THRASHER

ENGINEERING
ARCHITECTURE
FIELD SERVICES

CITY OF NEW CUMBERLAND
HANCOCK COUNTY, WEST VIRGINIA

CONTRACT #2 – CUMBERLAND HEIGHTS WATER STORAGE TANK REPLACEMENT & REHABILITATION AND SUNSET LANE WATER STORAGE TANKS

ADDENDUM # 3

January 21, 2021
THRASHER PROJECT NO. 101-010-1041

TO WHOM IT MAY CONCERN:

This Addendum #3 provides the revised Bid Opening Date and Time, a Specification for Hydrodynamic Mixing System and responses to questions provided prior to the close of questions on Wednesday, January 20, 2021.

Attention is directed to the fact that while information provided in this Addendum may reference specific locations in the Plans and Specifications, the information provided shall be applied to all applicable locations in the Plans and Specifications.

Please acknowledge receipt of all Addenda in the Bid Opening Requirements and in the Bid Form.

A. GENERAL

1. Bids will be received until 10:00 A.M., LPT, on Wednesday, January 27, 2021 at 104 N. Court Street, New Cumberland, Hancock County, WV. They will be publicly opened and read aloud at that time.

B. SPECIFICATIONS

1. Specification Section 464128, Hydrodynamic Mixing System (HMS), has been included with this Addendum.

C. QUESTIONS AND RESPONSES

QUESTION

1. Is it the contractor's responsibility to include pricing for a paint abatement contractor to remove the paint prior to demo, rehabilitation or scrapping or are respirators & disposable clothing enough?

RESPONSE

Contractors are required to follow all OSHA Regulations regarding demolition and rehabilitation of existing tanks that may contain lead-based paint on this project. It is the Engineer's understanding that lead abatement is not required prior to demolition. However, the Contractor performing these duties must be familiar with the Safety and Health Regulations concerning lead-based paint and follow all safety, monitoring and disposal requirements from the applicable agencies.

QUESTION

2. The response to Question #26 in Addendum #1 stated that the Contractor shall meet the requirements of Section 099050 of having painted five potable water tanks withing 12 months of the bid. Can this be reconsidered?

RESPONSE

After further consideration, the Engineer will require the Contractor to have painted five potable water tanks within 24 months of the bid date.

QUESTION

3. Please confirm if Superior has completed requirements that meet this specification and for what tank application as a follow up question to the response of Question #22 in Addendum #1.

RESPONSE

Superior Tank Company, Inc, is considered an "approved equal" for the Epoxy Coated Bolted Steel Tank as per the previous response. However, the tank submitted for consideration shall meet all requirements in the Contract Documents and Specifications that include the Addendums.

QUESTION

4. Is Cathodic Protection required for the 500,000 Gallon Water Storage Tank?

RESPONSE

Cathodic Protection shall be provided for the 500,000 Gallon Water Storage per AWWA D104 or D106. The Contractor is responsible for the design of the Cathodic Protection System, installation and testing. Cathodic Protection for the new tanks shall be provided as per the Specifications.

QUESTION

5. Has testing of the material or sludge in the bottom of the existing tanks been performed so approval for disposal at a landfill can be obtained?

RESPONSE

No testing of this material has taken place. The sludge shall be disposed of at a landfill approved for this type of material. All costs associated with removal and disposal of the sludge shall be paid for by the Contractor and included in the lump sum bid item associated with this work.

QUESTION

6. Is it the intent of the Owner to have the ability to award each Bid Form Item to separate contractors?

RESPONSE

The Method of Award at the end of the Bid Form states the Owner may award the Contract on the "Total Bid". Contracts will not be issued for individual Bid Items. The intent is to award two contracts on this project. Contract #1 for the Potable Water System Improvements and Contract #2 for the Cumberland Heights Water Storage Tank Replacement & Rehabilitation and Sunset Lane Water Storage Tanks.

QUESTION

7. Can you provide clarification for the Hydrodynamic Mixing System (HMS)?

RESPONSE

Specification Section 464128, Hydrodynamic Mixing System (HMS), has been included with this Addendum. This is intended for the two 109,000 Gallon Water Storage Tanks and the 294,000 Gallon Water Storage Tank. The existing 500,000 Gallon Water Storage that requires rehabilitation does not require an HMS.

Thank you for your interest in the project.

Sincerely,

THE THRASHER GROUP, INC.

1/21/2021

STEVEN V. BUCHANAN, PE, PS

Enclosures: Spec 464128 – Hydrodynamic Mixing System (HMS)

SECTION 464128 – HYDRODYNAMIC MIXING SYSTEM (HMS)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Hydrodynamic Mixing System.

B. Related Requirements:
1. Section 331613 – Epoxy Coated Bolted Steel Tanks.
2. Section 434111 – Glass Lined Bolted Steel Tanks.
3. Section 434113 – Welded Steel Tanks.

1.2 GENERAL

A. The Hydrodynamic Mixing System (HMS) is defined as a supplemental system installed within a potable water storage reservoir which passively utilizes the energy provided by the inlet water supply (via pumped or gravity head) and generates a sufficient inlet momentum to achieve a complete homogeneous blending of the water volume within the reservoir with the inlet supply flow. Determination of Complete Homogeneous Blending shall be defined by the modeling requirements and supporting hydraulic analysis as conducted by each individual manufacturer for their specific system configuration as defined within these specifications. System submittals not providing this validation shall not be considered as a viable Hydrodynamic Mixing System (HMS) and shall not be accepted as an equivalent to this system specification.

B. The specifications in this section include all components of the Reservoir Hydrodynamic Mixing System (HMS) consisting of a bi-directional or unidirectional flow manifold equipped with variable orifice duckbill inlet nozzles and outlet flow check valves that are NSF61 certified. When a reservoir includes a separate fill and drawn line, and reverse flow is not desired under any operating condition; the manifold piping shall not be equipped with outlet check valves. The HMS manufacturer shall be responsible for designing the system in accordance with the hydrodynamic criteria defined within these specifications and submit design calculations verifying compliance in accordance with the submittal requirements. The following is a description of the Hydrodynamic Mixing System.

C. All modeling and hydraulic and mixing calculations pertaining to the HMS shall originate from the duckbill valve manufacturer. Modeling and calculations provided by parties other than the duckbill valve manufacturer are not allowed.

D. The complete Hydrodynamic Mixing System shall be supplied by the variable orifice nozzle manufacturer to maintain single source responsibility for the system. The complete system shall be defined as all piping and appurtenances within the tank downstream of the tank penetration. Appurtenances include pipe, fittings, horizontal and vertical pipe supports, expansion joints, variable orifice duckbill check valves, and any other equipment specified within this section of the specifications. Approved manufacturer is Tideflex Technologies, Carnegie, PA 15106, or Engineer Approved Equal. Email: SUPPORT@REDVALVE.COM; Phone: (412)-279-0044.

E. Manufacturer's and/or contractors submitting an alternative to the named Tideflex Technologies mixing system shall be responsible for obtaining any and all proprietary rights, license fees, royalties, technology licenses, and/or permissions required to provide such a system. The Manufacturer shall indemnify and hold harmless the Owner and Engineer against all claims, damages, losses, and expenses arising out of any infringement of patent rights or copyright incident relating to this system.

1.3 REFERENCE STANDARDS

A. American National Standards Institute (ANSI)
1. B16.1 – Cast Iron Pipe Flanges and Flanged Fittings
2. B16.5 – Pipe Flanges and Flanged Fittings
3. B36.10 – American National Standard Weights and Dimensions of Welded and Seamless Wrought Steel Pip

B. American Society for Testing and Materials (ASTM)
1. A53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
2. A234 – Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
3. A240 – Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Application
4. A351 – Standard Specification for Castings, Austenitic, Austenitic-Ferritic (Duplex), for Pressure-Containing Parts
5. A536 – Standard Specification for Ductile Iron Castings
6. C110 – Ductile Iron and Gray-Iron Fittings, 3 In. through 48 In. for Water
7. D1330 – Standard Specification for Rubber-Sheet Gaskets
8. D1784 – PVC/CPVC Pipe Compounds
9. D1785 – PVC Pipe, Schedules 40, 80 & 120
10. D2466 – PVC Solvent Cement
11. D2855 – PVC Solvent Joints
12. D3261 – Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Fittings
13. D3915 – PVC Pipe Fitting Compounds

C. American Iron and Steel Institute (AISI)
1. AISI 304 – 304 Stainless Steel Plate
2. AISI 316 – 316 Stainless Steel Plate
3. AISI 1040 – Carbon Steel Plate

D. American Water Works Association (AWWA)
1. C104 – Cement-Mortar Lining of Ductile Iron Pipe and fittings for Water
2. C110 – Ductile-Iron and Gray-Iron Fittings, 3 In. through 48 In. for Water
3. C115 – Flange Ductile Iron Pipe with Ductile Iron or Gray Iron Threaded Flanges
4. C200 - AWWA Standard for Steel Water Pipe 6" and Larger
5. C207 – Standard for Steel Pipe Flanges for Waterworks Service – Size 4 In. to 144 In.
6. C220 – AWWA Standard for Stainless Steel Pipe, 4" and Larger

7. C900 – AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In. for Water Distribution
8. C905 – AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In Through 48 In. for Water Transmission and Distribution
9. C906 – AWWA Standard for Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 63 In. for Water Distribution

E. American Water Works Association Research Foundation (AwwaRF)
1. Project No. E20-J08 – Physical Modeling of Mixing in Water Storage Tanks (Forthcoming)

F. National Sanitation Foundation (NSF)
1. NSF Standard 14 – Plastic Piping System Components and Related Materials
2. NSF Standard 61 – Drinking Water System Components – Health Effects

1.4 VARIABLE ORIFICE DUCKBILL INLET NOZZLES

A. Inlet ports/nozzles shall be duckbill-style check valves that allow fluid to enter the reservoir during fill cycles and prevent flow in the reverse direction through the nozzle during draw periods. Inlet ports/nozzles may not be fixed-diameter ports or pipes.

B. The duckbill valves shall be NSF61 Certified. NSF61 approved/Certified materials will not be accepted in lieu of valve certification.

C. Inlet ports/nozzles shall have a variable diameter vs. flow hydraulic profile that provides a non-linear jet velocity vs. flow characteristic and a linear headloss vs. flow characteristic. The hydraulic characteristics of the duckbill valves shall be defined by "Hydraulic Code".

D. The inlet ports/nozzles shall discharge an elliptically shaped jet. The nozzle must have been modeled by an independent laboratory using Laser Induced Fluorescence (LIF).

E. Manufacturer shall have conducted independent hydraulic testing to determine headloss and jet velocity characteristics on a minimum of eight (8) sizes of duckbill valves ranging from 2" through 48". The testing must include multiple constructions (stiffness) within each size and must have been conducted for free discharge (discharge to atmosphere) and submerged conditions.

F. Manufacturer shall have conducted an independent hydraulic test where multiple valves (at least four) of the same size and construction (stiffness) were tested to validate the submitted headloss characteristics and to prove the repeatability of the manufacturing process to produce the same hydraulic characteristics.

G. Manufacturer shall have conducted independent hydraulic testing to study the flow distribution characteristics of duckbill valves installed on multiport manifolds.

H. Manufacturer to have conducted Finite Element Analysis (FEA) on various duckbill valves to determine deflection, stress, and strain characteristics under various load conditions. Modeling must have been done for flowing conditions (positive differential pressure) and reverse differential pressure.

I. Manufacturer must have conducted in-house backpressure testing on duckbill valves ranging from ¾" to 48".

J. Manufacturer shall have at least fifteen (15) years' experience in the manufacturing of "duckbill" style elastomeric valves.

K. Manufacturer must have duckbill valves installed on manifold piping systems in at least 100 distribution system reservoirs.

L. Manufacturer must have representative inspection videos showing the duckbill valves discharging water into the reservoir during an initial fill (unsubmerged). Manufacturer must also have representative underwater inspection videos showing the operation of the valves when submerged. Representative videos can be submitted upon request from the engineer.

M. The duckbill style nozzles shall be one-piece elastomer matrix with internal fabric reinforcing designed to produce the required discharge velocity and minimum headloss requirements as stipulated in the Submittals section. The flange portion shall be an integral portion of the nozzle with fabric reinforcing spanning across the joint between the flange and nozzle body.

N. The elastomer used in construction of the duckbill valves must have been tested by an accredited independent laboratory that confirmed there is no degradation in the elastomer when exposed to chlorine and chloramine per the ASTM D471-98 "Standard Test Method for Rubber Property – Effect of Liquids."

O. The manufacturer's name, plant location, serial number and product part number which designate nozzle size, material and construction specifications shall be bonded onto the surface of the nozzle.

1.5 OUTLET CHECK VALVES

A. The outlet flow valves shall be perforated disc type with elastomeric membrane.

B. The valves shall be NSF61 Certified. NSF61 approved/Certified materials will not be accepted in lieu of valve certification.

C. The perforated disc shall be fabricated of stainless steel plate with welded support gussets. The disc shall be flanged and drilled to mate with ANSI B16.1, Class 125/ANSI B16.5 Class 150 flanges. The disc shall have three (3) tapped holes used for fastening the membrane and support rod to the disc with stainless steel bolts, nuts, and lock washers. The top of the disc shall be tapped and supplied with lifting eyebolt for installation.

D. The membrane shall be circular, one piece rubber construction with fabric reinforcement. The diameter of the membrane shall allow adequate clearance between the membrane O.D. and the pipe I.D. The membrane shall be vulcanized with a specified convex radius to produce a compression set to allow the membrane to seal against the perforated disc at low reverse differential pressure.

E. The support rod shall be stainless steel and drilled with three (3) longitudinal holes to allow fastening of rod to membrane and perforated disc.

F. When line pressure inside the valve exceeds the backpressure outside the valve, the line pressure forces the membrane to open, allowing flow to pass through the perforations in the disc. When backpressure exceeds the line pressure, the membrane seats on the perforated disc preventing backflow.

G. The valve allows flow out of the reservoir during draw cycles and prevents flow into the reservoir during fill cycles.

H. The elastomer used in construction of the membrane must have been tested by an accredited independent laboratory that confirmed there is no degradation in the elastomer when exposed to chlorine and chloramine per the ASTM D471-98 "Standard Test Method for Rubber Property – Effect of Liquids."

I. The manufacturer's name, plant location, serial number and product part number which designates membrane size, material and construction specifications shall be bonded onto the surface of the membrane.

1.6 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

A. All PVC pipe and PVC fittings shall be a minimum Schedule 80 in accordance with ASTM D1785-83.

B. PVC pipe and fittings shall be NSF61 approved for potable water.

C. PVC pipe compounds shall be in accordance with the standards listed in Section 3.0: Referenced Standards.

D. PVC solvent and solvent joints shall be in accordance with the standards listed in Section 3.0: Referenced Standards.

E. Field solvent welding will not be allowed unless approved by the Engineer.

F. All pipe joints that are to be field connected shall be PVC Van Stone-type flanges. Flange drilling to be in accordance with ANSI B16.1/B16.5.

G. All fittings shall have the same pressure rating as the pipe unless otherwise noted.

1.7 FLANGE GASKETS

A. Flange gaskets shall be full-faced and shall be in accordance with ASTM D1330.

B. Flange gasket drilling pattern shall conform to ANSI B16.1/B16.5.

C. Flange gaskets shall be 1/8" thick.

D. Gasket material shall be EPDM.

1.8 FASTENERS

A. Hex head bolts and nuts shall be stainless steel 304 conforming to ANSI/ASME B18.2.1 and ANSI/ASME B18.2.2.

B. Plastic insulating sleeve/washers shall be utilized to isolate dissimilar bolt and flange metals where required.

1.9 PIPE SUPPORTS

A. All components of the bracket assembly shall be stainless steel 304 in accordance with the associated standards.

B. The bracket assemblies shall consist of four components:
1. A base plate (when required). For concrete tanks, the base plate will have four thru holes for expansion anchors.
2. A top-works weldment that consists of structural channel and angle iron. The TMS piping shall rest on the angle iron. The angle iron has predrilled holes for the U-bolt.
3. U-bolt with four hex nuts.
4. An 1/8" thick EPDM strip with a length equivalent to the circumference of the pipe. The strip shall be placed between the pipe and the angle iron and U-bolt.

C. The channel of the top-works weldment shall be field fit and modified to the required length. The channel shall then be field welded to the base plate.

D. For steel tanks, the base plate shall be field welded to the tank floor or shell. The location of the base plate shall avoid welded joints in the floor/shell plates.

E. For concrete tanks, the support shall be anchored to the concrete floor with stud type expansion anchors, the pull-out rating of the combined anchors shall be a minimum of 10 times greater than the static weight of the vertical pipe section.

F. Plastic insulating sleeve/washers shall be utilized to isolate dissimilar metals where required.

1.10 COATINGS

A. Following installation of the manifold system, all carbon steel and ductile iron pipe, fittings, bolted connections, pipe supports, and appurtenances shall be coated according to the interior tank paint specification as specified by the Engineer.

B. Surface preparation and coating procedures shall be provided by the Engineer and the coating supplier.

C. **Tideflex and Waterflex Valves shall not be coated.** The valves shall either be masked or be mounted after coating of the tank and piping. Contractor to ensure masking materials are removed after coating.

1.11 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer's product data for system materials and component equipment, including electrical characteristics and connection requirements.

C. Shop Drawings:

1. Indicate system materials and component equipment.

2. The duckbill valve manufacturer shall be responsible for providing engineering installation drawings of the complete manifold piping system as supplied by the manufacturer. These drawings shall include plan view piping arrangement, sections and elevations as required, support bracket installation details, duckbill nozzle orientation details, and all dimensions required for locating the system within the specified dimensions of the tank.

3. Six (6) sets of plans shall be provided to the Engineer for review and approval.

4. Two (2) sets of final fabrication and installation drawings shall be included with the shipment of the manifold piping equipment.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1. Certify installation is completed according to manufacturer's instructions and that mixers have been properly installed and tested and are ready for operation.

E. Manufacturer's Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

G. Manufacturer Reports: Indicate that equipment has been installed according to manufacturer's instructions.

H. Qualifications Statements:

1. Submit qualifications for manufacturer.
2. Submit manufacturer's approval of installer.

I. Independent CFD Modeling Validation

1. The mixing system designer/supplier must supply data or report from at least one project where an independent company conducted CFD modeling on their mixing system design and the modeling results verified the design achieved complete mixing.

J. Full Scale Tracer Study Validation

1. The mixing system designer/supplier must supply data or report from at least one project where a full scale tracer study using calcium chloride was conducted on a circular reservoir and the tracer study results verified the mixing system design achieved complete mixing.

K. Tideflex Inlet Nozzle and Waterflex Outlet Valve Testing and Validation

1. Verification of independent hydraulic testing to determine headloss and jet velocity characteristics on a minimum of eight (8) sizes of duckbill valves ranging from 2" through 48". The testing must include multiple constructions (stiffness) within each size and must have been conducted for free discharge (discharge to atmosphere) and submerged conditions.
2. Verification of Independent Laboratory Testing for Manufacturing Consistency - the duckbill valve manufacturer shall provide summary documentation of a report conducted by an Independent Laboratory for hydraulic testing where multiple duckbill valves (at least four) of the same size and construction (stiffness) were tested to validate the submitted headloss characteristics and to prove the repeatability and consistency of the manufacturing process to produce the same hydraulic characteristics.
3. Report of independent testing that studied the flow distribution characteristics of duckbill valves installed on multiport manifolds. The manufacturer must have been in the business of manufacturing duckbill valves at the time the report was published.
4. Verification of Finite Element Analysis (FEA) of duckbill valves. The duckbill valve manufacturer shall provide summary documentation of Finite Element Analysis modeling on representative duckbill nozzle sizes to determine deflection, stress and strain characteristics under various load conditions. Modeling must have been done for flowing conditions (positive differential pressure) and reverse differential pressure.
5. Verification of independent hydraulic testing to determine headloss characteristics on a minimum of three (3) sizes of perforated disc/elastomeric membrane check valves ranging from 6" through 36". Testing must have been conducted with and without the membrane installed. At least two (2) sizes shall have tested two (2) different membrane thicknesses.
6. Verification of Finite Element Analysis (FEA) modeling of a perforated disc/elastomeric membrane check valve to determine stress and deflection characteristics under reverse differential pressure.

L. Validation of Long-term Performance

1. The mixing system designer/supplier must supply at least one inspection report showing proper operation of, and no deterioration of, the duckbill valves after being in service in a water storage tank mixing application for a minimum of 10 years.

M. NSF61 Certification

1. Copy of the NSF61 Certified listing for the valves used in the Hydraulic Mixing System (HMS).
2. The valves themselves must be NSF61 certified, not just the elastomer used in construction of the valves. NSF61 approved/certified materials will not be accepted in lieu of valve certification.
3. The NSF61 Certification for the valves must be for a minimum volume of 2,000 gallons. Valves with NSF61 Certification for minimum volume of greater than 2,000 gallons are not acceptable.

N. Test Report of Elastomer Exposure to Chlorine and Chloramine
   1. Copy of test report from an accredited independent laboratory that confirmed there is no degradation in the elastomer when exposed to chlorine and chloramine per the ASTM D471-98 "Standard Test Method for Rubber Property – Effect of Liquids."

O. Design Calculations
   1. All Design Calculations, curves, and reference information listed below must originate and be submitted by the duckbill valve manufacturer. Calculations, curves, and reference information provided by contractors relating to the HMS are not allowed. The duckbill valve manufacturer MUST include within the submittal package the following design calculations, curves, and reference information:
   2. Calculations showing the fill time required, under isothermal conditions, for the HMS system to achieve complete mix of the reservoir volume at minimum, average and peak fill rates. Complete mixing defined as 95% homogenous solution. The theory and equations used in calculating the mixing times must be from a published AWWA reference manual or paper. The reference document(s) must be submitted with the equations and calculations.
   3. Calculations showing the water level drawdown required to achieve complete mixing on the fill cycles at minimum, average, and peak flow rates.
   4. Calculations of average storage tank water age for both fill-then-draw, and simultaneous fill and draw scenarios. Theory used in calculating water age must be submitted with the calculations.
   5. A representative Computational Fluid Dynamics (CFD) model evaluation of the proposed HMS system configuration applied within a reservoir of similar geometry. Model output documentation shall include all design variables applied for the simulation, plot of the 3-D geometry showing the mesh definition, velocity magnitude vector and contour plots at different cross-sections throughout the water volume, simulated tracer animations showing the spatial and temporal distribution of inlet water in real time during the fill cycle.
   6. Hydraulic calculations showing the resulting jet velocities of each inlet nozzle at minimum, average, and peak fill rates.
   7. Hydraulic calculations showing the flow distribution among all inlet ports at minimum, average, and peak fill rates.
   8. Manifold hydraulic calculations showing the total headloss of the HMS at minimum, average, and peak fill and draw rates. Headloss shall include all minor losses and headloss of nozzles and outlet check valves.
   9. Hydraulic curves showing thrust vs. flow for the inlet nozzles.
   10. Hydraulic curves for each outlet check valves showing headloss vs. flow.
   11. Calculations showing the terminal rise height of the jets that discharge at an angle above horizontal. The terminal rise height shall be calculated assuming 10°F and 20°F colder inlet water and calculated at minimum, average and peak fill rates. The theory and equations used to calculate the terminal rise height shall be included.
   12. Hydraulic curves for each inlet nozzle of Densimetric Froude number vs. flow
   13. If the calculations and supporting data provided do not show compliance with the hydrodynamic requirements of the system as interpreted by the Engineer or Owner then the submittal shall be rejected.

P. Installation, Operation and Maintenance Manuals

1. Within 30 days of final approval of the installation drawings, by the Engineer, the HMS valve manufacturer shall provide four (4) sets of the installation portion of the Installation, Operation and Maintenance (IOM) Manuals for the applicable system. Within 30 days of final approval, by the Engineer, of the installed system the manufacturer shall provide six (6) copies of the complete Installation, Operation and Maintenance (IOM) Manual for final review and approval.
2. The manuals shall be in the following format and include the listed required information as a minimum:
   a. Enclosed in a 3-ring binder with project title and system designation shown on the front cover and side binder.
   b. Table of contents
   c. Copy of design calculations for the manifold system as defined in the previous section.
   d. Copy of complete set of the installation plans.
   e. Copy of NSF61 Certified Listing for the valves
   f. Parts and equipment list with specification numbers for ordering of replacement parts.
   g. Product specification sheets for nozzles, outlet valves, expansion joints, concrete anchors, and any other specialized items supplied with the system.
   h. Installation guidelines for the HMS manifold system.
   i. Operational procedures for the HMS manifold system.
   j. Guidelines for repair of system components.
   k. Schedule for suggested periodic maintenance of the manifold system.

1.12 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for closeout procedures.

B. Project Record Documents: Record actual locations and final orientation of equipment.

C. Operation and Maintenance Data: Submit maintenance instructions for equipment and accessories.

1.13 MAINTENANCE MATERIAL SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for maintenance materials.

1.14 QUALITY ASSURANCE

A. Provide piping, tubes, equipment, and appurtenances in contact with potable water complying with NSF 61.

1.15 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver materials in manufacturer's packaging, including application instructions.

C. Inspection: Accept mixers on-Site in original packaging. Inspect for damage.

D. Store equipment and materials according to manufacturer's instructions.

E. Duckbill nozzles should be protected from contact with rigid objects during handling and storage. The contractor shall be responsible for replacing any duckbill nozzles or elastomeric components that are damaged after arrival on the site through installation and start-up of the system.

1.16 EXISTING CONDITIONS

A. Field Measurements: Verify field measurements prior to fabrication. Indicate field measurements on Shop Drawings.

1.17 WARRANTY

A. Section 017000 - Execution and Closeout Requirements: Requirements for warranties.

B. The complete manifold piping system shall be supplied by the HMS manufacturer to maintain single source responsibility for the system. The complete system shall be defined as all piping and appurtenances within the tank downstream of the tank penetration. Appurtenances include pipe, fittings, horizontal and vertical pipe supports, expansion joints, duckbill valves, and any other equipment specified within this section of the specifications.

C. All piping, pipe support brackets, joint connections, expansion joints, and anchors shall be warranted by the HMS manufacturer against failure under design conditions for a period on one (1) year from the date of final installation approval by the Engineer.

D. Inlet nozzles and outlet valves shall be warranted by the manufacturer against failure under design operating conditions for a period of one (1) year from the date of final installation approval by the Engineer. Elastomer components damaged as a result of maintenance activities, foreign debris, or excessive exposure to direct ultraviolet and thermal radiation shall be excluded warranted coverage.

1.18 SOURCE QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for testing, inspection, and analysis.

PART 2 - EXECUTION

2.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that paddle mixers are ready for installation.

2.2 INSTALLATION

A. Installation of the manifold system shall be in accordance with the installation plans and guidelines provided by the HMS manufacturer and as specified in the installation section of the IOM manual. Refer to section on Submittals for quantities and delivery schedules of the documents.

2.3 INSTALLATION INSPECTION AND START-UP TESTING PROCEDURES

A. The TMS manufacturer's authorized representative shall provide one (1) day inspection to verify that the system has been installed in accordance with the design specifications and installation drawings.

B. Start-Up Flow Testing
1. Following installation of the complete manifold piping system, the contractor shall open the upstream isolation valve to allow flow into the tank through the manifold system. The isolation valve must be opened slowly to prevent surge or over-pressurization of the manifold system. The isolation valve must be fully opened to inspect the flow characteristics of the manifold system.
2. The contractor and factory representative shall visually inspect the entire piping system for leakage.
3. The contractor and factory representative shall visually inspect all of the inlet nozzles to ensure flow is being discharged into the tank through all nozzles.

2.4 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.

2.5 DEMONSTRATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for demonstration and training.

B. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

2.6 ATTACHMENTS

A. Hydrodynamic Mixing System Schedule:

1. Sunset Lane – Tank 1
   a. Manifold Piping Flow: Unidirectional
   b. Horizontal or Vertical Installation: Horizontal
   c. Manifold Piping: 8" PVC Schedule 80 (Approximately 19 LF)
   d. Number of Check Valves: N/A
   e. Number of Variable Orifice Inlet Nozzles: Three (3)
   f. Pipe Supports: 304 Stainless Steel
   g. Hardware: Flanged Mounting Kit – 304 Stainless Steel Bolts, Nuts, Washers and NSF-61 Gaskets

2. Sunset Lane – Tank 2
   a. Manifold Piping Flow: Unidirectional
   b. Horizontal or Vertical Installation: Horizontal
   c. Manifold Piping: 8" PVC Schedule 80 (Approximately 19 LF)
   d. Number of Check Valves: N/A
   e. Number of Variable Orifice Inlet Nozzles: Three (3)
   f. Pipe Supports: 304 Stainless Steel
   g. Hardware: Flanged Mounting Kit – 304 Stainless Steel Bolts, Nuts, Washers and NSF-61 Gaskets

3. Cumberland Heights – Tank 1 (0.29 MG Reservoir)
   a. Manifold Piping Flow: Bi-directional
   b. Horizontal or Vertical Installation: Horizontal
   c. Manifold Piping: 6" PVC Schedule 80 (Approximately 31 LF)
   d. Number of Outlet Check Valves: Two (2)
   e. Number of Variable Orifice Inlet Nozzles: Three (3)
   f. Pipe Support: 304 Stainless Steel
   g. Hardware: Flanged Mounting Kit – 304 Stainless Steel Bolts, Nuts, Washers and NSF-61 Gaskets

END OF SECTION 464127

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