to be employed by Bidder; and (3) Bidder’s safety
precautions and programs.

F. Bidder agrees, based on the information and observations referred to in the preceding
paragraph, that no further examinations, investigations, explorations, tests, studies, or
data are necessary for the determination of this Bid for performance of the Work at the
price bid and within the times required, and in accordance with the other terms and
conditions of the Bidding Documents.

G. Bidder is aware of the general nature of work to be performed by Owner and others at
the Site that relates to the Work as indicated in the Bidding Documents.

H. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or
discrepancies that Bidder has discovered in the Bidding Documents, and confirms that
the written resolution thereof by Engineer is acceptable to Bidder.

I. The Bidding Documents are generally sufficient to indicate and convey understanding
of all terms and conditions for the performance and furnishing of the Work.

J. The submission of this Bid constitutes an incontrovertible representation by Bidder that
Bidder has complied with every requirement of this Article, and that without exception
the Bid and all prices in the Bid are premised upon performing and furnishing the Work
required by the Bidding Documents.

ARTICLE 4 – BIDDER’S CERTIFICATION

4.01 Bidder certifies that:

A. This Bid is genuine and not made in the interest of or on behalf of any undisclosed
individual or entity and is not submitted in conformity with any collusive agreement or
rules of any group, association, organization, or corporation;

B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a
false or sham Bid;

C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and

D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in
competing for the Contract. For the purposes of this Paragraph 4.01.D:

1. “corrupt practice” means the offering, giving, receiving, or soliciting of any thing of
value likely to influence the action of a public official in the bidding process;

2. “fraudulent practice” means an intentional misrepresentation of facts made (a) to
influence the bidding process to the detriment of Owner, (b) to establish bid prices at
artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and
open competition;

3. “collusive practice” means a scheme or arrangement between two or more Bidders,
with or without the knowledge of Owner, a purpose of which is to establish bid prices
at artificial, non-competitive levels; and
4. “coercive practice” means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

ARTICLE 5 – BASIS OF BID

5.01 Bidder will complete the Work in accordance with the Contract Documents for the following price(s):

BASE BID ITEMS

Item No. 1 – Influent Pump Station, Headworks and Equalization Tank Improvements

For furnishing all labor, materials, tools, equipment, supplies, taxes, other miscellaneous costs, profit, and overhead, both direct and indirect, for completion of all Work shown, described, and implied in the Contract Documents, the following lump sum price of

Dollars $_______________________

Item No. 2 – Contingency Allowance

For furnishing all labor, materials, tools, equipment, and incidentals required to perform unspecified additional work in the amount of 5% of the Lump Sum Bid (Item No. 1)

Dollars $_______________________

TOTAL OF ALL LUMP SUM BID ITEMS (Sum of totals for Bid Items No. 1 through 2 inclusive)

Dollars$________________________

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
<th>Unit</th>
<th>Estimated Quantity</th>
<th>Bid Unit Price</th>
<th>Bid Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Rock Excavation (Structures)</td>
<td>CY</td>
<td>520</td>
<td>$</td>
<td>$</td>
</tr>
<tr>
<td>4</td>
<td>Rock Excavation (Pipelines)</td>
<td>CY</td>
<td>1,200</td>
<td>$</td>
<td>$</td>
</tr>
<tr>
<td>5</td>
<td>Over Excavation and Backfill with Structural Fill</td>
<td>CY</td>
<td>400</td>
<td>$</td>
<td>$</td>
</tr>
</tbody>
</table>

TOTAL OF ALL UNIT PRICE BID ITEMS (Sum of totals for Bid Items No. 3 through 5 inclusive) $_____________________

TOTAL OF LUMP SUM AND UNIT PRICE BIDS ITEMS (Sum of totals for Bid Items No. 1 through 5 inclusive)

Words_________________________________________________________________________________________________________________________________________

_________________________________________________________________________________________________________________________________________

Dollars$_______________________________
ALTERNATE BID ITEMS

Alternate Bid Item No. 1 – Deletion of Jet Mix System Aeration Blowers (DEDUCT)

The following lump sum amount (if deduct is not offered, enter $0.00)

Dollars $________________________

Alternate Bid Item No. 2 – Non-Mechanically Induced Vortex Grit Removal System (DEDUCT OR INCREASE)

The following lump sum amount deduct / increase (circle one)

Dollars $________________________
(If a deduct or increase is not offered, enter $0.00)

Notes:

1. Total Bid Amount is to be shown in both words and figures. In the event of a discrepancy, the amount shown in words shall govern.
2. Bidders must bid on all items.
3. Bidder acknowledges that (1) each Bid Unit Price includes an amount considered by Bidder to be adequate to cover Contractor’s overhead and profit for each separately identified item, and (2) estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all unit price Bid items will be based on actual quantities, determined as provided in the Contract Documents.
4. The Bidder’s attention is called to the fact that the Owner reserves the right to reject any and all bids received. Also, the Owner reserves the right to compare bids on the basis of the above bid items; to reduce the scope of work by eliminating any bid item or portion of bid items; to make an award on the basis of available funding.
5. The Owner may elect to make the project award based on any combination of the base bid and alternate bid items at their discretion.

ARTICLE 6 – TIME OF COMPLETION

6.01 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with Paragraph 14.07 of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.

6.02 Bidder accepts the provisions of the Agreement as to liquidated damages.

ARTICLE 7 – ATTACHMENTS TO THIS BID

7.01 The following documents are submitted with and made a condition of this Bid:

A. Required Bid security;
B. Provide herein List of Proposed Subcontractors/Suppliers (Attachment A);
C. General Contractor Qualifications Statement (Attachment B);
D. Evidence of authority to do business in the state of the Project;
E. Photocopy of North Carolina General Contractor’s License.

ARTICLE 8 – DEFINED TERMS

8.01 The terms used in this Bid with initial capital letters have the meanings stated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

ARTICLE 9 – BID SUBMITTAL

BIDDER: [Indicate correct name of bidding entity]

By: [Signature]
[Printed name]
(If Bidder is a corporation, a limited liability company, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest: [Signature]
[Printed name]

Title:

Submittal Date:

Address for giving notices:

Telephone Number:

Fax Number:

Contact Name and e-mail address:

Bidder’s License No.: (where applicable)
ATTACHMENT A
LIST OF SUBCONTRACTORS/SUPPLIERS

LIST OF SUBCONTRACTORS

List the names and addresses of the subcontractors to be used for the portions of the work listed below (list “self” if work will be performed by prime contractor).

Electrical: ____________________________________________

Instrumentation: _______________________________________

HVAC: _______________________________________________

Plumbing: _____________________________________________

Excavation Stabilization, Sheetin & Shoring Protection Engineer: __________________________

________________________

Dewatering Engineer: ________________________________

Drilling & Blasting: __________________________________

Earthwork: ___________________________________________

Concrete: ____________________________________________

Paving: ______________________________________________

Surveying: __________________________________________

Other: _______________________________________________

___________________________________________________
The Contract Documents are based upon the equipment or products available from the Suppliers denoted as “A,” “B,” etc. The Bidder must indicate in his Bid which supplier the Bidder will use for each item of equipment listed on this form by circling one of the listed suppliers. Should a Bidder fail to circle a named item in each category, or if he circles more than one listed supplier, he hereby agrees to provide the item listed as “A.”

If the Bidder desires to propose an alternate supplier, the Bidder must submit a request for substitution to the Engineer at least 15 days prior to the first date specified for receipt of bids. No substitutions will be considered for the items listed in this section after receipt of bids. Procedures for submittal and Engineer Review of substitutions shall be in accordance with Section C-200. Substitutions accepted by the Engineer during the bidding period will be incorporated into the Contract Documents by Addendum.

If the proposed alternate supplier is determined “not equivalent” by the Engineer, the Bidder must circle one of the listed suppliers. If the Bidder fails to indicate which listed supplier the Bidder intends to use if an alternate is rejected, the Bidder must use the supplier listed as “A.” Also, if the Bidder circles more than one listed supplier, he must use the first supplier circled (unless an alternate is approved).

<table>
<thead>
<tr>
<th>Item</th>
<th>Equipment Item or Material</th>
<th>Bid or Supplier</th>
</tr>
</thead>
</table>
| 1.   | Wire Wrapped Prestressed Tanks | A. Crom  
|      |                             | B. Precon  
|      |                             | C. Preload |
|      |                             | B. Whipps, Inc.  
|      |                             | C. Hydrogate Corp.  
|      |                             | D. Waterman  
|      |                             | E. Aquanox |
|      |                             | B. Mixing Systems, Inc.  
|      |                             | C. Jet-Tech (Evoqua)  
|      |                             | D. Parkson |
|      |                             | B. ABS/Sulzer |
| 5.   | Self-Priming Horizontal Centrifugal Grit Pumps | A. Gorman Rupp |
|      |                             | B. John Meunier |
| 7.   | Non-Mechanically Induced Vortex Grit Collection Equipment and Grit Dewatering Equipment | A. Hydro International |
|   | Grit Classification Equipment | A. WesTech Engineering Inc.  
|   | B. John Meunier  
|   | C. Hydro International  
|   | Multi-Rake Bar Screen | A. Huber Technology  
|   | B. Vulcan Industries, Inc.  
|   | C. WesTech Engineering, Inc.  
|   | D. Headworks, Inc.  
|   | E. Kusters Water  
|   | Screenings Washer and Compactor | A. Huber Technology  
|   | B. Vulcan Industries, Inc.  
|   | C. WesTech Engineering, Inc.  
|   | D. Headworks, Inc.  
|   | E. Kusters Water  
|   | Diesel Engine Driver Generators | A. Caterpillar  
|   | B. Cummins  
|   | C. Kohler  
|   | D. Generac  
|   | Precast Concrete Building | A. Smith-Midland Corporation  
|   | B. Concrete Systems, Inc.  
|   | C. Rotundo & Sons, Inc.  
|   | 480-volt Motor Control Centers | A. Rockwell Automation  
|   | B. Schneider Electric  
|   | C. General Electric  
|   | D. Eaton Electric  
|   | E. Siemens  

Union County Public Works  
Crooked Creek WWTP  
IPS/Headworks/Equalization Project  
C-410-9  
28600-102840  
December 2015  
Bid Set
ATTACHMENT B
GENERAL CONTRACTOR QUALIFICATIONS STATEMENT

The undersigned warrants the truth and accuracy of all statements and answers herein contained. The information requested shall be completed in its entirety by the Bidder. Include additional sheets if necessary.

1. How many years has your organization been in business as a Prime Contractor?

____________________________________________________

2. Describe and give the date and owner of the last three projects that you have completed similar in type, size, and nature as the one proposed?
   a. ______________________________________________________
      ______________________________________________________
      ______________________________________________________
      ______________________________________________________
   b. ______________________________________________________
      ______________________________________________________
      ______________________________________________________
      ______________________________________________________
   c. ______________________________________________________
      ______________________________________________________
      ______________________________________________________
      ______________________________________________________

3. Have you ever failed to complete work awarded to you? If so, where and why?

____________________________________________________

____________________________________________________

4. Name three individuals or corporations for which you have performed work and will provide references to your work (provide contact names and phone numbers):

____________________________________________________

____________________________________________________
5. What equipment do you own that is available for the work?

_________________________________________________________________
_________________________________________________________________
_________________________________________________________________

6. What equipment will you purchase for the work?

_________________________________________________________________
_________________________________________________________________

7. What equipment will you rent for the work?

_________________________________________________________________
_________________________________________________________________

8. General Contractor shall provide a Financial Statement if requested by the Engineer.
PART 1 GENERAL

1.01 SCOPE

A. This Section includes specification for the measurement and payment of the various elements of the Work; with provisions applicable to lump sum and unit prices and allowances.

B. The Contractor shall furnish all labor, materials, tools, equipment, supervision, administration, services, and other unnamed efforts to complete the Work at the prices listed in the Bid Proposal.

C. In the case of conflict between this Section and the measurement methods specified in the individual technical Sections, the measurement methods in the technical specifications shall govern.

D. The Contractor shall receive no payment for any portion of the work until it is installed. The only exception to this is payment for stored materials on site if the Contract provides for the payment of stored materials. Partial payment may be requested for items partially installed.

1.02 RELATED WORK

A. Summary of Work is included in Section 01010.

B. Schedule of Values is included in Section 01370.

C. Applications for Payment are included in Section 01026.

D. General Conditions

1.03 LUMP SUM ITEMS

A. Lump Sum measurement will be for the entire item, unit of work, structure, or combination thereof, as specified and as indicated in the Bid Form. Measurement and payment for all bid items indicated as Lump Sums shall include the cost of all labor, materials and equipment necessary to furnish, install, clean, test, and place each bid item into operation; including permitting, general conditions, overhead and profit.

B. Progress payments will be based on the Schedule of Values prepared by the Contractor and approved by the Engineer and Owner before acceptance of the first Application for Payment.

C. In order for the Contractor to request progress payments against Lump Sum items, Contractor shall provide a disaggregation or breakdown in sufficient measureable detail that is acceptable to the Engineer.

D. Measurement
1. Measurement shall be based on the estimated percent complete of each item of the Schedule of Values, as determined by the Engineer.

E. Payment

1. Payment will be made at the lump sum price proportional to the completion percentages approved by the Engineer.

1.04 UNIT PRICE ITEMS

A. Quantity and measurement estimates stated in the Bid Form are estimates for bidding purposes only. Actual payments shall be based on actual quantities installed, in-place, as measured and/or verified by the Engineer.

B. Unless otherwise provided in the General Conditions, the bid unit prices shall be in effect throughout the contract duration, regardless of variances between the estimated quantities and the actual installed quantities.

C. The Contractor shall make no claim, nor receive any compensation, for anticipated profits, loss of profit, damages, or any extra payment due to any difference between the amounts of work actually completed, or materials or equipment furnished, and the estimated quantities.

D. Unless otherwise approved by the Owner, any unit quantities exceeded may not be invoiced until the estimated quantity is increased by contract change order.

E. Contractor shall assist Engineer by providing necessary equipment, workers, and survey personnel as required to measure quantities.

F. Measured quantities shall be rounded to the nearest whole integer, unless the value of the unit price exceeds $100, in which case measured quantities shall be rounded to the nearest half unit.

G. Measurement

1. Measurement for progress payment shall be made by, or approved by, the Engineer based on the estimated effective quantity installed. The effective quantity installed represents the actual units or quantities installed, adjusted for incomplete elements or components.

2. Unless otherwise provided for in the Bid Form unit price items are all-inclusive of all related work, direct and indirect, to provide a complete and functional item. For example, underground pipe installation would include trenching, shoring, dewatering, bedding, installation, backfill, testing, flushing, disinfection, and commissioning; including all labor, materials and equipment necessary to furnish, install, clean, test, and place into operation; including permitting, general conditions, overhead and profit.

3. The final measurement shall be based on actual quantities, jointly measured by Contractor and Engineer, complete, fully, tested and placed into service.

H. Payment

1. Progress payments shall be in accordance with the contract documents based on estimated effective quantities installed, paid at the bid unit price.
2. The final payment shall be based on actual quantities, fully installed, tested and placed into service, paid at the bid unit price.

1.05 ALLOWANCES

A. Allowances specified in the Contract Documents and indicated in the Bid Form are considered provisional amounts to be used only if needed. Allowances are exclusive of work indicated in the Contract Documents for which payment is included under other items in the Bid Form. No work may be performed under an allowance without prior written approval of the Owner.

B. Any unused balance of the allowances shall revert to the Owner upon completion of the project. Prior to final payment, the original amount provided for allowances shall be adjusted to actual costs by deductive Change Order, adjusting the contract price, accordingly.

C. The Contractor shall make no claim, nor receive any compensation, for anticipated profits, loss of profit, damages, or any extra payment due to any unexpended portion of the allowances.

D. The Contractor is to include time for allowance work in the construction schedule. No adjustment of Contract Time shall be allowed for any work performed under allowance items.

E. Allowance items shall be included in the Schedule of Values.

F. Unless otherwise indicated in the specific measurement and payment provisions under allowance items, the measurable and allowable costs for work performed under an Allowance item shall be limited to the actual, demonstrable, and direct costs associated with that Allowance item. Shipping and sales taxes are allowable costs.

1. No mark-up for overhead or profit shall be included for payment under an Allowance account item. Overhead and profit shall be included in the contract base bid or allocated across other bid items.

2. Work authorized by the Owner under an allowance may be performed as a lump sum (negotiated before the fact), unit prices (when applicable), or time and material. For work performed under time and material, Contractor shall submit detailed verification (break-down) of all costs, subject to the approval of the Engineer or Owner.
a. Payment to the Contractor of the total price bid for Item No. 1, in the Bid Form will be made and shall fully compensate the Contractor for furnishing all labor, materials, equipment, tools, incidentals, taxes, overhead and profit, insurance, performance and payment bonds, mobilization and demobilization costs, and other miscellaneous costs required to complete the work as shown and described in the Contract Documents. Building permit and inspection fees and other permitting fees shall also be included in the lump sum amount.

b. Payment shall also fully compensate the Contractor for any other work which is not specified or shown but which is required to complete the work of Item Nos. 1 through 4 as shown on the Drawings and as specified herein.

B. Bid Item No. 2 - Contingency Allowance

1. The Contingency Allowance is to provide payment for unforeseen conditions which may be encountered in the work and is to be used only upon a written work order from the Engineer. The Contingency Allowance shall be calculated as 5-percent of the Lump Sum Bid (Bid Item No. 1).

2. The Contingency Allowance will be included as part of the awarded Contract amount. However, the Contingency Allowance is not part of the lump sum contract and is not due to the Contractor except when authorized by a written Change Order or Work Change Directive executed by the Owner and Engineer as set forth in the General Conditions. The balance of the Contingency Allowance remaining at project completion shall remain the Owner’s and will not be paid to the Contractor.

C. Bid Items No. 3 and 4 – Rock Excavation (Structures and Pipelines)

1. Measurement

a. When rock is encountered, the material shall be uncovered or its subsurface limits demonstrated by drilling and the Engineer notified. The Engineer will then estimate the quantity of rock encountered based on the above observation or information. Failure to uncover the rock or demonstrate rock limits by drilling, notify the Engineer, and allow ample time for measuring the undisturbed material shall not give right of claim to any classification other than that allowed by the Engineer. If the Contractor proposes to blast prior to excavation of the overburden, agreement shall be reached in advance with the Engineer on the volume of rock involved.

b. At structures, including precast concrete manholes, measurement for rock excavation will be to the neat lines of the structure foundation plus 2 feet all around and 6 inches below bottom of the slab. No allowance will be made for removal beyond this limit.

c. For pipes, measurement for rock excavation will be limited to a depth 6 inches below the bottom of the pipe or to the bottom of the rock if rock does not extend to the full depth of the excavation. Measurement for width shall be limited to 18 inches beyond the outside of pipes to the top of the pipes and 24 inches beyond the outside of the pipes above the tops of the pipes. Pipe trench width referred to herein is the distance separating the vertical planes between which the pipe is to be laid. Pipe width is the barrel outside diameter.
d. The top of the rock will be the rock surface elevation as determined by the Engineer prior to or during excavation. The grade of the invert of the pipe shall be as shown on the Drawings.

e. The quantity of rock excavation to be paid for shall be the number of cubic yards of rock measured in place by the Engineer within the limits herein specified. No reduction in payment for the reduction in earth excavation paid for as rock will be required.

f. No additional payment will be made for imported common fill to replace rock excavation beyond the measurement limits for payment. Furnishing and placing of such fill shall be a subsidiary obligation under the Contract.

2. Payment

a. Payment for rock excavation will be made for the quantities as determined above, measured in cubic yards, at the unit price per cubic yard established in the Bid Form which price and payment shall be full compensation for excavation and proper off-site disposal of rock, blasting and explosives including blasting plan, blast monitoring, and pre-blast surveys, removal of rock by mechanical means, backfilling with common fill and providing imported common fill for any deficiency in quantity of excavated common fill and for the volume of rock displaced by the pipe, structures, and bedding, control and disposal of groundwater, and all work incidental thereto for which payment is not provided under other items. No specific payment shall be made for imported backfill materials to replace any deficiency of common fill for backfill.

D. Bid Item No. 5 – Over Excavation and Backfill with Structural Fill

1. Measurement

a. Measurement of excavation below normal grade and backfill with structural fill for trench and structure excavation will extend only downward (not horizontally beyond the bedding limits shown on the Drawings except as directed by the Engineer) from the excavation bottom (bottom of bedding) elevation shown on the Drawings to the depth directed by the Engineer and for the purpose of removing naturally occurring unsuitable foundation materials as determined by the Engineer.

b. If the excavation bottom is below grade through error by the Contractor or if improper dewatering or drainage softens the subgrade and additional excavation in the trenches is required by the Engineer before installing the bedding, such removal and replacement of material will be a subsidiary obligation of the Contractor and will not be measured for payment.

c. No material which runs or flows into the excavation from outside shall be measured for payment.

d. Measurement shall be made by the Contractor’s surveyor whose services shall be included in the unit price for the work.

e. Structural fill placed outside the above limits will not be measured for payment.

2. Payment
a. Payment for excavation below normal grade and backfill with structural fill will be made for the quantities as above determined above, measured in cubic yards, at the unit price per cubic yard established in the Bid Form, which price and payment shall be full compensation for sheeting/shoring, dewatering, excavation and disposal of all materials below normal grade and furnishing, placing and compacting structural fill refill and all work incidental thereto, for which separate payment is not provided under other items in the Bid Form. Structural fill and compaction shall be as defined in Division 2.

3.02 ALTERNATE BID ITEMS

A. Alternate Bid Item No. 1: Deletion of the Jet Mix System Aeration Blowers

1. Measurement

a. Measurement of the work of Alternate Bid Item No. 1 shall be on a lump sum basis.

2. Payment

a. This payment item represents the total deductive value of deleting the installation of the aeration blowers specified as part of the jet mixing and aeration system for the flow equalization tank. This shall include deletion of the equipment, control panels and electrical and control wiring for the equipment as noted on the Drawings. The necessary aeration piping, fittings and valves necessary for installation of this equipment in the future shall be installed as shown on the Drawings. Bid pricing for Alternate Bid Item No. 1, in the Bid Form shall represent the full cost for deleting this equipment including costs for equipment labor, materials, equipment, incidentals, taxes, overhead and profit.

B. Alternate Bid Item No. 2: Non-Mechanically Induced Vortex Grit Removal System

1. Measurement

a. Measurement of the work of Alternate Bid Item No. 2 shall be on a lump sum basis.

2. Payment

a. This payment item represents the total deductive or increase value of selecting the alternate grit removal system as specified in Section 11321 and as shown on the Drawings. This shall include any additional equipment, instrumentation, control panels and electrical and control wiring for the equipment. Bid pricing for Alternate Bid Item No. 2 in the Bid Form shall represent the full cost for this equipment including costs for labor, materials, equipment, tools, incidentals, taxes, overhead and profit.

END OF SECTION
SECTION 11282
SLIDE GATES

PART 1 GENERAL

1.01 SCOPE OF WORK
   A. Furnish all labor, materials, equipment and incidentals required and install complete, slide gates, operators, operating systems and appurtenances as shown on the Drawings and as specified herein.

1.02 RELATED WORK
   A. Concrete work is included in Division 3.
   B. Surface preparation and shop priming is included in Section 09901.
   C. Field painting is included in Section 09902.
   D. Instrumentation and control work, except as specified herein, is included in Division 13. Instrumentation and controls provided in this section shall adhere to Instrumentation and Control Specifications Sections in Division 13.
   E. Electrical work, except electric motor operators and controls, is included in Division 16.

1.03 SUBMITTALS
   A. Submit, in accordance with Section 01300, shop drawings and product data showing materials of construction and details of installation for:
      1. Complete description of all materials.
      2. Certified shop and installation Drawings showing all details of construction, dimensions and anchor bolt locations.
      3. Descriptive literature, bulletins and/or catalogs of the equipment.
      5. The weight of each component.
      6. Description of surface preparation and shop prime painting of gates and accessories.
   B. In the event it is not possible to conform to certain details of this Section, describe completely all non-conforming aspects.
   C. Operation and Maintenance Data
      1. Operating and maintenance instructions for each type of equipment shall be furnished to the Engineer as provided for in Section 01730.
1.04 REFERENCE STANDARDS

A. American Water Works Association (AWWA)
   1. ANSI/AWWA C561-14 Standard for Fabricated Stainless Steel Slide Gates

B. ASTM International

C. National Electrical Manufacturers Association (NEMA)

D. Aluminum Association, Inc. (AA)

E. Factory Mutual (FM)

F. Underwriters Laboratories (UL)

G. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. The slide gates, operators, operating stems and appurtenances specified under this Section shall be furnished by manufacturers with a minimum of 10 years’ experience designing and manufacturing water control gates. The manufacturer shall have manufactured water control gates for a minimum of 100 projects. The slide gates, operators, operating stems and all related equipment shall be designed, constructed and installed in accordance with the best practices and methods.

B. A factory representative who has complete knowledge of proper operation and maintenance of the equipment provided under this section shall be provided for one eight-hour day to instruct representatives of the Owner on the proper operation and maintenance of the equipment. This work may be conducted in conjunction with the inspection of the installation and test runs as provided under Part 3.

PART 2 PRODUCTS

2.01 STAINLESS STEEL SLIDE GATES

A. Materials shall be as follows:
   1. Frame and Slides: 316 Stainless Steel.
   5. Invert Seal, and Seals: Neoprene
   6. Seats: Ultra High Molecular Weight Polyethylene (UHMWPE)
B. The slide gates shall have the characteristics and dimensions as tabulated on Sheet M-11 of the Drawings.

C. The stainless steel slide gates and accessories shall be fabricated Type 316 stainless steel self-contained or non-self-contained type (as shown on the Drawings) with the disc arranged to raise to open and with the guides designed to mount on the face of, or embedded in concrete.

D. The frames shall be of flange back design, suitable for mounting flush onto a concrete wall surface.

E. The guides shall be of Type 316 stainless steel construction. The guides shall be designed for maximum rigidity, shall have a weight of not less than 6 lbs/ft for embedded guide, 11 lbs/ft for face-mounted guide and will be provided with holes for anchor bolts every 16-in for face mounted units or embedding keyways for embedded units.

F. A rigid steel member shall be welded to the guides across the invert of the opening on face-mounted gates, across the top of the opening for sluice gates, and up both sides of all gates. Gates shall be provided with self-adjusting UHMW polyethylene seat/seals to restrict leakage and to prevent metal to metal contact between the guide frame and slide. All seals must be bolted or otherwise mechanically fastened to the frame or slide. The seals shall be mounted so as not to obstruct the water way opening. Hollow neoprene “J” bulb or “P” seals are not acceptable.

G. The operating stem shall be Type 316 stainless steel with a minimum diameter of 1-1/2-in designed to withstand at least twice the rated output of the operator. The slenderness ratio (l/r) shall be less than 200.

H. Where the guides extend above the operating floor, they shall be sufficiently strong so that no further reinforcing will be required. Where required, the yoke to support the operating benchstand will be formed by two angles welded at the top of the guides to provide a one-piece rigid frame. The arrangement of the yoke will be such that the disc and stem can be removed without disconnecting the yoke.

I. The disc or sliding member shall be of Type 316 and the stainless steel plate reinforced with "U" or angle-shaped stainless steel members welded to the plate not more than 16-in apart. The disc shall not deflect more than 1/720 of the span of the gate under the design head. Reinforcing ribs shall extend into the guides so that they overlap the seating surface of the guide. The bottom seal shall be mechanically fastened to the frame. The side and top seals shall be of the self-adjusting type consisting of UHMWPE guides and nitrile neoprene compression cord seals. The shape of the seal shall produce a seating surface having a minimum width of 3/4-in and the seal shall extend into the secondary slot of the guide. The vertical face of the seal shall be in contact with the seating surface of the guide to provide a proper seal at the corners. Reinforcements, retainer and bolts shall be of the same material as the disc. The invert of embedded unit frames shall have an angle welded to the lower ends of the guides to form a seating surface for a resilient seal mounted on the disc. Angle shall be of the same material as the guides.

J. All parts of the gate shall have a minimum thickness of 1/4-in.

K. All necessary attaching bolts and anchor bolts shall be Type 316 stainless steel and shall be furnished by the slide gate manufacturer.
L. Stainless steel slide gates shall be as manufactured by Rodney Hunt Co., Orange, MA, Whipps, Inc., Athol, MA; Hydrogate Corporation, Longmont, CO; Aquanox Water Control Gates, Magog, Canada, or Waterman Industries.

2.02 OPERATORS

A. Unless otherwise shown on the Drawings, slide gates shall be operated by a gear operated handwheel or gear operated stand mounted on the yoke. The benchstand shall be fully enclosed, equipped with roller bearings above and below the operating nut and with a mechanical seal around the operating nut. The pinion shaft shall be stainless-steel and supported on roller bearings. A mechanical seal shall be provided around the pinion shaft where it extends from the hoist enclosure.

B. A side mount or front mount operator system utilizing right angle bevel boxes, stainless steel interconnecting shafting, and flexible couplings shall be furnished by the manufacturer when the benchstand is located over 48-in above the operating floor. The transmission system design shall provide for the gate to be operated from a position 30-in above the operating floor.

C. Bevel boxes for the transmission system shall be provided with stainless-steel pinion shafts supported on roller bearings. A mechanical seal will be provided around the pinion shaft where it extends from the bevel box enclosure.

D. Floor stands shall be furnished for all other gate operators not supported on the gate yoke. Floor stands shall be stainless steel construction. The pedestal height shall be such that the crank shaft will be approximately 36-in above the operating floor. Wall brackets shall be used to support floor stands where shown on the Drawings and shall be furnished in cast iron or welded steel construction, designed to withstand all normal operating loads. Where shown on the Drawings, floor stands shall be offset type mounted on the floor surface and offset to align with the gate stem. The floor stand shall be mounted on a stainless steel bracket anchored to the concrete with Type 304 stainless steel anchors. The bracket and anchor bolts shall be sized to transfer the upward or downward thrust required to ultimately fail the stainless steel stem. The design and detail of the brackets and anchor bolts shall be provided by the gate manufacturer and shall be approved by the Engineer. The bracket, anchors, backplate and accessories shall be supplied as part of the gate assembly by the gate manufacturer.

E. Manual operators shall be furnished where shown and shall consist of a handwheel or crank operator mounted on the gate yoke or on a floor stand, as indicated in the Drawings.

1. Handwheel operators shall have a minimum 18-in diameter handwheel and shall operate the gate under the specified operating head with not greater than 40-lbs of force on the handwheel. The operator shall be fully enclosed, equipped with roller bearings above and below the operating nut and mechanical seals. Alternatively, polyethylene bearing pads may be used.

2. Crank operators shall have either single or double gear reduction depending upon the lifting capacity required. Double reduction operators shall also be 2-speed type with a square nut drive on the high speed and low speed shafts. Each type shall be provided with a threaded cast bronze lift nut to engage the operating stem. Bearings shall be provided above and below a flange on the operating nut to support both opening and closing thrusts. Operators shall be designed for a maximum crank effort of 40 lbs under the specified operating conditions. Gears, where required, shall be steel with machined cut teeth.
designed for smooth operation. The pinion shafts on crank-operated floorstands, either single or double ratio, shall be supported on tapered roller bearings and enclosed in a cast iron case and cover. Positive mechanical seals shall be provided on the operating nut and the pinion shafts to exclude moisture and dirt and prevent leakage of lubricant out of the hoist. Lubricating fittings shall be provided for the lubrication of all gears and bearings. The crank shall be of cast iron with a revolving brass grip. The crank shall be removable.

3. Operators shall be equipped with fracture-resistant clear butyrate plastic or high impact acrylic stem covers which shall not discolor or become opaque for a minimum of five years after installation. The top of the stem cover shall be closed. The bottom end of the stem cover shall be mounted in a housing or adapter plate for easy field mounting. Stem covers shall be complete with indicator markings to indicate gate position.

4. An arrow with the word "OPEN" shall be permanently attached or cast onto the operator to indicate the direction or rotation to open the gate. The direction of rotation to open shall be clockwise.

5. On gates as shown, provide non-rising stem type operators consisting of a stem with 2-in square nut on top mounted in a cast iron floor box set in the concrete floor above the gate. Provide one tee wrench for each gate.

F. Electric operators shall be furnished where shown on the Drawings and shall be electric operated floor or bench stand mounted and shall include the motor, operator unit gearing, limit switch gearing, limit switches, torque switches, stem nut, declutch lever and auxiliary handwheel. The motor operator shall drive the gate stem at a rate of one foot per minute.

1. The motor shall be specifically designed for gate operator service and shall be continuous duty rated (modulating service only), of a high torque, totally enclosed non-ventilated construction with the motor leads brought into the limit switch compartment without having external piping or conduit box. The motor shall be of ample size to open or close the gate against maximum load when voltage to the motor terminals is within ten percent of the nominal voltage. It shall be pre-lubricated and all bearings shall be of the anti-friction type. Motors shall be of weatherproof construction unless otherwise shown and shall have encapsulated windings with void free slot penetration and be capable of passing water immersion test as outlined in NEMA MGI-20.48 to provide protection against moisture ingress and condensation when the motor is not running. Threaded condensate drain holes shall be suitably positioned on the lower external surface to expel any moisture that may have accumulated. Motor power requirements shall be as specified below. In addition, the motor shall conform to all applicable portions of Section 15100.

2. The power gearing shall consist of carburized and hardened alloy steel worms with threads ground after heat treating. The worm gear shall be of alloy bronze, accurately cut with a hobbing machine. Where required, additional generated helical gears of heat treated steel shall be used. All power gearing shall be suitably lubricated with oil or grease and shall be suitable for mounting in any position. Ball or roller bearings shall be used throughout.

3. Limit switches and gearing shall be an integral part of the gate operator. The limit switch gearing shall be totally enclosed in its own gear case and permanently grease or oil lubricated. The limit switch mechanism shall be designed so that one set of limit switches is provided for each direction of travel and shall be provided with two normally open and two normally closed contacts per set of switches. The switches shall be adjustable to allow
the switch to trip at any point on the gate's travel. The limit switches shall be geared to the drive mechanism and in step at all times whether the unit is in motor or manual operation. A mechanical gate position indicator shall be provided to indicate gate opening.

4. The gate control shall be equipped with a double torque switch. The torque switch shall be adjustable and shall be responsive to load encountered in either direction of travel. It shall operate during the complete cycle to protect the gate should excessive load be met because of obstruction in either direction of travel.

5. The operator shall have a stem nut of high tensile bronze for open-close service. Stem nuts for modulating service shall have a nylon stem nut. The nut arrangement shall be of the 2-piece type to simplify field replacement. The stem nut shall be capable of being removed from the top of the operator without the necessity of removing the operator from the floor stand or disassembling any of the gearing within the operator.

6. A handwheel shall be provided for manual operation. The handwheel shall not rotate during electric operation, but shall be responsive to manual operation at all times except when the motor is in operation. The motor shall not rotate during hand operation, nor shall a fused motor prevent hand operation. When in the hand operating position, the unit shall remain in this position until the motor is energized, at which time the operator shall automatically return to electric operations and shall remain in the electric position until hand operation is again desired. This movement from electric to hand operation shall be accomplished by a positive declutching lever which shall disengage the motor and motor gearing mechanically, but not electrically. It shall be impossible to place the unit in hand operation when the motor is running. When in hand operation, not more than 40 lbs of force shall be required on the handwheel for operation of the gate. An arrow shall be cast on the handwheel labeled to indicate the direction of rotation to open the gate. The direction of rotation to open shall be clockwise.

7. Furnish floor stands as required for operators and as specified above. The floor stand, anchors and accessories shall be supplied as part of the gate assembly by the gate manufacturer.

8. A weatherproof locking device shall be provided on the gate operator to prevent use of the manual operator and prevent access to the locally mounted electric controls. The device shall allow remote operation.

9. Furnish fracture-resistant clear butyrate plastic stem covers complete with indicator markings to indicate gate position. Stem covers shall not discolor or become opaque for a minimum of five years after installation. The top of the stem cover shall be closed. The bottom end of the stem cover shall be mounted in a housing or adapter plate for easy field mounting.

10. Enclosures shall be FM certified or UL certified and shall be provided with space heaters to prevent condensation.

11. Each operator shall be provided with its own electrical controls housed in a NEMA 4X enclosure (unless otherwise shown) which shall be part of the operator. For outdoor installation, the controls shall be completely factory wired to the motor, limit switches and torque switch such that the only field wiring connection required, shall be for power supply and signal. All field wiring shall be to terminal strips.
12. Electrical operators arranged for open-close operation shall open and close the gate between the limit switch settings in response to a local or remote signal. The controls shall consist of a combination lockable circuit breaker and reversing starter with control power transformers. Control power shall be 110 Volt. A Raise-Stop-Lock-Lower pushbutton station shall be furnished and mounted as an integral part of the controls. A lockable Hand-Off-Remote selector switch shall also be provided to allow response to a remote Raise-Stop-Lower control. In addition to the mechanical position indicator, two indicating lights, one green and one red, shall be furnished. The lights shall be wired such that the green light shall be illuminated when the gate is fully closed, the red light shall be illuminated when the gate is fully open and both lights shall be illuminated when the gate is in any intermediate position. The power supply to the gate operator shall be 480 Volts, 3 Phase, 60 Hz.

13. Class 1, Division 1 locations: Operators installed in Class 1, Division 1 locations shall be explosion proof, marked with a T3B temperature code label, and UL listed for use in Class 1, Division 1, Groups C & D hazardous location. The temperature code marking shall appear on the nameplate. Refer to the Electrical Drawings for hazardous locations.

14. The electric operators shall be by Limitorque Corp.; Rotork by Rotork Inc. or equal, designed for operation of a rising stem gate.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation of all gates and guides shall be done in a workmanlike manner. Handle, store and install the equipment specified in this Section in strict accordance with the manufacturer's drawings and recommendations. Frames and guides shall be installed in a true vertical plane and shall be installed with 90 degree corners.

B. Gates with embedded guides and inverts shall be installed in accordance with the recommendations of the manufacturer subject to the Engineer's approval.

C. The installation of all gates shall be under the supervision of a representative of the manufacturer furnishing the gates.

3.02 FIELD TESTING

A. Furnish the services of a factory representative, as provided under Part 1, who has complete knowledge of proper operation and maintenance to inspect the final installation and supervise a test of the equipment. These services may be combined with those provided under Part 1.

B. After installation, all slide gates and weir gates shall be field tested at maximum differential head to ensure that all items of equipment are in compliance with this Section, including the leakage requirements.

1. Maximum allowable leakage for slide gates and weir gates shall be 0.05 gpm/ft of perimeter under the design seating head.

C. In the event that any unit fails to meet the above requirements, the necessary changes shall be made and the unit retested. If the unit remains unable to meet the test requirements to the
satisfaction of the Engineer, it shall be removed and replaced with a satisfactory unit at no additional cost to the Owner.

END OF SECTION
SECTION 13350
VENDOR PLC HARDWARE AND SOFTWARE

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section includes Programmable Logic Controllers (PLCs) for control of process equipment, process oriented machinery, and process systems. The requirements specified in this section shall apply to all PLCs contained in process equipment local control panels.

1.02 RELATED WORK

A. Section 13300 “Instrumentation and Controls - General Provisions.”

B. Section 13330 “Control Panel Enclosures and Panel Equipment.”

1.03 SUBMITTALS

A. Refer to Section 13300.

B. Descriptive literature, bulletins, catalog cuts and Drawings for the equipment specified herein.

C. Complete bill of materials for the equipment.

D. Spare parts list.

1.04 REFERENCE STANDARDS

A. ASTM D 999-91: Vibration.

B. (CFR) Title 47, Part 18 (European EN 55011 (formerly CISPR 11)).

C. CSA Certification Class I, Division 2, Group A, B, C, D Hazardous or non-hazardous locations.


E. IEC 61000 Electromagnetic compatibility (EMC) - Testing and measurement techniques:

1. Part 4-2: Electrostatic discharge immunity test.

2. Part 4-3: Radiated, radio-frequency, electromagnetic field immunity test.


5. Part 4-6: Immunity to conducted disturbances, induced by radio-frequency fields.

G. IEC 801-3: RFI Immunity.

H. IEC 801-5: Ground Continuity.

I. IEC 801-2: Electrostatic Discharge.


K. MIL STD 461B CS02: RFI/EMI Susceptibility.


M. NSTA Project 1A.

N. UL 508 and CSA Standard C22.2 No. 142 (Isolation Voltages).

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer shall be capable of providing training, parts, and coordination of emergency maintenance and repairs.

B. Programmable controller and all of the corresponding components within the family of controller products shall be manufactured by a company who regularly manufactures and services this type of equipment.

C. Manufacturer shall comply with ISO9001 standards for "Quality Systems - Model for Quality Assurance in Design/Development, Production, Installation, and Servicing".

D. Manufacturer shall provide complete technical support for all of the products. This shall include factory or on-site training, regional application centers, local or factory technical assistance, and a 24/7/365 technical support phone service.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver PLC components in packaging designed to prevent damage from static electricity and physical damage.

B. Store PLC equipment according to manufacturer requirements. At a minimum, store indoors in clean, dry space with uniform temperature to prevent condensation. Protect PLCs from exposure to dirt, fumes, water, corrosive substances, and physical damage. Also, protect the PLC from all forms of electrical and magnetic energy that could reasonably cause damage.

1.07 NOMENCLATURE AND IDENTIFICATION DEFINITIONS

A. AI: Analog Input.

B. AO: Analog Output.
C. Fixed I/O: A PLC style consisting of a fixed number of I/O, a processor, and a power supply all in one enclosure. Some fixed PLCs have limited expansion ability.

D. CPU: Central Processing Unit.

E. DI: Discrete Input.

F. Distributed I/O: Hardware specially designed to function as Remote I/O.

G. DO: Discrete Output.

H. HMI: Human-Machine Interface.

I. I/O Input and/or Output.

J. Master/Slave: Communication between devices in which one device, the master, controls all communications. The other devices, the slaves, respond only when queried by the master. Typically used in a Remote I/O application.

K. Modular: A PLC style consisting of cards that are assembled to comprise a complete unit. All I/O, CPU, and Power Supply are dedicated cards. Typically, these cards are inserted into a chassis.

L. Peer to Peer: Communication between two or more devices, typically PLC's, in which each device can control the communication exchange.

M. PID: Control action, proportional plus integral plus derivative.

N. PLC: Programmable Logic Controller.

O. Remote I/O: I/O that is located remotely from the processor. Remote I/O can communicate over a variety of communication protocols and can use standard rack based I/O, or special Remote I/O hardware referred to as Distributed I/O.

P. SCADA: Supervisory Control and Data Acquisition.

1.08 SPARE I/O AND SLOTS

A. Each panel containing PLC I/O shall include at least 20 percent (minimum of four) points of each type (AI, AO, DI, and DO) for future use, regardless of whether any of those point types are used in that panel or not. The spares shall be the same type of I/O modules supplied.

B. Spare output points that require the use of an external relay shall be supplied with the external relay.

C. Regardless of the spare requirement, all installed unused points on all I/O modules shall be wired to terminal blocks in the order that they occur on the I/O modules. Unwired spares shall not be acceptable.
PART 2  PRODUCTS

2.01 COMPACT PROGRAMMABLE LOGIC CONTROLLER

A. Provide Programmable Logic Controller equipment with the required memory and functional capacity to perform the specified sequence of operation with the scheduled input and output points.

B. Processor Systems shall include processor, power supply, input/output modules, communication modules, and remote interface modules as required to meet system requirements.

C. PLC shall support expansion I/O modules but not necessarily be chassis based in design.

D. Furnish products listed and classified by Underwriters Laboratories (UL), CSA, or FM approval as suitable for purpose specified and indicated.

E. All equipment and devices furnished hereunder shall be designed for continuous industrial service. The system shall contain products of a single manufacturer, insofar as possible, and shall consist of equipment models that are currently in production.

F. All equipment furnished shall be designed and constructed so that in the event of power interruption the systems shall go through an orderly shutdown with no loss of memory, and resume normal operation without manually resetting when power is restored.

G. The PLCs shall communicate between the operator workstation and field-mounted transducers, switches, controllers, and process actuators. Communications protocol shall be completely transparent to process operators at the Human Machine Interface (HMI).

H. The PLC shall be capable of stand-alone operation in the event of failure of the communication link to the HMI subsystem.

I. Agency and environmental specifications:

1. Electrical supply voltage to the PLC shall be 120 VAC, plus or minus 15 percent, 48 - 63 Hz. PLC system power supplies shall be fused for overload protection.

2. Vibration: 3.5 mm Peak-to-Peak, 5 - 9 Hz: 1.0G, 9 - 150 Hz. The method of testing is to be based upon IEC 68-2-6 and JIS C 0911 standards for vibration. The system shall be operational during and after testing. Vibration Rating of 2.0G maximum peak acceleration for 10 to 500Hz. in accordance with at least one of the following:
   a. Installed rating: DIN rail mounted PLC: 10 - 57 Hz, amplitude 0.075 mm, acceleration 25 - 100 Hz.
   b. Panel or plate mounted PLC: 2 - 25 Hz, amplitude 1.6mm, acceleration 25 - 200 Hz.
   c. In compliance with IEC 60068 and IEC 61131.

3. Shock: 15G, 11 msec. The method of testing is to be based upon IEC 68-2-27 and JIS C 0912 standards for shock. The system is to be operational during and after testing.

4. Temperature:
   a. Operating Temperature: 0° to 60 °C (+32° to 140 °F).
   b. Storage Temperature: -25° to 70 °C (-40° to 185 °F).
5. Relative Humidity:
   a. Operating Relative Humidity: 10 to 95%, non-condensing.


7. Altitude:
   a. Operation: 0 - 6,500 feet.
   b. Storage: 0 - 9,800 feet.


9. All products shall have corrosion protection.

J. All major assemblies and sub-assemblies, circuit boards, and devices shall be identified using permanent labels or markings indicating:

1. Modules product type such as analog or digital.
2. Modules catalog number.
3. Modules major revision number.
4. Modules minor revision number.
5. Module manufacturer vendor.
6. Module serial number.

K. All necessary cables shall be included. All cables and connectors shall be as specified by the manufacturer. Cables shall be assembled and installed per the manufacturer recommendations.

L. Central Processing Unit (CPU):

1. CPU shall be, at a minimum, a 16-bit microprocessor that provides system timing and is responsible for scheduling I/O updates, with no user programming required to ensure discrete or analog update. It shall execute user relay ladder logic programs, communicate with intelligent I/O modules, and perform on-line diagnostics. The CPU shall consist of a single module which solves application logic, stores the application program, stores numerical values related to the application processes and logic, and interfaces to the I/O.

2. CPU shall sample all the discrete and analog inputs and outputs including internal coils and registers, and service special function modules every scan. The CPU shall process the I/O with user program(s) stored in memory, then control the outputs based on the results of the logic operation.

3. Supply CPU with a battery-backed time of day clock and calendar.

4. CPU family shall allow for user program transportability from one CPU model to another.
M. Diagnostics:

1. CPU shall perform on-line diagnostics that monitor the internal operation of the PLC. If a failure is detected, the CPU shall initiate system shutdown and fail-over. The following, at a minimum, shall be monitored: Memory failure, memory battery low, and general fault, communications port failure, scan time over run, I/O failure, and analog or special function I/O module failure.

2. All diagnostic information shall be accessible to the host communications interfaces and to the PLC program.

3. PLC shall have indicators and on board status area to indicate the following conditions:
   a. CPU run.
   b. CPU error or fault.
   c. I/O failure or configuration fault.
   d. Status of Battery or back-up power module.
   e. Communications indicator.

N. Memory:

1. User program and data shall be contained in non-volatile battery backed memory of type CMOS RAM program memory or equivalent.

2. Memory Backup System: provide lithium battery backup or equivalent capable of retaining all memory for a minimum of three months and a Flash memory system capable of reloading program in the event of memory loss.
   a. Backup Storage: The backup battery or module shall be capable of being replaced without disrupting memory integrity. Provide a visual indication of low battery voltage or module error and an alarm bit in the PLC program.
   b. Flash or SD Memory Card: Memory card storage capacity shall be equal to or greater than processor memory capacity. Memory cards shall be installed in processors for factory testing.

3. Operating system shall be contained in non-volatile firmware. The memory containing the operating system shall be field updateable via a separate update tool.

O. Programming Environment:

1. Programming port: The PLC shall utilize a serial, USB, or Ethernet port for programming.

2. On-Line programming: Application programs may be modified or stored while the CPU is running, with minimal impact on the scan time.

3. Online programming including runtime editing

4. IEC 61131-3 programming languages supported: Ladder logic, function block, sequential function chart, and structure text.

5. Supply all hardware and software necessary to program the CPU in these languages.

P. Analog and Digital I/O:
1. PLC shall include embedded I/O and/or expansion I/O modules to accommodate project needs.

2. PLC shall support a variety of discrete and analog modules to meet required project I/O needs.

Q. Communication Ports:

1. Include minimum of 1: 10/100 Mbps Ethernet port.

2. The CPU shall be expandable and supplied with additional modules to support the required communication interfaces.

R. Machine Readable Documentation

1. The supplier shall provide two sets of documented unprotected as-built Electronic PLC, PC, HMI, and all other required software files on CD-ROMs in native machine readable format, final software programs and any passwords or hardware/software required to modify or restore all programs and configurations developed under this Contract. This machine readable documentation shall include all documentation files including logic and annotation files. Any changes made during or after factory acceptance test shall be incorporated at no additional cost to the Owner. Supply of these items shall not require any ongoing support contract or long term relationship with the supplier.

S. Site Conditions

1. Prior to leaving the site, the supplier shall ensure that all devices or programming computers that the Owner will use to maintain the system can monitor the control processors on-line, make on-line changes, upload, and download the processors to ensure proper communication has been set up and that programming software versions are compatible with the processors provided.

2. Prior to leaving the site, the supplier shall ensure the PLC and HMI addresses ("IP addresses" if an Ethernet network) are configured to be compatible with the plant's SCADA system.

T. Manufacturers:

1. Provide all PLCs from a single manufacturer. If the PLC manufacturer has authorized third party vendors to provide modules that are compatible with their platforms, then products manufactured by these authorized third party vendors will be acceptable.

2. Provide the PLC system by one of the following:
   a. Rockwell Automation: CompactLogix.
   c. GE Intelligent Platforms: Rx3i.
   d. Siemens: SIMATIC S7-300.
   e. or equal.
2.02 OPERATOR INTERFACE TERMINAL (OIT)

A. OITs shall be mounted on control panels and shall run interface software separate from the HMI software specified in Section 13315.

B. Manufacturers:

1. Provide operator interface terminals (OIT) from one of the following:
   b. GE Loaded QuickPanel View series.
   c. Modicon Magelis HMI GTO series.
   d. Siemens SIMATIC HMI IPC series.
   e. Or equal.

C. Software:

1. Operator Interface Terminal shall be pre-packaged with all configuration and programming software necessary to perform functions as shown on drawings and within the specifications.

2. Integrated OIT software shall have the following features:
   a. Trending.
   b. Data Logging.
   c. Alarms.
   d. Graphic Symbols.
   e. Animations.

D. I/O Ports and Devices:

1. OIT shall have a minimum of one Ethernet 10/100 Mbps for connectivity or programming.

2. OIT shall have a minimum of one Serial RS232 port.


4. Compact flash ports shall be Type 2.

5. OIT shall have a minimum of one USB port.

E. Display:

1. OIT display size shall be 10".

2. Type of display for the OIT shall be Color Active Matrix TFT.

3. Display resolution shall be a minimum of 800 x 600 for 8" to 12" displays.

4. Display shall support touch screen input.

F. Environmental:
1. Rating: OIT shall be rated to maintain the rating of the control panel it will be mounted in.

2. Temperature: Operating temperature range of the OIT shall range 0 - 50 °C.

2.03 SPARE PARTS

A. General requirements for spare parts are specified in Section 13300.

B. The following PLC spare parts shall be furnished:

1. Processors: Provide spare processor unit(s) for each unique processor installed.

2. Memory Cards: Provide spares for each type of card installed.

3. I/O Cards: Provide one spare for each unique I/O module type installed.

4. Network interface, remote I/O, and communication modules: Provide one spare communication module for each unique communication module installed.

5. Specialty Modules: Provide as a minimum a spare of each type of module installed.

6. PLC Power supplies: Provide spare power supplies for each unique power supply installed.

7. Miscellaneous components (including cables): Provide spares for each unique component installed.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION

A. Maintain area free of dirt and dust during and after installation of programmable controller products.

B. Anchor PLCs within enclosures as recommended by the PLC manufacturer.

C. Ventilation slots shall not be blocked, or obstructed by any means.

D. Examine areas, surfaces, and substrates to receive PLCs for compliance with requirements, installation tolerances, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

E. Install in accordance with manufacturer's instructions.

F. Unload, unpack and transport equipment to prevent damage or loss.

G. Replace damaged components as directed by Engineer.

H. Provide individual device protection for any 4-20 mA signal and for any 120VAC power to an instrument or equipment mounted outside of the building or facility housing. Instruments shall be housed in a grounded metallic case. Device surge protectors shall be mounted within the
instrument enclosure or a separate junction box coupled to the enclosure. Provide gas tube or metal oxide varistors (MOVs) surge protection.

3.02 PANEL LAYOUT

A. Coordinate size and configuration of enclosure to meet project requirements. Drawings indicate maximum dimensions for PLCs, minimum clearances between PLCs, and adjacent surfaces and other items.

B. Comply with PLC vendors’ maximum dimensions and clearances.

   1. Provide spacing around PLC as required by the PLC manufacturer to ensure adequate cooling. Insure that the air surrounding the PLC has been conditioned to maintain the required temperature and humidity range.

   2. Wires entering and exiting PLC components shall be sized to comply with the PLC manufacturers requirements. Doors on all components shall be able to be fully closed when all the wires are installed.

   3. PLC lights, keys, communication ports, and memory card slots shall be accessible at all times. Lights shall be visible at all times when enclosure door is opened.

C. Control panel designer shall provide independent line fuses or circuit breakers, per the PLC manufacturer recommendation, for each power supply, input module, output module, and other modules with separately derived power requirements.

D. Control panel designer shall insure that communication signals, 4-20 mA signals (including those with embedded HART), are properly conditioned for the PLC and protected from all sources of radiated energy or harmonics.

E. Where multiple sets of mechanical equipment are provided for process redundancy, arrange their field connections to I/O modules so that the failure of a single I/O module will not disable the redundant system. This applies to all I/O types. The acceptability of the I/O arrangement shall be at the discretion of the engineer.

F. Provide all required cables, cords, and connective devices for interface with other control system components.

END OF SECTION