Division 46

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SECTION 460030
WATER STORAGE TANK ACTIVE JET MIXER

PART 1. PART 1 GENERAL

1.01 SUMMARY

A. The CONTRACTOR shall furnish all labor, material, tools, supervision, transportation and installation equipment to furnish and install a complete VFD driven active jet mixer

1.02 WATER STORAGE TANK INFORMATION

A. Water Storage Tank Information:

Location	Hilee Rd, Rhinebeck, NY 12572	
Tank Type	Ground	
Tank Material	Prestressed Concrete	
Gallons of Stored Water	2	MGD
Average Asset Turnover	0.02	MGD
Tank Diameter	130	FT
Tank Height	21	FT
High Water Level	20.25	FT
Low Water Level	18	FT

1.03 SUBMITTALS

A. Supplier shall submit three (3) sets of shop drawings. In general, shop drawings shall include equipment descriptions, specifications, dimensional and assembly drawings, parts lists, and job specific drawings. Detailed shop drawings shall be as follows:

1. Submittal drawings showing plan, elevation and cross sections of the equipment.

2. Component details

3. Materials and Manufacturing specifications.

4. Installation instructions. Submit after approval of equipment and prior to shipment.

B. Operation and Maintenance Manuals

1. Supplier shall submit three (3) sets of Operation and Maintenance manuals. The manuals shall include equipment descriptions, operating instructions, troubleshooting techniques, and a recommended maintenance schedule.

1.04 QUALITY ASSURANCE:

A. All equipment furnished under this Section shall be of a single manufacturer who has been regularly engaged in the design and manufacture of the equipment and demonstrates, to the satisfaction of the Engineer, that the quality is equal to equipment made by those manufacturers specifically named herein.

B. The equipment furnished shall be fabricated, assembled, erected, and placed in proper operating

condition in full conformity with approved drawings, specifications, engineering data, and/or recommendations furnished by the equipment manufacturer.

C. Manufacturer shall provide calculations certified by a Registered Professional Engineer to demonstrate adequate mixing to:

1. Eliminate thermal stratification

2. Decrease ice formation

3. Rapidly blend and distribute doses of residual disinfectant

4. Maintain uniform chemical and temperature conditions

D. Upon written request, the ENGINEER shall provide all water quality data required by the manufacturer to perform the calculations above.

E. The Manufacturer shall certify to the ENGINEER that operation of the proposed mixer shall in no way result in damage to the tank interior surface, including the tank coating.

PART 2. PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. If the CONTRACTOR proposes an “or equal” system, it shall be understood that the proposed system meets or exceeds the specified performance.

B. Acceptable Manufacturers

1. PAX Water Technologies

2. Or Equal

2.02 DESIGN CRITERIA & MATERIALS

A. The physical layout of the system as shown on the contract drawings and the equipment specified herein are based upon a system as manufactured by PAX Water Technologies. The use of this system does not remove any responsibility of the CONTRACTOR to verify suitability of the proposed mixer for the existing tank and flows.

B. General Material Requirements

1. Material - housing: stainless steel

2. Material - motor seals: chlorine/chloramine-resistant NBR rubber

3. Material - feet: chlorine/chloramine-resistant EPDM rubber

4. Wiring: NSF 61 & UL-listed submersible pump cable 14 AWG (2.1 mm^2) XLPE

C. Active Jet Mixer:

1. Stainless-Steel ballast ball and housing
2. EPDM molded foot
3. Integrated power cable
4. The ability to function continuously regardless of tank cycles
5. 230V Three phase 2 horsepower water-cooled motor powered by the
6. PAX Control Center
7. 50 ft stainless-steel installation chain

D. Control Center Dry Assembly with SCADA Compatibility, including:

1. Outdoor Rated Corrosion Proof NEMA 4X Enclosure:
    a. Lockable and weather resistant
    b. Overall weight of control center 55 lbs.
    c. Operating temperature range -4 ºF to 129 ºF (-20 ºC to 55 ºC)
    d. Green and Red LED Indicator lights to display motor status
    e. White LED Indicator light to display power
    f. Cooling fan
2. Motor Controller/VFD:
    a. Allen Bradley
    b. On-site power requirement: 230VAC single phase
    c. VFD Rating: 3 HP
    d. HOA Switch
    e. Manual speed control
    f. Thermal shut-off protection built-in
    g. Current overload protection built-in
    h. 300mA trip level GFCI

i. Sine filter

j. Branch-circuit protection

3. SCADA outputs included:

a. Digital Output signal indicating motor running

b. Digital Output signal indicating fault

c. Digital Input/Output signal for remote motor on/off

d. RS-485 or Dry Contact connections

e. 4-20mA signal

4. Cable 130 ft., including Flat-jacketed 4-conductor

PART 3. EXECUTION

3.01 DELIVERY, STORAGE AND HANDLING

A. The equipment shall be packaged in containers constructed for normal shipping, handling and storage.

B. Any damage to the equipment during shipment and offloading shall be responsibility of the Contractor.

3.02 INSTALLATION

1. Follow equipment manufacturer's recommendations for sequencing of equipment installation.

2. Control and electrical riser conduit to enter from tank wall a minimum of one (1) foot above the tank overflow elevation. Penetrations to be watertight to prevent rainwater or other contaminants from entering the tank.

3.01 FIELD QUALITY CONTROL

B. Operational Test

1. Prior to acceptance by OWNER, formal start-up and testing of all equipment be conducted by the CONTRACTOR, in the presence of the ENGINEER and a representative of the equipment vendor, to determine if the installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that all equipment is mechanically, structurally, and otherwise acceptable; it is safe and in optimum working condition; and conforms to the specified operating characteristics

2. Should the system fail under any of these conditions, the tests shall be halted and the problem corrected. If, after several attempts, the system does not successfully pass the testing requirements, the faulty portion of the equipment shall be replaced and retested at no additional cost to the Owner.

A. Manufacturer Training

1. A representative of the of the diffuser equipment supplier shall, at the successful completion of start-up provide one session of on-site training for the operators and shall demonstrate the basic operation and maintenance procedures. This training may not be conducted until such time that all start-up and testing has been successfully completed. The vendor is cautioned that these training sessions must be scheduled in advance and have prior approval to be considered completed.

3.02 WARRANTY

A written one-year standard warranty from the date of the successful equipment start-up shall be provided by the equipment supplier to guarantee that there shall be no defects in material or workmanship in any item supplied.

END OF SECTION

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SECTION 461000
HIGH LIFT DISTRIBUTION PUMPS

PART 1. GENERAL

1.01 SCOPE

A. The CONTRACTOR shall furnish all labor, material, tools, supervision, transportation and installation equipment to furnish and install:

1. Two (2) fully operational submersible pumps and controls as specified herein and shown on the Drawings.

2. Variable Frequency Drives (VFD) and accessories for speed control of either constant or variable torque loads.

B. The two provided pumps are replacements for two pumps in an existing three-pump system. The third existing pump will remain operational. The two new pumps will be controlled by the same control logic as the pumps they are replacing.

C. Pumps that are supplied under this specification shall be vertical turbine open lineshaft design with product lubrication, including a bowl assembly, column assembly, discharge head and driver. The discharge head shall be designed to carry the entire weight of the bowl and column assembly along with the specified driver without excessive vibration or noise. All of the supplied equipment shall conform to this specification.

D. The required units shall be Gould's Water Technology Model 12WAHC with 5 stages, or an approved equal.

1.02 QUALITY ASSURANCES

A. Warranty

1. The manufacturer shall warrant their pumps to be free of defects for a period of one year after the product is put into operation or eighteen months from the shipment date, whichever occurs first.

B. Certifications

1. The pump manufacturer shall be certified to the ISO 9001 standard for design and manufacture of vertical turbine pumps.

2. The manufacturer shall be capable of producing vertical turbine pumps certified to NSF/ANSI 61 & 372.

3. Pressure containing fabrications shall be welded only by those whom are qualified on ASME code section IX. Welder certification shall be provided with the submittal package.

C. Foundry

1. The manufacturer shall own and operate its own U.S. based foundry producing vertical turbine components.

D. Testing Standards

1. All vertical turbine pumps shall conform to ANSI/AWWA E101-88 and to the most current edition of Hydraulic Institute Standards.

1.03 SUBMITTALS

A. With the proposal, the contractor shall submit complete fabrication and assembly drawings together with detailed specifications covering materials, parts, devices, and accessories. The data and specifications for each pumping unit shall include, but not be limited to the following:

1. Name of Manufacturer
2. Type and Model
3. Design Rotational Speed
4. Number of Stages
5. Type of Bowl Bearings
6. Type of line shaft bearings
7. Size of Shafting
8. Size of Pump Column
9. Size of Discharge Outlet
10. OD of Pump Bowls
11. Weight
12. Type of Finish
13. Total Weight
14. Total Pump Length
15. Complete performance curves showing capacity versus head, NPSH required, efficiency, and BHP plotted scales consistent with performance requirements

PART 2. PRODUCTS

2.01 MANUFACTURER

A. Goulds Water Technology, A Xylem Brand.

B. Or Approved Equal.

C. The equipment covered by this specification shall be standard products as manufactured by Gould's Water Technology or an approved equivalent. All pumps and pump components specified in this specification shall be supplied by a single pump manufacturer. The pump manufacturer shall be required to supply the pumps and drivers, and shall be responsible for their compatibility only.

2.02 OPERATION SELECTION

A. Stated total dynamic head (TDH) includes lift and all system pressure. Pump manufacturer shall include pump's internal loses.

1. Pump item number: Goulds VIT 12 WAHC

2. Number of required units: Two (2)

3. Capacity: 700 gpm @ 415 ft TDH

4. Driver horsepower: 100 Hp

5. Efficiency: 779% - 85.9 %

6. Maximum pump operating speed: 1,770 rpm

7. Minimum column and discharge diameter, inches:11.6 in.

8. NPSHR not to exceed: 18.1 ft

B. The pump horsepower requirements for any point on the curve shall not utilize the service factor nor exceed the motor nameplate horsepower rating.

2.03 SERVICE CONDITIONS

A. Liquid to be pumped: Drinking Water

B. Pumping temperature (PT): Approximately 45-55 F

C. Specific gravity at PT: 0.998

D. Viscosity at PT: 1.31 centipoise (cP)

E. Vapor pressure at PT/max temp:

F. Pumping Liquid pH: 7.2-7.3

G. Suction pressure: 9.21 mmHg

H. Available liquid level from sump floor: 13 feet

I. Site elevation: 16 ft

J. Distance from bottom of strainer to bottom of sump: 12’-4”

2.04 MATERIALS AND CONSTRUCTION

A. The vertical turbine lineshaft can pump shall conform to the materials of construction for enclosed lineshaft with oil lube design. (Insert table from Xylem Online pump configuration, or review and edit applicable table below)

DISCHARGE HEAD ASSEMBLY			
Description	**MC**	**Material Description**	**ASTM**
Headshaft	2227	SST 416	A582 S41600
Adjusting Nut	2242	Steel 1018	A108 G10180
Gib Key	2242	Steel 1018	A108 G10180
Slinger	5121	Rubber	3CA715A25 B14
Discharge Head	9645	Steel	A120 GRB
Stuffing Box Bearing	1109	Bronze	B584 C90300
Stuffing Box	1003	Cast Iron	A48 CL30
Stuffing Box Gasket	5136	Acrylic Gasket	Garlock Blue Guard
Split Gland	1203	SST 316	A744 GR.CF-8M
Gland Adjusting Screw	2229	SST 316	A276 S31600
Packing	5026	Acrylic Yarn	Packmaster 2
COLUMN AND LINESHAFT ASSEMBLY			
Column Pipe (FLG)	6501	Black Pipe	A53
Column Bolting	2298	Grade 8	SAE J429 GR8
Lineshaft	2227	SST 416	A582 S41600
Bearing Retainer	1003	Cast Iron	A48 CL30
Lineshaft Bearing	1109	Bronze	B584 C90300
Lineshaft Coupling	2265	SST 416	A582 S41600
BOWL ASSEMBLY			
Bowl Shaft	2227	SST 416	A582 S41600
Intermediate Bowl	6911	Coated Cast Iron	A48 CL30
Inter Bowl Bearing	1109	Bronze	B584 C90300
Impeller	1398	Bronze	B584 C87600
Impeller Taper Lock	2242	Steel 1018	A108 G10180
Wear Rings (optional)	1128	Bronze	B148 C95200
Hex Bolt	2298	Grade 8	SAE J429 GR8
Sand Collar	1205	SST 304	A744 S30400
Suction Bowl / Bell	1003	Cast Iron	A48 CL30
Suction Bearing	1109	Bronze	B584 C90300
Suction Strainer	6952	Galvanized Steel	A108 G10180
Plug	1046	Mal Iron	A197

B. Bowl Assembly

1. The suction bowl shall be designed to provide conservative entrance velocities and direct the flow to the first stage impeller. The inner surface of the suction bell shall be smooth and free of sharp projections which could cause turbulence or cavitation. The suction casing shall be designed to house the suction bell bearing by means of four vanes.

2. The bowls shall be smooth and free of sharp projections and shall have register fits for alignment and be connected by flanged and bolted construction. Bowl sizes 6" to 15" shall be porcelain enameled on the bowl interior. Bowl sizes 16" and larger shall be epoxy-lined.

3. The impellers shall be machined and finished smooth to insure proper performance. They are to be balanced prior to assembly. The impellers shall be connected to the bowl shaft by means of collet design.

4. The suction strainer shall be a threaded basket design and have a free inlet area of at least 3-4 times the impeller eye area. The suction strainer shall be connected to the bowl assembly suction casing.

C. Column Assembly

1. The column shall include flanged connections and shall be of open design with product lubrication.

2. The bearing spacing shall be selected to insure operation at a minimum of 25% above or below the first critical speed. Bearing spacing shall not exceed 5 feet.

3. For 3"-12" product lubricated column assemblies, the column shall be designed with drop-in steel or cast-iron bearing retainers. The interior of the column shall be free of offsets, burrs, discontinuities and irregularities.

4. The lineshaft shall be of adequate size to transmit the full power of the pump without slip, excessive vibration or elongation, and shall have threaded joints. Lineshaft lengths shall not exceed 10 feet. The lineshaft shall have left hand threads that tighten during pump operation.

D. Discharge Head Assembly

1. For above ground service, the discharge head shall be fitted with a flanged discharge connection. The flange shall be a 150 LB R.F. ANSI flange for fabricated steel heads. The discharge head shall be designed to carry the entire weight of the complete pump and driver without distortion when spanning an opening of sufficient size to permit removal of the complete pump assembly. The discharge head shall be provided with a coupling guard. Lifting lugs shall be provided as standard.

2. The stuffing box shall be designed for 6 rings of packing and lantern ring. An extra-long bearing shall be located below the packing in the stuffing box. Packing lubrication leakage through the stuffing box shall be drained back to the sump. The packing gland shall be of a two piece design.

E. Driver

1. The driver will be a VHS electric motor. The driver and any related equipment will ship unmounted from the pump to ship.

2.05 COATING

A. The bowl assembly exterior shall be coated with Tnemec 141; minimum dry film thickness 8 mils.

B. The column assembly interior and exterior shall be coated with Tnemec 141; minimum dry film thickness 8 mils.

C. The head assembly interior and exterior shall be coated with Tnemec 141; minimum dry film thickness 8 mils.

D. For oil lubrication configuration, tube assembly exterior shall be coated with Tnemec 141; minimum dry film thickness 8 mils.

2.06 TESTING

A. All factory testing shall conform to the most current edition of the Hydraulic Institute Standards. All pump performance testing shall be performed at the manufacturer’s facility. (Specify if there are any additional standards)

B. Performance testing shall be non-witnessed and performed on the fully assembled unit with job motor. The test shall cover seven points including the design point (HI 14.6). The design point shall be used for any performance evaluation. Certified test results shall be provided for record purposes for approval prior to shipment.

C. Hydrostatic testing shall be non-witnessed in compliance with HI14.6. Hydro testing is to be performed on the pressure containing components. Certified test results shall be provided for record purposes for approval prior to shipment.

D. All non-witness testing shall require written prior to release for shipment.

E. Field/functional testing will be performed by the contractor to insure proper mechanical operation at the jobsite. All testing data to be used for evaluation shall be performed at the pump manufacturer's facility.

F. Motor tests and test reports shall be provided as required in accordance with the motor specification.

2.07 SPARE PARTS

A. MECHANICAL

1. One (1) complete set of mechanical seals for each pump type.

2. One (1) complete set of bearings for each pump type.

3. One (1) complete set of o-rings for each pump.

4. One (1) impeller for each size pump.

PART 3. EXECUTION

3.01 DELIVERY, STORAGE, HANDLING, AND INSTALLATION

A. Contractor shall off-load equipment at installation site using equipment of sufficient size and design to prevent injury or damage. Immediately after off-loading, contractor shall inspect complete pump and appurtenances for shipping damage or missing parts. Any damage or discrepancy shall be noted in written claim with shipper prior to accepting delivery. Validate all pump serial numbers and parts lists with shipping documentation. Notify the manufacturer's representative of any unacceptable conditions noted with shipper.

3.02 INSTALLATION

A. Installation must be in accordance with written instructions supplied by the manufacturer at time of delivery.

B. Suction pipe connections are vacuum tight. Fasteners at all pipe connections must be tight. Install pipe with supports and thrust blocks to prevent strain and vibration on pump piping. Install and secure all service lines (level control, air release valve or pump drain lines) as required.

C. Check motor and control data plates for compatibility to site voltage. Install and test the station ground prior to connecting line voltage to control panel.

D. Prior to applying electrical power to any motors or control equipment, check all wiring for tight connection. Verify that protective devices (fuses and circuit breakers) conform to project design documents. Manually operate circuit breakers and switches to ensure operation without binding. Open all circuit breakers and disconnects before connecting utility power. Verify line voltage, phase sequence and ground before actual start-up.

E. The Drawings show the general arrangement of the equipment and the major components. The Contractor is responsible for installing a fully operational unit complete with ancillary connections such as air, water, power, and instrumentation. The Contractor is responsible for providing all necessary supports, braces, pads, connections, etc. to make the unit fully functional and operational in accordance with the manufacturer's instructions.

3.03 FIELD QUALITY CONTROL

A. Operational Test

1. Prior to acceptance by OWNER, formal start-up and testing of all equipment and control systems shall be conducted by the CONTRACTOR, in the presence of the ENGINEER and a representative of the pump vendor, to determine if the installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that all equipment is electrically, mechanically, structurally, hydraulically and otherwise acceptable; it is safe and in optimum working condition; and conforms to the specified operating

characteristics. No additional compensation shall be made for repeat tests if the first test should prove unsuccessful.

B. Manufacturer Training

1. A representative of the of the pump supplier shall, at the successful completion of start-up provide one day of on-site training for the operators and shall demonstrate the basic operation and maintenance procedures. This training may not be conducted until such time that all start-up and testing has been successfully completed. The vendor is cautioned that these training sessions must be scheduled in advance and have prior approval to be considered completed.

C. Follow-up service:

1. The manufacturer's representative shall return to the facility at the end of the Warranty period to address any operational issues which have arisen. This inspection does not eliminate the possible need for the representative to return sooner if equipment problems arise.

3.04 WARRANTY

A. A written two-year standard warranty from the date of the successful equipment start-up shall be provided by the equipment supplier to guarantee that there shall be no defects in material, performance, or workmanship in any item supplied.

B. Warranties and guarantees by the suppliers of various components in lieu of a single source responsibility by the manufacturer or representative will not be accepted. the manufacturer shall be solely responsible for the guarantee of the complete pump.

C. In the event a component fails to perform as specified or is proven defective in design, material or workmanship during the guarantee period, the manufacturer shall provide replacement parts without cost to the owner.

END OF SECTION

SECTION 464000
UV DISINFECTION UNIT

PART 1 – GENERAL

1.1. WORK OF THIS SECTION

A. Furnish all labor, materials, equipment and appurtenances required to provide a pressurized vessel, amalgam lamp based, ultraviolet (UV) disinfection system. The UV system to be complete and operational with all control equipment and accessories as shown on Contract Drawings and specified herein.
B. The Contractor is responsible for providing a fully functioning system complete with mechanical, electrical, instrumentation.

1.2. QUALITY ASSURANCE

A. Pre-qualification Requirements:

1. Any alternate UV manufacturer that is not listed as approved equal must submit the following 15 days prior to the bid to be considered for approval:
2. Evidence of previous successful performance utilizing low-pressure amalgam lamp systems in similar applications. The proposed manufacturer must be able to demonstrate at least two hundred (200) permanent installations of this equipment type.
3. Submittal including Reactor Details, Control Panel, lamp and ballast descriptions, and engineering reports stating headloss.
4. A Validation Certificate for the proposed system from DVGW (per W294). **OR** A Validation Certificate for the proposed system from a qualified independent third (3rd) party in full compliance with EPA 815-R-06-007, Ultraviolet disinfection Guidance Manual For The Final Long Term 2 Enhanced Surface Water Treatment Rule, released November 2006.
5. A statement by the equipment manufacturer listing any deviations or exceptions taken to these specifications shall be submitted. State specification reference and proposed alternative with reason for exception.
6. Description of manufacturer's service capabilities including local support offered for technical service.

1.3. DESIGN CITERIA

A. Provide UV equipment, which shall disinfect municipal water with the following characteristics:

Peak Flow:	1.50 MGD
Target Organism-Cryptosporidium/ Giardia/Virus (If Applicable)	3
Water Temperature Range:	34 to 104 degrees F (1 to 40 degrees C)
Ultraviolet Transmittance @ 253.7 nm:	90 %
Iron (Fe) Content:	< 0.3 mg/L
Manganese (Mn) Content :	< 0.05 mg/L
Hardness:	< 200 mg/L as $CaCO_3$
pH Range:	6.5 to 8.5
Equipment Redundancy:	1 Redundant Trains

B. Each UV reactor will be configured as follows:
   1. The UV reactor will be supplied pre-assembled and ready for installation.
   2. The UV system will consist of 2 UV reactor(s) with an automatic cleaning system (if applicable). Each UV reactor will consist of a minimum of 2 UV intensity sensor(s) and one Control Panel per reactor.
   3. The UV system must fit within the piping footprint as stated without modification.
   4. The maximum operating pressure of the UV System shall be 300 psi. Reactor will be tested to a minimum of 350 psi for a minimum of 10 minutes.

C. Performance Requirements:
   1. RED at end of lamp life: 32.2 mJ/cm^2 (minimum). The lamps will operate at the design setpoint which is a Crypto dose of 12 mJ/cm^2 based.

1.4. SUBMITTALS

B. Submit for review, engineering drawings showing the following:
   1. Complete description in sufficient detail to permit an item comparison with the specifications.
   2. Dimensions and installation requirements.
   3. Electrical Drawings
   4. DVGW Validation Certificate documenting the dose delivered by the system. OR A qualified independent third (3rd) party validation certificate in full compliance with EPA 815-R-06-007, Ultraviolet disinfection Guidance Manual For The Final Long Term 2 Enhanced Surface Water Treatment Rule, released November 2006.
   5. Company information including descriptions of quality control procedures and certifications (eg. ISO 9001 Registration).

1.5. GUARANTEE

A. The equipment furnished under this section (excluding UV lamps) will be free of defects in materials and workmanship, including damages that may be incurred during shipping for a period of one (1) year from start-up or 18 months after shipment, whichever occurs first.
B. The UV lamps are warranted for 12,000 hours of operation (prorated at 9,000 hours) or thirty-six (36) calendar months from shipment, whichever comes first, without exception

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. The physical layout of the system as shown on the Engineering Drawings and the equipment specified herein are based solely upon the TrojanUVSwiftTMSC Model D06, Amalgam Lamp System, as manufactured by Trojan Technologies.
B. To be acceptable, the UV system must operate in an enclosed vessel and use amalgam UV lamps. In order to maximize hydraulic efficiency, the UV reactor is to be configured such that flow enters parallel to the lamps and exits through a flange located perpendicular to the UV lamps.
C. The UV system must be designed to fit within the piping and footprint described, without modification.
D. The UV system is to be furnished with the latest components and equipment available at the time of shipment.

2.2 GENERAL REQUIREMENTS

A. Provide a UV system complete with UV reactor(s), control panel(s), automatic wiping system (if applicable), and UV intensity monitoring system(s), as herein specified.
B. Each system shall be designed to allow for complete system shut down or by-pass.
C. UV reactor(s) will not require draining in order to change UV lamps.
D. When the distribution system pressure falls below the operating setpoint, prompting activation of the highlift pumps, a relay signal will activate the UV disinfection units. The highlift pumps will be programmed to start after a three (3) minute delay to ensure adequate warm-up time for the UV unit lamps.

2.3 DESIGN, CONSTRUCTION AND MATERIALS

A. General:

1. All metal components in contact with the feed water shall be Type 316L stainless steel.
2. All material exposed to UV light shall be Type 316L stainless steel, Type 214/219 quartz or a suitable UV resistant material.
3. The system shall be designed for complete immersion of the UV lamps including electrodes and the full length of the lamp in the water. All lamp electrical connections shall be at one end of the UV lamp. The major axis of the UV lamps shall be parallel to flow.
4. The headloss based on the performance curve of the Trojan UV D6 model, at the design flow of 700 gpm, is approximately 4 inches of water column or 0.144 psi.

B. UV Reactor:
1. Each UV reactor shall be manufactured using stainless steel.
2. Each UV reactor shall have a drain port fixed to its outer wall.
3. Each UV reactor shall be designed to fit into the existing pipe work.
4. Each UV reactor shall accept its respective UV lamps and quartz sleeves through only one end of the vessel. This end of the UV reactor shall allow for complete reactor entry so internal inspection and/or service can be accomplished.
5. UV reactors shall be able to operate at a maximum inlet pressure of 300 psi and be furnished with a factory certified pressure test report detailing a minimum hydrostatic pressure test of 350 psi for a minimum of 10 minutes.
6. Lamp position within the reactor will be indicated using a numbering system fixed to the lamp wiring at the service end of the UV reactor.

C. UV Lamps:
1. UV lamps will be low pressure, high output amalgam lamps.
2. The filament will be significantly rugged to withstand shock and vibration.
3. Lamp bases to be resistant to UV light.
4. All electrical connections to the UV lamp will be terminated at one end.
5. UV lamps will have a lamp base design that which prevents arcing between electrical pins.
6. UV lamps will have a monochromatic spectral output with the emissions peaking at 254 nanometers.

D. Lamp End Seal and Lamp Holder:
1. The open end of the UV lamp sleeves will be sealed to the sleeve guide by a suitable compression o-ring.
2. The O-ring compression is made by a sleeve nut that will require no special tools for

installation or removal.

3. Each UV lamp electrical connection will incorporate a sealing boot, which is held firmly in place by the sleeve nut to prevent emission of ultraviolet rays.

E. UV Lamp Sleeves:
   1. Sleeves will be clear fused Type 214 quartz with a minimum UV transmissibility of 89 percent.
   2. Sleeves will be domed at one end and be accessible through the reactor service entrance

F. Electronic Power Supplies:
   1. UV lamps are to be operated by an electronic power supply.
   2. A pair of UV lamps shall be powered by one electronic power supply.
   3. Each lamp within the pair shall operate on its own circuit within the power supply so as to provide electrical independence.

G. UV Sensors:
   1. Each UV reactor must be supplied with one UV Intensity Sensors for UV Reactors sized for the USEPA UVDGM 2006 OR The minimum number of UV Intensity Sensors installed shall meet the requirements of DVGW W294 standard (minimum of one sensor per ten (10) lamps).
   2. The UV Intensity Sensor must be approved by the DVGW W294 Standard.
   3. Each unit shall include a reference sensor.

H. Electrical Control Panel:
   1. Each UV reactor shall be powered from a Control Panel by means of a water resistant cable and strain relief. The Control Panel to Reactor cable length shall not exceed 4.5 m (14'-9") (Includes Conduit).
   2. The Control Panel shall be located indoors.
   3. The Control Panel shall be of 24" x 16" x 10" (610mm x 406mm x 254mm).
   4. Control Panel electrical rating shall be a minimum of Type 12.
   5. Total power consumption of each reactor under normal operating conditions shall be no greater than 1.80 kW.
   6. Electrical supply to each Control Panel shall be 208 Volt, 1 phase, 2 wire + ground, 50 / 60 Hz L-L.
   7. Signal wiring interfacing the UV system and the Control Panel shall be as shown on the Engineering Drawings.

I. Control and Instrumentation:
   1. System Control:
   2. One microprocessor-based controller shall be provided per reactor. Microprocessor to be located within the Control Panel and shall include an Operator Interface display consisting of a VFD readout with keypad.
   3. Remote ON/OFF control capabilities shall be provided.
   4. Five 4-20mA input signals will be available.
   5. A total of (7) configurable non powered discrete dry contact outputs rated at 24 VDC. Please see Part H.2 for available configurable alarm conditions.
   6. One (1) 4-20 mA output included.

7. System Status Alarm List:

These status items indicate that an alarm or alarms in the group are active:

Common Alarm Names and Status	**Description**
System Warming	Active during 3 minute warm-up
System On-line	Active after warm-up with no alarms
Wiper General Alarm	Any of the 3 wiper alarms
Common Alarm	Any Minor, Major or Critical Alarm
Common Minor Alarm	Any Minor Alarm
Common Major Alarm	Any Major Alarm
Low UV Common Minor	Any Sensor Minor UV Intensity for UV systems with Multiple Sensors.
Low UV Common Major	
Common Major Siren	Any Major or Critical alarm is active

On a minor fault the UVR will remain On-line. Minor alarms will display on the CP and alarm relays will be deactivated.

Wiper alarms are only valid if the UV System has the Wiper Option.

Minor Alarm Name	**Description**
Low UVT Minor Alarm	If UVT value measured is lower than the set-point.
Valve Open Minor	Valve is open greater than Minor alarm set-point
End Of Lamp Life Hours	The lamp has exceeded the EOLL according to factory programmed set point.
Wiper Revolution Alarm	Incomplete Wiper Cycle. Motor Failure, mechanical Jam, no revolution counts in 1 s.
Wiper Home Alarm	Appears when there is a Wiper Failure during a home cycle. Motor Failure or a mechanical Jam or no revolution counts within 1 second.
Wiper Limit Switch Alarm	Appears when there is a Limit Switch Failure in the “closed circuit” position. (Normally “Open circuit” LED Off

On a Major alarm immediate action is required by the Operator to ensure that disinfection is not compromised. Alarm relays will be deactivated upon alarm.

Major alarms will shut down the distribution pumps and UV units, and send a signal to

SCADA to alert the operator so that immediate corrective action may be taken.

Major Alarm Name	**Description**
Low UV Intensity 1 Major	**Pacing:** If UV Intensity has dropped below the calculated low UV Intensity alarm set-point. **DVGW Basic Dose:** If UV Intensity has dropped below the factory set point.
Low UV Intensity 2 Major - DVGW only for 11 - 20 Lamps	
Low UV Intensity 2 Major - DVGW only for 21 - 30 Lamps	
Low UVT Major Alarm	If UVT is below the alarm set-point
Multiple Lamp Alarms	Multiple lamps not functioning. Factory setpoint is based on 2 or more lamps. Configurable on site if increasing lamp quantity is required.
Low Dose Major (DVGW)or MS2 RED Low Major (EPA)	UV Intensity dropped below factory set-pt (DVGW) or calculated set-point (EPA) results dose below design.
Lamp Alarm XX Major	Lamp is not functioning, lost power, or lost board comm.
Ballast XX Alarm Major	Ballast is not functioning, lost power, or lost Board comm.
High Flow Alarm Major	Flow Rate exceeds major alarm set point.
Valve Open Major	Valve is open greater than the Major alarm set-point
No Flow Alarm Major	Flow Rate signal is not present below 2.0mA
No UVT Alarm Major	UVT signal is not present below 2.0mA
No Valve Data Major	Valve signal is not present below 2.0mA
SCADA Comm. Alarm Major	SCADA Comm. connection has been lost.
Reactor Hi Temp Major (Analog Temperature Option)	High Temperature Alarm occurs as a warning. This option is available only when an Analog High Temperature is configured.

Minor and major alarms shall flash on the Operator Interface. Upon a high temperature critical alarm, the reactor shall shut down

J. Wiping System :
   1. Automatic Wiping System
   2. Each UV reactor will be provided with an automatic on-line sleeve wiping system. The wiping system to be automatically initiated by the Control Panel, and will operate while the UV system is in operation.
   3. The automatic wiping system will be driven by an internal stainless steel screw drive mechanism and an externally mounted electric motor.
   4. The wiper rings will be fabricated of food-grade Viton rubber.
   5. The automatic wiping system will operate on a timed cycle. The frequency of wiping cycles will be field adjustable from 0,0.5,1,2,3,4,6,8,12,24,48 or 96 hours intervals.

K. Dose Pacing (Optional D Series Only)
   1. A dose-pacing system shall be supplied to modulate the lamp power levels based on the flow rate, UV sensor signal(s) and UV transmission values according to the Validation Report.
   2. The system shall be dose-paced such that as the flow rate, water quality, and lap conditions change, the UV RED (dose) target shall be achieved while conserving power.

2.4 SPARE PARTS

A. The following spare parts which are identical to the original parts shall be furnished in clearly marked packaging:
   1. (8) UV lamps
   2. (4) Lamp sleeves
   3. (4) O-ring seals
   4. (2) Ballasts
   5. (2) Duty UV Sensors
   6. (2) Reference UV Sensors
   7. (1) operator safety kits including face shields and gloves

PART 3 EXECUTION

3.1 SHIPPING AND EQUIPMENT DELIVERY

A. All equipment and materials shall be inspected against approved Shop Drawings at time of delivery. Equipment and materials damaged or not meeting requirements of the approved Shop Drawings shall be immediately returned to the EQUIPMENT SUPPLIER for replacement or repair.
B. The CONTRACTOR shall handle and store the equipment and materials in a dry location and protect them from the elements according to the manufacturer's instructions.

3.2 INSTALLATION

A. The Drawings show the general arrangement of the equipment and the major components. The Contractor is responsible for installing a fully operational unit complete with ancillary connections such as air, water, power, and instrumentation. The Contractor is responsible for providing all necessary supports, braces, pads, connections, etc. to make the unit fully functional and operational in accordance with the manufacturer's instructions.

3.3 COMMISSIONING AND START UP

A. The EQUIPMENT SUPPLIER / MANUFACTURER'S REPRESENTATIVE shall inspect equipment installation, piping and wiring to ensure proper installation of each component in accordance with approved submittals. CONTRACTOR shall make at its own cost any modifications required to meet EQUIPMENT SUPPLIER installation recommendations. A written statement certifying that the equipment has been properly installed and interconnected shall be provided by the EQUIPMENT SUPPLIER.
B. The EQUIPMENT SUPPLIER shall coordinate commissioning of the system and verify that each component of the SYSTEM is ready for operation. SYSTEM commissioning shall include testing and calibration of each component of the system. A written statement certifying that the SYSTEM has been commissioned and is ready for operation shall be provided.
C. The EQUIPMENT SUPPLIER shall coordinate initial SYSTEM start-up to ensure operating procedures are followed in accordance with approved submittal's instructions manuals.

3.4 TRAINING

A. The EQUIPMENT SUPPLIER/ MANUFACTURER'S REPRESENTATIVE shall provide operator training at the site for a period no less than one (1) 8-hr day. Training shall include operation, maintenance and trouble shooting for each component of the SYSTEM.

SECTION 464000
UV DISINFECTION UNIT

END OF SECTION

SECTION 468000
POTASSIUM PERMANGANATE SYSTEM

PART 1. GENERAL

1.01 SUMMARY

A. This section provides acceptable products and requirements for equipment to be installed with relation to the chemical storage and feeding system. Contractor shall be responsible for furnishing and installing all components necessary to provide a complete and functional system.

B. The chemical feed system consists of:
   1. Chemical feed and mixing tank
   2. Spill containment tank
   3. Chemical dosing pump system
   4. Chemical mixer
   5. Combination emergency shower/eyewash station
   6. Copper and PVC plumbing
   7. Water meters, isolation valves, and pressure gauges

1.02 SUBMITTALS

A. Catalog cuts and shop drawings shall be submitted for approval for all equipment herein specified.

B. An Order Specification shall be included which shall describe in detail all equipment provided.

C. Manufacturer's wiring diagrams that are not job-specific (standard drawings with options crossed out, etc.) are not acceptable. Standard sales brochures shall only be provided to supplement technical data. Interconnection details shall be shown on the wiring diagrams for all field mounted instrumentation.

D. A Description of Operation shall be provided detailing the operation of the component and initial configuration settings.

E. Supplier shall submit three (3) sets of Operation and Maintenance manuals. The manuals shall include equipment descriptions, operating instructions, drawings, troubleshooting techniques, a recommended maintenance schedule, and the recommended lubricants.

1.03 QUALITY ASSURANCE

A. Provide functional testing of all installed components in accordance with a schedule approved by the Engineer.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Equipment will not be delivered to the site until they are ready to be installed. Equipment stored on site will be stored in clean dry heated space and protected by the Contractor at his expense until the item is to be installed.

PART 2. PRODUCTS

2.01 STORAGE

A. Chemical Mixing and Dosing Tank requirements.

1. Tank shall be 200-gallon open-top type with a lid and exterior graduation marks.
2. Vent pipe shall be installed with a 24-mesh non-corrodible insect screen.
3. A minimum of a 6-inch air gap shall be provided between the discharge of the fill pipe and the top of the tank.
4. The chemical tank shall be designed to meet all requirements of 6 NYCRR Part 599. The tank manufacturer shall certify and label the tanks for compliance with these requirements.
5. The following shall be clearly noted on the tank.
   a. Tank Manufacturer – Name, address and contact information
   b. Intended service, including intended chemical and tank nominal capacity.
   c. Tank materials of construction
   d. Special Notes – certification of tank meeting 6 NYCRR Part 599, Tank # and Tank Serial #
   e. Chemical specific full disclosure sign
6. Tank shall be graduated in gallons.
7. Tank shall be made of material suitable for potassium permanganate solution.
8. Lid shall be removable without tools.
9. A low-level alarm shall be located 6” off the bottom of the tank (float to be supplied by SCADA vendor). The alarm will send signal to the PLC. A mechanical float switch manufactured of chlorine resistant material shall be used.

2.02 SPILL CONTAINMENT

A. Spill Containment tank to be an IBC Spill Containment Pallet, Model H-4435, or equal.

B. The provided spill containment tank shall have a minimum capacity of 220 gallons and be suitable for a potassium permanganate solution.

2.03 CHEMICAL FEED SYSTEM

A. Chemical feed pump to be Stenner Peristaltic Pump, 22 GPD, 100 PSI, 3/8" Tubing, 45MJH7A3S, or equal.

B. Chemical feed pumps to be Walchem Iwaki America, Inc., or equal, rated for potassium permanganate. Each pump shall be rated for 8.5 gallons per hour at 105 PSI.

C. Each pump shall be provided with the following components:
   1. Quick connect mounting plate
   2. Double ball valves
   3. Degassing head
   4. Chemical dosing shall be based off of WTP influent flow meter reading
   5. Analog (4-20 mA) input
   6. Analog (4-20mA) output for flow
   7. Injection quill and PFAS-free chemical feed tubing
   8. Materials of construction:
      a. Dosing Head: PVC
      b. Valve Ball: Ceramic
      c. Gasket: FKM
   9. Installation set:
      a. Foot valves (1 per pump skid)
      b. Input control cables (per pump), 4-20 mA, start/stop - 7’ in length
      c. Output control cables (per pump), 4-20 mA, run status, HOA status, general fault - 7’ in length

10. Any and all other components necessary to provide a fully functional chemical feed system that are not listed in this Section.

2.04 MIXER

A. Manufacturer: Dayton, Model 32V133, or equal.
B. Power: 115/230V Single phase
C. Motor: 1/4 HP single speed
D. Shaft: 32-inch
E. Impeller 3-blade ss316
F. Speed: 1,750 rpm
G. Mount: Side clamp

2.05 BACKFLOW PREVENTER – REDUCED PRESSURE ZONE (RPZ)

A. Manufacturer: Watts Model LF009M2, or equal.
B. Compliance: NSF-61
C. Size: 1 inch
D. Include all components necessary to provide a fully functional system that are not listed in this Section.

2.06 EMERGENCY COMBONATION SHOWER WITH EYEWASH STATION

A. The provided unit shall be a Global Industrial, Model 70882SS, or equal.
B. Specifics:
1. Compliance: NSF-61
2. Construction: Stainless Steel
3. Ball Valve Type: Stay-Open Ball Valve
4. Number of Heads: 2
5. Approvals and Certifications: ETL Listed 101496/ANSI Z358.1-2014
6. Shower Head Diameter 10”
7. Shower Head Activation: Pull Rod
8. Mount Type: Floor Mount
9. Dust Covers: Yes
10. Motor: 1/4 HP single spped
11. Shaft: 32-inch
12. Impeller 3-blade ss316
13. Speed: 1,750 rpm
14. Mount: Side clamp
15. Any and all other components necessary to provide a fully functional system that are not listed in this Section.

2.07 MISCELLANEOUS

A. Provide all necessary equipment including piping, fittings, valves, flow meters, pressure gauges, and other appurtenances required to provide a complete functioning system in compliance with the Contract Drawings.

2.08 SPARE PARTS

A. Manufacturers recommended repair kits for each pump model

PART 3. EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect

for damage.

B. Store materials according to manufacturer instructions.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

2. Provide additional protection according to manufacturer instructions.

3.02 EXAMINATION

A. Verify that items provided by other Sections of Work are ready to receive Work of this Section.

3.03 INSTALLATION

A. According to manufacturer instructions and as indicated on Drawings.

3.04 ADJUSTING

A. Field-calibrate local controls and indicators.

3.05 DEMONSTRATION

A. Demonstrate Chemical Feed Pump operation, routine maintenance, and emergency repair procedures to Owner's personnel.

3.06 WARRANTY

A. A written two-year standard warranty from the date of the successful equipment start-up shall be provided by the equipment supplier to guarantee that there shall be no defects in material or workmanship in any item supplied.

END OF SECTION

SECTION 469000
TRIDENT CLARIFICATION UNITS

PART 1. GENERAL

1.01 DESCRIPTION

A. The Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish, install and test the treatment, and shall furnish and install all piping and fittings, all valves, piping, all wiring and conduit, plus all additional appurtenances as shown on the plans, to include couplings, check and isolation valves, and all other manual valves.

1. A pre-engineered system consisting of a pretreatment and filtration system contained in a single shippable tank
2. The system shall be furnished by one manufacturer to ensure a properly designed and integrated water treatment system.
3. Factory built steel modular tanks, each designed with tube settling compartment.
4. The treatment system shall include chemical treatment, tube sedimentation, automatic process valves, controllers, and the system control panel.

1.02 QUALITY ASSURANCE

A. This section provides acceptable products and requirements for equipment to be installed with relation to the water treatment clarification units.

B. The Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish, install and test (if applicable) the treatment, and shall furnish and install all piping and fittings, all valves, piping, all wiring and conduit, plus all additional appurtenances as shown on the plans, to include couplings, check and isolation valves, and all other manual valves.

C. Provide functional testing of all installed components in accordance with a schedule approved by the Engineer.

1.03 SUBMITTALS

A. Catalog cuts and shop drawings shall be submitted for approval for all equipment herein specified.

B. An Order Specification shall be included which shall describe in detail all equipment provided.

C. Drawings showing dimension and with manufacturer's wiring diagrams that are not job-specific (standard drawings with options crossed out, etc.) are not acceptable. Standard sales brochures shall only be provided to supplement technical data. Interconnection details shall be shown on the wiring diagrams for all field mounted instrumentation.

D. A Description of Operation shall be provided detailing the operation of the component and initial configuration settings.

E. Supplier shall submit three (3) hardcopy sets of Operation and Maintenance manuals. The manuals shall include equipment descriptions, capacity and performance data, operating instructions, drawings, troubleshooting techniques, a recommended maintenance schedule, and the recommended spare parts.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Equipment will not be delivered to the site until they are ready to be installed. Equipment stored on site will be stored in clean dry heated space and protected by the Contractor at his expense until the item is to be installed.

PART 2. PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. The physical layout of the system as shown on the contract drawings and the equipment specified herein are based upon the Trident HSR-350 as manufactured by WesTech. The use of this system does not remove any responsibility of the CONTRACTOR to verify dimensions and elevations to ensure the equipment will fit within the area. The use of an "or equal" system will require the manufacturer to provide a modified layout subject to the approval of the ENGINEER at no additional cost the OWNER. The system shall be in compliance with these specifications and plans and shall be one of the following manufacturer models:

1. WesTech
2. Or Equal

B. If the CONTRACTOR proposes an "or equal" system, it shall be understood that the proposed pump meets or exceeds the specified performance and construction and offers a cost savings to the OWNER. The CONTRACTOR may be responsible for engineering time to review proposed substitutions.

2.02 CLARIFICATION UNITS

A. Design Criteria:

1. This equipment shall consist of two (2) Trident HSR-350 Water Treatment Units with associated equipment to comprise a complete system.
2. The treatment system shall be furnished by a single manufacturer who shall comply with the following:
   i. The single manufacturer supplying equipment to this specification shall furnish proof of a minimum of 100 installations and 10 years of manufacturing treatment systems similar to the specified system.
   ii. Due to the potential for higher-than-normal turbidities, the system manufacturer must furnish proof to both the Engineer and the local Department of Health, prior to acceptance of the proposed unit, that treatment of raw water with turbidity over 60 NTU for sustained periods of time, and spike loading in excess of 400 NTU, can be accomplished.
   iii. Due to a potential taste and odor problem, or to provide the capability for carbon adsorption, the system manufacturer shall furnish proof of the system's ability to perform properly while feeding Powdered Activated Carbon at a minimum dosage level of 25 mg/l. This must be demonstrated by a minimum of 3 pilot studies and/or operating plants showing positive results.
   iv. The system must be capable of operating at a range of 50 percent to 100 percent of the standard design flow.
   v. Components of the packaged treatment system shall be certified to NSF® Standard 61. Specifically, the tube settlers and paint system shall satisfy this

requirement.

3. The units shall be a Microfloc® products Trident HSR Water Treatment Clarifier model 2HSR-350 for treating raw water of the following characteristics:
   i. Number of Tanks: 2
   ii. Total Plant Flow (gpm): 1120
   iii. Total Flow to Clarification Units (gpm): 420
   iv. Flow per Tank (gpm): 210
   v. Tube Clarifier Area (ft2)/unit: 70
   vi. Tube Clarifier Hydraulic Loading (gpm/ft2): 5 (@ design flow)
4. A static mixer shall be provided for the common plant raw water line. Static mixer shall be sized for the common influent line and include flanged end connections.
5. Influent operating pressure of 20-30 feet (measured from base of tank) shall be available at the inlet to the static mixer.

2.03 PACKAGE SYSTEM CONSTRUCTION

A. Tank Fabrication:
   1. The clarification process shall be contained in single, rectangular steel tanks. Major components shall be of the size and configuration shown on the drawings and fabricated of 0.3125 (5/16) inch thick minimum steel plate, except the bottom which should be a minimum of 0.250 (1/4) inch thick, suitably braced and supported.
   2. All exterior tank connections except the sludge recirculation connection shall be provided with flanged connections.

B. Tube Clarifier Details
   1. Primary clarification shall be provided by tube settlers with integral sludge recirculation system.
   2. The tube clarifier influent distribution system shall be constructed of Sch. 40 steel headers with orifices located to provide uniform dispersion of the raw water across the bottom of the tube settlers. The header system shall be factory installed and supported from the settling tube supports.
   3. Settling tube supports shall be provided as required by the manufacturer.
   4. A fixed sludge recirculation pipe shall be provided directly below the tube settlers to allow collection of flocculated solids while minimizing grit and sand passage through the recirculation pump.
   5. A sludge removal header system shall be field installed to collect the sludge from the bottom of the tube clarifier basin. The header, guide rails, cable, and sludge withdrawal hose shall be constructed from corrosion resistant materials. The guiderails shall be designed to support the header from the tank side walls. The header shall be supported from the guiderails using V-groove roller wheels to minimize friction forces.
   6. A 3 inch diameter flexible high density polyethylene sludge extraction hose shall be provided to effectively remove sludge and operate within appropriate headloss constraints. The flexible hose shall be smooth on the interior and heavily ribbed on the exterior for strength and abrasion resistance. It shall be field installed to a tank wall connection which terminates with a flanged connection.
   7. Each sludge removal header shall include a drive unit which includes a vertical helical gear reducer driven by a ¼ horsepower TEFC, variable speed DC electric motor with stainless steel shaft, sheave arrangement and overload clutch. All drive components shall be mounted on an adjustable base. A corrosion resistant

enclosure shall be provided for each drive.

8. PVC settling tubes shall include a 60 degree incline design. Modules shall be 41 inches deep and cut to fit the tank interior. Settling tubes shall be field installed.
9. A series of five sample lines and manual valves shall be provided for sample collection directly below and from within the tube settlers at various depths. The sample lines and associated valves shall be routed to a waste collection trough on the outside of the unit. The waste collection trough will be equipped with a drain coupling. The installing contractor shall provide and install drain piping to the waste sump.
10. A Sch. 80 PVC header and lateral collector shall be provided for uniform collection of clarified water. The header and laterals shall be properly supported and designed for field installation.
11. A 14 inch x 18 inch access manway shall be included near the base of the settling tube compartment to allow access to the area below the tube settlers without removing the tubes.
12. The components shall be shipped loose for installation by the Contractor.

C. Plant Process Valves

1. The treatment plant manufacturer shall provide all process control valves in sizes shown on the drawings.
2. Automatic modulating control valve system for the tube clarifier influent line shall incorporate a mag meter and modulating valve to control the flow rate. The mag meter shall be installed in the influent line upstream of the control valve.
3. Automatic modulating control valve system for the effluent shall incorporate a radar level sensor and modulating valves to maintain buffer tank water level. Radar level sensor shall be mounted at the top of the effluent buffer tank section and positioned to properly sense the liquid level.
4. All automatic modulating valves shall be provided with an integral filter-regulator assembly mounted at the valve actuator.
5. Automatic open-close valves shall be provided for the clarifier transfer, sludge recirculation, and tube clarifier sludge blowdown for each tank.
6. The automatic valves for all systems except the sludge recirculation and blowdown shall be wafer-type butterfly valves with pneumatic actuators. The sludge recirculation and blowdown valves shall be a diaphragm type valve. The modulating valves shall have positioners to accept a 4-20 mA signal. The open/close valves shall be pilot solenoid controlled and arranged so that the valves shall automatically return to the service position should power fail.
7. All automatic and manual butterfly valves shall be of wafer construction with nylon coated disc, EPDM seat and seals, carbon steel stem and semi-steel body.
8. Manual wafer-type butterfly valves complete with lever actuators shall be provided by the treatment plant manufacturer. Manual butterfly valves shall be provided for influent isolation and tube clarifier pump suction isolation.
9. Manual valves for tube clarifier drain and sludge recirculation isolation shall be ball valves with lever actuators.
10. A manual plug valve shall be provided for installation in the sludge blowdown line for the purposes of controlling rate.
11. All valves shall be shipped loose for field installation by the Contractor.
12. The Contractor shall furnish and install all valves not furnished by the manufacturer as shown on the plans. This item to include couplings, check and isolation valves, and all other manual valves for service.

D. Clarifier Transfer and Sludge Recirculation Pump Systems

1. Each treatment unit shall include a clarifier transfer pump located in the effluent line of the tube settler system and a sludge recirculation pump. Both pumps shall be a product of the same manufacturer.
2. The pumps shall be designed so that they operate at maximum possible efficiency throughout the duty range, cause no overloading of motors under all operating conditions and be capable of continuous operation.
3. The centrifugal pumps shall be direct connected to the drive motor. The electric motor shall be sized to be non-overloading at all points on the pump performance curve. Motor enclosure shall be TEFC, and suitable for operation in a humid, outdoor environment. Motors shall be 3 phase, 60 Hertz, 460 volt power. All motors shall comply with manufacturer's standard design, construction and testing procedures as defined by applicable IEEE, NEMA, and ANSI standards.
4. Automatic flow adjustment of the sludge recirculation pump shall incorporate a mag meter and variable speed pump controller to maintain set point flow rate.
5. Recirculation pump and motor assemblies shall be field mounted on the treatment tanks with factory installed mounting brackets. Clarifier transfer pump and motor assemblies shall be field mounted next to the treatment tanks on a concrete base provided by the installer.
6. Automatic flow adjustment of the transfer pump shall incorporate a radar level sensor and variable speed pump controller to maintain water level in the tube settler compartment. Radar level sensor shall be mounted at the top of the tube settler section and positioned to properly sense the liquid level.
7. The components shall be shipped loose for installation by the Contractor.

E. Piping, wiring, and conduit
1. The installing contractor shall furnish and install all piping and fittings, plus all valve, piping, all wiring and conduit

2.04 PLANT CONTROL – GENERAL

A. Influent flow to the system shall be regulated by an operator adjustable flow control loop consisting of a flow element (mag meter); PLC/PID based flow control, and modulating butterfly valve in each tank influent line.

B. PLC based control subsystem shall be supplied to monitor and control the Package Treatment System. The PLC based system shall be capable of operating in an automatic mode, completely autonomously, or semi-automatic mode requiring some operator intervention. The control panel shall provide automatic starting and stopping of the Treatment System, based on tube clarifier tank level or device failure.

C. The control panels shall be supplied complete including all necessary equipment to provide a complete and functioning system. The components shall include PLC, operator interface, control relays, push-buttons & selector switches, indicating lights, power supplies, fuses and terminal strips. The PLC shall have an interface port, capable of future interface to a SCADA System via Ethernet network.

D. The Trident HSR control system shall interface with downstream process control systems to provide a coordinated operating system.

E. Control panels shall be shipped loose for installation by the Contractor.

F. The contractor shall furnish and install all wiring and conduit.

2.05 TREATMENT SYSTEM CONTROL PANEL

A. The treatment system controls shall consist of one Master Control Panel (MCP) per system working in conjunction with Unit Control Panels (UCP, one per unit). The control panels shall be supplied in a NEMA 12 steel enclosure suitable for indoor

use. The front panel of the cabinet shall contain all push buttons, and operator interface (MCP only) as detailed within this specification. The internal portion of the cabinet shall contain all rail-mounted PLC equipment, power supply, processor, and interface cards. Relays and terminals shall also be contained within the cabinet. The PLC subsystem shall be as manufactured by Allen Bradley. Terminal strips for all field wiring shall be furnished within the panel.

B. Fuses and duplex outlet shall be provided within the panel.

C. All digital outputs shall be provided with relay contacts.

2.06 PLC BASED CONTROL PANEL I/O FIELD INTERFACE SIGNALS

A. Within the PLC based control panel all PLC ladder logic shall reside performing all necessary process monitoring and control for the Package Treatment System. All necessary I/O cards shall be supplied to monitor and control the field signals. All PLC and I/O rails shall be supplied with 10 percent spare I/O point to accommodate future expansion.

B. The PLC based MCP shall be comprised of the following
   1. NEMA 12 Wall Mounted Control Panel
   2. PLC CPU Card – (dc voltage)
   3. PLC I/O Rail
   4. PLC I/O Cards
   5. Operator Interface Terminal – Allen-Bradley PanelView Plus 7 series 10" color/touch
   6. Power Supplies
   7. Pilot Lights and Pushbuttons
   8. Fuses
   9. Terminal Strips
   10. Convenience Outlet
   11. Remote I/O via Ethernet
   12. Control Relays
   13. Misc. Wire and Conduit

C. Each UCP shall be comprised of the following:
   1. NEMA 12 Wall Mounted Control Panel
   2. Interface Module
   3. PLC I/O Cards and module mounting rail
   4. Power Supplies
   5. Pilot Lights and Pushbutton
   6. Fuses
   7. Terminal Strips
   8. Misc. Wire and Conduit

2.07 DEVICES FOR OPERATOR INTERFACE

External face mounted devices for operator interface shall be as follows:

A. Pushbuttons
   1. Pushbuttons shall be as manufactured by Allen Bradley. Panel Mounted Pushbuttons shall be provided for Emergency Stop purposes.

B. Operator Interface Terminal (MCP Only)
   1. An Operator Interface Terminal to the PLC shall be included and mounted on the front of the MCP enclosure. The Interface shall allow the operator to view and modify system variables within the PLC. The display shall be a touch screen. The

color display shall be STN type, VGA 640 x 480 pixels (10 inches) with 60,000 hour backlight. The unit shall include a real-time clock, built-in alarm functionality, Ethernet communications port and RS-232 Printer port. The unit shall operate on 24 VDC with 0.6 A maximum power consumption. The display shall support the standard ASCII character set. Terminal configuration shall be via Microsoft Windows based software. The unit shall be manufactured by Allen Bradley Panel View Plus 7 series 1000**,** or approved equivalent

2.08 PROCESS CONTROL SYSTEM FUNCTIONS

A. The MCP shall automatically control the treatment process. The MCP Terminal shall provide control input for the following process and field equipment.
   1. Coagulation Pump
   2. Polymer Pumps
   3. Sludge Recirculation Pumps
   4. Sludge Collector Drive
   5. Clarifier Transfer Pumps
   6. Trident HSR Process Valves

B. The MCP shall control the following process functions:
   1. Tube Clarifier Level Control
   2. Automatic System Start-Up and Shut Down
   3. Influent Flow Control to each unit
   4. Emergency Shutdown of each unit via pushbutton
   5. Effluent Turbidity Feedback Coagulant Feed Control with flow pacing
   6. Automatic Start/Stop Polymer Feed Control
   7. Timed Based Flush Initiation
   8. Loss of Head Flush Initiation

C. The MCP Interface shall provide operator adjustable set points for the following parameters:
   1. Influent Flow Rate Setpoint
   2. Effluent Turbidity Coagulant Control Setpoint
   3. Recirculation Flow
   4. Blowdown Frequency and Duration

D. The MCP Interface shall provide running and alarm indication for the following devices:
   1. Raw Water Pump (pump by others)
   2. Sludge Recirculation Pumps
   3. Clarifier Transfer Pumps
   4. Sludge Collector Drive

E. The following manual control switches/pushbuttons shall be part of the Operator Interface which is mounted on the door of the MCP.
   1. Sequence Start
   2. Sequence Stop
   3. Alarm Acknowledgement
   4. Fault Acknowledgement
   5. Clarifier Transfer Pump Start/Stop
   6. Sludge Recirculation Pump Start/Stop
   7. Sludge Collector Drive Start/Stop
   8. Process Valve Open/Close Control

F. A Power On indicator light shall be mounted on the doors of the panels noted.

G. The following alarm conditions shall be monitored by MCP. All alarms shall be visible via the Operator Interface Terminal.

1. Sludge Recirculation Pump Fault
2. Sludge Collector Drive Fault
3. Sludge Recirculation Low Flow Alarm
4. Transfer Pump Fault
5. Trident HSR High Turbidity Alarm
6. Trident HSR High High Turbidity Alarm

2.09 FIELD INSTRUMENTS

A. The instruments provided by the manufacturer shall be shipped loose for installation by the Contractor.

B. Low Range Turbidity Monitoring (HSR effluent)

1. The turbidity monitoring system shall include one turbidimeter per tank (tube clarifier effluent) and necessary interface units for turbidimeter communication. The system shall be capable of functioning as a single or dual sensor system and shall have two 4-20 mA outputs and three setpoint alarms, each equipped with an SPDT relay with unpowered contacts.
2. The turbidimeters shall be a microprocessor-based, continuous-reading, on-line nephelometric instrument meeting all design and performance criteria specified by USEPA method 180.1. Light shall be directed through the surface of the sample and the detector shall be immersed in the sample, eliminating glass windows and flow cells. The turbidimeter body shall be constructed of corrosion-resistant polystyrene, and shall include an internal bubble trap to vent entrained air from the sample stream. The turbidimeter shall offer the choice of formazin-based (20 or 1 NTU) or instrument comparison-based calibration methods. Accuracy shall be ± 2 percent of reading from 0 to 40 NTU.
3. The interface unit shall allow operators to control sensor and network functions with user-friendly, menu-driven software, and shall provide data logging of measurement data from one or two turbidimeters for 15 minute, 1 hour, 24 hours, 30 days, or 180 days, and the optional capability to transfer data to a computer or printer via direct MODBUS communications or directly into a Personal Digital Assistant (PDA) via a wireless IR port. The interface unit and internal DC power supply shall be housed in NEMA-4X (indoor) industrial metal/plastic enclosure and the power supply shall automatically accept input in the range of 100 to 230 Vac, 50/60 Hz. All system components shall be ETL listed to UL 61010A-1, certified to CSA C22.2 No. 1010.1 and CE certified by manufacturer to EN61010-1. All system components shall be CE certified to EN 61326 (industrial levels) for immunity and emissions, Class A. All system components shall be meet FCC Part 15 for North America and Canadian Interference-Causing Equipment Regulation ICES-003 and CISPR 11 Class A levels for the rest of the world. The turbidimeters shall be Hach TU5300 sc low range turbidimeter with sc4500 controller or equal.

2.10 CHEMICAL MIXING AND FEED SYSTEMS

A. All chemical feed system listed below are furnished by the plant supplier and shall be shipped loose for installation by the contractor. All other chemical feed systems are to be provided by the contractor.

1. A liquid emulsion polymer feed system for flocculation aid shall be provided. This system shall be an inline system and shall consist of:
   a. A direct-coupled, motor driven high energy mixing chamber.
   b. Mechanically actuated diaphragm-type polymer metering pump with high

viscosity liquid handling unit,
c. Water solenoid valve,
d. Electronic flow sensor for primary and dilution water,
e. 304 stainless steel open chassis design, and system controls.
f. One unit shall be required for each treatment tank. The polymer feed system shall be sized to deliver an average feed rate of 1.0 ppm with a maximum feed rate of 3.5 ppm.

2.11 FINISH

A. The interior and exterior of the tanks shall be thoroughly cleaned of loose mill scale and grease.
B. The interior of the treatment units shall be sandblasted to SSPC-SP10 and prime painted with one shop coat of Tnemec Series 21-1255 (Beige) Epoxoline primer, or equivalent, one stripe coat of Tnemec Series 21-WH16 (off-White) Epoxoline paint, and one coat of Tnemec Series 21-WH16 (off-White) Epoxoline finish paint, or equivalent.
C. The exterior of the tanks shall be sandblasted to SSPC-SP6 and prime painted with one shop coat of Tnemec Series 21-1255 (Beige) Epoxoline primer, or equivalent.
D. The tank bottom shall be bare for field placement onto a coal tar or mastic base pad coating to be provided and installed by the contractor.

PART 3 EXECUTION

3.01 INSTALLATION INSPECTION, START-UP AND OPERATOR TRAINING

A. The Trident HSR is a pre-engineered system consisting of a pretreatment and filtration system contained in a single shippable tank. The internal components and ancillaries shall be shipped loose for field installation by the contractor.
B. The Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish, install and test the treatment, and shall furnish and install all piping and fittings, all valves, all wiring and conduit, plus valves not furnished by the plant supplier as shown on the plans, to include couplings, check and isolation valves, and all other manual valves.
C. The Manufacturer shall inspect the installation of all equipment in this section prior to start-up in order to verify that the equipment has been properly installed and operates properly as a system and individually.
D. After the equipment has been properly installed the Manufacturer shall calibrate the equipment with the Owner's operator present.
E. The Manufacturer's representative shall be present for fifteen (15) days in four (4) trips of installation assistance described above.
F. Effluent quality laboratory analysis shall be provided by the Owner.

3.02 INSTALLATION

A. According to manufacturer instructions and as indicated on Drawings.

3.03 WARRANTY

A. A written one-year standard warranty from the date of the successful equipment start-

up shall be provided by the equipment supplier to guarantee that there shall be no defects in material or workmanship in any item supplied.

3.04 SPARE PARTS

A. All recommended spare parts per Manufacturers recommendations.

END OF SECTION