XLPE gasket. The 24-inch covers shall have two (2) XLPE gaskets and the bolts shall be polyethylene. The 17" covers shall be threaded and provided with an XLPE gasket

f. Tanks shall have their contents stenciled at two locations on the tank, using 2-inch high block lettering. These locations shall be at 90^{o} locations around the tank circumference, at a height at 6'-0" from tank bottom, and shall be visible from outside the containment areas.

g. Tanks shall be equipped with lifting brackets or other means of lifting for future removal or hoisting, without damage or distorting the tank.

7. All tanks shall be factory tested with water. All fittings shall be installed prior to testing. Certified test reports shall be submitted to the Engineer prior to field installation of the tanks.

8. Tank manufacturer shall supply a flexible expansion joint matching the size of the bulk tank outlet connection to be installed by the Contractor as shown on the Drawings for each bulk tank.

B. High Density Cross Linked Polyethylene Tanks:

1. The bulk storage tanks shall be high-density cross-linked polyethylene (HDXLPE) and manufactured by the rotational molding process and in accordance with the definitions given in ASTM D1998, latest edition. Linear polyethylene tanks will not be accepted.

2. The molding powder shall be Paxon 7000Series, as manufactured by ExxonMobil Chemical Company 66, or powders of equal physical and chemical properties.

3. The sodium hypochlorite tank shall include an integrally molded, oxidation resistant, internal polymer liner of OR-1000 as provided by Poly Processing Company, or equal.

4. The plastic shall not contain any fillers. All plastic shall contain a long term U.V. stabilizer.

5. The tank construction shall be in accordance with ASTM D1998 Type I, with the minimum for the mechanical properties of the material as follows, based on molded parts:

Cross-Linked Polyethylene Tanks

PROPERTY	ASTM	VALUE
Density (Resin)	D1505	0.940 - 0.945 g/cc
Tensile (Yield Stress 2" min)	D638 Type IV Spec	2600 psi
Elongation at Break (2"/min)	D638 Type IV Spec	400%
ESCR (10% Igepal, 125 mils F50)	D1693	>1000 hrs.
Vicat Softening Temperature	D1525	240 deg. F
Brittleness Temperature	D746	-130 deg. F
Flexural Modulus	D790	88,700 psi

6. The tanks shall be designed for 1.9 Specific Gravity with a hoop stress value of no greater than 600 psi at 100°F, with a minimum safety factor of no less than 2. Wall thickness shall be determined by using the Barlow formula.

7. The finished appearance of the tank shall be free of visual defects such as foreign inclusions, air bubbles, pinholes and craters.

8. Tolerance on the outside diameter, including out of roundness shall be ±3%. The knuckle radius at the bottom of the wall shall be 1-inch minimum.
9. All cut outs shall have smooth edges.
10. All dome fittings shall be two-flange, universal ball, dome style. The flange attached to the dome wall shall be 150 lb. ANSI, constructed of PVC, with 1/4-inch gasket. There shall be a minimum of four 1/2-inch diameter, all-thread bolts with bolt heads encapsulated in polyethylene. The polyethylene encapsulation shall fully cover the bolt head and 1/4 inch of the threads closest to the bolt head. Each bolt shall have a 1/4-inch gasket on the inside of the tank, and each flange shall have a 1/4-inch gasket on the outside of the tank. All dome fittings shall have a PVC flange adapter and shall be 150 lb. ANSI.
11. The caustic tanks (two required) shall be:
    a. Dimensions:
        i. Minimum capacity measured to top of straight shell or wall height – 2,550 gallons.
        ii. Approximate outside diameter - 7 feet 1-inches.
        iii. Maximum total height to tank top – 10 feet 3.5-inches.
    b. Chemical Storage Requirements (capable of storage of either of the following:
        i. Chemical
            a) 45% potassium hydroxide, specific gravity - 1.46,
            b) 50% sodium hydroxide, specific gravity - 1.53,
            c) 25% sodium hydroxide, specific gravity - 1.27,
        ii. Pressure – Atmospheric,
        iii. Maximum temperature - 150 degrees F.
    c. Fittings:
        i. Bolt material - 316 stainless steel,
        ii. Gasket material – EPDM.
12. The sodium hypochlorite tanks (2 required) shall be:
    a. Dimensions:
        i. Minimum capacity measured to top of straight shell or wall height – 2,550 gallons.
        ii. Approximate outside diameter - 7 feet 1-inches.
        iii. Maximum total height to tank top – 10 feet 3.5-inches.
    b. Chemical Storage Requirements:
        i. Chemical - 12.5% Sodium Hypochlorite,
        ii. Specific gravity - 1.2,
        iii. Pressure – Atmospheric,
        iv. Maximum temperature - 150 deg. F.
    c. Fittings:
        i. Bolt material - Titanium,
        ii. Gasket material – Viton.
13. The hydrofluorosilicic acid tank shall be:
    a. Dimensions:
        i. Minimum capacity measured to top of straight shell or wall height – 545 gallons.
        ii. Approximate outside diameter - 4 feet 0-inches.
        iii. Maximum total height to tank top – 7 feet 1.5-inches.
    b. Chemical Storage Requirements:
        i. Chemical – 25% Hydrofluorosilicic Acid
        ii. Specific gravity - 1.2
        iii. Pressure – Atmospheric,
        iv. Maximum temperature - 150 deg. F.
    c. Fittings:

i. Bolt material – C-276
ii. Gasket material – EPDM.

14. The ortho-polyphosphate tank shall be:
    a. Dimensions:
        i. Minimum capacity measured to top of straight shell or wall height – 905 gallons.
        ii. Approximate outside diameter - 5 feet 4-inches.
        iii. Maximum total height to tank top – 6 feet 11.5-inches.
    b. Chemical Storage Requirements:
        i. Chemical – 37.5% ortho polyphosphate
        ii. Specific gravity - 1.39
        iii. Pressure – Atmospheric,
        iv. Maximum temperature - 150 deg. F.
    c. Fittings:
        i. Bolt material – 316 stainless steel
        ii. Gasket material – EPDM.

C. Fiberglass Reinforced Plastic Tank

1. FRP tank shall be of filament wound construction in conformance with the latest edition of ASTM D3299 and the Society of Plastics Industry Products Standard for Filament Wound Reinforced Plastic Tanks of contact molded construction. All nozzles shall be conically gusseted from the outer flange to the tank wall and give full 360° support to the flange. All nozzles shall be one piece contact molded. Press molded or glued nozzles are not allowed. All nozzles shall have 150 lb. ANSI drilling.
2. The tank shall have an inner corrosion barrier with a total minimum thickness of 120 mils. The inner corrosion barrier shall consist of a resin rich interior surface with a two ply synthetic surfacing veil by Burlington Nexus or equal. Each ply shall be separately gelled prior to application of the subsequent ply. The resin rich interior surface shall be 20 mils minimum thickness. The layer adjacent to the interior surface shall be 100 mils minimum thickness consisting of approximately 30 percent randomly oriented chopped strand Type "E" glass fiber reinforced and approximately 70 percent resin. The tank bottom shall be integral to the sidewalls. Seams are not allowed.
3. The structural wall reinforcement shall be filament wound continuous glass roving reinforced laminate with a resin content between 45 to 50 percent and a glass content of 50 to 55 percent. The resin used for the structural wall shall be the same as the internal corrosion barrier.
4. The tank shall be free from cracks and glazing inside and out.
5. The tank shall be covered with a gel coat finish with a white pigment.
6. The tank wall thickness shall be designed per ASTM D3299. The FRP shall exhibit the following structural characteristics:

Property	ASTM Designation	Minimum Value (psi)
Ultimate Tensile Strength	D638	14,000
Tensile Modulus of Elasticity	D638	800,000
Ultimate Flexural Strength	D790	19,000
Flexural Modulus of Elasticity	D790	600,000

7. The tank shall have a uniform appearance. The tank shall be free from excessive visual defects, foreign inclusions, dry spots, air bubbles, pinholes, pimples, exposed glass fibers, and delaminations.

8. All resin used in the manufacture of the tank shall be a premium vinyl-ester. The resin shall be Derakane 411, Hetron 922, or equal which is recommended for continuous exposure to the specified process liquids at temperatures up to 140 degrees F.
9. Thixotropic (Cab-O-Sil) compounds shall not be applied to any of the layers of the 120 mil thick inner corrosion barrier.

D. Wafer-Style Butterfly Valves:
1. The tank supplier shall furnish 2 wafer style PVC or CPVC butterfly valves for each bulk tank for installation on the outlet of the bulk tank and on the tank drain connection.
   a. Valve seals, gaskets, and bolts shall be suitable for the chemical it contacts.
   b. Furnished with lever-type operator.
   c. Size to be same as tank outlet.

2.02 DAY TANKS

A. The day tanks shall each be fabricated of linear polyethylene or polypropylene.
1. Circular day tanks shall be flat-bottomed and shall be provided in the following sizes:
   a. Caustic – 275 gallons, 42" diameter x 48" high
   b. NaOCl - 330 gallons, 45" diameter x 48" high
   c. Hydrofluorosilicic Acid - 30 gallons, 18" diameter x 29" high
   d. Phosphate – 30 gallons, 18" diameter x 29" high
2. The day tanks shall have a flanged outlet located at the lowest possible point in the day tank to allow for drainage.
3. The day tanks shall also have flanged overflows at the top of the sidewall of the day tank:
   a. 1.5" for hydrofluorosilicic acid and phosphate day tanks.
   b. 2.5" for NaOH and NaOCl day tanks.
4. Flanges shall be 150 pound ANSI with gasket.

B. The day tanks shall be equipped with one-piece cover of the same material as the tank.
1. Tank covers shall be provided with the following connections:
   a. Fill pipe connections of size indicated on the drawings.
      i. Fill pipes shall extend to within 3-inches of the tank bottom.
      ii. Shall have a union connection on top of cover.
   b. Union vent connection:
      i. 3" vent on caustic and hypochlorite day tanks.
      ii. 2" vent on hydrofluorosilicic acid and phosphate day tanks.
   c. Equipped with the recommended fittings to accommodate the tank level sensors to be provided under Section 13100, Instrumentation & Controls.
2. Tank covers shall be bolted in place with polyethylene bolts supplied by the tank manufacturer.

C. Provide tank stands of polyethylene construction for each day tank.
1. Tank stand shall elevate the day tank a minimum of 18-inches above the finished floor.
2. Stands shall be designed for the weight of the tank including the weight of the chemical, when full.

2.03 CHEMICAL TRANSFER PUMPS

A. The chemical transfer pumps shall be close-coupled, magnetic drive units, with all wetted parts of materials suitable for intended chemical use.
   1. The caustic and sodium hypochlorite pumps shall be:
      a. Rated at 55 gpm at 12 feet TDH.
      b. Furnished with a 1/2 horsepower, 120-volt, 1-phase motor.
   2. The hydrofluorosilicic acid and phosphate pumps shall be:
      a. Rated at 8 gpm at 8 feet TDH.
      b. Furnished with a 1/4 horsepower, 120-volt, 1-phase motor.
   3. The control panel for operation of the transfer pump shall be furnished under Section 13100 – Instrumentation and Control.

2.04 WEIGH SCALE:

A. Weigh scale shall be:
   1. Single load cell design with weight transferred via a pivoted platform to a single stainless steel load cell of the electronic strain gauge type, 200 pound capacity.
   2. Scale platform shall be PVC plastic and sized to accept up to a 16- inch diameter carboy.
   3. Platform scale coating system shall be a minimum dry thickness of 80 mils and be resistant to moisture, chemicals, abrasion, impact and UV light.

B. The remote wall-mounted indicator shall be:
   1. 4½ digit backlit LCD with .5" characters for ease of readability in low light conditions.
   2. NEMA 4X, UL approved enclosure.
   3. To allow indication of net weight, indicator shall be equipped with a sealed ten-turn knob for tare adjustment.
   4. 4-20mA output signal for remote monitoring.
   5. 5 feet of flexible cable shall be provided for connection of platform to indicator.

C. Scale accuracy shall be better than 1%, and shall carry a Full Five (5) Year Factory Warranty. “Limited” Warranties shall be considered unacceptable.

D. Scale shall be as manufactured by Force Flow or approved equal.

E. The carboy weigh scale shall be installed on FRP grating. Weigh scale model furnished shall be appropriate for mounting to the top of FRP grating.
   1. Weigh scale platform shall be secured to grating utilizing nylon nuts.
   2. Provide non-metallic, non-corrodible backplates on underside of grating for bolting.

2.05 ELECTRONIC METERING PUMPS:

A. Peristaltic-Type Tubing Pumps:
   1. The metering pumps shall be microprocessor controlled, peristaltic-type Model M3 as manufactured by Blue-White Industries, or approved equal. The metering pumps shall have the following attributes:
      a. Output:

Caustic	Quantity:	2
	Capacity:	0.0017-17.4 gph @ 65 PSI
Chlorine:	Quantity:	2
	Capacity:	0.0017-17.4 gph @ 65 PSI

Hydrofluorosilicic Acid:	Quantity:	2
	Capacity:	0.0002-2.10 gph @ 125 PSI
Phosphate:	Quantity:	2
	Capacity:	0.0002-2.10 gph @ 125 PSI
PACl:	Quantity:	2
	Capacity:	0.0002-2.10 gph @ 125 PSI

b. Tubing: For intended chemical
c. Connection fittings: 3/8" OD flexible tubing
d. Turndown ratio: 10,000:1
e. Enclosure Rating: NEMA 4X
f. Power Requirements: 115 VAC, 60 Hz
g. Power Cord: 6 foot (2 wire plus ground) with twist-lock plug
h. Control: Analog (4-20mA pacing signal)
Analog (4-20mA speed reportback)
Tube failure detection
i. Options (each pump): Flow verification sensor
Foot valve (where required)

2. Pump shall be capable of running dry without damage.
3. Accuracy: +/- 0.5 percent of full scale. Repeatability: +/- 0.5 percent.
4. Pump shall be warranted by the manufacturer for a period of five years.
   a. Warranty shall include chemical damage to the pump head and roller assembly for a period of two years.
5. Pump Head:
   a. Tube failure detection sensors shall be wholly located in the pump head.
      i. Float type switches shall not be used. Process fluid waste ports or leak drains shall not be provided.
   b. Squeeze rollers with encapsulated ball bearings shall be directly coupled to a one piece thermoplastic rotor.
      i. The roller diameters and occlusion gap shall be factory set to provide the optimum tubing compression; field adjustment shall not be required.
      ii. Spring loaded or hinged rollers shall not be used.
   c. Pump head and tubing compression surface shall be corrosion resistant thermoplastic.
6. Flow Verification Sensor:
   a. Flow verification sensor shall be a paddlewheel type sensor.
   b. Sensor body, paddle, lens cap, and axle material shall be PVDF.
   c. Sensor operating range shall be coordinated with the pump flow range.
7. Motor:
   a. Reversible, DC gear motor rated for continuous duty.
   b. Motor shall include overload protection.
8. Control Circuitry:
   a. The pump shall be capable of automatically calculating the pump motor speed required to achieve a part per million dosing output that is proportional to a variable system flow rate.
      i. The pump shall permit the user to input the dispensing chemical percentage concentration from 0% to 100.0% in 0.1% increments.
      ii. The pump shall permit the user to input the dispensing chemical specific gravity from 0.1 to 9.9 in 0.1 increments.
      iii. The pump shall permit the user to input a K-factor in pulses per liter from a sensor in the water system that outputs a high speed

digital pulse from 0 to 1000 Hz that is proportional to the system water flow velocity.

iv. The pump shall permit the user to input the required dosing parts per million (PPM) from 0.1 to 100.0 in 0.1 increments.

b. Provide a front panel user touchpad control for stop/start, configuration menu access and navigation, operating mode selection, auto priming, display options selection, tube life data, and reverse direction.

c. Provide a multi-color VGA graphic LCD display for menu driven configuration settings, pump output value, service alerts, tube failure detection (TFD) system and flow verification system (FVS) alarms status, remote input signal values, tubing life timer value.

d. Provide four contact closure alarm outputs, each assignable to monitor any of the following pump functions:
- Tubing failure detection system
- Flow verification system
- Motor run/stop
- Motor failed to respond to commands
- Motor is running in reverse
- General alarm (TFD, FVS, and/or motor over current)
- Revolution counter (tube life) set-point.

e. Provide a four digit password protected configuration menu.

f. Provide a power interruption pump restart option which is user programmable to either automatically restart or require a user re-start if AC power is interrupted.

B. Suction and discharge tubing shall be as specified in Section 15108 – Tubing, Hose, Fittings and Appurtenances.

C. Each pump will be furnished with a chemical feed pump control station that will provide for manual or automatic control of the chemical feed metering pump, and will energize/deenergize the remote electrical outlet onto which the pump is connected.

1. The control station enclosure shall be designed to insulate and house control devices in wet, dusty, and/or corrosive environments.

a. Enclosure shall be rated NEMA Type 4X and shall be constructed of Polycarbonate material.

b. Power shall be 115VAC.

c. Each control station shall include but not be limited to the following:

i. Hand-Off-Auto Selector Switch with spring return from the Hand position.

ii. LED “On” Status Indicator.

iii. Emergency Stop Pushbutton push to activate and twist to release.

iv. Panel mount alarm device for providing visual and audible indication.

v. Front panel mount 3 to 60 minute analog timer, operator adjustable from the front dial.

vi. “On” status contact to provide indication to PLC or SCADA.

vii. “In AUTO” contact to provide switch position indication to remote PLC or SCADA.

viii. 115VAC and dry contact output to energize metering pump outlet.

ix. Fuse holder and 10 amp fuse. Fuse shall be accessible from the outside without opening the Control Station enclosure.

2. Control shall be as follows:
   a. With the 3 position selector switch turned momentarily to the HAND (manual) position the control station will energize the pump outlet and the following will occur:
      i. An audible and visual indication (red flashing LED) shall annunciate on the control station while the pump is running in the HAND.
      ii. The adjustable timer at the control station is started. At the end of the timing cycle the metering pump outlet will be de-energized and the audible and visual indication will be turned off.
   b. With the 3 position selector switch in the AUTO position the metering pump outlet will be energized upon receipt of a start signal from an external remote PLC, SCADA, Flow Switch, or other interlock device. The start signal shall be a normally open dry contact that upon closure shall cause the pump to start.
   c. The E-Stop pushbutton on the control station will provide for emergency stop of the metering pump in either the HAND or AUTO mode of operation.
   d. A green LED "On" status indicator light shall indicate that the metering pump outlet is energized.
3. Pump Control Station shall be Model #XPCS by CTI Dynamix, LLC, or equal.

2.06 WALL-MOUNTED METERING PUMP SKIDS

A. General:
1. The chemical metering skids shall be HDPE Roto-molded monolithic double wall design. The design of the skid shall include gussets and supports as required for all components and shall be self-supporting. All components of the chemical metering system shall be contained within the skid. The skids shall be manufactured using Roto-molded technology. The skids shall be provided in a color to match 10 state standards, for example bleach skid color is yellow, acid skid color is red, caustic skid color is green. The skid color is provided as a safety measure to aid in the identification of the specific chemical being used. Pedestals shall be provided to elevate the metering pumps above the skid base.
2. For each chemical metering pump, unless otherwise indicated on the Drawings, the piping system shall include:
   a. (1) discharge manifold block
   b. (1) suction isolation valve
   c. (1) pressure relief valve
   d. (1) backpressure valve
   e. (1) diaphragm protected pressure gauge
   f. Cross connect valves shall be supplied as required
   g. (1) flushing outlet and all required piping, valves and supports.
3. Piping shall include isolation valves and unions for all serviceable components. The chemical supply piping shall allow for single inlet connections, including flush valve, y-strainer and a calibration column connected to suction manifold, that provides for off gassing shall also be provided. The discharge piping from each pump shall be connected to a common discharge header, with isolation valves for each.
4. The piping shall be attached to the chemical metering skid with a non-metallic corrosion resistant support system.

5. A NEMA 4X terminal box shall be provided for each pump on the skid back panel for termination of all wiring, unless a separate control panel is provided that includes an internal terminal strip. A power outlet with a single twist-lock outlet and weatherproof cover shall be provided for any metering pumps or accessories that require an outlet. The inside cover of the terminal box shall include a wiring diagram detailing the function of all terminals.
6. The chemical metering skids shall be completely assembled and tested by the manufacturer prior to delivery to the job site. Each skid shall be labeled as to which chemical it is to meter using minimum one-inch high engraved lettering on plastic laminate placards affixed to skids.

B. Accessories
1. Refer to subsection 2.07 below.

C. Piping
1. PVC piping shall be as specified in specification Section 15104.
2. Tubing shall be as specified in specification Section 15108.

D. Valves
1. Valves shall be as specified in specification Section 15110.

2.07 CHEMICAL FEED PUMP ACCESSORIES

A. Backpressure valves shall be furnished at all chemical injector locations, including soare injectors, and shall be PVC and hypalon-coated.
1. Backpressure valves shall be factory set to:
a. 50 psig for all installations where a peristaltic is not being used.
b. Minimum psi for installations utilizing peristaltic pumps.

B. Hybrid combination backpressure valves/pulsation dampeners shall be provided on the discharge of each metering pump as indicated on the chemical feed system schematic drawings. Hybrid valves shall be manufactured by Blacoh Fluid Control or approved equal.
1. Shall be suitably sized for the displacement of each pump.
2. Constructed of PVC and of the type which has a diaphragm separating the upper and lower chambers.
a. Diaphragm shall be of molded construction and shall prevent the air charge from being dissolved in the process fluid.
3. Upper chamber shall be equipped with a tire valve type of charging valve and air pressure gage, and charged with compressed air to 50 percent of the expected line pressure.
4. All materials shall be suitable for the intended service.
5. The Contractor shall furnish a hand or foot operated air pump for charging of the dampeners.
a. The air hose shall be long enough to reach all dampeners.
b. Equipped with a hand-operated, lever-type valve for connection to the air valve on the dampeners.
6. Backpressure valves shall be factory set to 50 psig.

C. Each pressure relief valve shall be supplied with a pressure gauge on the discharge piping, which will allow for setting of the relief valves.

1. Gauges shall be 2-inch diameter, 0-100 PSI, glycerin filled, and equipped with diaphragm assemblies that separate the gauge from the fluid.

D. PVC calibration columns shall be provided for use with the chemical metering pumps.
1. Calibration columns shall be furnished for each chemical feed system as follows:
a. For chemical feed systems where the metering pumps are served by hard-piped suction lines, calibration columns shall be furnished and installed as indicated on the schematic drawings.
b. Calibration column fill ports shall be furnished with required PVC bushings to allow a 2" long ½" fill pipe and ½" true-union ball valve.
2. Calibration chambers shall be sized to provide a minimum of 1-minute capacity at the maximum metering pump setting, but shall be no smaller than 250 ml.

E. Two (2) flushing adapters shall be provided. One end of the adapter shall screw onto the top of the Tru-union valve onto which the calibration column is connected. The other will contain a 3/4-inch female hose adapter.

F. Strainers shall be clear PVC, Y-pattern type with a 100-mesh screen.
1. All materials in the strainer shall be compatible for the service intended.
2. Strainers shall be installed so as to allow for removal of screens without disconnecting piping.
3. Ball valves shall be as specified in Section 15100, Valves and Appurtenances.

G. Corporation Stop and Nozzle Assembly:
1. Contractor shall furnish and install corporation stop and nozzle assembly with check and isolation valves as shown on the detail in the Drawings. The assembly shall consist of a polypropylene nozzle, bronze corporation cock, PVC check and isolation valves, and vinyl covered stainless steel cable.
2. Injector assemblies for ½-inch chemical lines shall be ¾-inch corporation size, and 1-inch corporation size for ¾-inch chemical lines.
3. The assembly is to be of a design to allow removal of the injection nozzle from the pipeline without shutting down the pipeline.

H. Accessories shall include:
1. Laminated pump labels to be coordinated with Engineer and field applied.
2. Instructions for operation and maintenance.
3. Parts catalog.

I. Spare Parts shall include:
2 tubing assemblies per peristaltic pump (20 total)
2 pressure gauges and isolation diaphragm assemblies
4 backpressure valves
2 pressure relief valves
1 box of each type of fuse used
1 box of each type of light bulb used

PART 3 EXECUTION

3.01 INSTALLATION

A. The Contractor shall have full responsibility for installing all of the chemical feed equipment as part of two complete, independent, functioning and tested systems.

B. Unless otherwise directed by Engineer, piping of the metering pumps shall be as indicated on the Drawings. In general, the piping shall be as follows:
   1. Bulk tank fill piping shall be CPVC.
   2. Transfer pump suction and discharge piping shall be CPVC.
   3. Connections to suction and discharge side of metering pump heads shall be flexible piping.
   4. Pressure relief shall be flexible tubing.
   5. Vents shall be PVC.

C. The proposed mounting of the chemical metering pumps, tanks, piping/tubing, and accessories shall be reviewed with the Owner and Engineer prior to installation. Should the Contractor install the equipment in a manner that is not to the Owner's satisfaction, the Contractor shall revise the installation at no additional cost to the Owner

D. The tank manufacturer's supplied flexible fitting of the size indicated on the Drawing shall be installed on the outlet of all bulk tanks and the caustic and NaOCl day tanks to relieve any piping stresses caused by flexure of the tank walls.

3.02 TESTING

A. The Contractor shall include the coordination of field testing with a representative of the manufacturer to insure a complete and functioning system as part of the work.
   1. Pump output shall be checked at 10%, 25%, 50%, 75%, and 100% speed.

B. All bulk chemical storage tanks shall be field tested with water.
   1. Any tank found to leak will be rejected, and shall be replaced.
   2. Field repairs of tanks will not be accepted.
   3. All costs associated with the replacement of the tank shall be borne by the Contractor.

3.03 STARTUP

A. Equipment shall be monitored to insure pumps are varying feed rate of chemical in relation to 4-20mA signal

3.04 TRAINING

A. The manufacturer's field representative shall provide a minimum of 4 hours of training to Owner's personnel in the use and care of the equipment to the Owner's representative. The training shall be separate from and in addition to start-up services.

B. Initial and repeat training of Owner personnel and scheduling thereof shall meet all requirements as outlined in Specification Section 01445 Manufacturer's Services.

END OF SECTION

SECTION 11525

PROCESS EQUIPMENT

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Included: Provide process equipment as required by the Contract Documents.
   1. In general the work of this Section includes providing miscellaneous equipment required for handling and maintenance of the treatment facility processes.

1.02. RELATED WORK

A. Documents affecting the work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.03 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.04 SUBMITTALS

A. Comply with the pertinent provisions of Section 01300.

B. Product Data:
   1. Materials list of items proposed to be provided under this Section.
   2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Process furnishings shall not be delivered to the job site until substantial completion and after all construction operations in the building have been completed.

PART 2 PRODUCTS

2.01 PROCESS FURNISHINGS AND EQUIPMENT

A. Push Broom: Provide three (3).
   1. Acid, solvent, oil, fungus and liqiud resistant for wet or dry sweeping applications.
   2. Type: Medium, general purpose sweeping applications.
   3. Block length: 24-inches.
   4. Handle: Threaded Hardwood Tip/ Hardwood Handle 60-inches long.

B. Dust Pan and Brush: Provide three (3).
   1. Material of construction: (Dust pan) Molded plastic as made by Rubbermaid.

2. Material of construction: (Brush) Plastic fill. Durable wet or dry; acid, alkali resistant.

C. Storage Cabinet: Provide three (3).
1. Size: 36-inches by 18-inches by 72-inches high, double doors with three point locking handle.
2. Four (4) full width adjustable (shelf support tabs) shelves.
   a. Shelf loading: 150 lbs.
3. Raised base.
4. Sixteen (16) gage steel frame construction.
5. Four knuckle hinges.
6. Pre-assembled

D. Plastic Mop Bucket/Wringer Combination: Provide two (2).
1. Rubbermaid brand
2. Size: 35 quart bucket capacity.
3. Down pressure wringer.
4. Color: Yellow.

E. Wet Mop and Handle: Provide three (3).
1. Rubbermaid brand.
2. ValuePro Rayon #24.
3. Handle: 54-inches in length.
4. Furnish three (3) spare mop heads

F. Floor Squeegee: Provide two (2).
1. One (1) 24-inch and one (1) 36-inch, curved blade
2. Neoprene rubber
3. 56-inch long aluminum handle

G. Miscellaneous: Accessories shall be as supplied by McMaster-Carr or equal.
1. Two (2) Model No. 6582A74, 36" 4-holder, mop and broom holders.
2. Two (2) Model No. 12845A32, 24" stainless steel 3-hook coat hangers.
3. Two (2) Model No. 15295A3, wall-mounted zinc-plated steel ladder hooks.

H. Extension Cords: Provide three (3).
1. One (1) 100’ and two (2) 50’.
2. No. 14 gauge, 3 wire.
3. Extra thick insulated grounded cord with integrally molded plug.

I. Wet/Dry Vacuum Cleaner with Portable Blower:
1. 18 gallon capacity canister mounted on casters.
2. Onboard tool storage.
3. Includes:
   a. 12 feet of 2-1/2-inch diameter, 360^{o} swivel hose.
   b. 2 extension wands.
   c. Utility nozzle.
   d. 14” floor nozzle with brush and squeegee inserts.
   e. Crevice tool.
   f. Blower nozzle.
   g. Dusting brush.
   h. Concentrator nozzle.
   i. 4 replacement filter cartridges.
4. Global Industrial Catalog No. WBB3133878, or equal.

J. Heavy Duty Rubber Hose:
   1. Four (4) 50 foot sections of 3/4-inch commercial/industrial quality reinforced rubber hose, W.W. Grainger Catalog No. 423H85, or equal.
   2. Gun type spray nozzle, W.W. Grainger Catalog No. 3VA94, or equal.

K. Hose Reel Cart:
   1. Plastic Material.
   2. Hold 175 feet of 5/8-inch diameter hose.
   3. W.W. Grainger Catalog No. 56LV28 or equal.

L. Heavy Duty Type I Industrial Stepladder:
   1. 6 foot height
   2. Fiberglass with steel hardware side locks
   3. W.W. Grainger Catalog No. 4W078
   4. Furnish with Catalog No. 4GNL2 pail shelf.

M. Hand Grease Gun:
   1. 18-inch long whip hose
   2. W.W. Grainger Catalog No. 6Y894, or equal.

N. Hand Oiler:
   1. Pistol type.
   2. Rigid spout.
   3. One pint capacity.

O. Portable Platform Truck:
   1. 26" folding handle
   2. 600-lb. Capacity.
   3. Wrap-around bumper
   4. 5" rubber wheels – 2 swivel, 2 rigid casters
   5. Uline Model No. H-180.

P. Package Ejector Pump (analyzer drains):
   1. 20" dia. X 30" high polyethylene basin with:
      a. 1-piece bolted cover and stainless bolts.
      b. 4" molded external inlet hub.
      c. Molded torque stops for securing pump
   2. 2" combination ball/check valve
   3. Submersible sump pump:
      a. Rated 10 gpm @ 17' head
      b. Power: 115-volt
      c. Cast iron housing and volutes, epoxy coated.
      d. 2" discharge
      e. 15-foot power cord.
   4. Start/stop float switches (non-mercury).
   5. Contractor shall install a 1" PVC overflow pipe at the highest possible point on the tank side wall, which shall discharge to the trench drain.

2.02 BUY AMERICA BUY AMERICA ACT (BABA) REQUIREMENTS

A. The process furnishings and equipment listed in this section are to be defined as "not an integral part of the structure or permanently affixed to the infrastructure project" as described in the Office of Management and Budget's Memorandum M-22-11 and

therefore not required to comply with the BABA requirements defined in Specification Section 00820G.

PART 3 EXECUTION

3.01 INSTALLATION

A. Items shall be uncrated, assembled as required, and placed or attached where directed.

END OF SECTION

SECTION 11610

MAGNETIC ION-EXCHANGE (MIEX) TREATMENT SYSTEM

PART 1 GENERAL

1.01 DESCRIPTION

A. This section of the specification covers all labor, materials, equipment, and appurtenances required to furnish, provide installation and start-up assistance, training, and testing of a fully automatic magnetic ion exchange (MIEX) system, complete and operable, as described herein and as required by the Contract Documents.

B. The equipment and processes specified herein is based on a MIEX ion exchange treatment system furnished by IXOM Watercare Incorporated, which utilizes magnetic ion exchange resin. The MIEX process was piloted and received approval by the Massachusetts Department of Environmental Protection (MassDEP) for use by the Owner with the required MassDEP New Technology Approval. Any manufacturer other than IXOM Watercare Incorporated shall adhere to the requirements outlined in paragraph 1.03 – QUALITY ASSURANCE.

C. The MIEX equipment is designed to effectively remove organic carbon (TOC) as a treatment step in the overall WTP treatment scheme. The MIEX treatment process shall utilize three (3) continuous flow contactors in a 3 x 50% design, allowing uninterrupted flow, redundancy, and a consistent water quality. Auxiliary equipment to regenerate resin shall also be provided. The MIEX treatment system shall consist of the following equipment and appurtenances:

1. One (1) Raw Water standpipe
2. Three (3) Contactor Tanks
3. One (1) Loaded Resin Tank
4. One (1) Fresh Resin Pump Skid
5. One (1) Salt Saturator Pump Skid
6. Two (2) Regeneration Skids
7. One (1) Recycle Brine Tank
8. One (1) Recycle Brine Pump Skid
9. One (1) Virgin Resin Skid
10. Two (2) Air Compressors
11. One (1) Salt Saturator Tank
12. One (1) elevated FRP access platform for the regeneration skids
13. One (1) elevated FRP access platform for the contactors and loaded resin tank.
14. Initial MIEX® Resin Supply
15. Initial Salt Supply
16. Valves
17. Piping
18. MIEX System Instrumentation and Electrical Controls

D. The system shall operate using automated controls. The following functions shall be fully automatic, requiring no physical labor to execute the following tasks:

1. Regeneration of saturated resin including, but not limited to, resin transfer, draining of regen vessels, flushing of resin, and recirculation.
2. Brine recycle operations.

3. Switching of duty-standby status of the three contactors.
4. Monitoring and alarming of MIEX process variables, measured through online instrumentation.
5. Interfacing with SCADA system for start-stop, setpoint adjustment, and alarming.

E. The MIEX system control logic shall be provided by an Allen-Bradley programmable logic controller (PLC) for compatibility with the Owner's SCADA system. The PLC shall be protected by a surge suppressor. Operator access to controller registers shall be by touch pad type interface with digital display mounted on a MIEX Main Control Panel (MMCP). The MMCP shall include a UPS sized to power the PLC, OIT, loop power supplies and control devices within the panel for a minimum of 30 minutes.

F. The Manufacturer shall provide project design engineering including, but not limited to, compilation of P&ID, outline drawings, a complete operating manual and electric/pneumatic schematics, controls, PLC and screen software programs.

G. The Manufacturer shall provide project support including, but not limited to, installation support, onsite startup and commissioning services, and training (number of days on site for various visits outline in this specification).

H. The Contractor shall install equipment and interconnecting piping in accordance with the Drawings and Specifications.

I. Electrical Contractor shall install control panels and provide conduit and power and control wiring in accordance with the Drawings and Specifications.

J. All labor, materials, and consumables not explicitly called out as provided by "Manufacturer", needed to provide a complete and operable MIEX system in accordance with these specifications shall be provided by the Contractor.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. The following items are a part of the contract work but are specified elsewhere herein:
1. Concrete work is specified under Division 3.
2. Electrical work specified under Division 16.
3. Painting is specified under Division 9.
4. Process Piping and Valves are specified under Division 15.
5. Instrumentation and Control is specified under Section 13100.
6. Above ground Fiberglass Reinforced Tanks are specified under Section 11611.

1.03 QUALITY ASSURANCE

A. The equipment specified shall be the product of a company experienced in the design and manufacture of magnetic ion exchange resin. The minimum acceptable qualifications shall be five (5) years of continuous manufacturing of ion exchange systems, have at least five (5) similar installations, and a minimum five (5) installations operating at expected bed volumes regeneration rates equal to or higher than the regeneration rate specified. This list shall also include location, customer with contact person and phone number, unit size, capacity in GPM, and year installed.

B. The MIEX system shall be furnished by a single manufacturer, IXOM Watercare Incorporated, or approved equal. As this system design is based on a pilot study using MIEX® resin, suppliers other than the above specifically named, shall submit for examination detailed drawings and specifications of their system, using MIEX® resin meeting the conditions established in the pilot study.

C. Use adequate numbers of skilled work persons who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.04 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
   1. Process design submittals including the following
      a. Process and instrumentation drawings (P&IDs) showing all components of the MIEX system and all ancillary equipment being provided and/or controlled by the MIEX system PLC.
      b. Equipment summary schedule.
      c. Mechanical valve schedule.
      d. Process instrument schedule.
      e. All process equipment supplier datasheets (agitators, pumps, valves, instruments, package equipment).
   2. Contactor and Raw Water Standpipe equipment submittal including the following:
      a. Overall contactor vessels internal equipment drawing(s).
      b. Influent water distributor drawing(s).
      c. Tube settler modules and support drawing(s).
      d. Resin recycle air lift pump(s), guide box and supports drawing(s).
      e. Resin sample sink(s) drawing(s).
      f. Loaded resin tank drawings(s).
      g. Stairs and platform drawing(s).
      h. Influent water standpipe mounting plate details including the number, size, and spacing of necessary anchor bolts, standpipe weight, design overturning moment, load assumptions, and base plate thickness calculations.
   3. Regeneration Equipment submittals including the following:
      a. General arrangement drawing of the complete resin regeneration system.
      b. General arrangement drawings of regeneration tanks, brine recycle tank, saturated, and salt tank.
      c. General arrangement drawing of virgin resin skid.
      d. Stairs and platform drawing(s).
   4. Electrical equipment submittals including the following:
      a. One line power and instrumentation drawings
      b. Electrical panel layout drawings and bill of materials.
      c. Electrical panel wiring drawings showing all field wiring from panel(s) to field devices.
      d. System controls narrative including alarms list, SCADA interface description, and HMI graphics.

4. Upon Substantial Completion, as built, non-password protected (unlocked), copies of the PLC and HMI software, containing all code documentation such as rung comments and tag descriptions, shall be provided to the Owner, at no additional cost, for use by their controls integrator to maintain and service the MIEX system.
5. Catalog cut sheets for all control valves, actuators, manual valves, instrumentation, control components, and all other equipment items included.
6. Materials of construction for all major components, surface preparation and painting.
7. Overall dimensions, site interface connections, and weights for all MIEX system equipment.
8. Elevation and plan views including general arrangement drawings of the MIEX system, including the location and orientation of all nozzles, manways, gravity overflows, and connections.
9. Operation and maintenance manuals.

B. The equipment to be furnished under this section shall be coordinated with all applicable structural and mechanical process drawings, including addenda.
1. If no changes are required, provide a statement that no changes are required.
2. If changes are required, furnish marked up drawings or statement detailing the modifications necessary for the equipment proposed.

Failure to include all drawings or a statement applicable to the equipment specified in this section will result in submittal return without review until a complete package is submitted.

C. A copy of this specification section with addenda, with each paragraph check-marked to indicate specification compliance or marked and indexed to indicate requested deviations and clarifications from the specified requirements.
1. If deviations and clarifications form the specifications are indicated, therefore requested by the Contractor, provide a detailed written justification for each deviation and clarification.

Failure to include a copy of the marked-up specification sections and or the detailed justifications for any requested deviation or clarification will result in submittal return without review until marked up specifications and justifications are submitted in a complete package.

D. The Operation and Maintenance Manuals shall include:
1. Manufacturer's instructions for equipment installation, startup, operation, preventive maintenance, servicing, and troubleshooting procedures.
2. MIEX system data sheets, control panel wiring, process logic control, etc. and final as-built drawings of all equipment.
3. Standard operating procedures, written as a series of sequential work instruction steps, describing all routine tasks required by plant operations staff to operate and maintain the equipment.
4. Name, address, and telephone number of factory service technician.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store contactors, tanks, skids, media, valves, piping, and ancillary components on site according to Manufacturer's recommendations.

B. Prior to shipment of the equipment the Manufacturer shall coordinate and schedule an onsite factory inspection of the equipment at the discretion of the Owner and Engineer. If the onsite factory inspection is waived, sufficient digital photos must be made available prior to shipment. Shipment will not occur until authorization has been provided by the Engineer.

1.06 PERFORMANCE REQUIREMENTS

A. System Water Quality Requirements
1. Source water supplied to the MIEX system shall be slow sand filter effluent as detailed in the pilot testing report.
2. Anticipated MIEX System Influent Water Quality:
   a. Total Organic Carbon (TOC) - 2.0 to 10.0 mg/l
   b. Manganese – less than 1.0 mg/l
   c. Iron – less than 0.5 mg/l
   d. Inlet Sulfate – less than 25 mg/L
   e. pH – 5.5 to 8.5
   f. Temperature – 33 ^{o}F to 70 ^{o}F
   g. Nitrates (As N) - less than 10 mg/L.
3. Plant Effluent Guarantee. Provided that the feed water is within the above ranges, the MIEX system shall produce contactor effluent with the following quality:

   a. Effluent shall meet or exceed the TOC Removal Requirements for Enhanced Softening Systems Using Surface Water or Groundwater Under the Direct Influence of Surface Water and Using Conventional Treatment as defined in Massachusetts Drinking Water Regulations (310 CMR 22.00) and summarized in the table below for all samples collected:

Required Removal of TOC by Enhanced Softening for Systems Using Surface Water or Groundwater Under the Direct Influence of Surface Water and Using Conventional Treatment			
Source-water TOC, mg/L	Source-water alkalinity, mg/L as $CaCO_3$		
	0-60	>60-120	>120
>2.0-4.0	35.0%	25.0%	15.0%
>4.0-8.0	45.0%	35.0%	25.0%
>8.0	50.0%	40.0%	30.0%

   b. TOC – If the Influent TOC is equal to or greater than 5 mg/L, the MIEX process shall remove at least 65% of the TOC from the influent at 1,000 bed volume treatment rate (BVTR) over a seven (7) day average. If the Influent TOC is less than 5 mg/L, the effluent TOC must be reduced to less than 1.8 mg/L over a seven (7) day average with removal percentage defined per the equation below:

$$Removal\ (\%) = 1 - \frac{Effluent\ TOC\ (\frac{mg}{L})}{Influent\ TOC\ (\frac{mg}{L})}$$

c. Sodium – The average amount of sodium added by the MIEX process shall be less than 10 mg/l, when comparing effluent to influent concentrations. Up to 14 staged samples may be required to provide adequate averaging.

c. Chloride - The average amount of chloride added by the MIEX process shall be less than 12 mg/l, when comparing effluent to influent concentrations. Up to 14 staged samples may be required to provide adequate averaging.

B. System Design and Performance Requirements

1. The MIEX system shall be designed to:

a. Treat influent flowrates of up to and including of 2.0 million gallons per day (MGD) at 1,000 BVTR.

b. Produce no more than 550 gallons per day of brine per MGD treated.

c. Require less than 490 pounds per day per MGD treated of NSF grade, dry sodium chloride salt crystals.

d. Require a regeneration frequency of not less than 1,000 bed volumes processed to achieve effluent TOC criteria.

e. Require less than 7,500 gallons per day per MGD treated of water used for all MIEX process ancillary operations such as but not limited to regenerations, resin transfers, and flushing.

f. Consist of three (3) contactors to provide 3 x 50% design.

d. Require less than 2.0 gallons of fresh resin per million gallons treated.

1.07 SEISMIC DESIGN REQUIREMENTS:

A. Conform to the requirements indicated on the structural drawings.

B. The Contractor shall conform to the seismic design requirements for this project and for the work of this specification section.

C. Provide all equipment bases, anchorage, supports and foundations designed in accordance with the seismic requirements indicated and specified.

PART 2 PRODUCTS

2.01 BABA CLASSIFICATION

A. The MIEX System shall be classified as one complete and single “manufactured product” as it relates to Build America Buy America (BABA) Act compliance defined in Specification Section 00820G. The list of products below shall be considered “components” of this manufactured product as it relates to BABA compliance. Due to the specific equipment requirements for the MIEX System, a BABA waiver through the USEPA will be applied for by the Owner for the MIEX System, and the contractor shall obtain standard MIEX equipment as included herein.

2.02 PREFILTERED WATER STANDPIPE

A. The Manufacturer shall provide one (1) prefiltered water standpipe, common to the entire MIEX system.

B. Prefiltered water standpipe shall be provided which meets the following criteria:
   1. Constructed from 36" nominal bore, 304 SCH 10 SS.
   2. Designed to be vertically mounted, with the top open to atmosphere and bottom anchored to the floor.
   3. The Standpipe shall be provided with an integral base made from of 3/4" 304 SS plate to allow the bottom to be anchored to a concrete floor with quantity up to 12 – 3/4" x 6" anchor bolts. Baseplate shall be provided by the Manufacturer. Anchor bolts to be specified by Manufacturer and provided by Contractor. It is responsibility of the Manufacturer to design the base plate to be compatible with the concrete slab design and safely transmit the maximum overturning moment loads imposed from the pipe to the concrete base. The base plate shall be designed such that the moment of stability is greater than the overturning moment due to all reasonable forces such as wind, seismic requirements, and inadvertent forces from maintenance activities such as the removal of piping.
   4. Shall have an overall height of 23'-3" including the baseplate in accordance with the plans.

C. The prefiltered water standpipe shall have the following process connections mounted at the height and orientation as shown on the plans.
   1. 1 x 12" 150# ANSI Flange (Overflow)
   2. 1 x 12" 150# ANSI Flange (Inlet)
   3. 3 x 10" 150# ANSI Flange (Outlet)
   4. 1 x 3" 150# ANSI Flange (Fresh Resin Inlet)
   5. 1 x 2" 150# ANSI Flange (Carrier Water)
   6. 1 x 4" 150# ANSI Flange (Resin In)
   7. 1 x 2" 150# ANSI Flange (Drain)
   8. 1 x 1" NPT Coupling (Level instrument)
   9. 1 x 6" 150# ANSI flange (Bottom hand-hole)

D. All process connections shall be welded to prefiltered water standpipe to achieve a minimum pressure rating of 65 psi.

E. The prefiltered water standpipe shall be supplied with the following ancillary components shipped loose for installation by the Contractor.
   1. One (1) Liquid Level Pressure Transmitter.
      a. Shall be IFM Effector model PN2697.

2.03 CONTACTORS

A. The Manufacturer shall provide three (3) Contactor tanks. The contactor tanks are where prefiltered water is in contact with MIEX resin in an up-flow path, before overflowing as effluent. Each contactor tank:
   1. Shall be constructed from fiberglass reinforced plastic (FRP) in accordance with specification section 11611 (Fiberglass Reinforced Plastic Tanks).
   2. Shall be provided with sufficient number of 304SS lifting lugs designed to support the entire weight of empty tank for offloading and placement.

3. Shall be supplied with the necessary influent, effluent, resin sample, overflow, and drain process connections fitted to vessel.
    a. Flanges shall be used for process connections 2" or greater
    b. For process connections less than 2" threaded fittings may be used
4. Shall be supplied with 24" side manway.

B. Each Contactor tank shall be constructed to meet the following dimensional requirements:
1. Inside Diameter = 11 feet
2. Overall Height = 19.5 feet

C. Each contactor tank shall be provided with the following process connections affixed and mounted in accordance with the process drawings:
1. 1 x 8" #150 ANSI Flange (Raw Water Inlet)
2. 4 x 1" FPT couplings (Sample Ports)
3. 2 x 3" 150# ANSI Flange (drains)
4. 1 x 20" 150# ANSI Flange (Effluent Outlet)
5. 1 x 3" 150# ANSI Flange (Fresh Resin Inlet)
6. 1 x 2" 150# ANSI Flange (Loaded Resin Outlet)
7. 1 x 1" 150# ANSI Flange (High Level Switch)

D. Each contactor tank shall be supplied with the following ancillary components shipped loose for installation by the Contractor.
1. Inlet distributor
2. Tube settlers and supports
3. Effluent Troughs
4. High-level switch
    a. Shall be IFM Effector model LMT105
5. Sample Sink Assembly
6. Recirculation Pump
    a. Shall be Grundfos model CR65-1-1 A-G-A-E-HQQE
    b. Shall be supplied with a factory supplied and mounted: 3phase, 60 hertz, 480VAC, TEFC motor.
    c. Shall be controlled by a Manufacturer supplied VFD to be located in the MIEX Main Control Panel (MMCP).
7. One Circulation Standpipe Pressure transmitter
    a. Shall be IFM Effector model number PN2697.
8. One Circulation Pump Pressure Transmitter
    a. Shall be IFM Effector model number PN2696.
9. One (1) Recirculation flow transmitter
    a. Shall be GF Signet type 2551 model number 3-2551-P1-42 or Seametrics iMAG4700p.
    b. Shall be supplied with 6" Saddle Tee for mounting.
10. One (1) Loaded Resin Transfer Line Flow Switch
    a. Shall be IFM Effector model number SR5900.
11. Shipped loose Valves
    a. Refer to the MIEX valve schedule in Appendix E for list, model, and size of all MIEX Manufacturer supplied contactor valves.
    b. Shipped loose valves will be supplied by Manufacturer for site installation by the Contractor. The Contractor will be responsible for the supply of any necessary mounting hardware such as flanges, gaskets, and flange bolting hardware.

E. Contactor/Contractor Piping
   1. Piping not explicitly referenced as “Manufacturer Supplied” above shall be the responsibility of the Contractor in accordance with the plans and specifications.

F. The Contactors shall be provided with a remote I/O panel, defined throughout the plans and specifications as MIEX Local Control Panel No. 1, or MLCP-1.
   1. MLCP-1 shall be shipped loose for installation by the Electrical Contractor.

2.04 LOADED RESIN TANK

A. The Manufacturer shall provide one (1) loaded resin tank common to all contactors. The loaded resin tank accumulates and decants resin loaded with TOC from the contactors prior to regeneration.
   1. The tank shall be Ace-Roto Mold model number CB1000-64.
   2. Shall be provided with the necessary influent, effluent, vent, overflow, and drain process connections fitted to vessel.
      a. Flanges shall be used for process connections 2” or greater,
      b. For process connections less than 2” threaded fittings may be used.
   3. Shall be provided with a tank stand made from painted carbon steel, procured as a complete assembly from the tank manufacturer.
   4. Shall be provided with a removal lid to access the inside of the tank for maintenance.
   5. Shall be provided with spare ring.
   6. Additional supports to achieve tank elevation and mount to platform shall be provided by Manufacturer.

B. The loaded resin tank shall be constructed to meet the following dimensional requirements (approximate):
   1. Diameter = 65 inches
   2. Overall Tank Height = 98 inches (excludes support stand)
   3. Shall contain a working volume of 800 gallons
   4. Shall have a conical bottom.

C. The loaded resin tank shall be provided with the following process connections affixed and integrally mounted in accordance with the process drawings:
   1. 1 x 4” 150# ANSI Flange (Overflow to prefiltered water standpipe)
   2. 1 x 4” 150# ANSI Flange (Loaded resin inlet from air-lift pumps)
   3. 1 x 2” 150# ANSI Flange (Service water inlet)
   4. 1 x 3” 150# ANSI Flange (Outlet)

D. The loaded resin tank shall be supplied with the following ancillary components shipped loose for installation by the Contractor.
   1. Shipped loose valves.
      a. Refer to Appendix E for list, model, and size of all MIEX system valves.
      b. Shipped loose valves will be supplied by Manufacturer for site installation by the Contractor. The Contractor will be responsible for the supply of any necessary mounting hardware such as flanges, gaskets, and flange bolting hardware.

E. Loaded Resin Tank Piping
1. Piping not explicitly referenced as “Manufacturer” supplied above shall be the responsibility of the Contractor in accordance with the plans and specifications.

2.05 FRESH RESIN PUMP SKID

A. The Manufacturer shall provide with one (1) fresh resin pump skid. The fresh resin pump skid shall provide the necessary hardware and functionality to send batches of regenerated, or fresh resin back into the prefiltered water standpipe. Each fresh resin pump skid shall be provided with the following components:
1. Two (2) parallel transfer pumps
a. Shall be Discflo Model number GPI2015-8-2HHD.
b. Shall be configured to run duty-standby
c. Shall have Duplex Stainless casing and impeller.
d. Shall be supplied with a factory supplied and mounted: 3phase, 60 hertz, 480VAC, TEFC motor.
e. Shall be controlled by a Manufacturer supplied VFD to be located in the MIEX Main Control Panel (MMCP).
2. One (1) pressure transmitter
a. Shall be IFM Effector Model PN2696
3. One (1) conductivity sensor transmitter
a. Shall be IFM Effector LDL Series model LDL2200
b. Shall be ranged from 0.1 to 1,000 mS/cm.
4. Valves
a. Refer to Appendix E for list, model, and size of all MIEX system valves.
5. Skid Piping
a. Shall be PVC Schedule 80.
b. Shall be provided in accordance with specification section 15104.

B. All Fresh Resin Pump Skid components shall be supplied from the Manufacturer as a complete assembly, affixed and contained within an aluminum frame conforming to the following specifications:
1. Length = 72 inches (approximate)
2. Width = 42 inches (approximate)
3. Aluminum shall conform to ASTM B308 (I-Beams, channels, angles and ASTM B221 (square tube).

C. The fresh resin pump skid shall be provided by the Manufacturer with the following process connections affixed and integrally mounted in accordance with the process drawings:
1. 1 x 1/2” FNPT (Pump seal water flush)
2. 1 x 3” 150# ANSI Flange (Fresh resin suction from Regeneration Tanks)
3. 1 x 3” 150# ANSI Flange (Fresh Resin Outlet to Raw Water Standpipe)

2.06 SALT SATURATOR PUMP SKID

A. The Salt Saturator Skid transfers fresh salt into the regeneration system. The Manufacturer shall provide this skid with the following components:
1. Two (2) magnetic drive centrifugal pumps
a. Shall be Iwaki Model MX-401CV6

b. Shall be supplied with a factory supplied and mounted: 3phase, 60 hertz, 480VAC, TEFC motor.
c. Shall be controlled by a Manufacturer supplied VFD to be located in the MIEX Main Control Panel (MMCP).

2. One (1) pressure transmitter
a. Shall be IFM Effector model PN2696.

3. Valves
a. Refer to Appendix E MIEX Valve Schedule for list, model, and size of all MIEX system valves.

4. Skid Piping
a. Shall be provided in accordance with specification section 15104.
b. Shall be Schedule 80 PVC pipe.

B. All Salt Saturator Pump Skid Components shall be supplied from the Manufacturer as a complete assembly, affixed and contained within an aluminum frame conforming to the following specifications:
1. Length = 72 inches (approximate)
2. Width = 30 inches (approximate)
3. Aluminum shall conform to ASTM B308 (I-Beams, channels, angles and ASTM B221 (square tube).

C. The Salt Saturator Pump Skid shall be provided by the Manufacturer with the following process connections affixed and integrally mounted in accordance with the process drawings:
1. 1 x 2" 150# ANSI Flange (Saturated Salt suction from tank)
2. 1 x 2" 150# ANSI Flange (Saturated salt discharge)

D. The Salt Saturator Pump Skid shall be provided with a remote I/O panel, defined throughout the plans and specifications as MIEX Local Control Panel No. 4, or MLCP-4.
1. MLCP-4 shall be integrally mounted to the skid frame.

2.07 REGENERATION SKIDS

A. The Manufacturer shall provide two (2) regeneration skids. The regeneration skids provide the necessary hardware and functionality to regenerate resin loaded with TOC by flushing with a sodium chloride solution. Each regeneration skid shall be provided with the following components:
1. One (1) Resin Regeneration Vessel
a. Each resin vessel shall be constructed from fiberglass reinforced plastic (FRP) in accordance with specification section 11610 (Fiberglass Reinforced Plastic Tanks).
b. Shall have the dimensions of 5'-0" internal diameter and 9'-9" overall actual height.
c. Shall be properly supported through an aluminum frame.

2. One (1) Vessel Agitator
a. Shall be SPX/Lightnin model ECL
b. Shall be supplied with a factory supplied and mounted: 3phase, 60 hertz, 480VAC, TEFC motor.
c. Shall be controlled by a vendor supplied VFD to be located in the MIEX Main Control Panel (MMCP).
d. Shall be mounted and affixed to the tank and skid assembly.

3. One (1) Underdrain Pump

a. Shall be an air operated, non-metallic diaphragm pump, Wilden model number P200/PKPP/EPS/EP/PTV.
b. Shall be provided with pulsation dampener, model number SD-PCP-NE-TV-502.

4. One (1) Vessel Level Transmitter
   a. Shall be Endress and Hauser Level Flex FMP51.
5. One (1) Vessel Underdrain Conductivity Probe and Transmitter
   a. Shall be IFM Effector LDL220 series.
6. One (1) Vessel High Level Switch
   a. Shall be IFM Effector LMT105 switch.
7. One (1) Tank Inlet Flow Transmitter
   a. Shall be GF Signet model 2551.
8. One (1) Tank Underdrain Pressure/Vacuum Indicator
   a. Shall be Wika type 233.53.
9. Valves
   a. Shall be Schedule 80 PVC.
   b. Refer to MIEX Valve List in Appendix E for model and size of all MIEX system valves.
10. Skid Piping
    a. Shall be provided in accordance with specification section 15104.
    b. Shall be Schedule 80 PVC pipe.
11. All components on each Regeneration skid shall be supplied from the Manufacturer as complete assemblies, with each respective skid affixed to and contained within an aluminum frame conforming to the following specifications:
    a. Length = 150 inches (approximate)
    b. Width = 85 inches (approximate)
    c. Aluminum shall conform to ASTM B308 (I-Beams, channels, angles and ASTM B221 (square tube)

B. Each Resin Regeneration Skid shall be provided by the Manufacturer with the following process connections affixed and integrally mounted in accordance with the process drawings:
1. 2" 150# ANSI Flange (Virgin Resin Inlet Header)
2. 3" 150# ANSI Flange (Loaded Resin Inlet Header)
3. 2" 150# ANSI Flange (Sat Brine Inlet Header)
4. 2" 150# ANSI Flange (Recycle Brine Inlet Header)
5. 2" 150# ANSI Flange (Service Water Inlet Header)
6. 3" 150# ANSI Flange (Regenerated Resin Outlet Header)
7. 2" 150# ANSI Flange (Recycle Brine Discharge Header)
8. 2" 150# ANSI Flange (Carrier Water Discharge Header)
9. 2" 150# ANSI Flange (Waste Discharge Brine Header)
10. 1" #150 ANSI Flange (Compressed Air Inlet Header)

C. The Manufacturer shall provide each Regeneration Skid with a remote I/O panel, defined throughout the plans and specifications as MIEX Local Control Panel No. 2 (MLCP-2) for Regeneration System No. 1 and (MLCP-3) for Regeneration System No. 2.
1. Each MLCP shall be integrally mounted to the skid frame.
2. MLCP-3 shall contain all the I/O to accommodate the instrumentation on the Fresh Resin Pump skid.

2.08 RECYCLE BRINE TANK

A. The Manufacturer shall provide one (1) Recycle Brine Tank.
   1. The tank shall be Assman model number ICT1000
   2. Shall be provided with the necessary influent, effluent, vent, overflow, and drain process connections fitted to vessel.
      a. Flanges shall be used for process connections 2" or greater,
      b. For process connections less than 2" threaded fittings may be used.
   3. Shall be provided with a tank stand made from painted carbon steel, procured as a complete assembly from the tank manufacturer.
   4. Shall be provided with a removal lid to access the inside of the tank for maintenance.
   5. One (1) Level Switch
      a. Shall be IFM Effector Model Number LMT105
   6. One (1) Pressure/Level Transmitter
      a. Shall be IFM Effector Model Number PN2697.
   7. Additional supports to mount to platform shall be provided by Manufacturer.

B. The Recycle Brine Tank shall be constructed to meet the following dimensional requirements:
   1. Diameter = 5 feet - 4 inches
   2. Height = 6 feet - 0 inches
   3. Shall contain a working volume of approximately 800 gallons.

A. The Recycle Brine Tank shall be provided, by the Manufacturer, with the following process connections affixed and integrally mounted in accordance with the process drawings:
   1. 1 x 3" 150# ANSI Flange (Outlet)
   2. 1 x 4" 150# ANSI Flange (Overflow)
   3. 2 x 1" 150# ANSI Flange (Instrumentation Connections)
   4. 2 x 2" 150# ANSI Flange (Inlets)

B. The Recycle Brine tank shall be supplied, by the Manufacturer, with the following ancillary components shipped loose for installation by the Contractor.
   1. Shipped loose valves
      a. Refer to Appendix E MIEX Valve Schedule for the list, model, and size of all MIEX system valves.

2.09 RECYCLE BRINE PUMP SKID

A. The Recycle Brine Pump Skid transfers sodium chloride solution, called brine, into the regeneration system. It shall be provided by the Manufacturer, with the following components:
   1. Two (2) parallel transfer pumps
      a. Shall be Iwaki Model MX-401CV6
      b. Shall be configured to run duty-standby.
      c. Shall be supplied with a factory supplied and mounted: 3phase, 60 hertz, 480VAC, TEFC motor.
      d. Shall be controlled by a vendor supplied VFD to be located in the MIEX Main Control Panel (MMCP).
   2. One (1) pressure transmitter
      a. Shall be IFM Effector Model PN2696.
   3. One (1) Conductivity probe and transmitter

a. Shall be IFM Effector Model LDL220.

4. Valves
   a. Refer to Appendix E MIEX Valve Schedule for list, model, and size of all MIEX system valves.
5. Skid Piping
   a. Shall be provided in accordance with specification section 15104.
   b. Shall be Schedule 80 PVC pipe.

B. All Recycle Brine Skid Components shall be supplied from the Manufacturer as a complete assembly, affixed and contained within an aluminum frame conforming to the following specifications:
1. Length = 75 inches (approximate)
2. Width = 30 inches (approximate)
3. Aluminum shall conform to ASTM B308 (I-Beams, channels, angles and ASTM B221 (square tube).

C. The Recycle Brine Skid shall be provided by the Manufacturer with the following process connections affixed and integrally mounted in accordance with the process drawings:
1. 1 x 2" 150# ANSI Flange (Inlet Brine)
2. 1 x 2" 150# ANSI Flange (Pump discharge back to tank)
3. 1 x 2" 150# ANSI Flange (Exit Brine)

D. The Recycle Brine Skid shall be provided by the Manufacturer with a remote I/O panel, defined throughout the plans and specifications as MIEX Local Control Panel No. 5, or MLCP-5.
1. MLCP-5 shall be integrally mounted to the skid frame.

2.10 VIRGIN RESIN LOADING SKID

A. The Virgin Resin Loading skid shall add resin into the regeneration system. It shall be provided by the Manufacturer with the following components:
1. One (1) suction nozzle and spray wand
   a. Shall be as Manufactured by IXOM Watercare.
2. One (1) pressure indicator
   a. Shall be Wika type 233.53.
   b. Shall have a range of 0-100 psi.
3. One (1) water flow indicator
   a. Shall be Hedland EZ Flowmeter or approved equal ranged for 7 to 75 gpm.
4. One (1) Eductor
   a. Shall be Miller Plastics rated for 25 gpm at 50 psi.
5. Valves
   a. Refer to MIEX Valve Schedule in Appendix E for list, model, and size of all MIEX system valves.
6. Skid Piping
   a. Shall be provided in accordance with specification section 15104.
   b. Shall be Schedule 80 PVC pipe and hoses.

B. All Virgin Resin Loading Skid Components shall be supplied from the Manufacturer as a complete assembly, affixed and contained within an aluminum frame conforming to the following specifications:
1. Length = 60 inches (approximate)

2. Width = 18 inches (approximate)
3. Aluminum shall conform to ASTM B308 (I-Beams, channels, angles and ASTM B221 (square tube)

D. The Manufacturer shall provide the Virgin Resin Loading Skid with the following process connections affixed and integrally mounted in accordance with the plans:
1. 2 x 1.5" Female CAM Lock (flexible Hosing to Resin Tote)
2. 1 x 2" 150# ANSI Flange (Pump discharge back to tank)
3. 1 x 2" 150# ANSI Flange (Exit Brine)

2.11 AIR COMPRESSORS

A. The Manufacturer shall provide two (2) air compressors. The air compressors provide the instrument quality air for all MIEX operations such as actuating pneumatic valves and providing air for resin lift pump. Each air compressor must meet the following criteria:
1. Each compressor shall be sized to meet the entire system demand allowing for duty-standby operation.
2. Provided with controls to interface with the MIEX Control Panel System allowing duty-standby operations and alarm functionality.
3. Shall be Ingersoll Rand model UP6-15-125 air compressor.
4. Shall be supplied with one (1) low sound enclosure.
5. Shall be supplied with one (1) refrigerated air drier.
6. Shall be supplied with one (1) coalescing pre-filter unit (prior to drying).
7. Shall be supplied with pressure transmitter to monitor supply air pressure (common pressure transmitter for both compressors).
8. Shall be supplied with 200-gallon tank.
9. Shall be 15 hp with TEFC motor.
10. Shall be supplied with internal motor starter and controls.
11. Shall be supplied with one (1) set of manual valves.
    a. Refer to Appendix E MIEX Valve Schedule for list, model, and size of all MIEX system valves.
12. Shall have approximate dimensions of 84" length x 40" wide x 60" height

B. The two air compressors shall be controlled from the MMCP with the following functionality:
1. Start/Stop and Duty-Standby status of the two air compressors shall be determined and controlled by the MIEX PLC with periodic switchover to allow for even usage as well as emergency switchover capability.
2. Monitoring and alarming of compressors based on the air pressure transmitter.

2.12 SALT SATURATOR TANK

A. The Manufacturer shall provide one (1) Salt Saturator tank meeting the following requirements
1. Shall be constructed from fiberglass reinforced plastic (FRP) in accordance with specification section 11611 (Fiberglass Reinforced Plastic Tanks).
2. Shall be manufacturer by Mid-Western Fabricator or engineer approved equal.
3. Shall be provided with sufficient number of lifting lugs designed to support the entire weight of empty tank for offloading and placement.

4. Shall be supplied with 24" side manway, access ladder.
5. Shall be sized to contain 30 tons (60,000 lbs.) of dry salt.
6. Shall be constructed of materials and hardware compatible with dry sodium chloride bulk crystals and brine solutions.
7. Shall contain the appropriate nozzles and inlet piping to be able to accept deliveries directly from pneumatic salt delivery tankers.
8. Shall be designed and provided with dust arrestor system(s) to minimize salt dust.
9. Shall be designed and provided with a dual layer media underbed meeting NSF 61 and AWWA B100 standards. Media supplied and installed by Contractor based on Manufacturer recommendations
10. Shall be designed and supplied with 6-inch-wide translucent strip for visual monitoring of salt stock level.

B. Salt Saturator tank shall be constructed to meet the following dimensional requirements:
1. Diameter = 10.0 feet
2. Straight Wall Height = 13.0 feet (total height 14 feet - 2 inches)

C. Each Salt Saturator shall be provided with the following process connections affixed and mounted in accordance with the process drawings by the Manufacturer:
1. 1 x 4" Female CAM Lock (Dry Salt Inlet)
2. 1 x 2" 150# ANSI Flange (Service Water Inlet)
3. 1 x 3" 150# ANSI Flange (Drain Valve)
4. 1 x 1" 150# ANSI Flange (Level Switch)
5. 1 x 1" 150# ANSI Flange (Pressure Transmitter)
6. 1 x 3" 150# ANSI Flange (Outlet Brine)
7. 1 x 8" 150# ANSI Flange (Vent Line)

D. The Manufacturer shall supply the Salt Saturator with the following ancillary components shipped loose for installation by the Contractor.
1. One (1) Liquid Dust Arrestor
2. One (1) Level Switch
   a. Shall be IFM Effector Model LMT105.
3. Two (2) Strainers
   a. Shall be Hayward SB series or approved equal.
4. One (1) Pressure/Level transmitters
   a. Shall be IFM Effector Model 2697.
5. Shipped loose Valves
   a. Refer to Appendix E MIEX Valve Schedule for list, model, and size of all MIEX system valves.
   b. Loose supplied valves supplied by Manufacturer shall be installed by the Contractor, including any necessary mounting hardware such as flanges, bolts and gaskets.
6. Piping
   a. Shall be provided in accordance with specification section 15104.
   b. Shall be Schedule 80 PVC pipe.

2.13 WASTE BRINE FILTER

A. The Manufacturer shall provide one (1) waste brine filter meeting the following requirements
1. Shall be manufactured by Rosedale and shall be model number NC08-15-2P-

3-150-S316-B-N-PB.

2. Shall be sized for 200 micron filters.
3. Shall be provided with drain valve, vent valve, and instrumentation factory mounted.
4. Shall be supplied with 6 month supply of 200-micron filters.

2.14 STAIRS AND PLATFORM FOR REGENERATION SKIDS

A. Stairs and a platform for viewing and access of the two regeneration skids shall be provided by the MIEX Manufacturer meeting the following requirements:

1. Design and provide platforms and stairs as shown on Drawings and as specified herein. The items to be provided under this section include:
   a. Grating and walkway adjacent and over the two regeneration skids. See Drawings.
   b. Stairs, railings, and treads where shown on the drawings.
   c. Guardrails around the perimeter of the grating where required. Railings and guardrails shall be provided to a height of 3'-6" above the platform, or as required by State Building Code, with a 4-inch high kickplate.
   d. All connections, accessories and appurtenances associated with these items.
2. Platforms and Grating shall be provided in accordance with the fiberglass-reinforced plastic (FRP) specifications in Section 06610. Platform fasteners including anchor bolts shall be Type 316 stainless steel.
3. Shall be rated for a 100 PSF live load plus equipment weight.
4. Anticipated platform location, dimensions and elevations are indicated on the Drawings. The exact locations, dimensions, elevations, and clearances of the platforms shall be coordinated with and approved by the Owner and Engineer prior to fabrication. Every reasonable effort shall be made to minimize the number of vertical supports required, to minimize obstruction to the first floor process area. Any changes to the design shall be incorporated by the Contractor at no additional cost to the Owner.
5. Coordinate the layout of grating panels with work of this and other sections to provide openings for approved mechanical equipment and other items which require penetrations or openings in the grating.
6. Platforms, supports, railings and stairs to meet local and state structural and building code, and shall be designed and stamped by a registered Massachusetts structural engineer.

2.15 STAIRS AND PLATFORM FOR CONTACTORS AND LOADED RESIN TANK

A. Stairs and a platform for viewing and access of the three contactors and for the support and access of the loading resin tank shall be provided by the MIEX Manufacturer meeting the following requirements:

1. Design and provide platforms and stairs as shown on Drawings and as specified herein. The items to be provided under this section include:
   a. Grating and walkway adjacent and over the three contactors. This platform shall also support the Resin Transfer Tank. See Drawings.
   b. Stairs, railings, and treads where shown on the drawings.
   c. Guardrails around the perimeter of the grating where required. Railings and guardrails shall be provided to a height of 3'-6" above the platform, or as required by State Building Code, with a 4-inch high kickplate.

d. All connections, accessories and appurtenances associated with these items.

2. Platforms and Grating shall be provided in accordance with the fiberglass-reinforced plastic (FRP) specifications in Section 06610. Platform fasteners including anchor bolts shall be Type 316 stainless steel.
3. Shall be rated for a 100 PSF live load plus equipment weight.
4. Anticipated platform location, dimensions and elevations are indicated on the Drawings. The exact locations, dimensions, elevations, and clearances of the platforms shall be coordinated with and approved by the Owner and Engineer prior to fabrication. Every reasonable effort shall be made to minimize the number of vertical supports required, to minimize obstruction to the first-floor process area. Any changes to the design shall be incorporated by the Contractor at no additional cost to the Owner.
5. Coordinate the layout of grating panels with work of this and other sections to provide openings for approved mechanical equipment and other items which require penetrations or openings in the grating.
6. Platforms, supports, railings and stairs to meet local and state structural and building code, and shall be designed and stamped by a registered Massachusetts structural engineer.

2.16 MIEX® RESIN

A. The Manufacturer shall supply an initial inventory of MIEX® Resin sufficient for all installation activities such as start-up and commissioning and initial WTP operations. A six (6) month supply of resin shall be included as part of this contract and the Manufacturer's scope of supply.
1. Resin shall be supplied in 275-gallon IBC totes.
2. Site unloading, storage and handling of resin by Contractor.

B. MIEX Resin shall be defined as "not an integral part of the structure or permanently affixed to the infrastructure project" as described in the Office of Management and Budget's Memorandum M-22-11 and therefore not required to comply with the BABA requirements defined in Specification Section 00820G.

2.17 REGENERATION SALT

A. The Contractor shall supply sufficient sodium chloride salt for all installation activities such as start-up and commissioning and placing the MIEX system into initial operations.
a. Salt shall be supplied by pneumatic bulk delivery tanker.
b. Salt shall be NSF 60 certified or listed.
c. Salt shall meet the following MIEX criteria (for max. levels of impurities):

Impurity	Maximum Concentration, Dry Weight Basis
Sulphate, as SO_4^{-2}	5,000 ppm
Calcium, as Ca+2	900 ppm
Magnesium, Mg+2	600 ppm
Iron, as Fe+2/Fe+3	30 ppm
Total water insolubles	0.15 % w/w

B. Potential suppliers are:

1. Cargill Salt
   P.O. Box 5621
   Minneapolis, MN 55440
   Phone: 888-385-SALT (7258)
   www.cargill.com/salt
   Contact: Sarah Johnson
   Contact phone number: 952 742-1188
   Contact email address: sarah_johhnson@cargill.com

2. US Salt
   1020 W Black Dog Rd
   Burnsville, MN 55337
   Office: (952) 890-8448
   Email: sales@ussalt.com
   Contact: Patrick Dacey
   Contact phone number: 315 436-3240
   Contact email address: pdacey@usasaltllc.com

C. Regeneration salt shall be defined as "not an integral part of the structure or permanently affixed to the infrastructure project" as described in the Office of Management and Budget's Memorandum M-22-11 and therefore not required to comply with the BABA requirements defined in Specification Section 00820G.

2.18 PIPING AND FITTINGS

A. The Contractor's attention is directed to the fact that a combination of MIEX Manufacturer supplied piping and fittings and Contractor supplied piping and fittings will be required for a complete installation. Refer to the Drawings for details on location of valves and fittings, scope of supply, small diameter piping plan, pipe type and diameter.
   1. Piping to be furnished and installed, skid mounted by the MIEX Manufacturer shall be as noted on the drawings.
   2. Piping to be furnished and installed by the Contractor between skids shall be shown on the drawings.

2.19 VALVES

A. Valves necessary for the operation of the MIEX equipment shall be provided by the MIEX Manufacturer in accordance with the plans and specifications. The MIEX Valve Schedule in Appendix E contains a list of all Manufacturer supplied valves in accordance with the Drawings and Specifications.
   1. The Manufacturer shall supply all the valves in accordance with the plans and specifications. Any valves not identified as "Manufacturer" supplied are the responsibility of the General Contractor.
   2. The Manufacturer shall supply a combination of skid mounted and shipped loose valves for installation by the Contractor. The valve schedule, defines this for each valve with:
      a. "Shipped loose" indicating that the Manufacturer will furnish these valves for installation by Contractor.

b. "Mounted on Skid" indicating that the Manufacturer will supply the valve and install it on the skid including all respective instrumentation and pneumatic connections.

B. All valves shall be tagged with an identifying number that corresponds to the valve number on the Plans in accordance with manufacturer's final valve identifications.
1. Tags shall be 304SS and attached to the valve/actuator with stainless steel chain.

2.20 MIEX SYSTEM ELECTRICAL CONTROLS

A. The MIEX system shall be supplied with a controls system to include all hardware and software as further described herein, to monitor and control the MIEX system as well as communicate with the WTP SCADA system. The MIEX Manufacturer shall provide a control system which meets the following:
1. Shall be provided with an Allen-Bradley processor and touch screen interface to provide automatic process control, visual monitoring, and alarming of the complete MIEX system.
2. Shall be provided with a written description of the control loops, process steps, setpoints, and alarm conditions upon which the system controls are based.
3. Shall be linked via Ethernet to the computerized SCADA main terminal unit that will monitor and control all other functions within the treatment facility.
4. Shall control all MIEX system functionality from a PLC with touch pad interface that shall also be accessible via the SCADA workstation computer.
5. Shall be provided by the MIEX manufacturer, who shall guarantee its operation.
6. Shall provide all necessary logic and sequences to regenerate loaded resin automatically without operator intervention.
7. The MIEX control system shall be designed and supplied using a Main MIEX Control Panel (MMCP) and five (5) MIEX Local Control Panels (MLCPs) utilizing remote I/O panels and feeding the MMCP connected via Ethernet.
8. All Control Panels shall be designed and built in accordance with electrical and controls specifications defined respectively in Divisions 16 and 13 herein.

B. MIEX Main Control Panel (MMCP)
1. The main panel shall be housed in a NEMA 4 enclosure, UL approved and labeled.
2. PLC shall be located in the MMCP. It shall be an Allen-Bradley CompactLogix or ControlLogix, and supplied with appropriate power supply, discrete I/O and analog cards as required.
3. Operator interface HMI shall be a 15" color TFT Touch Screen Allen-Bradley PanelView Plus.
a. All screens shall be provided to the SCADA integrator for replication and display on the SCADA system.
b. Screens should allow setpoint adjustment, alarm reset and history, navigation, visual status of key process parameters such as flowrates and valves.
4. The main control panel shall meet the following sizing requirements:

a. Power Feed: 3 phase, 480VAC, 60 hertz
b. Full Load Amps: 100 amps
c. Length: 112 inches
d. Width: 20 inches
e. Height: 86 inches

5. Shall be designed to be located in the process room and supplied with Air Conditioning (AC) unit mounted to the side of the MMCP.
   a. The AC unit shall be as manufactured by Kooltronic or Engineer approved equal.
   b. The AC unit shall be NEMA 4X rated.
   c. The AC unit shall have the maximum efficiency rating available.
6. Shall contain all necessary hardware such as, relays, auxiliary contacts, transformers, motor starters, breakers and thermal overload protection, etc.
7. Shall be prewired and factory tested to the greatest extent possible.
8. The main control panel shall be supplied with the following VFDs or motor starters, mounted and wired in the MMCP:
   a. VFD for Mixer 1
   b. VFD for Mixer 2
   c. VFD for Fresh Resin Transfer Pump A
   d. VFD for Fresh Resin Transfer Pump B
   e. Motor Starter for Brine Transfer Pump A
   f. Motor Starter for Brine Transfer Pump B
   g. Motor Starter for Saturated Salt Pump A
   h. Motor Starter for Saturated Salt Pump B
   i. VFD for Contactor Recirc Pump 1
   j. VFD for Contactor Recirc Pump 2
   k. VFD for Contactor Recirc Pump 3
9. The MMCP shall be furnished with circuit breakers for the power feed to the two compressors.
10. The MMCP shall be provided with UPS/surge protection sized to provide 30 minutes back-up power for the following:
    a. PLC, OIT, loop power supplies and control devices within the panel.
11. The MMCP shall be supplied in accordance with specification section 13100 (Instrumentation and Controls).
12. The MMCP shall be mounted as shown on the plans.

C. The MIEX System shall be provided with five (5) remote I/O panels, referenced throughout the plans and specifications as MIEX Local control Panels, or MLCPs. These panels are designated as No. 1 thru No. 5 for the following respective pieces of equipment or skids; MLCP No. 1 is assigned to Contactors, MLCP No. 2 is assigned to Regeneration Skid No. 1, MLCP No. 3 is assigned to Regeneration Skid No. 2, MLCP No. 4 to the Salt Skid, and MLCP No. 5 to the Recycle skid.

1. Shall be designed to minimize field wiring between the MIEX supplied equipment skids.
2. Shall be prewired and factory tested to the greatest extent possible.
3. Shall be housed in a NEMA 4X enclosure, UL approved and labeled.
4. Shall be Allen-Bradley, ethernet based remote I/O controls
5. The panels shall meet the following sizing requirements:
   a. Power Feed: 1 phase, 120VAC, 60 hertz
   b. Main Breaker size: 20 amps

c. MLCP No 1. Shall have dimensions of 36 inches wide x 36 inches height x 8 inches depth.
d. All other MLCPs, Nos. 2-5, shall have dimensions of 30 inches wide x 30 inches height x 8 inches depth.

6. Shall contain all necessary hardware such as, relays, auxiliary contacts, transformers, motor starters, analog power supplies, breakers and thermal overload protection, etc.
7. The MIEX Local Control Panels (MLCP) shall be supplied in accordance with specification section 13100 (Instrumentation and Controls)
8. All MLCP panels shall be mounted as shown on the plans.

D. The MIEX System shall be designed and programmed to interface with the WTP SCADA system through produced and consumed tags messaged over ethernet.
1. The MIEX system shall provide an organized table of tags to be read and utilized by the SCADA. These tags shall be provided along with an interface description to allow the SCADA integrator to provide start stop functionality of the equipment feeding and receiving flow from the MIEX system.
2. The MIEX manufacturer shall provide a list of critical information needed from the SCADA integrator to be tabulated to be read from the MCP for MIEX system functionality.
3. The MIEX system shall tabulate all system information such as scaled system instrumentation readings, outputs, valve statuses, setpoints, alarm, system status, accumulators, etc. The table should be documented for use in the SCADA historian by the system controls integrator.

PART 3 EXECUTION

3.01 INSTALLATION

A. The General Contractor shall provide all field labor and equipment for installation of the MIEX system. The General Contractor shall unload, assemble, and install the complete MIEX system including the contactors, which includes piping, valves, instrumentation, accessories and any other equipment pertinent to the system. Electrical and mechanical connections to the equipment and any instruments or monitoring devices shall be provided by the Electrical Contractor or Contractor, respectively, as specified elsewhere.

B. Upon setting tanks, skids, and stairs on equipment pads, the Contractor shall shim the base and pack with non-shrink grout to ensure the vessels are level, and fully supported on the pad.

C. The General Contractor shall install the MIEX equipment in accordance with the plans and specifications and follow Manufacturer's guidelines and recommendations.

D. No form of energy shall be turned on to any part of the MIEX system prior to receipt by the Engineer of a certified statement of approval of the installation from the Contractor containing the MIEX manufacturer's authorization for turning on energy to the system.

E. Prior to loading resin, the MIEX Manufacturer must certify that the MIEX system has been verified as properly installed and resin loading and system commissioning can commence. The statement of approval shall also certify that the MIEX Manufacturer has verified that all specified communications between the MMCP and SCADA system as defined under Section 13100 – Instrumentation and Controls has been coordinated and tested with the SCADA integrator.

3.02 MANUFACTURER'S SERVICES

A. The Manufacturer shall maintain a qualified staff of factory trained field service personnel. This staff shall include regular, full-time employees with suitable training and experience in installation and operation of MIEX equipment.

B. The supervisory service of a factory trained service engineer, who is specifically trained on the equipment being provided, will be available to provide the following services during the contract.
1. Installation Assistance Services
2. Commissioning Services
3. Training Services

C. Scheduling of service is at the discretion of the General Contractor. Unused service time will transfer and be available for subsequent service requirements. Unused service hours will expire 12 months after Substantial Completion.

D. The MIEX Manufacturer shall provide six (6) cumulative 8-hour man days of onsite assistance consisting of up to two (2) trips, during construction to assist the contractor or subcontractor with technical advice on the installation of the major components of the treatment equipment to include:
1. Proper setting of the interior and inter skid piping.
2. Placement of tanks and gravity overflow lines.
3. Proper placement of shipped loose components.
4. Advice on proper electrical valve sequence and methods of protecting all of the equipment prior to placing it into service.
5. Proper installation of tank internals.
6. Proper placement of saturator internals and packing.

C. Upon completion of the installation, Manufacturer's services shall be furnished for all system commissioning activities such as, but not limited to, field acceptance testing, initial start-up, and formal acceptance testing as outlined herein. These services shall be at no cost to the Owner and included with contract price and include travel time and expenses.
1. The manufacturer shall provide a minimum of 21 day(s) onsite to perform these services to be coordinated with the Contractor.
2. The manufacturer shall provide up to three (3) trips to be coordinated with the Contractor.
3. The Manufacturer shall include any additional hours or trips to site, based on past experience, to ensure that the required Manufacturer's services described herein are included with the contract price.

D. In addition, the services of the above field service representative shall be provided for training and instruction of the Owner's personnel in the operation and maintenance of the MIEX treatment equipment as described herein, but as necessary for Owner's full understanding of operations.

3.03 FIELD ACCEPTANCE TESTING

A. Contractor to perform all testing under the direction of manufacturer's field service representative. Notify the field service representative and the Engineer at least (3) weeks before testing begins.
   1. Power the equipment as described herein.
   2. Verify all valves fully open and close before setting position limits.
   3. Test and verify functionality of all instrumentation, equipment, and system controls.
   4. Test all inputs, outputs, OIT screens and pushbuttons on the control panel. Test all equipment in automatic and manual modes.
   5. Make all adjustments necessary to place equipment in specified working order prior to start-up.
   6. Start-up will not be initiated until the calibration and testing of equipment stated above is completed, vendor training has been completed, and all certifications have been submitted.
   7. Completely flush all pipes and the contactor tanks prior to initial startup. Do not use untreated source water. Do not install resin until the piping has been pressure tested, cleaned, and disinfected.

3.04 DISINFECTION

A. At the conclusion of installation and field acceptance testing, and as planned immediately prior to initial start-up, each contactor vessel shall be thoroughly disinfected by chlorination at a concentration of 50 parts per million (ppm) in accordance with AWWA Standards. All start-up and/or disinfection chemicals, etc. shall be provided and disposed of by the General Contractor.

3.05 RESIN LOADING

A. Initial Resin loading shall be performed after disinfection of the contactors.
   1. The Contractor shall provide labor to install the resin under the supervision of the MIEX system manufacturer.
   2. Resin loading related information such as lot number and volumes shall be documented and provided to Engineer.

3.06 INITIAL START-UP

A. Operate units to demonstrate the ability to operate continuously without vibration, jamming, leakage, or overheating and to perform specified functions, after installation, and after manufacturer's field representative check of installed equipment.

B. Clean water from start-up operation shall be discharged to stormwater collection area or as otherwise directed by Engineer.

C. Adjust chemical feed systems and system controls.

D. Collect and properly dispose of all brine waste generated throughout the duration of startup and testing until Substantial Completion.

E. Comply with manufacturer's operating and maintenance instruction.

F. Correct promptly the improper installation of equipment at no additional cost to the Owner.

G. Coordinate with Manufacturer and SCADA Integrator at time of start-up in making of all final adjustments to place equipment in satisfactory working order.

H. Upon acceptance of the water quality by the MassDEP, the MIEX system will be placed in operation.

3.07 TRAINING

A. During various phases of the system installation, the manufacturer shall provide the services of a service engineer for a period of not less than four (4) 8-hour days for instructing the operating personnel.
   1. One day shall be reserved for training of operators prior to powering of equipment and field testing. This training shall include at a minimum:
      a. Location of major pieces of equipment.
      b. Walkthrough of the system instrumentation and piping.
      c. Safety.
   2. A portion of the training shall be conducted while the system is in satisfactory operation during the 7-day performance test described below.
   3. Two days shall be dedicated to a combination of formal classroom training and hands-on training with syllabus to include:
      a. First Principals of Resin and Adsorption Technology
      b. Explanation of various pieces of equipment and functionality
      c. Sequence of Operations and Controls Description
      d. Overview of the Interface Screens
      e. Troubleshooting
      f. Equipment Maintenance
      g. Training on all periodic tasks such as, but not limited to: switching out of filters, replacing resin totes, and drain down of contactor.

B. Contractor shall submit resume and qualifications/certifications of training personnel to Owner for approval 90 days in advance of commencement of training services.

C. In addition to the above training, Contractor shall provide the services of a fully qualified factory-trained representative to provide additional training of new Owner's personnel, or to assist the operators in optimizing MIEX performance. Additional Manufacturer's Services shall consist of not less than three (3) separate 8-hour days, which can be requested at any time by Owner within one (1) year after Substantial Completion.

3.08 PERFORMANCE TESTING

A. The General Contractor for the construction of the water treatment facility shall be required to conduct a 7-day performance test of the entire facility. This will only occur after all the requirements of paragraph 3.01 have been satisfied by the MIEX Manufacturer and within 60-days of initial start-up.

B. Performance testing shall demonstrate conformance with the performance criteria specified under Paragraph 1.06.

1. The water quality performance listed in Paragraph 1.06 shall be determined through measurement by a MassDEP certified lab. The Contractor is responsible for sample collection and costs associated with measurement. The MIEX Manufacturer is granted a minimum of 7 and up to 14 influent and effluent samples to be obtained and reasonably weighted and averaged to demonstrate system performance meets the criteria listed in Paragraph 1.06.A. The set of influent and effluent samples shall include as a minimum:
   a. Total Organic Carbon (TOC)
   b. Total Iron
   c. Total Manganese
   d. Sodium
   e. Chloride
   f. pH
   g. Sulfate
   h. Nitrates
   i. Bromides

2. The system performance parameters listed in paragraph 1.06.B shall be determined through system instrumentation and recorded by the SCADA system through instrumentation described in the plans and specifications. In the event that instrumentation is unavailable to reasonably measure the parameter, the requirement will be considered met. In all other cases, a mass balance consisting of the entirety of the 7-day performance test will be used as the basis to determine conformance.

C. The MIEX Manufacturer shall provide the General Contractor with a contact name and telephone number to assist the Contractor with any problems that may occur during the performance test period.

D. Should the system fail to meet the required performance criteria and such failure is attributed to improper MIEX design and or installation of the MIEX system, all costs associated in correcting the deficiencies and reconducting of the 7-day performance test shall be borne by the Contractor and Manufacturer.

3.10 WARRANTY

A. The equipment supplier shall warrant its equipment for a period of one (1) year after Substantial Completion by the Owner. The Contractor will be responsible for providing the MIEX Manufacturer with the specific date of the start of warranty.

3.11 SERVICE REQUIREMENTS

A. Prior to the end of the warranty period, the equipment supplier shall present in writing to the Owner, optional service and resin supply agreements for one (1) year, three (3) years, and five (5) years.

END OF SECTION

SECTION 11611

ABOVE GRADE FIBERGLASS REINFORCED PLASTIC (FRP) TANKS

PART 1 GENERAL

1.01 DESCRIPTION

A. Work included: Provide fiberglass reinforced plastic (FRP) tanks and accessories, all as required by the Contract Documents.

B. Related Work:
1. Section 03300 Cast-In-Place Concrete
2. Section 15060 Pipe Hangers and Supports
3. Section 15100 Ductile Iron Pipe and Fittings
4. Section 15104 Plastic Pipe and Fittings
5. Section 15110 Valves and Appurtenances

1.02 SUBMITTALS

A. Comply with pertinent provisions of Section 01300.

B. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
1. Materials list of items proposed to be provided under this Section.
2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
3. Shop Drawings in sufficient detail to show fabrication, installation, anchorage and interface of the work of this Section with the work of adjacent trades.
4. Manufacturer's recommended installation procedures which, when approved by the Engineer, will become the basis for accepting or rejecting actual installation procedures used on the Work.
5. Data required to be furnished under Paragraph 1.04 Quality Assurance of the Specification Section.

C. The equipment to be furnished under this section shall be coordinated with all applicable structural and mechanical process drawings, including addenda.
1. If no changes are required, provide a statement that no changes are required.
2. If changes are required, furnish marked up drawings or statement detailing the modifications necessary for the equipment proposed.
3. Failure to include all drawings or a statement applicable to the equipment specified in this section will result in submittal return without review until a complete package is submitted.

D. A copy of this specification section with addenda, with each paragraph check-marked to indicate specification compliance or marked and indexed to indicate requested deviations and clarifications from the specified requirements.
1. If deviations and clarifications form the specifications are indicated, therefore requested by the Contractor, provide a detailed written justification for each deviation and clarification.

2. Failure to include a copy of the marked-up specification sections and or the detailed justifications for any requested deviation or clarification will result in submittal return without review until marked up specifications and justifications are submitted in a complete package.

E. Certification of satisfactory installation shall be provided by the system manufacturer following contractors installation of all equipment.

F. No material furnished under this Specification shall be shipped to the jobsite until submittals have been approved by the Engineer.

1.03 STANDARDS

A. The following reference standards form a part of this specification as referenced:
1. Tank must meet the standards of ANSI/AWWA D120 - Thermosetting Fiberglass-Reinforced Plastic Tanks.
2. Tank manufacturer shall be recognized by Underwriters Laboratories as a manufacturer of tanks listed to the UL-1316 standard.

B. All above grade FRP tanks shall be listed or certified to meet:
1. NSF/ANSI 61: Drinking Water System Components

1.04 QUALITY ASSURANCE.

A. Above grade FRP tanks shall be furnished by a single manufacturer who shall:
1. Furnish proof that supplier has qualified personnel with successful tank design experience by evidencing the ability to furnish FRP tanks in the tank shell material being supplied.
2. Guarantee for one (1) year from the date of acceptance that all equipment is free from defects in design, materials and workmanship.

B. FRP tanks shall be specifically designed for use as resin contactors in the IXOM Watercare MIEX process. IXOM WaterCare is located in Centennial, CO.

C. All paints, coatings and sealants to be in contact with the water shall be NSF 61 approved for use in potable water service.

1.05. DELIVERY, STORAGE AND HANDLING

A. Delivery, storage and handling shall be in accordance with manufacturer's written recommendations.

B. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer.

C. Shipping:
1. Ship equipment, material and spare parts complete except where partial disassembly is required by transportation regulations or for protection of components.
2. Pack spare parts in containers bearing labels clearly designating contents and pieces of equipment for which intended.
3. The Contractor shall obtain spare parts from the manufacturer at the same time as pertaining equipment. The Contractor shall maintain possession of spare parts

until Substantial Completion at which time, all spare parts shall be turned over to the Owner.

D. Receiving:
1. Inspect and inventory items upon delivery to site.
2. Store and safeguard equipment, material and spare parts in accordance with manufacturer's written recommendations and instructions.

PART 2 PRODUCTS

2.01 FRP Tanks

A. Manufacturers
1. Midwestern Fabricators located in Salt Lake City Utah.
2. Engineer approved equal.

B. Tank Design
1. The tank size, fittings and accessories shall be as shown on the drawings.
2. Tank shall be manufactured with structural ribs, as required, which are fabricated as an integral part of the tank wall.
3. Tank shall be manufactured with a laminate consisting of resin and glass fiber reinforcement only. No sand/silica fillers or resin extenders shall be used.
4. Tank shall be vented to atmospheric pressure.
5. Tank shall be capable of handling liquids with specific gravity up to 1.1
6. Tank shall be compatible with liquids identified in the manufacturer's standard limited warranty.

C. Tank Loading Conditions
1. Internal/External Hydrostatic Pressure - Tank shall be designed for at least 2X the maximum liquid volume and a safety factor of 5:1 against general buckling.

D. Tank Accessories
1. Tank anchoring points shall be designed and supplied as integral components of the tank and wound into the FRP as appropriate.
2. Tank shall be supplied with all pipe fittings, hardware, manways. and mounting brackets shown on the plans.
3. All tank accessories shall be factory installed and tested. Field modifications to the FRP tanks are only allowed with approval by the Engineer.

PART 3 EXECUTION

3.01 INSTALLATION

A. TESTING
1. Tank shall be tested according to the tank manufacturer's Installation Manual and Operating Guidelines in effect at time of installation.

B. INSTALLATION

1. Tank shall be installed according to the tank manufacturer's Installation Manual and Operating Guidelines in effect at time of installation.
2. Tank installation process shall be documented in accordance with tank manufactuer Installation Manual and Operating Guidelines.

END OF SECTION

SECTION 11612

BELOW GRADE FIBERGLASS REINFORCED PLASTIC (FRP) TANKS

PART 1 GENERAL

1.01 DESCRIPTION

A. Work included: Provide fiberglass reinforced plastic (FRP) tanks and accessories, all as required by the Contract Documents.

B. Related Work:
1. Section 03300 Cast-In-Place Concrete
2. Section 15060 Pipe Hangers and Supports
3. Section 15100 Ductile Iron Pipe and Fittings
4. Section 15104 Plastic Pipe and Fittings
5. Section 15110 Valves and Appurtenances

1.02 SUBMITTALS

A. Comply with pertinent provisions of Section 01300.

B. Product data: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:
1. Materials list of items proposed to be provided under this Section.
2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
3. Shop Drawings in sufficient detail to show fabrication, installation, anchorage and interface of the work of this Section with the work of adjacent trades.
4. Manufacturer's recommended installation procedures which, when approved by the Engineer, will become the basis for accepting or rejecting actual installation procedures used on the Work.
5. Data required to be furnished under Paragraph 1.05 Quality Assurance of the Specification Section.

C. The equipment to be furnished under this section shall be coordinated with all applicable structural and mechanical process drawings, including addenda.
1. If no changes are required, provide a statement that no changes are required.
2. If changes are required, furnish marked up drawings or statement detailing the modifications necessary for the equipment proposed.
3. Failure to include all drawings or a statement applicable to the equipment specified in this section will result in submittal return without review until a complete package is submitted.

D. A copy of this specification section with addenda, with each paragraph check-marked to indicate specification compliance or marked and indexed to indicate requested deviations and clarifications from the specified requirements.
1. If deviations and clarifications form the specifications are indicated, therefore requested by the Contractor, provide a detailed written justification for each deviation and clarification.

2. Failure to include a copy of the marked-up specification sections and or the detailed justifications for any requested deviation or clarification will result in submittal return without review until marked up specifications and justifications are submitted in a complete package.

E. Certification of satisfactory installation shall be provided by the system manufacturer following contractors installation of all equipment.

F. No material furnished under this Specification shall be shipped to the jobsite until submittals have been approved by the Engineer.

1.03 STANDARDS

A. The following reference standards form a part of this specification as referenced:
1. American Concrete Institute (ACI) standard ACI 318, Building Code Requirements for Structural Concrete.
2. ANSI/AWWA D120 - Thermosetting Fiberglass-Reinforced Plastic Tanks.
3. Tank manufacturer shall be recognized by Underwriters Laboratories as a manufacturer of tanks listed to the UL-1316 standard.

1.04 QUALITY ASSURANCE.

A. Below grade FRP tanks shall be furnished by a single manufacturer who shall:
1. Furnish proof that supplier has qualified personnel with successful tank design experience by evidencing the ability to furnish below-grade, horizontal tanks in the tank shell material being supplied.
2. Guarantee for one (1) year from the date of Substantial Completion that all equipment is free from defects in design, materials and workmanship.

1.05. DELIVERY, STORAGE AND HANDLING

A. Delivery, storage and handling shall be in accordance with manufacturer's written recommendations.

B. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer.

C. Shipping:
1. Ship equipment, material and spare parts complete except where partial disassembly is required by transportation regulations or for protection of components.
2. Pack spare parts in containers bearing labels clearly designating contents and pieces of equipment for which intended.
3. The Contractor shall obtain spare parts from the manufacturer at the same time as pertaining equipment. The Contractor shall maintain possession of spare parts until Substantial Completion at which time, all spare parts shall be turned over to the Owner.

D. Receiving:
1. Inspect and inventory items upon delivery to site.
2. Store and safeguard equipment, material and spare parts in accordance with manufacturer's written recommendations and instructions.

PART 2 PRODUCTS

2.01 BABA CLASSIFICATION

A. Each Underground Storage Tank shall be classified as one complete and single "manufactured product" as it relates to Build America Buy America (BABA) Act compliance defined in Specification Section 00820G. The list of products below shall be considered "components" of this manufactured product as it relates to BABA compliance.

2.02 FRP Tanks

A. Manufacturers
1. Xerxes Corporation located in Minneapolis, MN
2. Engineer approved equal.

B. Tank Design - Fiberglass reinforced plastic (FRP) tanks:
1. The tank size, fittings and accessories shall be as shown on the drawings and be sized to contain at least 32,000 gallons of a 10% sodium chloride brine solution.
2. Tank shall be manufactured with structural ribs which are fabricated as in integral part of the tank wall.
3. Tank shall be manufactured with a laminate consisting of resin and glass fiber reinforcement only. No sand/silica fillers or resin extenders shall be used.
4. Tank shall be vented to atmospheric pressure.
5. Tank shall be capable of handling liquids with specific gravity up to 1.1
6. Tank shall be compatible with liquids identified in the manufacturer's standard limited warranty.
7. Tank shall be designed for frequent empting via vacuum truck.
8. The tank shall be designed as a double-wall vessel as specified and shown on the Drawings
9. Interstitial Space:
   a. The interstitial space between the primary and secondary walls shall be constructed with a glass reinforcement material such as Parabeam, which provides a structural bond between the two tank walls, while creating a defined interstice that allows for free flow of liquid.
   b. A tank top fitting shall be provided to allow for a monitoring sensor to be installed at the bottom of the interstice.
   c. The interstice of the tank shall be designed to withstand 20-psig (138 kPa) pressure.

C. Loading Conditions - Tank shall meet the following design criteria:
1. Internal Load - Tank shall be designed to withstand a 5-psig (35 kPa) air-pressure test with a 5:1 safety factor.
2. Surface Loads - Tank shall be designed to withstand surface H-20 and HS-20 axle loads when properly installed according to manufacturer's current Installation Manual and Operating Guidelines.
3. External Hydrostatic Pressure - Tank shall be designed for 7 feet (2.1 m) of overburden over the top of the tank, the hole fully flooded, and a safety factor of 5:1 against general buckling.

D. Tank Accessories - Industrial Wastewater and Chemical Storage Applications:

1. Tank Anchoring:
   a. Anchor straps shall be as supplied by tank manufacturer and designed for a maximum load of 25,000 lbs (11340 kg).
   b. Galvanized turnbuckles shall be supplied by the tank manufacturer.
   c. Prefabricated concrete anchors shall be supplied by the tank manufacturer, designed to the ACI 318 standard, manufactured with 4,000 psi concrete and shall have adjustable anchor points.
   d. Tank Anchoring to be confirmed with the tank manufacturer.
2. Access Openings:
   a. All access openings shall have a diameter of 30 inches complete with riser, lid and necessary hardware.
3. Attached Access Risers:
   a. Attached access risers shall be PVC or FRP as supplied by tank manufacturer.
   b. Attached access risers shall be 48 inches diameter
   c. Access risers shall be attached to access openings during installation utilizing adhesive or FRP bonding kits as supplied by the tank manufacturer.
4. Piping and Fittings:
   a. Tank shall be equipped with factory-installed threaded fittings, or pipe stubs.
   b. PVC piping shall at a minimum meet the requirements of ANSI Schedule 40.
   c. All flanged nozzles shall be flanged and flat-faced, and conform to Class 150 bolting patterns as specified in ANSI/ASME/ B16.5.
   d. Carbon steel and stainless steel NPT fittings shall withstand a minimum of 150 foot-pounds (203 NM) of torque and 1,000 foot-pounds (1356 NM) of bending, both with a 2:1 safety factor.
5. Manway Openings:
   a. The standard manway shall be flanged, 30 inch I.D. and complete with gaskets, bolts and cover.
   b. Manway openings shall be designed to withstand 5-psig (35 kPa) test pressure with a 5:1 safety factor.
6. Containment Collars and Sumps:
   a. The tank shall have factory installed 48-inch diameter containment collars.
   b. Containment sumps in 48 inches diameter shall be provided by the tank manufacturer and designed for mounting on the containment collars.
   c. Adhesive shall be provided by the tank manufacturer with each containment collar and sump.
   d. Containment collars and sumps shall be designed and supplied as a containment system. Only sumps provided by the manufacturer shall be allowed.
7. Access Ladder
   a. The tank and riser shall be fitted with a permanent fixed ladder to allow for access into the tank.
   b. The tank ladder shall be supplied by the tank manufactured and installed per all manufacturer's guidelines. The ladder shall be 16" wide and provide access from the tank bottom through the riser to the access hatch.
   c. All ladder components must be compatible with the brine solution.

d. The ladder shall meet all OSHA fixed ladder requirements such as but not limited to rung spacing, rung strength, distance from centerline, etc.

PART 3 EXECUTION

3.01 INSTALLATION

A. TESTING
1. Tank shall be tested according to the tank manufacturer's Installation Manual and Operating Guidelines in effect at time of installation.

B. INSTALLATION
1. Tank shall be installed according to the tank manufacturer's Installation Manual and Operating Guidelines in effect at time of installation.
2. Tank installation process shall be documented in accordance with tank manufactuer Installation Manual and Operating Guidelines.

END OF SECTION

INDEX

DIVISION 12 FURNISHINGS

SECTION 12300

BREAK ROOM CASEWORK

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials, and equipment necessary to complete the work of this Section, including but not limited to the following:
   1. Kitchen/Break Room Cabinetry:
      a. Door Style: Wood (Species and style as noted below)
      b. Cabinet Body: MDF.
   2. Kitchen/Break Room Countertops:
      a. Post-formed High Pressure Decorative Laminate

B. Related Work: The following items are not included in this Section and are specified under the designated Sections:
   1. Section 06100 – Rough Carpentry
   2. Section 09650 – Resilient Flooring
   3. Division 15 – Mechanical
   4. Division 16 – Electrical

1.02 REFERENCES

A. ANSI/KCMA A161.1 2000 Performance & Construction Stds. For Kitchen Cabinets- the industry recognized standard for residential cabinet construction.

B. HUD – Severe Use Specifications for Public and Indian Housing – Sept. 1993

C. AWI – American Woodwork Institute- materials and finish grades

D. ANSI161.2 1979 Performance Standards for High Pressure Decorative Laminate Countertops

E. NSF/ANSI 51 Performance Std. For Solid Surface Products in Food Service

F. UL 723,(ASTM E84) Fire Resistance Ratings for Solid Surface Materials

G. Massachusetts DDS Design Guidelines (for Special Needs Housing)

1.03 SUBMITTALS

A. Submit under provisions of Section 01300 - Submittals.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings: Indicate type, location, size, and hand of each component. Include requirements for blocking and relationship with adjacent construction.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors.

E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square representing actual product, color, and patterns.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum ten (10) years experience manufacturing similar products.

B. Installer Qualifications: Minimum two (2) years experience installing similar products.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.06 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: Wood Cabinetry:
   1. Advanta Cabinets - Basis of Design
   2. Echelon Cabinetry
   3. Kraftmaid Cabinets

B. Acceptable Manufacturer: Post-formed High Pressure Decorative Laminate
   1. Pionite
   2. Formica
   3. Wilsonart

2.02 WOOD CABINETRY MATERIALS

A. Exposed face and door materials to consist of the following selections: Birch

B. Plywood: plywood core with Birch facings where exposed.

C. Hardware:

1. Door knobs / pulls: To be chosen from manufacturer's full range of selections.
2. Drawer knobs / pulls: To be chosen from manufacturer's full range of selections.

D. Drawer glides:
1. High-quality epoxy coated steel, Extreme grade, side mounted guides, self-adjusting in mounting brackets. Mounting brackets are screwed to solid pine back hanging rails. Built-in stop, self-closing, and stay- closed features with a 100 lb. rated load capacity.
2. Door hinges: To be chosen from manufacturer's select range of selections.

2.03 WOOD DOOR STYLES

A. Wood Door Style (per Basis of Design Advanta Cabinets*):*
1. Siena 5-PC Birch – 3/4" thick solid birch door frames and drawer fronts / Genuine birch wood veneer recessed flat panel in frame / Assembled with five-piece mortise and tenon joinery / Available in square design for all cabinets; offered with 5-Piece drawer fronts / Standard reveal doors
2. Color: Selected by the Owner.

2.04 FABRICATION

A. Fabricate casework in accordance with ANSI/ KC MA 161. 1 .

B. Fabricate casework utilizing following fabrication requirements for wall, base, tall, and vanity cabinets. Specialty cabinets may vary from specified requirements, using manufacturer's standard fabrication process.

C. Shop assemble cabinet in units of sizes and configurations indicated.

D. Fabricate corners and joints without gaps and in accessible spaces.

E. Fabricate each unit to be rigid, not dependent on adjacent units for stability.

F. Attach corner braces to cabinet corners to ensure cabinet squareness.

2.05 COMPONENTS

A. Extreme Construction Series
1. Front Frames - 3/4" thick kiln dried solid hardwood. Bore and dowel or pocket screw construction frame joinery rein forced with glue and nail. Stiles: 1 1/2" wide. Mulls 3" wide. Rails 1 3/4" wide. Stiles and top and bottom rails dadoed to receive ends, tops, and bottoms.
2. End Panels - Standard: Nominal 1 /2" (12mm) thick, multi -ply Type I exterior glue hardwood plywood, dadoed to receive tops and bottoms. Ends are inserted into dado in face frame and recessed 3/16" and rabbeted to receive backs Upgrade: Nominal 1/2" (12mm) thick, multi-ply hardwood plywood with oak veneer on exterior surface and birch veneer on interior surface. All end panels are constructed with the same joinery as noted above.
3. Top/ Bottom Panels - Nominal 1 /2" (12mm) thick multi-ply hardwood plywood. Tops and bottoms let into end panels, front rails and hang rails, glued and stapled. Bottoms are supported at rear of base cabinets by nominal l /2" thick multi-ply

hardwood plywood.

4. Hanging Rails - Wall cabinets have nominal 3/4" (18mm) thick x 3" high multi-ply hardwood plywood, running full cabinet length at the top and bottom. Base cabinets have nominal 3/4" (18mm) thick x 7 1/4" high solid pine at the top. All hang rails are rabbeted to inset in end panels and to receive backs.
5. Back Panel - Nominal l/4" (6mm) thick, hardwood plywood. Securely glued and stapled to rabbets in end panels and hang rails.
6. Shelves-Nominal 1 /2" (12mm) thick multi-ply hardwood plywood, 10 7/8" deep with hardwood veneer banded front edge. Shelves are fixed into dadoes in end panels on all cabinets.
7. Toe Kick- Toe kick is 4" high and recessed 4". Standard: Nominal 3/4" (18mm) thick, 3-sided ACQ* pressure treated toe board attached inside end panels.
8. Base Corner Braces - Two 1/2" thick (12mm) x 2 7/8" wide plywood braces running full depth front to back of cabinet, recessed down 1/2" from top. All braces are glued and stapled at top of cabinet to front frame and hang rail, and dadoed into end panel.
9. Drawer Boxes - Standard: Nominal 5/8" (16mm) Solid hardwood with dovetail construction. Drawer bottoms are nominal 1/4" plywood inserted into dado in front, back, and sides. Drawer bottoms are glued and stapled into sides
10. Drawer Guides - High-quality epoxy coated steel, Extreme grade, side mounted guides, self-adjusting in mounting brackets. Mounting brackets are screwed to solid pine back hanging rails. Built-in stop, self-closing, and stay-closed features with a 100 lb. rated load capacity.
11. Hinges - refer to Engineer/Owner selection.
12. Finish - Furniture quality protective finish system on doors, drawer fronts, front frames and veneer plywood end panels consisting of sanding, stain, catalyzed sealer, and catalyzed clear top coats.

2.06 INSTALLATION

A. Set & secure casework in place; rigid, plumb, & level no more than 1/4" every 8'.

B. Use concealed joint fasteners to align & secure adjoining cabinets.

C. Carefully scribe & miter trims, apply with pin nails, fill holes.

D. Carefully scribe casework abutting to other fixed components (i.e. wall) with maximum gaps of 1/32 inches.

E. Install pulls & knobs if required in alignment with each other.

F. Carefully adjust doors for alignment.

G. Carefully adjust drawers & slide out trays for alignment and smooth.

2.07 HIGH-PRESSURE DECORATIVE LAMINATE COUNTERTOPS

A. Acceptable plastic laminate manufacturers:
   1. Pionite
   2. Formica
   3. Wilsonart

B. Performance Requirements: Meet performance requirements of the following, unless otherwise specified:
   1. ANSI/KCMA A161.2.
   2. AWI/AWMAC/WI Architectural Woodwork Standards, Section 11 – Countertops.
   3. GREENGUARD Indoor Air Quality Certified.
   4. CARB Phase II.

C. Types:
   1. Postformed countertops with integral backsplashes.
   2. Conformance: ANSI/NEMA LD 3.
   3. Postforming (HGP).; WA Type 350

D. Pattern & Color:
   1. To be selected by Owner/Engineer from standard colors.

E. Substrates:
   1. MDF:
      a. Description: 100 percent pre-consumer recycled wood fiber with no added urea formaldehyde, industrial grade.
      b. Conformance: ANSI A208.2.
      c. FSC certified.
      d. Thickness: 3/4 inch.

F. Adhesives: Water-based polyvinyl acetate (PVA).

G. Backing Sheets:
   1. Conformance: ANSI/NEMA LD 3.
   2. Type: Phenolic backer.
   3. Thickness: 0.020 inch, plus or minus 0.005 inch.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Engineer of unsatisfactory preparation before proceeding.

C. Examine surfaces to receive countertops.

D. Notify Engineer of conditions that would adversely affect installation or subsequent use.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Verify casework and supports are plumb, level, square, and secure before installation of countertops.

D. Inspect countertops before installation to determine they are sound and free from defects and damage.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install countertops in accordance with manufacturer's instructions and AWI/AWMAC/WI Architectural Woodwork Standards, Section 11 – Countertops.

C. Install countertops at locations indicated on the Drawings.

D. Install countertops level, plumb, and square.

E. Securely anchor countertops to casework and supports.

F. Install joints to be watertight.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 12345

LABORATORY CASEWORK

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Included: Provide laboratory casework and appurtenances as required by the Contract Documents.
   1. In general the work of this Section includes stock laboratory casework units, complete with laboratory countertops with curbs, tub sink, cup sink, service fittings (faucets and drains) and accessories for casework detailed on the Drawings in the laboratory.

1.02 RELATED WORK

A. Documents affecting the work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
   1. Section 04200 Unit Masonry
   2. Section 15400 Plumbing

1.03 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Single Source Responsibility: Provide laboratory casework with tops, sinks, and service fittings, manufactured or furnished by same laboratory furniture company for single responsibility.

C. Catalog Standards: Manufacturer's catalog numbers may be shown on Drawings for convenience in identifying certain laboratory cabinet work. Unless modified by notation on Drawings or otherwise specified, catalog description for indicated number constitutes requirements for each such cabinet.

1.04 SUBMITTALS

A. Comply with the pertinent provisions of Section 01300.

B. Product Data:
   1. Materials list of items proposed to be provided under this Section.
   2. Manufacturer’s specifications and other data needed to prove compliance with the specified requirements.
   3. Shop drawings for laboratory casework and fittings showing plan layout, elevations, ends, cross-sections, service run spaces, location and type of service fittings, together with associated service supply connection required.

a. Include details and location of anchorages and fitting to floors, walls, and base, including required blocking or back-blocking.
b. Include layout of units with relation to surrounding walls, doors, windows, and other building components.
c. Coordinate shop drawings with other work involved.
d. Include manufacturer's recommendations for blocking and securing of laboratory casework units and fittings.

4. Manufacturer's recommended installation procedures which, when approved by the Engineer will become the basis for accepting or rejecting actual installation procedures used on the work.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver laboratory casework only after wet operations in building are completed.
1. Store completed laboratory casework in a ventilated place, protected from the weather, with relative humidity of 50 percent or less at 70°F (22°C).
2. Protect finished surfaces from soiling and damage during handling and installation. Keep covered with polyethylene film or other protective covering.

1.06 EXTRA MATERIALS

A. Furnish complete touch-up kit for each type and color of laboratory casework provided. Kit to include touch-up paint and other materials necessary to perform permanent spot repairs to damaged casework finish.

PART 2 PRODUCTS

2.01 METAL LABORATORY CASEWORK

A. Metal: Prime furniture steel, stretcher or roller leveled, free of scales, buckles, or other defects; ASTM A366, Class 1 (matte) finish.

B. Minimum Metal Gauge: Provide steel laboratory furniture components of following minimum thicknesses, expressed in both inches and U.S. Standard gauges.
1. 0.0396-inch thick (20-gauge): Back panels, inner door panels, outer door and drawer pan, inner door and drawer pan and body, and shelves. Add reinforcement or use 0.0516-inch thick (18-gauge) material for shelves over 36 inches long.
2. 0.0516-inch thick (18-gauge): Sides, ends, fixed backs, bottoms, tops, soffits, and other items not otherwise noted. Bottoms may be 0.0396-inch thick (20-gauge) if reinforced.
3. 0.0635-inch thick (16-gauge): Intermediate horizontal rails, table frame aprons and cross rails, center posts, top gussets.
4. 0.0785-inch thick (14-gauge): Drawer runners, sink supports, hinge reinforcements.
5. 0.1084-inch thick (12-gauge): Leveling and corner gussets.

C. Fabrication, General:
1. Complete assembly and finish work at point of manufacture.

2. Perform unit assembly on precision jigs to provide units which are square; fully reinforced with angles, gussets, and channels; integrally framed and welded to form a dirt and vermin-retardant enclosure.
3. Where applicable, reinforce base cabinets for heavy sink support.
4. Maintain uniform clearance around door and drawer fronts of between 1/16-inch minimum to 3/32-inch maximum.
5. Fabricate units on precision dies to permit interchangeability of drawers, hinged doors, and similar pieces of like sizes.

D. Flush Doors: Outer pan and inner pan formed and telescoped into box formation, with channel reinforcements full height on center of each pan.
1. Fill doors solid with fire-resistant, sound-deadening material.

E. Glazed doors: Hollow metal stiles and rails of similar construction as flush doors, with glass held in resilient channel or gasket material.

F. Hinged doors: Mortise at flanges for hinges and reinforce with minimum 0.0635-inch thick (16-gauge) angle, welded inside inner pan at hinge edge.
1. Provide nylon roller catches and stainless steel strike welded to door assembly.

G. Drawers: Assemble fronts from telescoping inner and outer pans, designed to eliminate raw edge of steel at top.
1. Fabricate sides, back, and bottom of one piece, with rolled or formed top of sides for stiffening and comfortable grasp for drawer removal.
2. Weld drawer front to sides, back, and bottom to form a single, integral unit.
3. Provide drawers with rubber bumpers, runners and positive stops to prevent metal-to-metal contact or accidental removal.

H. Drawer guides: Provide guides designed to provide self-closing of drawer and to prevent rebounding action when drawers are closed.

I. Adjustable Shelves: Sides and ends formed down, and returned to front and back.

J. Clear Float Glass for Glazed Doors: ASTM C1036, Type I, Class 1, Quality q3, double strength.

K. Filler Strips: Provide where required for closing space between cabinets and walls and ceilings, of same material and finish as cabinets. Hem exposed edges.
1. Job fabricated fillers not acceptable.

L. Utility Space: Provide space, cutouts, and holes for pipes, conduits, and fittings in cabinet bodies to accommodate services and their support-strut assemblies.

M. Toe space: Approximately 4-inch high by 3-inch deep, fully enclosed, metal toe space with no open gaps or pockets.

N. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering metal laboratory casework that may be incorporated in the work, include.
1. Fisher Hamilton,
2. Kewaunee Scientific Corp.
3. Or equal.

2.02 CHEMICAL AND PHYSICAL RESISTANCE OF LABORATORY CASEWORK FINISHES

A. General: Provide laboratory casework with a factory-applied finish that is capable of withstanding the tests specified in this article with no permanent change in gloss, color, film hardness, adhesion, or film protection.

B. Acids: Not less than 10 drops (0.50 cc) of the following reagents applied to finish surface, covered with watch glass, convex side down, for 60 minutes, then washed and dried,
1. Hydrochloric acid (37 percent),
2. Sulfuric acid (85 percent),
3. Nitric acid (25 percent),
4. Phosphoric acid (75 percent),
5. Acetic acid (98 percent).

C. Solvent: Not less than 10 drops (0.5 cc) of the following reagents applied to finish surface, covered with watch glass, convex side up, for 60 minutes, then washed and dried.
1. Ethyl alcohol,
2. Butyl alcohol,
3. Methyl alcohol,
4. Toluene,
5. Acetone,
6. Benzene,
7. Carbon tetrachloride,
8. Formaldehyde (37 percent),
9. Gasoline,
10. Ethyl acetate,
11. Ethyl ether,
12. Methyl ethyl ketone,
13. Naphtha,
14. Kerosene,
15. Xylene,
16. Glycerin,
17. Furfural.

D. Bases and Salts: Not less than 5 drops (0.25 cc) of the following reagents applied to finish surface, covered with watch glass, convex side up, for 60 minutes, then washed and dried.
1. Sodium hydroxide (25 percent),
2. Ammonium hydroxide (28 percent),
3. Potassium hydroxide (40 percent),
4. Saturated zinc chloride,
5. Saturated sodium chloride,
6. Saturated sodium sulfide,
7. Saturated sodium carbonate,
8. A poultice of "Tide" laundry detergent and water.

E. Moisture Resistance: No visible effect when finish surface exposed to the following:
1. Hot water at a temperature of 190°F (91°C) to 205°F (96°C), trickled down surface at 45-degree angle for 5 minutes.
2. Constant moisture using a 2-inch by 3-inch by 1-inch cellulose sponge, soaked with water, in contact with surface for 100 hours.

F. Cold Crack: No effect when subjected to 10 cycles of temperature change from 20°F (14°C) for 60 minutes to 125°F (52°C) for 60 minutes.

G. Adhesion and Flexibility: No peeling or cracking or exposure of metal when metal is bent 180 degrees over a 1/2-inch-diameter mandrel.

2.03 FINISH FOR STEEL LABORATORY CASEWORK

A. General: Provide steel laboratory casework with a factory-applied enamel finish that complies with chemical and physical resistance requirements specified.
   1. Pretreatment: After assembly, thoroughly clean surfaces of grease, dirt, oil, flux, and other foreign matter by physical and chemical means.
      a. Treat entire unit with metallic phosphate process leaving surfaces with uniform, fine-grained, crystalline phosphate coating providing excellent bond for subsequent finish.
   2. Top Coats: One coat high-bake primer followed by a minimum of two coats of high-bake chemical-resistant enamel to provide a hard and smooth, satin luster finish applied to treated surfaces.
      a. Unless otherwise indicated, up to two colors to be selected by Engineer from manufacturer's standard palette of at least 5 colors.

2.04 CASEWORK HARDWARE AND ACCESSORIES

A. Hardware, General: Provide manufacturer's standard satin finish, commercial quality, heavy-duty hardware complying with requirements indicated for each type.

B. Hinges: Stainless steel institutional 5-knuckle hinges.
   1. Provide one pair for doors less than 4 feet high and 1-1/2 pair for doors over 4 feet high.

C. Pulls: Satin finish stainless steel for drawers and swing doors, mounted with 2 screws fastened from back.
   1. For sliding doors, provide recessed flush pulls.
   2. Provide 2 pulls for drawers over 24-inches wide.

D. Door catches: Nylon-roller spring catch or dual self-aligning, permanent magnet catch.
   1. Provide 2 catches on doors over 4-feet high.

E. Drawer guides: Provide nylon-tired, ball-bearing rollers with metal guide channels and integral stops to eliminate accidental removal of drawer.
   1. Provide guides designed to provide self-closing of drawer and to prevent rebounding action when drawers are closed.

F. Drawer stops: Designed to permit easy removal, and yet prevent inadvertent drawer removal.
   1. Provide on all drawers, located on the inside.

G. Label Holders: Sized to receive standard label cards approximately 1-inch by 2-inch nominal size.
   1. Satin chrome-plated.
   2. Screw attachment, stick-on holders unacceptable

3. One each door/one each drawer head.

H. Filler Strips: Provide where required for closing space between cabinets and walls and ceilings, of same material and finish as cabinets.

I. Drawer and Cupboard Locks: Half-mortise type, 5-pin tumbler and dead bolt, round cylinder only exposed, brass with plated finish.

J. Sliding Door Hardware Sets: Manufacturer's standard, to suit type and size of sliding door units.

K. Cabinet Base Molding: Extruded vinyl or rubber, black, 4-inches high.
1. Provide on exposed sides and fronts of floor-mounted cabinets.

L. Adjustable Shelf Supports: Wrought steel, mortise-mounted.

M. Soffits for the underside of wall mounted cabinets.

2.05 TOPS, SINKS, AND ACCESSORIES

A. Tops, Box Curbs, Splash Rim: Provide smooth, clean exposed tops and edges in uniform plane free of defects.
1. Make exposed edges and corners uniformly rounded.

B. Top Thickness: 1-inch thickness, with tolerance not exceeding plus or minus 1/32-inch.
1. Provide front and end overhang of 1-inch over base cabinets, formed with continuous drip groove on under surface 1/2-inch from edge.

C. Cast Epoxy Resin: Factory-molded tops of modified epoxy resin formulation, uniform mixture throughout full thickness. Provide in smooth, nonspecular finish of color indicated.
1. Color: Black,
2. Physical Properties: Comply with the following minimum requirements:
   a. Flexural strength: 15,000 psi,
   b. Compressive strength: 35,000 psi,
   c. Hardness (Rockwell M): 100,
   d. Water absorption (24 hrs): 0.02 percent (maximum),
   e. Heat distortion point: 350 deg. F (176 deg. C),
   f. Thermal shock resistance: Highly resistant,

3. Chemical Resistance: Spot test with the following reagents in standard laboratory concentrations, in contact with finished top for 24 hours; top shall be entirely unaffected or show only slight dulling of finish:
   a. Glacial acetic acid,
   b. Nitric acid,
   c. Sulfuric acid,
   d. Ammonium hydroxide,
   e. Sodium hydroxide,
   f. Amyl acetate,
   g. Benzene,
   h. Ethyl acetate,
   i. Ethyl ether,

j. Hydrogen peroxide,
k. Methyl ethyl ketone,
l. Phenol,
m. Trichloroethylene,
n. Zinc chloride,
o. Hydrochloric acid,
p. Phosphoric acid,
q. Chromic acid,
r. Calcium hypochlorite,
s. Acetone,
t. Aqua regia,
u. Butyl alcohol,
v. Ethyl alcohol,
w. Formaldehyde,
x. Methyl alcohol,
y. Silver nitrate,
z. Zylene.

4. Workmanship: Cast surfaces very smooth, with factory cutouts for sinks and drip grooves.
   a. Fabricate plain butt-type joints assembled with epoxy adhesive and pre-fitted, concealed metal spline.

2.06 TUB SINK

A. Size: 21 inches long, 18 inches wide by 10 inch deep (Kewaunee Scientific Corp. catalog No. 1022-00) or manufacturer's closest stock size of equal or greater volume, as acceptable to Engineer.

B. Outlet:
   1. 2 inch diameter.
   2. 6-inch minimum length.
   3. Fabricated of cast epoxy resin.

C. Overflow: Provide overflow of standard beehive or open top design and with separate strainer.
   1. Height 2-inches less than sink depth.
   2. Provide in same material as sink.

D. Cast Epoxy Resin Sink: Black, molded in one piece with surfaces smooth, corners coved and bottom sloped to outlet.
   1. Minimum physical properties and chemical resistance as specified for cast epoxy resin tops.
   2. 1/2-inch minimum thickness.

2.07 FAUCET AND SINGLE FAUCET

A. Deck mounted mixing faucet shall be Kewaunee Scientific Corp. Catalog No. W-0340-00 and the deck mounted single cold faucet shall be Kewaunee scientific Corp. Catalog No. W-0337-6V or an approved equal.

B. Service Fittings: Provide units complete with washers, lock nuts, unions, nipples and other accessories for positive mounting to supporting laboratory units.
   1. Include wall and deck flanges, escutcheons, handle extension rods, remote valves, and similar items required.
   2. Fabricate units to withstand test pressure of 100 psig.

C. Material and Finish: Fabricate service fittings from cast or forged red brass containing a minimum of 85 percent copper.
   1. Provide exposed surfaces, including fittings, escutcheons, and trim, with a polished chrome-plated finish.

D. Service Outlets Identification: Provide colored plastic index discs with embossed identification letters at each service fitting handle or knob.
   1. Secure discs to fitting handles to be virtually tamperproof.
   2. Color code discs as follows:

Service	Color	Code	Letter Color
Hot Water	Red	HW	White
Cold Water	Dark Green	CW	White

E. Water Valves and Faucets: Provide units with renewable barrel locked in valve body.
   1. Barrel shall contain all wearing parts, with renewable discs.
   2. Provide 3-arm or 4-arm forged brass handles.

F. Hand of Fittings: Furnish right-hand fittings except where "L" is indicated on drawing symbol identification.

G. Vacuum Breakers: Provide vacuum breakers on all water fittings (hot and cold).

2.08 PEGBOARD

A. Shall be Kewaunee Scientific Corp. Catalog No.'s: X-020014-BK with F-2939-00.
   1. Catalog No. X-020000 shall be 20" long x 29" high x 1" thick black composite resin.
      a. Thirty two (32) 1/2" diameter by 6 1/8" long black polypropylene pegs.
   2. Catalog No. F-2939-00 shall be a stainless steel drip trough that mounts to the bottom of the above specified pegboard.
      a. ½" OD drain outlet.
      b. 1 ½" high by 2 ½" wide by 20" long.

PART 3 EXECUTION

3.01 CASEWORK INSTALLATION

A. Install plumb, level, true and aligned with no distortions.
   1. Shim as required, using concealed shims.
   2. Where laboratory casework abuts other finished work, scribe and apply filler strips for accurate fit with fasteners concealed where practicable.

B. Base Cabinets: Set cabinets straight, plumb, and level.
   1. Adjust sub-tops within 1/16-inch of a single plane.
   2. Fasten each individual cabinet to floor at toe space with fasteners spaced 24-inches on center.
   3. Bolt continuous cabinets together.
   4. Secure individual cabinets with not less than 2 fasteners into floor where they do not adjoin other cabinets.
   5. Where required, assemble units into one integral unit with joints flush, tight, and uniform.
   6. Align similar adjoining doors and drawers to a tolerance of 1/16-inch.

C. Wall Cabinets: Securely fasten to solid supporting material and not to plaster, lath, or wallboard.
   1. Anchor, adjust, and align wall cabinets as specified for base cabinets.
   2. Reinforcement of stud walls to support wall-mounted cabinets will be accomplished during wall erection by trade involved; however, indicating accurate location and sizing of reinforcement is responsibility of laboratory casework Installer.

D. Install hardware uniformly and precisely after final finishing is complete.
   1. Set hinges snug and flat in mortises unless otherwise indicated.
   2. Turn screws to flat seat.
   3. Adjust and align hardware so that moving parts operate freely and contact points meet accurately.
   4. Allow for final field adjustment after installation.

E. Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind.
   1. Lubricate operating hardware as recommended by manufacturer.

3.02 INSTALLATION OF TOPS

A. Field jointing: Where practicable, make in same manner as factory jointing using dowels, splines, adhesives, and fasteners recommended by manufacturer.
   1. Locate field joints as shown on accepted shop drawings, factory-prepared so there is no job site processing of top and edge surfaces.

B. Fastenings: Secure tops to cabinets with epoxy cement, applied at each corner and along perimeter edges of not more than 48-inches on center.

C. Abut top and edge surfaces in one true plane, with internal supports placed to prevent any deflection.

1. Provide flush hairline joints in top units using clamping devices.
2. At stone-type material joints, use manufacturer's recommended adhesives and holding devices to provide joint widths not more than 1/16-inch wide at any location, completely filled and flush with abutting edges.
3. Where necessary to penetrate tops with fasteners, countersink heads approximately 1/8-inch and plug hole flush with material equal in chemical resistance, color, hardness, and texture to top surface.

D. Provide holes and cutouts as required for mechanical and electrical service fittings.

E. Carefully dress joints smooth, remove any surface scratches, clean and polish entire surface.

F. Provide scribe moldings for closures at junctures of top, curb, and splash with walls as recommended by manufacturer for materials involved.
1. Use chemical-resistant, permanently elastic sealing compound where recommended by manufacturer.

3.03 INSTALLATION OF SINKS

A. Underside Installation: Use manufacturer's recommended adjustable support system for table-type and cabinet-type installations.
1. Set top edge of sink unit in manufacturer's recommended chemical-resistant sealing compound and firmly secure to produce a tight and fully leak proof joint.
2. Adjust sink and securely support to prevent movement.

3.04 INSTALLATION OF ACCESSORIES

A. Install accessories in accordance with approved location drawings and manufacturer's installation recommendations.
1. Turn screws to a flat seat; do not drive.
2. Adjust moving parts to operate freely and smoothly without binding.

3.05 CLEANING AND PROTECTION

A. Repair or remove and replace defective work as directed upon completion of installation.

B. Clean factory and shop-finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish.

C. Protection: Provide 6-mil plastic or other suitable water-resistant covering over countertop surfaces.
1. Tape to underside of countertop (minimum of 4-feet on center).
2. Advise Contractor of procedures and precautions for subsequent protection of installed laboratory casework and fittings from damage by work of other trades.

END OF SECTION

SECTION 12346

LABORATORY EQUIPMENT AND SUPPLIES

PART 1 GENERAL

1.01 DESCRIPTION

A. Work included: Provide all the laboratory equipment and supplies as required by the Contract Documents.

1.02 RELATED WORK

A. Documents affecting the work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
   1. Section 12345 Laboratory Casework.

1.03 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.04 SUBMITTALS

A. Comply with pertinent provisions of Section 01300.

B. Product data: Within 90 calendar days after the Contractor has received the Owner's Notice To Proceed, submit:
   1. Materials list of items proposed to be provided under this Section.
   2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

1.05 PRODUCT HANDLING

A. Comply with manufacturer's requirements.

B. The shelf life of perishable supplies and reagents, shall not be exceeded on any item for one (1) year, starting at the date of acceptance by the Engineer.

PART 2 PRODUCTS

2.01 LABORATORY EQUIPMENT

A. For the purposes of BABA compliance, laboratory equipment listed in this section as shall be classifed as “manufactured products”, in accordance with the Table of products provided for Q2.6 in Specification Section 00820G defining BABA requirements.

B. For the purpose of designating type and quality for the work of this Section, the following listing of equipment (Model/ Catalog Numbers) is based on Fisher Scientific Co., (2021) Online Catalog and Hach (2021) Online Catalog.

Item No.	Qty.	Manufacturer	Model/Catalog No.	Item Description
1	1	Myron L	Ultrameter II 6PFCE	Conductivity Meter
2	1	Thermo Scientific	Smart2Pure/10-451-045	Deionized Water System
3	1	Thermo Scientific Orion	13-645-541PM	Benchtop pH/ISE Meter w/Electrode & Field Kit including buffer solutions
4	1	Thermo Scientific Orion	13-641-712B	Electrode Holder
5	1	Hach	DR/6000 UV VIS	Spectrophotometer
6	1	Hach	LPV442.99.03012TU5200	Benchtop Turbidimeter
7	1	Hach	LTV082.53.40001	DRB 200 Reactor
8	1	Mettler Toledo	30029096/01-912-405	Toploading Balance
9	1	Fisherbrand	11-520-16S	Magnetic Stirrer 4-inch plate
10	1	Thermo Scientific	11-494Q	Hot Plate
11	1	Fisherbrand	15-077-32	Digital Thermometer -30 to +150 deg C; -58 to+302 deg F.

2.02 LABORATORY SUPPLIES

A. For the purposes of BABA compliance, laboratory supplies listed in this section as shall be defined as "not an integral part of the structure or permanently affixed to the infrastructure project" as described in the Office of Management and Budget's Memorandum M-22-11 and therefore not required to comply with the BABA requirements defined in Specification Section 00820G.

B. For the purpose of designating type and quality for the work of this Section, the following listing of supplies (Model/ Catalog Numbers) is based on Fisher Scientific Co., (2004/2005) Catalog and Hach (2004) Catalog.

Item No.	Quantity	Manufacturer	Model/Catalog No.	Item Description
1	10	Hach	2299264	pH buffer powder, pH 4, 7, pkg 2x15
2	5	Hach	2227166	pH buffer powder, pH 10, pkg 50
3	2	Oakton	13-200-270	pHTester 30
4	4	Hach	LZV946	Sample Cells for TU5200
5	1	Hach	LZY835	Calibration Standards for TU5200
6	10	Hach	2105769	Reagent: Iron, Total, pkg 100
7	10	Hach	2527025	Reagent: Fluoride, pkg 25 (ampule)
8	10	Hach	2651700	Reagent: Manganese, low range, pkg 50
9	10	Hach	2502025	Reagent: Chlorine, Free, pkg 25 (ampule)
10	5	Hach	2105669	Reagent: Chlorine, Total, DPD, pkg 100
11	10	Hach	2760345	Reagent: Organic Carbon, Total
12	2	Hach	2624410	DR6000 TOC Sample Cell
13	1	Fisherbrand	14-513-82	Spinbar Assortment
14	1	Fisherbrand	05-718-40	Drying Rack
15	2	Fisherbrand	13-681-102A	Pipet Pump Bulb Type
16	1	Fisherbrand	13-650-6F	Pipets 10 mL (case of 12)
17	1	Fisherbrand	13-650-6J	Pipets 25 mL (case of 12)
18	2	DWK Life Sciences	140050/02-539G	50 mL Beaker (pkg 12)
19	2	DWK Life Sciences	14000100/02-539H	100 mL Beaker (pkg 12)
20	2	DWK Life Sciences	14000400/02-539L	400 mL Beaker (pkg 12)
21	2	DWK Life Sciences	14000600/02-539M	600 mL Beaker (pkg 6)
22	1	DWK Life Sciences	20025K10/08-549-5B	10 mL Grad. Cyl. (pkg 4)
23	2	DWK Life Sciences	20025K50/08-549-5D	50 mL Grad. Cyl. (pkg 4)
24	2	DWK Life Sciences	20025K100/08-549-5E	100 ml. Grad. Cyl. (pkg 4)
25	2	DWK Life Sciences	20025K500/08-549-5G	500 mL Grad. Cyl. (pkg 2)
26	2	DWK Life Sciences	20025K1000/08-549-5H	1,000 mL Grad. Cyl. (pkg 2)
27	2	Thermo Scientific	08-572-6G	1,000 mL Grad. Cyl. (polypropylene)

Item No.	Quantity	Manufacturer	Model/Catalog No.	Item Description
30	1	Thermo Scientific	12010100/02-591-10B	100 mL Poly-Beaker (pkg 12)
31	1	Thermo Scientific	12010600/02-591-10F	500 mL Poly-Beaker (pkg 4)
32	1	Thermo Scientific	12011000/02-591-10G	1,000 mL Poly-Beaker (pkg 3)
33	2	Ansell	950042/19501-045	PVC Apron
34	1	Thermo Scientific	20020008/02-923D	250 mL. Bottles (pkg 12)
35	1	Thermo Scientific	23180050/02-963BB	20 Liter Carboy w/Spigot
36	1	Thermo Scientific	24020250/03-409-10D	250 mL Wash Bottle (pkg 4)
37	1	Thermo Scientific	41080250/10-041-17D	250 mL Erlenmeyer Flask (pkg 4)
38	2	Hach	2087114/50-199-5282	4L HDPE bottle
39	4	Honeywell	S3241HS/19-185-669	Protective Spectacles
40	2	Thermo Scientific	11-409-5	Poly. Face Shield.
41	1	Fisherbrand	19-816-845	Latex Gloves (Lrg)(pkg/dz.)
42	1	Fisherbrand	19-816-846	Latex Gloves (Med.) (pkg/dz)
43	10	Fisher Scientific	19-041-171D	Nitrile Gloves (Lrg) (pkg 200)
44	10	Fisher Scientific	19-041-171D	Nitrile Gloves (xLrg) (pkg 200.)
45	1	Honeywell	0197110006L/17-377-000	First Aid Kit
46	1	Thermo Scientific	63790004/10-437-35	Safety Waste System
47	15	Kimberly-Clark	06-666C	Kim Wipes. 15x17
48	2	Wearwell	222.12X24X36BK/19-003-153	Lab Mat

PART 3 EXECUTION

3.01 INSTALLATION

A. All equipment shall be assembled and installed in accordance with the manufacturer's printed instructions.

B. All glassware shall be uncrated, inspected and stored as directed by the Engineer. All damaged pieces shall be replaced at no additional cost to the Owner.3.02 TESTING

C. All equipment shall be tested for operation by a representative of the manufacturer and shall be witnessed by the Engineer.

END OF SECTION

SECTION 12510

HORIZONTAL LOUVER BLINDS

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Included: Provide horizontal louver blinds as required by the Contract Documents.
   1. In general the work of this Section includes providing horizontal louver blinds for the eight (8) exterior windows in the WTP.

1.02. RELATED WORK

A. Documents affecting the work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
   1. Section 08520 Aluminum Windows

1.03 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.04 SUBMITTALS

A. Comply with the pertinent provisions of Section 01300.

B. Product Data:
   1. Materials list of items proposed to be provided under this Section.
   2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
   3. Samples of the blades, showing all colors available in the products proposed to be used.
   4. Manufacturer's recommended installation procedures which when approved by the Engineer shall become the basis for accepting or rejecting actual installation procedures used on the work.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver blinds only after operations in building are completed.
   1. Store in a ventilated place, protected from the weather, with relative humidity of 50 percent or less at 70°F (22°C).
   2. Protect finished surfaces from soiling and damage during handling and installation.

PART 2 PRODUCTS

2.01 HORIZONTAL LOUVER BLINDS

A. Provide Riviera 1" Contract Blinds as manufactured by Levolor Corporation or an approved equal with the following attributes:
   1. One (1) inch wide, 5000 series magnesium aluminum alloy slats,
   2. All hardware shall be enclosed in the metal headrail.
   3. Tilt wand,
   4. Cord lock,
   5. Color: As selected from manufacturer's standard color chart.

2.02 OTHER MATERIALS

A. Provide other materials not specifically described (installation brackets, extension plates and etc.) but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Engineer.

PART 3 EXECUTION

3.01 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.02 COORDINATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

3.03 INSTALLATION

A. Install the work of this Section in strict accordance with the manufacturer's recommendations as approved by the Engineer, anchoring all components firmly into position, plumb, level and in proper operating condition.

B. Upon completion of the installation operate the blinds through at least five operating cycles and adjust as needed. Damaged blinds shall be replaced at no cost to the Owner.

C. All blinds shall be cleaned after installation and immediately prior to acceptance.

END OF SECTION

SECTION 12625

OFFICE/LAB FURNITURE

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Included: Provide office and laboratory furniture as required by the Contract Documents.
   1. In general the work of this Section includes providing desks, tables, chairs, file cabinets, storage bins, stools and appurtenances.

1.02. RELATED WORK

A. Documents affecting the work of this Section include, but are not necessarily limited to, General Conditions and Sections in Division 1 of these Specifications.
   1. Section 12345 Laboratory Casework

1.03 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.04 SUBMITTALS

A. Comply with the pertinent provisions of Section 01300.

B. Product Data:
   1. Materials list of items proposed to be provided under this Section.
   2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Furniture shall not be delivered to the job site until Substantial Completion and after all construction operations in the building are complete.
   1. Store furniture in a ventilated place, protected from the weather, with relative humidity of 50 percent or less at 70°F (22°C).
   2. Protect finished surfaces from soiling and damage during handling and installation. Keep covered with polyethylene film or other protective covering.

PART 2 PRODUCTS

2.01 FURNITURE SCHEDULE

Manufacturer	Model No.	Description	Quantity
Steelcase	Universal Table	Break Room Tables	2
Steelcase	Criterion Plus	Swivel Chairs	7
SitOnIt	Lumin 1011 FT1	Stackable Chairs	8
Steelcase	Ellipse	Desks	1
Steelcase	Ellipse	Mobile Pedestal Cabinets	3
Steelcase	Groupwork	Small Conference Tables	2
Kewaunee Scientific	F-4941-00	Lab Stools	2
Steelcase	Ellipse	Lateral File Cabinet	1
Safco	4972LG/4971LG	Lateral Drawing File Cabinet	1
Evans Console	Response	Control Room Console	1
Durham	3404-95	Work Station	1
Durham	HWBMT-366034-95	Work Benches	5
Edsal	BC4801	Bin Storage Cabinets	2
Lyon Metal Products	Series 8000	HD Closed Shelving Starter	1
Lyon Metal Products	Series 8000	HD Closed Shelving Add-On	1
Lyon Metal Products	Series 8000	HD Open Shelving Starter	2
Lyon Metal Products	Series 8000	HD Open Shelving Add-On	4
Rubbermaid	7 gal.	Wastebaskets	8
Rubbermaid	40 gal.	Waste Containers	3

2.02 FURNITURE AND ACCESSORIES

A. Break Room Tables (F-1):
1. Manufacturer and Model: Steelcase, Inc., Universal Table.
2. Nominal Size: 60-inch deep by 36-inch wide by 28 1/2-inch high.
3. High pressure laminate table surface.
4. Post legs with leveling glides are required by the manufacturer.

B. Desk Chairs (F-2):
1. Manufacturer and Model: Steelcase, Inc.; Criterion Plus No. 453-5331B, with dual-wheel casters and soft arm caps.
2. Seat Height: 17 to 22 inches.
3. Seat Depth: 16 to 18 1/2 inches.
4. Seat Width: 23 inches.
5. Back Height from Seat: 23 to 25 inches.
6. Distance Between Arms: 15 1/2 to 23 inches.
7. Arm Height from Seat: 7 1/2 to 11 1/2 inches.

C. Stackable Chairs (F-3):
1. Manufacturer and Model: SitOnIt.; Lumin 1011 FT1.
2. Plastic 4-leg design, mesh back.
3. Seat Height: 17.9 inches.
5. Seat Depth: 18.2 inches.
6. Seat Width: 22.2 inches with arms.

7. Back: 18.2 inches W x 17.5 inches H.
8. Nominal Size: 22-inch deep by 20-inch wide by 30-inch high.
9. Weight Capacity: 300 lbs.

D. Desk (F-4):
1. High pressure laminate surface desk with plastic center drawer, two grommets, and modesty panel.
2. Manufacturer and Model: Steelcase, Inc., Ellipse ADXM3060L0 with ASHC1921X1.
3. Size: 30-inch deep by 60-inch wide by 29-inch high.

E. Mobile Pedestal with Cushion Top (F-5):
1. Two drawer cabinet on casters with cushion top.
2. Manufacturer and Model: Steelcase, Inc.; Ellipse RPM2421C and RPXTC24P.
3. Nominal Size: 24-inch deep by 15-inch wide by 23-inch high.

F. Small Conference Table (F-6):
1. Rectangular high pressure laminate top with two pairs of flip-top legs with dual-wheel casters.
2. Manufacturer and Model: Steelcase, Inc.; Groupwork.
3. Nominal Size: 24-inch deep by 48-inch wide by 27-inch high.

G. Laboratory Stools (F-7): Shall have the following attributes:
1. Black vinyl upholstery.
2. Urethane foam seat.
3. Adjustable seat height between 22 1/4-inches to 27 1/2-inches.
4. Adjustable backrest.
5. Height controlled by pneumatic lift.
6. Adjustable chrome foot rest.
7. Five leg base.
8. Two-inch soft wheel ball bearing casters.
9. Manufacturer and Model: Kewaunee Scientific; F-4941-00.

H. Lateral File Cabinet (F-8):
1. Four 12-inch high drawer lateral file cabinet.
2. Manufacturer and Model: Steelcase, Inc.; Ellipse RLF18424.
3. Nominal Size: 18-inch deep by 42-inch wide by 52-inch high.

I. Lateral Flat Drawing File Cabinet (F-9):
1. 5-drawer heavy-duty cabinets on elevated pedestal.
2. Manufacturer and Model: Safco; 4972LG cabinets on 4971LG base.
3. Inside Drawer Size: 31.5-inch deep by 43-inch wide by 1.25-inch high.
4. Nominal Size: 32-inch deep by 47-inch wide by 37-inch high.

J. Control Console (F-10):
1. Nominal 39-inch deep plastic laminated console with adjustable height. Hidden cable management system shall run uninterrupted to adjacent consoles in the upper and lower portion of the base console. Two built-in surge protected power bars provided to accommodate equipment shown on drawings and to allow for future growth.

2. Integrated upper cable tray shall be accessible by removing the matching integrated HPL access panels on work surface.
3. Adjustable work surface with hand crank for console allows for work surface adjustment 26-inch to 31-inch (customizable).
4. Slatwall and Accessories:
    a. 12-inch high slatwall for mounting the following accessories: Four (4) single articulating monitor arms, independent task lighting, two letter trays, two binder storage shelves, pen/pencil cups, and phone trays with articulating arms.
    b. Under-counter pencil drawers for each console.
    c. Built-in door-mounted central processing unit (CPU) storage to accommodate computer equipment shown on drawings and allow for future growth. Maximum PC size with door shelf to be 16-3/4 inches by 8-1/2 inches by 17-1/2 inches. Fixed shelves to be included in each additional module to provide for future growth. Maximum PC size with fixed shelf to be 21 inches by 8-3/4 inches by 19 inches.
    d. Ventilation fans for CPU enclosures, grill kits on additional modules.
5. Manufacturer and Model: Evans Consoles; Response.
6. Nominal Size: 13'-11" by 5'-5"

K. Work Station (F-11):
1. Work station with cabinet with fixed shelf, 4 drawers, and vice support.
2. Manufacturer and Model: Durham; 3404-95.
3. Nominal Size: 24-inch deep by 60-inch wide by 36-inch high.

L. Work Benches (F-12):
1. Extra heavy duty work bench.
2. Manufacturer and Model: Durham; HWBMT-366034-95.
3. Nominal Size: 36-inch deep by 60-inch wide by 34-inch high

M. Bin Storage Cabinets (F-13):
1. 176 total bins with 48 bins in 3 sizes in large cabinet and 64 bins in each door in 2 sizes.
2. Manufacturer and Model: Edsal; BC4801.
3. Nominal Size: 24-inch deep by 48-inch wide by 72-inch high.

N. Heavy-Duty Closed Metal Shelving Starter Unit (F-14):
1. Closed back and two ends with 8 shelves with 800 pound capacity per shelf.
2. Lyon Metal Products, Inc., No. 8000 series.
3. Heavy duty, 20-gauge metal construction.
4. Nominal Size: 36 inches wide by 24 inches deep by 84 inches high.

O. Heavy-Duty Closed Metal Shelving Add-On Unit (F-15):
1. Closed back and one end with 8 shelves with 800 pound capacity per shelf.
2. Lyon Metal Products, Inc., No. 8000 series.
3. Heavy duty, 20-gauge metal construction.
4. Nominal Size: 36 inches wide by 24 inches deep by 84 inches high.

P. Heavy-Duty Open Metal Shelving Starter Unit (F-16):
1. Open back and two ends with 8 shelves with 800 pound capacity per shelf.
2. Lyon Metal Products, Inc., No. 8000 series.

3. Heavy duty, 20-gauge metal construction.
4. Nominal Size: 36 inches wide by 24 inches deep by 84 inches high.

Q. Heavy-Duty Open Metal Shelving Add-On Unit (F-17):
1. Open back and one end with 8 shelves with 800 pound capacity per shelf.
2. Lyon Metal Products, Inc., No. 8000 series.
3. Heavy duty, 20-gauge metal construction.
4. Nominal Size: 36 inches wide by 24 inches deep by 84 inches high.

R. Wastebaskets:
1. Seven (7) gallon as manufactured by Rubbermaid.
2. Able to fit under standard desk.
3. All plastic construction.

S. Waste Containers:
1. 40 gallon "Square Brute" as manufactured by Rubbermaid
2. Square container with flat lid.
3. Provided with four (4) wheel dolly.

2.03 BUY AMERICA BUY AMERICA ACT (BABA) REQUIREMENTS

A. The furniture and accessories listed in this section are to be defined as "not an integral part of the structure or permanently affixed to the infrastructure project" as described in the Office of Management and Budget's Memorandum M-22-11 and therefore not required to comply with the BABA requirements defined in Specification Section 00820G.

PART 3 EXECUTION

3.01 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.02 COORDINATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

3.03 INSTALLATION

A. Furniture shall be uncrated, assembled as required, and placed or attached where directed. No furniture shall be put in place until after Substantial Completion of the contract.

B. Furniture shall be checked for nicks, scratches and imperfections. Damaged furniture shall be replaced at no cost to the Owner.

C. All furniture shall be cleaned to the satisfaction of the Engineer immediately prior to acceptance.

END OF SECTION

INDEX

DIVISION 13 SPECIAL CONSTRUCTION

SECTION 13100

INSTRUMENTATION AND CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. The work covered under this Section of the Specifications includes the furnishing of all plant, labor, equipment, appliances and materials, and in performing all operations in connection with the furnishing and installation of all equipment, materials, accessories, and incidentals necessary and required for instrumentation and Supervisory Control and Data Acquisition (SCADA) systems for the new Water Treatment Plant (WTP), complete in place, in accordance with the Specifications and Drawings.

The work includes:

1. Furnishing and installation of two new control panels. These panels are the Main Control Panel (MCP) and a Remote I/O Panel (RIOP-1).
2. Maintenance of the existing SCADA and water supply/treatment system at the existing Wading River Pump Station and well site while the new WTP is under construction.
3. Tie in the new WTP MCP with the existing Master Terminal Unit (MTU) at the West Street WTP via cable.
4. Linking and integration of the Filter Control Panel (FCP) and RIOP-A, RIOP-B, and RIOP-C furnished by the GreensandPlus Filter Vendor, the MIEX Main Control Panel (MMCP) and five MIEX Local Control Panels (MLCPs) furnished by the MIEX Vendor, and the RIOP-1 with the MCP via CAT-6 Ethernet cable.
5. Expansion of the existing Operator Workstation (OWS) screens, alarm monitoring, and report generation packages to include monitoring and control of the new facilities at the West Street WTP.
6. Construction, installation, commissioning, and training support.

B. In general, all process signals, alarms, and controls shall be either monitored or controlled by the supervisory control and data acquisition (SCADA) system. The central point of the SCADA monitoring and control system shall be the programmable logic controller (PLC) in the existing MTU at the West Street WTP. All monitoring and control of the new WTP and associated high lift, intermediate, and well pumps shall be via the PLC in the MCP to be provided under this section.

C. The Contractor shall contract with the Town's SCADA system integrator (SI), Woodard & Curran, (W&C), to perform the systems integration of the hardware and software for the project, which will communicate with the Main Control Panel (MCP) in the Wading River Water Treatment Plant (WTP) via cable. W&C will develop all programming required for the local and remote monitoring and control functions described herein. All equipment shall be supplied, installed, calibrated, and warranted by the Contractor. W&C will provide the following integration services:

1. Review of shop drawings for panels and equipment supplied by others under this project, for coordination of signaling and control requirements.
2. Provide all required software/existing software updates as necessary to accommodate the work required under this contract.

3. Programming of the MCP and Human-Machine Interface (HMI) software at the operator workstations (OWS) to include monitoring and control of the functions described herein.
4. Install and set up specified alarms as included in this specification and as requested by the Owner.
5. Perform an I/O checkout with the Electrical Contractor.
6. Assist during startup and testing of the new controls and signals.
7. Prepare O&M manuals for the SCADA equipment furnished under this contract and any upgrades to the existing remote MTU (i.e.: final as-built panel drawings, new/revised OIT displays, etc.) and review O&M manuals if equipment is furnished by others (instruments, features, etc.).
8. Provide operator training on the new work furnished under this contract. Minimum training hours shall be as specified herein.

The Contractor shall obtain a quote for the work described in paragraph 1.01.C from:

Rob Laird, P.E.
Woodard & Curran
980 Washington Street
Dedham, MA 02026
(800) 446-5518

1.02 RELATED WORK

A. Documents affecting the work of this Section include, but are not necessarily limited to, General and Supplementary Conditions, and Sections in Division 1 of these Specifications.
1. Division 11 Equipment
2. Division 16 Electrical

1.03 RELATED WORK NOT INCLUDED

A. Power and signal conduit and wiring, relays, starters, motor control centers, etc., and wiring required for operation of the equipment shall be furnished and installed under Division 16 of these specifications.

B. All electrical devices and panels furnished under this Section shall be installed under Division 16.

C. Installation of piping, valves, fittings, flow tubes, pressure and level sensors, and appurtenances shall be covered under Division 15.

D. The Horizontal GreensandPlus Pressure Filters are provided under Section 11240.

E. The Magnetic Ion Exchange (MIEX) treatment equipment is provided under 11610.

F. Chemical metering pumps, tanks, and appurtenances shall be provided under Section 11423.

1.04 RESPONSIBILITY FOR EQUIPMENT

A. Scope of Work. The Contractor shall furnish required equipment and accessory equipment to provide a complete operating system. All equipment shall be furnished as indicated on the drawings and specified herein, or as required to ensure proper system functioning.

B. Responsibility and Coordination. The Contractor's attention is directed to the fact that the instrumentation and control system shall be furnished by one Control System Supplier (CSS) who shall provide all of the equipment and appurtenances regardless of manufacturer, and shall be responsible for coordinating its work with that of the SI to assure a complete and integrated system. Substitutions of functions specified will be unacceptable.
   1. It shall be the responsibility of the Contractor to coordinate the work of the CSS, SI, and equipment vendors such as pressure filter suppliers and MIEX supplier so as to furnish a complete and fully operational instrumentation and control system.
   2. It should be noted that controls integration will need to be coordinated between the vendor equipment and the WTP MCP such as permissions to run, flow setpoints, and alarm statuses.

C. All of the equipment shall be of the manufacturer's latest proven and most modern design and shall, as far as practical, be of one manufacturer. Overall system and component accuracy shall be as guaranteed by the specified manufacturer.

D. The drawings and specifications are intended to include all details of a complete equipment installation, but do not purport to cover all details entered into the design of the complete system. The Contractor shall be responsible for all details, which may be necessary to properly install, adjust and place in operation the complete installation. The Contractor shall assume full responsibility for additional costs, which may result from unauthorized deviations or substitutions from the specifications.

1.05 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections. Other Division 13 Sections may have additional submittal requirements.
   1. A job index sheet.
   2. Component specifications check sheets indicating all pertinent data and identifying each component and listing all tagging data.
   3. Component drawings showing dimensions, mounting and external connection details including external piping and/or wiring for all field and pipeline mounted equipment.
   4. Where panels are furnished, provide fabrication and nameplate legend drawings; and internal wiring and piping schematic drawings clearly showing all equipment, terminal, and bulkhead numbers.
   5. A system schematic drawing illustrating all components being supplied, complete with pneumatic, hydraulic and electrical interconnections all of which shall be clearly identified and complete with terminal and bulkhead numbers. Literature shall be submitted in PDF format in accordance with submittal requirements in Division 1.
   6. Any other information that the manufacturer or supplier feels will assist the Engineer with the review.

B. Although one complete submittal is preferable, it may be permissible for the Contractor to submit in two parts the above information as follows:
   1. One submittal shall consist of: job index sheets; specification check sheets for all equipment; component drawings; panel fabrication and nameplate legend drawing; a schematic drawing lacking only terminal and bulkhead numbers, and spare parts list.
   2. The second submittal shall consist of all remaining literature and in particular; job index sheets; panel internal piping and wiring drawings; final panel dimension and graphic drawings; and completed system schematic drawings.

C. Operation and Maintenance Manuals:
   1. The Contractor shall furnish clear, typewritten easy-to-understand, tightly bound instruction manuals as specified in Division 1, for daily operation and maintenance of the system. Specifically, the manuals shall contain explicit instructions and well-diagramed procedures for system operations, display generation, report generation, and system maintenance. The instruction manuals shall include as a minimum the following information:
      a. Photographs and data sheets of major system components.
      b. Input/output terminal diagrams.
      c. Logic and block diagrams.
      d. Manufacturer-published operation and maintenance instructions on all equipment.
      e. Description of system operation, editing, and troubleshooting.
      f. Configuration language description.
      g. Configuration disks.
      h. Names, addresses, and telephone numbers of local software package representatives.
      i. Listing of expendable materials by form, stock, or model number (e.g., paper, magnetic discs, ribbons, etc.)
   2. Manuals shall be provided for use by system operators and shall include as a minimum:
      a. A simple pictorial presentation and description of the system.
      b. A functional description of all operator interfaces at all levels of control should be described.
      c. A description of each type of data format.
      d. A description for each of operator controls, its tasks, and method of recognizing a response to operator manipulation. This description shall include all buttons and keyboards.
      e. A glossary of terms.
      f. Separate step-by-step procedure shall be provided for each action to be performed in operating the system. These procedures should include, but not be limited to, the following:
         i. Start/stop operation.
         ii. Emergency procedures.
         iii. Controls mode changes.
         iv. All software housekeeping or caretaking operations changing date and time, point calibration, point activation, point deactivation, tuning parameter and setpoint changes.
         v. Software procedures that are beneficial to operator to determine that system is functioning properly.
         vi. Procedures for changing paper, tape and other housekeeping operations.
   3. These manuals shall be separately bound and shall contain all information required by the system operator to perform all functions related to this project.

Manuals shall be available at the time of the operator's training course and shall be covered as part of the course material.

D. All literature submitted in the final transmittal shall reflect all "as built" modifications.

E. Original Licensed Software
1. Submit original software flash drives or CD-ROMs of all software provided under this Contract. Submit original paper based and electronic documentation for all software provided. Submit license agreement information including serial numbers, license agreements, User Registration Numbers, etc. All software provided under this Contract shall be licensed to the Owner at the time of purchase. Provide media in software sleeves within O&M manual.

F. Electronic O&M Information
1. In addition to the hard copy of O&M data, provide an electronic version of all equipment manuals flash drive, CDROM or DVD. Electronic text shall be supplied in PDF format.
2. Provide electronic files for all custom-developed manuals. Text shall be supplied in both Microsoft Word format and PDF format.
3. Provide digital copies of all training videos. Videos shall be in a format that is readable by standard DVD players and by standard PC flash drives. Format and shall be a minimum of 800 by 600 pixels and shall include sound.

1.06 QUALITY ASSURANCE

A. The CSS shall be regularly engaged in the design and installation of instrumentation and SCADA systems and their associated subsystems as applied to the municipal water industry. For the purposes of this Section, a CSS shall be interpreted to be an organization that complies with all of the following criteria:
1. Employs personnel on this project who have successfully completed ISA or manufacturers' training courses on general process instrumentation. Key personnel, which include field personnel, shall hold ISA CCST Level 1 certification.
2. Has successfully completed work of similar or greater complexity on at least ten (10) previous projects within the last five (5) years.
3. Has been actively engaged in the type of work specified in this Section for a minimum of ten (10) years. CSSs without the required minimum experience as a business entity shall not be allowed to substitute experience of individuals in lieu of the required business experience.

B. The CSS shall maintain a permanent, fully staffed and equipped service facility with full-time employees capable of designing, fabricating, calibrating, and testing the systems specified herein. The CSS shall provide on-site response within six (6) hours of notification starting at one month before scheduled startup to one month after startup completion. During other time frames of the project, including during the warranty period, the CSS shall provide 24 hour on-site response.

C. The CSS shall have on staff at least five (5) qualified instrument technicians and shall maintain stock inventory of spare parts for all major components in the system.

D. At least three separate toll free phone numbers available 24 hours a day, seven days a week for customers to call in for technical support on both hardware and software.

E. The CSS's employees need not perform actual installation of the instrumentation system, but shall be responsible for the technical supervision of the installation by providing on-site supervision to the installers of the various components.

1.07 DELIVERY, STORAGE AND HANDLING

A. Delivery, storage and handling shall be in accordance with section 01610.

B. Shipping Precautions
1. After completion of shop assembly, factory test and approval of all equipment, cabinets, panels and consoles shall be packed in protective crates and enclosed in heavy duty (5 mil) polyethylene envelopes or secured sheeting to provide protection from damage, dust and moisture. Dehumidifiers shall be placed inside the polyethylene coverings. The equipment shall then be skid-mounted for final transport. Lifting rings shall be provided for moving without removing protective covering. Boxed weights shall be shown on shipping tags together with instructions for unloading, transporting, storing and handling at the job site.
2. Manufacturer's special instructions for proper field handling, storage and installation required for proper protection, shall be securely attached to the packaging for each piece of equipment prior to shipment. The instructions shall be stored in resealable plastic bags or other acceptable means of protection.
3. If any apparatus has been damaged, such damage shall be repaired at no additional cost to the owner.

1.08 NOMENCLATURE AND IDENTIFICATION

A. Field Instrument Tags
1. A permanent stainless steel or other non-corrosive material tag firmly attached and permanently and indelibly marked with the instrument tag number, as indicated in the Drawings, shall be provided on each piece of equipment supplied under this Section. Equipment shall be tagged before shipping to the site.
2. Provide 1/8-in by 3/8-in, Type 316 stainless steel button head machine screws.
3. All supplied field instrument transmitters and field instrument transmitter elements shall have a stainless steel identification tag attached to each transmitter and element prior to shipment. Tag shall be attached via stainless steel chain or stainless steel wire (24 gauge min) to a non-removable part of the device. The tag size shall be a minimum of 1.5 square inches. Tag shall include the ISA alphanumeric instrument number as indicated in the P&ID, loop, and detail drawings. The alphanumeric instrument number shall be stamped into the tag and shall have a minimum of 3/16-in high alphanumeric characters.

1.09 WARRANTY

A. The Contractor shall guarantee that the materials and workmanship of the equipment and software be free from defects for a period of one year from date of Substantial Completion, providing the equipment has been installed, operated, and maintained in accordance with the manufacturer's recommendations.

B. The CSS shall provide, at the time of start-up, a letter certifying that the equipment has been installed properly, calibrated and is in working order suitable for operation.

C. The CSS in conjunction with the SI shall prepare detailed design information, procure, configure, prepare graphics, install, start-up, make ready for use, the complete instrumentation systems as indicated on the Plans and in these Specifications. The Specifications and Plans include descriptions of functional operation and performance, as well as standards, but do not necessarily enumerate detailed specifications for all components and devices, which are essential for system operation. However, all components and devices shall be furnished and installed as required to provide complete and operable systems for accomplishing the functions and meeting the performance set forth hereinafter.

D. The Contractor shall include in the bid an allowance for factory-trained service personnel (other than sales representatives) to supervise and assist in the installation or adjust all the equipment until the system has been completely accepted. The Engineer shall approve the results of these tests. In addition, factory bench-test data shall be submitted to show that the manufacturer's proposed equipment has been tested in the specified arrangement and found to achieve specified accuracy.

1.10 PROJECT/SITE REQUIREMENTS

A. Environmental Requirements. Refer to Division 16 for specific environmental and hazardous area classifications.

B. Elevation: Equipment shall be designed to operate at the project ground elevation.

C. Temperature:
1. Outdoor areas' equipment shall be suitable for -40 to 140 F degrees ambient.
2. Equipment located in indoor locations shall be suitable for 10 to 35 C degrees ambient minimum.
3. Storage temperatures shall range from 0 to 50 C degrees ambient minimum.
4. Additional cooling or heating shall be furnished if required by the equipment as specified herein.

D. Relative Humidity. Air-conditioned area equipment shall be suitable for 20 to 95 percent relative, non-condensing humidity. All other equipment shall be suitable for 0 to 100 percent relative, condensing humidity.

1.11 SYSTEM DESCRIPTION

A. Each loop description contains the basic functional description of the process. All components necessary to complete these functions shall be provided to satisfy the requirements of this section.

B. Contacts referred to in the Instrument Loop Descriptions shall be of the dry type either normally open or normally closed as required for the function described.

C. The scales of instruments and devices described in the instrument loop descriptions shall be as specified within the loop description, as noted in Part 2 – PRODUCTS, or shall be furnished during shop drawing review.

D. The loop descriptions shown are intended to provide for system operation. Each of the loops may or may not show all specific components required for each system operation. The instrumentation supplier shall provide all necessary components required for complete system operation as described below.

E. Instrument Loop Descriptions.

1. **Distribution System Storage Tanks and Remote Water System Facilities:** Monitoring and control of the existing remote water system facilities is performed by the existing MTU in the West Street WTP and will remain unchanged. The existing OWS at the WTP will be upgraded as needed and updated to provide monitoring and control, and alarming of the new Wading River WTP via cable connection between the existing MTU at the West Street WTP and the MCP in the new Wading River WTP.

2. **Existing Infiltration Basins:** River water is diverted to two sand-filled infiltration basins referred to as the East and West Basins. Each basin is equipped with a submersible pump and pitless adaptor contained in an underground vault in an earthen mound within each basin. The pumps are speed controlled by variable frequency drives housed in the existing Wading River Pump Station. The sand-filled infiltration beds serve to prefilter and provide 2-log removal of Giardia cysts. The existing pumps and level transducers in each basin will be replaced under this contract.

3. **Existing Wading River Emergency PFAS Treatment Facility, Chemical Feed Facility, Chlorine Contact Tank, and High-Lift Pump Station:** The well pumps in the existing infiltration basins pump at a rate set by the variable frequency drives as described above, to a 5,000-gal polyethylene break tank in the Emergency PFAS Treatment Facility. Two booster pumps, one duty and one standby, pump at a rate to maintain a constant level in the break tank as monitored by a level transducer. The booster pumps force water through two self-flushing horizontal screen filters (duty and standby), through two cartridge filters (duty and standby), two PFAS-removal contactors (lead and lag, elaborated below), a chemical feed vault, and up to the existing baffle overflow in the chlorine contact tank.

   The Emergency PFAS Treatment Facility houses two 10-foot diameter PFAS vessels and valve tree that operate in a lead/lag configuration. The facility is monitored by the SCADA system in the existing chemical feed facility via a remote input/output panel (RIOP) linked via fiber optic cable. Under this contract, the PFAS system (vessels and valve tree with interconnecting piping) will be relocated to the new Wading River WTP in the sequence described in 01100 Special Project Procedures. The RIOP and/or its components shall be maintained as spare parts for the control system in the new WTP.

   The existing chemical feed facility provides dosages of sodium hydroxide (NaOH), sodium hypochlorite (NaOCl), phosphate, and hydrofluorosilicic acid (HFS) to injection points in the chemical feed vault according to the pumping rate. From the chlorine contact tank, the water flows by gravity along the baffled wall path to provide 1-log Giardia removal by disinfection and residual disinfection before flowing to the existing high-lift pump station. From the high-lift pump station, the potable water is pumped to the distribution system.

   Under this contract, The existing facilities will be abandoned. The existing RTU shall be maintained as spare parts. Communication between the existing RTU and MTU at the West Street WTF shall be relocated to the new WTF.

4. **Water Treatment Plant:** Start/stop operations of the new Wading River WTP will be interlocked with the start/stop operations of the East and West Basin

pumps, which are on/off controlled based on the elevation of the controlling distribution system storage tank.

The East and West Basin pumps will start/stop either manually from the SCADA system or from the respective VFD in the Electrical Room, or automatically by the SCADA system. The Operator via the OWS at the Wading River WTP or at the West Street WTP shall set the start and stop setpoints of each basin pump based on the distribution system storage tank elevations selected to control WTP operations, as done presently. The operator shall set the WTP influent flow rate and select which pumps are to operate at the SCADA (lead/lag). The SCADA will control the speed of the pump/VFD to maintain the preset flow rate. For flows up to 700 gpm, the lead pump will operate alone and above 700 gpm, both pumps will operate. For 2-pump operation, the SCADA shall operate the pumps at the same speed.

HAND-OFF-AUTO (H-O-A) switches on the variable speed drive cabinets will allow either automatic or local manual start/stop operation of the pumps. Manual operation is performed in the HAND and OFF positions. In the AUTO position, pump operation is on/off controlled by the SCADA in response to distribution system tank levels. A “Not-in-Auto” alarm will annunciate on the SCADA system if the switch is not in AUTO. A LOCAL/REMOTE (L-R) selector switch on the VFD will allow the pump to be speed controlled by the SCADA system when the H-O-A switch is in either the "HAND" or "AUTO" mode of operation when in "REMOTE". In "LOCAL" the pump speed will be varied manually by a potentiometer on the respective VFD. A “Not-in-Remote” alarm will annunciate on the SCADA system if the switch is not in REMOTE. The VFD will provide a 4-20mA signal to the SCADA in proportion to the actual pump speed.

The West Basin pump VFD will be equipped with a bypass starter in the event of a VFD fault/failure. A VFD/BYPASS selector switch will provide an “IN BYPASS” signal for annunciation on SCADA. When operating in bypass, the starter will provide a digital “running” status signal to SCADA.

Lead/lag well pump selection is operator selected at the SCADA. Should the lead pump fail to start, the standby pump will automatically take its place if set on AUTO, and a respective well pump failure alarm will be annunciated. A well pump failure is defined by the lack of either the digital pump “status” (bypass mode) or speed report back signal from the VFD or no minimum flow indication (i.e.: 100 gpm) within a preset adjustable time period as monitored by the SCADA.

Well level sensors installed in each basin pump casing shall allow monitoring of the basin level by the SCADA system. At a preset adjustable low water level programmed into the SCADA, a respective “Low Basin Level” alarm will be annunciated at the SCADA system. At a second “Low-Low” level, the basin pump shall stop.

A magnetic flow meter on the prefiltered water header in the WTP basement pipe gallery that feeds the MIEX treatment system is equipped with a flow transmitter which will allow local indication at the flow meter and will transmit a 4-20mA signal for flow indication on the SCADA system. The SCADA system in turn will provide a prefiltered water flow pacing signal to the MIEX Main Control Panel (MMCP) for control of the MIEX system. Water from the MIEX treatment system will flow by gravity to the below-grade Intermediate Wetwell.

A sample line on the prefiltered water header prior to MIEX treatment provides water to a pH/temperature analyzer in the basement pipe gallery, which outputs respective pH and temperature signals to the SCADA for monitoring and recording.

Operation of the MIEX treatment system is monitored and controlled (pumps, valves, etc.) by the MMCP and shall not be described herein. The MMCP shall be linked to the SCADA MCP via Ethernet for process monitoring and alarming.

However, the below-grade Waste Brine Tank constructed to receive waste brine from the MIEX system operates in conjunction with the MIEX system and its associated level signals are connected to the MCP and MMCP as shown on the Drawings. The Waste Brine Tank shall be equipped with a radar level sensor/transmitter, which transmits a 4-20mA signal to the SCADA for level monitoring. An adjustable level setpoint on the SCADA will annunciate a high level Waste Brink Tank alarm. A high level float shall also be provided, which will be wired to contacts within the MMCP to provide hardwired shutdown of the MIEX regeneration process at a set high level in the Waste Brine Tank. A level switch located in the secondary/exterior shell of the double walled Waste Brine Tank will activate a tank leak alarm on the SCADA system to warn of a leak in the primary/interior tank of the double walled Waste Brine Tank.

Two VFD-driven Intermediate Pumps (IMPs, one a spare) pump the MIEX effluent water to the GreensandPlus filters and PFAS contactors. The speed of the pumps will be varied by the SCADA to maintain a constant water level in the MIEX Effluent Water Intermediate Wetwell (6.5 to 7.0 feet, adjustable). A magnetic flow meter on the Intermediate Pump discharge (MIEX Effluent) water header shall provide local flow indication and will provide a 4-20mA signal for flow indication and totalization on the SCADA. The SCADA will provide a proportional 4-20mA flow pacing signal to the NaOH (caustic), polymer, and NaOCl (chlorine) metering pumps adding chemical ahead of the GreensandPlus pressure filters.

The Intermediate Wetwell shall be equipped with a radar level sensor and local level indicator/transmitter, which transmits a 4-20mA signal to the SCADA for level monitoring. Adjustable level setpoints on the SCADA will annunciate high and low level Wetwell alarms. A high level float shall also be provided, which will be wired to contacts within the MCP which in turn are wired to the well pump VFDs to provide hardwired shutdown of the pumps at a set high level. A low level float shall be wired directly to the IMP VFDs to provide hardwired stoppage of the pumps at the set low level.

HAND-OFF-AUTO (H-O-A) switches on the IMP VFD cabinets will allow either automatic or local manual start/stop operation of the pumps. Manual operation is performed in the HAND and OFF positions. In the AUTO position, pump operation is on/off controlled by the SCADA in response to the Intermediate Wetwell level. A “Not-in-Auto” alarm will annunciate on the SCADA system if the switch is not in AUTO. A LOCAL/REMOTE (L-R) selector switch on the VFD will allow the pump to be speed controlled by the SCADA system when the H-O-A switch is in either the "HAND" or "AUTO" mode of operation when in "REMOTE". In "LOCAL" the pump speed will be varied manually by a potentiometer on the respective VFD. A “Not-in-Remote” alarm will annunciate on the SCADA system if the switch is not in REMOTE.

The VFD will provide a 4-20mA signal to the SCADA in proportion to the actual pump speed.

The IMP VFD No. 2 will be equipped with a bypass starter in the event of a VFD fault/failure. A VFD/BYPASS selector switch will provide an "IN BYPASS" signal for annunciation on SCADA. When operating in bypass, the starter will provide a digital "running" status signal to SCADA.

Lead/Standby IMP selection is operator selected at the SCADA. Should the lead pump fail to start, the standby pump will automatically take its place if set on AUTO, and a respective IMP pump failure alarm will be annunciated. An IMP pump failure is defined by the lack of either the digital pump "status" (bypass mode) or speed report back signal from the VFD or no minimum flow indication (i.e.: 100 gpm) within a preset adjustable time period as monitored by the SCADA.

A sample line on the MIEX Effluent water header prior to the GreensandPlus filters provides water to a combination pH/chlorine analyzer in the laboratory, which outputs respective pH and chlorine residuals to the SCADA for monitoring. High and low adjustable setpoints for both parameters annunciate respective alarms on the SCADA.

The effluent water from the Intermediate Wetwell will be treated for iron and manganese removal via the GreensandPlus pressure filtration system. Filter monitoring and control is via an Allen-Bradley based filter control panel (FCP) furnished with the filter system. The PLC in the FCP will be linked to the SCADA MCP via Ethernet, and will allow the operator full monitoring and control of the filters, including but not limited to:

a. Individual filter flows, totalized flow, and hours of operation since backwashing.
b. Backwash/rinse flow indication and totalization (combined).
c. Filter status (on-line, backwashing, off-line)
d. Filter bank differential pressure.
e. Open/closed status of individual filter valves.
f. Air scour "INCLUDE-OMIT" selection.
g. Initiation of backwash from the SCADA OWS.
h. Annunciation of all individual filter system operational alarms.
i. Modification of automatic filter backwash initiation setpoints (i.e.: differential pressure, totalized filter flow, and hours of filter operation since last backwash).
j. Modification of automatic filter backwash parameter setpoints (i.e.: backwash flow rates and time durations of each step in the backwash process).

The backwash pumps are controlled by the SCADA MCP. A call to start/stop the backwash pumps and the backwash flow rate will be furnished from the FCP to the SCADA as described later in this section.

The operator shall be able to select backwashing to occur in either an "Automatic" (backwashing occurs automatically based on either differential pressure, total flow, or total hours has elapsed) or "Semi-Automatic" (manual initiation of backwash upon annunciation of need for backwashing) mode of operation, and stop a backwash sequence either from the SCADA OWS or activation of the high level switch in the Spent Backwash (SBW) Tank.

Activation of the start backwash "button" on the SCADA display will cause a confirmation box to pop up, requiring the operator to confirm that a backwash is being called for, to prevent accidental initiation.

The operator via the SCADA shall be able to INCLUDE or OMIT an air scour to allow either a conventional "water only" backwash, or combination air/water wash of the filters.

One air blower is furnished with the filter system and is start/stop controlled by the FCP via the SCADA.

The starter for the blower is located in the Electrical Room. The starter has a HAND-OFF-AUTO (HOA) switch which allows manual operation in the HAND and OFF positions. In AUTO, start/stop control of the blower is by the FCP via the MCP. Contacts on the HOA switch provide indication of the blower being set in AUTO at the FCP and SCADA via the MCP. The FCP furnishes a start/stop signal to the MCP for blower control. Contacts on the starter provide a running status signal to the MCP for alarming of a blower failure if the blower fails to start after a preset time.

If the differential pressure across the filters exceeds an adjustable setpoint (i.e.: 15 psi), the SCADA will automatically stop the WTP and annunciate an alarm.

The spent backwash water and filter-to-waste flow from the filters discharge to a below-grade spent backwash water collection/decant tank (Spent Backwash Tank). After an adjustable preset time period programmed into the SCADA system has elapsed after completion of the backwashing cycle, one of two supernatant pumps (one a standby) will draw the supernatant from the top of the SBW tank via a floating decant device and will pump the water back to the MIEX effluent water header ahead of the GreensandPlus filters whenever an IP is in operation. Pumping will continue until either a preset SBW tank low level is reached, the IPs have stopped, or filter backwashing is restarted. Should the IPs stop prior to the level in the SBW Tank reaching the supernatant pump shutdown elevation, the lead supernatant pump will restart in unison with the restart of an IP provided the filters are not in the backwash mode, and the preset time has expired since the last filter was backwashed.

The SBW Tank shall be equipped with a radar level sensor and local level indicator/transmitter, which transmits a 4-20mA signal to the SCADA for level monitoring. SBW Tank elevation set points programmed into the SCADA system will stop the supernatant pumps at a preset low level (i.e.: 2 feet above the top of sump), stop the filter backwash sequence at a preset high level, and annunciate high and low level alarms. A high level float switch in the tank shall provide a direct signal to the FCP for positive filter backwash shutdown. Under either high level filter backwash shutdown scenario, backwashing shall remain locked out until the SBW Tank level drops to an operator selectable intermediate level, or the operator initiates a "RESUME BACKWASH" at the SCADA.

A flow meter on the supernatant pump discharge header is equipped with a flow transmitter which will provide a 4-20mA signal to the SCADA to allow remote monitoring and recording of supernatant flow at the SCADA system. The SCADA will output a 4-20mA signal to the supernatant pump VFDs in proportion to an operator selectable flow setpoint (50-300 gpm) that assures the tank level can accommodate the next scheduled backwash.

HAND-OFF-AUTO (H-O-A) switches on the supernatant pump variable speed drive cabinets will allow either automatic or local manual start/stop operation of the pumps. Manual operation is performed in the HAND and OFF positions. In the AUTO position, pump operation is on/off controlled by the SCADA in response to the SBW Tank level. A “Not-in-Auto” alarm will annunciate on the SCADA system if the switch is not in AUTO. A LOCAL/REMOTE (L-R) selector switch on the VFD will allow the pump to be speed controlled by the SCADA system when the H-O-A switch is in either the "HAND" or "AUTO" mode of operation when in "REMOTE". In "LOCAL" the pump speed will be varied manually by a potentiometer on the respective VFD. A “Not-in-Remote” alarm will annunciate on the SCADA system if the switch is not in REMOTE. The VFD will provide a 4-20mA signal to the SCADA in proportion to the actual pump speed.

The supernatant pump VFD No. 2 will be equipped with a bypass starter in the event of a VFD fault/failure. A VFD/BYPASS selector switch will provide an “IN BYPASS” signal for annunciation on SCADA. When operating in bypass, the starter will provide a digital “running” status signal to SCADA.
Lead/standby supernatant pump selection is operator selected at the SCADA. Should the lead pump fail to start, the standby pump will automatically take its place if set on AUTO, and a respective supernatant pump failure alarm will be annunciated. A supernatant pump failure is defined by the lack of either the digital pump “status” (bypass mode) or speed report back signal from the VFD or no minimum flow indication (i.e.: 20 gpm) within a preset adjustable time period as monitored by the SCADA.

One residuals pump is provided for pumping of the settled particulates in the SBW tank to either a tanker truck or the onsite lagoon for disposal, dependent on manual valve selection. The pump may be manually started or stopped either at the motor control center (MCC), or the tanker truck fill station. A HAND-OFF-REMOTE (HOR) switch on the MCC will allow control of the pump from the ON and OFF pushbuttons at the tanker truck fill station in the "REMOTE" position. In HAND, the motor starter is engaged, and manual operation may be controlled utilizing the lock-out station at the pump. Contacts on the motor starter will provide pump “running” indication at the SCADA system. A float switch in the SBW tank will stop the residuals pump on low level.

From the GreensandPlus filters, the water flows to the PFAS contactors. The PFAS treatment system is comprised of three (3) contactor units, each unit consisting of two PFAS contactor vessels, valve “tree”, and interconnecting piping. The flow to each unit flows through the lead contactor and then the lag contactor before discharging to the common outlet header. A magnetic flow meter on the inlet of each unit provides local indication of the influent flow rate and provides a 4-20mA signal for monitoring by the SCADA. Any significant flow differences noted by the operator may be indicative of a partially closed valve or the need to backwash the filter.

Backwash and lead/lag contactor operations shall be controlled by manual operation of the valves on the valve “tree”. A differential pressure sensor on the common PFAS influent and effluent mains allows monitoring of the pressure across all contactors. At an adjustable preset high differential pressure, an alarm shall be annunciated for the operators to review local pressure gauges across individual contactors to determine the need to backwash a unit or multiple units.

From the PFAS contactors, the treated water flows to Clearwell (chlorine contact tank), with a portion of the flow being diverted to the refilling the Backwash Supply Tank, if required, as described below. The water line serving the Clearwell is equipped with a magnetic flow meter and backpressure sustaining valve. The flow meter is equipped with a local digital indicator/transmitter which provides a 4-20mA signal to the SCADA for monitoring. The SCADA will provide a proportional 4-20mA flow pacing signal (the difference of the total treated water flow minus the flow to the Backwash Supply Tank as discussed below) to the phosphate and hydrofluorosilicic acid (HFS/fluoride) metering pumps adding chemical prior to the clearwell. Two additional chemical flow pacing outputs shall be provided for future potential addition of post-NaOCl (chlorine) and post-NaOH (caustic) addition. The backpressure valve maintains a minimum backpressure on the PFAS vessels to prevent filter draindown/ siphonage upon stoppage of WTP operations.

A sample line on the PFAS treated water header after chemical injection but before the clearwell provides water to a combination pH/chlorine analyzer in the laboratory, which outputs respective pH and chlorine residuals to the SCADA for monitoring and recording. High and low adjustable setpoints for both parameters annunciate respective alarms on the SCADA.

The smaller Backwash Supply Tank refill line is equipped with a flow meter and modulating flow control valve. The flow meter is equipped with a local digital indicator/transmitter which provides a 4-20mA signal to the SCADA for monitoring. The operator via the SCADA sets a refill rate (150-300 gpm) and the SCADA will provide a proportional 4-20mA signal to the motorized valve control module to vary the valve opening to maintain the desired flow rate.

Both the Clearwell and Backwash Supply Tank shall each be equipped with a radar level sensor and local level indicator/transmitter, which transmits a 4-20mA signal to the SCADA for level monitoring. Adjustable level setpoints on the SCADA will annunciate high and low level alarms for both tanks. A high level float in the clearwell shall also be provided, which will be wired to contacts within the RIOP in the Pump Room which in turn are wired to the IMP VFDs to provide hardwired shutdown of the pumps. A high level float switch in the Backwash Supply Tank provides a signal to the RIOP to shut the Backwash Supply Tank refill valve in case of level sensor failure/mis-calibration. Low level floats in both tanks shall be wired to contacts within the RIOP in the Pump Room which in turn are wired to the backwash pump (BWP) and high lift pump (HLP) VFDs to provide hardwired stoppage of the respective pumps at the set low level.

Two VFD-driven HLPs pump the chemically-treated finished water in the Clearwell to the distribution system. The speed of the pumps will be varied by the SCADA to maintain a constant water level in the Clearwell (7.5 to 8.0 feet, adjustable). A magnetic flow meter on the finished water header shall provide local flow indication and will provide a 4-20mA signal for flow indication and totalization on the SCADA.

Two VFD-driven BWPs pump the non-chemically treated finished water in the Backwash Supply Tank to the GreensandPlus filters when called upon by the FCP. The speed of the pumps will be varied by the SCADA to maintain a constant backwash flow rate programmed at the FCP. A magnetic flow meter on the backwash supply water header shall provide local flow indication and will

provide a 4-20mA signal for flow indication and totalization on the SCADA, and speed control of the backwash pump.

HAND-OFF-AUTO (H-O-A) switches on the HLP and BWP variable speed drive cabinets will allow either automatic or local manual start/stop operation of the pumps. Manual operation is performed in the HAND and OFF positions. In the AUTO position, HLP operation is on/off controlled by the SCADA in response to well pump operations, while the BWP is on/off controlled by the FCP. A “Not-in-Auto” alarm will annunciate on the SCADA system if the switch is not in AUTO. A LOCAL/REMOTE (L-R) selector switch on the VFD will allow the pump to be speed controlled by the SCADA system when the H-O-A switch is in either the "HAND" or "AUTO" mode of operation when in "REMOTE". In "LOCAL" the pump speed will be varied manually by a potentiometer on the respective VFD. A “Not-in-Remote” alarm will annunciate on the SCADA system if the switch is not in REMOTE. The VFD will provide a 4-20mA signal to the SCADA in proportion to the actual pump speed.

The HLP and BWP VFDs No. 2 will be equipped with a bypass starter in the event of a VFD fault/failure. A VFD/BYPASS selector switch will provide an “IN BYPASS” signal for annunciation on SCADA. When operating in bypass, the starter will provide a digital “running” status signal to SCADA.

Lead/standby HLP and BWP selection is operator selected at the SCADA. Should the lead pump fail to start, the standby pump will automatically take its place if set on AUTO, and a respective HLP or BWP pump failure alarm will be annunciated. A pump failure is defined by the lack of either the digital pump “status” (bypass mode) or speed report back signal from the VFD or no minimum flow indication (i.e.: 100 gpm) within a preset adjustable time period as monitored by the SCADA.

A sample line from a tap on the finished water main downstream of the high lift pumps provides water to both a fluoride and combination pH/chlorine/ temperature analyzer in the laboratory, which outputs respective fluoride, pH, and chlorine residuals and temperature to the SCADA for monitoring and recording. High and low adjustable setpoints for fluoride, pH, and chlorine annunciate respective alarms on the SCADA and shutdown the WTP.

Two low-range and one high range turbidimeters shall be provided that monitor the following sampling locations:

a. Prefiltered water prior to MIEX treatment (low-range).
b. Post-GreensandPlus filtered water (low-range).
c. Supernatant return line (high-range).

The prefiltered and post-GreensandPlus samples are required as part of the Surface Water Treatment Rule and have adjustable high turbidity alarm setpoints. The supernatant turbidimeter shall be an inline insertion probe used to monitor turbidity and suspended solids in the returned water for determining the need to extend spent backwash water settling times or the need to remove the settled residuals in the tank. Two indicator/controllers shall be furnished to provide local display of the turbidimeter readings and transmit the turbidity signals to SCADA for monitoring and recording. The two low-range turbidimeters shall be connected to a single indicator/controller and the high-range will be connected to its own unit.

The three turbidimeters and the prefiltered water pH/temperature analyzer all drain to a self-contained ejector pump basin that pumps the sample waste flow to the Spent Backwash Tank.

Sodium hydroxide (caustic), sodium hypochlorite (chlorine), liquid phosphate hydrofluorosilicic acid (HFS), and salt for the MIEX system will be purchased in bulk and stored in bulk tanks. The caustic and hypochlorite systems will have 2 bulk tanks each, while the phosphate, HFS, and salt will have a single bulk tank. Each tank will be equipped with a radar level sensor for monitoring tank levels by the SCADA system (the salt tank level sensor shall be furnished by the MIEX vendor), and for indication both locally on the respective transfer pump control panel (TPCP) (no TPCP for the salt tank so not applicable), and at the respective exterior fill stations (7 total). At a preset high level as programmed at the SCADA system, an audible alarm will sound at the respective fill station, and a respective high tank level alarm will be annunciated at the SCADA system. The exterior horn will continue to annunciate until acknowledged either at the SCADA system, or by activation of the acknowledge button on the fill station panel.

The above chemical feed systems are each equipped with a single day tank and transfer pump. The day tanks are refilled by manual operation of a local "ON/OFF" switch which must be manually maintained in the ON position during filling of the tank. The transfer pump may also be stopped automatically by the high level switch in the day tanks. Radar level sensors on the day tanks provide level indication to the SCADA system and locally on the respective TPCP.

Polyaluminum chloride (PACl) is purchased in carboys and stored on a grated containment area. A carboy is placed on a digital weigh scale that transmits a 4-20mA signal to the SCADA in proportion to weight.

Daily day/carboy and bulk tank usage will be recorded at the SCADA. Resetting of the daily totals will be via the operator initiating a manual reset button on the SCADA. Low level/weight setpoints for each day tank/carboy and bulk tank shall annunciate a respective alarm on the SCADA.

The chlorine and caustic feed systems shall be equipped with a 3-way motorized valve connecting the outlet of the two bulk tanks on each system. Selection of the bulk tank to be utilized for day tank refilling will be via a selector switch (Tank No. 1/Tank No. 2) mounted on the respective TPCP.

Each feed system is equipped with two metering pumps (one a standby), that pump chemical to the appropriate water header as shown on the drawings, in proportion to the respective metered water flow. Each metering pump shall be furnished with a local control panel containing a HOA switch. Local operation requires activation of the spring-loaded switch to the ON position, at which point the pump operates for a period of time set on the panel's timer. Contacts on the HOA switch provide an "In AUTO" signal to the SCADA.

With all metering pumps in AUTO at the local control panels, the operator via the SCADA selects which of each system's pumps is lead/standby. The SCADA system will provide individual start/stop signals to each lead pump that is interlocked as follows:

a. The caustic, PACl, and chlorine pumps will energize to feed chemical to the MIEX Effluent main prior to the GreensandPlus filters whenever an

IMP starts and the water flow signal exceeds a preset setpoint (i.e.: 100 gpm), and deenergize when all IMP pumps stop.

b. The phosphate and HFS pumps will energize and feed chemical to the Treated Water header prior to the clearwell whenever an IMP starts and the Treated Water flow to the clearwell exceeds a preset setpoint (i.e.: 100 gpm), and deenergize when the IMP pumps stop.

The SCADA shall also have AUTO and STOP selection for each metering pump that will prevent a respective pump from operating when set to OFF.

The SCADA system will provide individual 4-20mA pacing signals to each metering pump based on the appropriate pacing water flow meter (same as interlocked flow meter for start/stop signals). The SCADA system shall be programmed with operator adjustable setpoints for the density of the chemical solution in lbs/gallon, the chemical solution strength in a percentage by weight, and the required chemical dosage in mg/L, and then the SCADA program will properly pace the chemical metering pump based on these setpoints and the water flow measured through the respective water flow meter.

All metering pumps will be equipped with tube failure/leak sensors which will annunciate a respective tube failure alarm on the SCADA. The metering pumps shall also output an analog flow signal to the SCADA for monitoring. Daily chemical usage based on the flow signal will be recorded at the SCADA for comparison with bulk and day tank recordings. Resetting of the daily totals will be via the operator initiating a manual reset button on the SCADA. Upon failure to detect a report back signal after a preset delay from the metering pump called upon to start, or a tubing failure/leak detection, the SCADA shall annunciate a respective pump failure alarm, de-energize the failed pump, and will automatically start the standby pump in the failed pump's place if the metering pump's local control panel is in "AUTO".

The SCADA system shall be programmed to prevent both metering pumps from operating at the same time via SCADA, when the local control panels for each pump are in "AUTO". If one local control panel is in "AUTO" and the other local control panel is in "HAND", the SCADA system shall allow both pumps to operate.

Level switches located in all five chemical containment areas will activate respective alarms on the SCADA system to warn of a chemical spill.

Flow switches on the water supply line to each emergency shower/eyewash unit on the main floor and in the basement will activate an emergency alarm on the SCADA system to warn of a potential employee injury. Separate alarms will be annunciated for the following:

a. Caustic containment area
b. Chlorine containment area
c. Phosphate containment area
d. HFS containment area
e. PACl containment area
f. Basement Shower No. 1 and No. 2
g. Mezzanine Laboratory

A temperature transmitter located in the process area of the WTP will provide a 4-20mA signal to the SCADA in proportion to room temperature. Respective

"high" and "low" temperature alarms will be annunciated at the SCADA at preset high and low temperature setpoints.

A float switch located in a basement sump of the WTP will annunciate an alarm to warn of a high level.

A relay within the MCP will furnish a "Loss of Power" alarm to the SCADA upon either loss of normal power, or power is turned off to the panel. Loss of normal power and/or loss of communication with all panels linked to the MCP via Ethernet shall be annunciated on SCADA.

A relay in the automatic transfer switch will furnish a "loss of normal power" alarm to the SCADA.

Contacts within the emergency generator control panel shall furnish a "running" status signal and common "trouble" alarm to the SCADA for generator alarm annunciation.

Contacts on the fire and intrusion alarm systems furnished under Division 16 shall provide respective notifications to the SCADA system.

PART 2 PRODUCTS

2.01 INSTRUMENTATION: GENERAL

A. All equipment shall be of the latest proven design. First generation equipment with less than three years general use shall have documentation on construction, operation, field test and user list. Approval shall be at the discretion of the Engineer.

B. All equipment shall be suitable for operation in the environment of the project.

C. Transmission to and from analog devices shall be 4-20 mAdc. Distribution within a panel may use variable voltage. Discrete (digital) signals to and from the SCADA panel and remote devices shall be 24-volt.

D. All signal converters, power regulators, or power converters shall be the responsibility of the instrument supplier as noted within these specifications.

E. Equipment necessary to complete the functional requirements shall be supplied by the systems supplier and shall be of the same manufacturer as the recorders, controllers and indicators unless otherwise specified (e.g. signal converters, integrator, computing devices, alarm trips, etc.).

F. All necessary fuses or switches required by the instrumentation manufacturer for his equipment shall be provided with the equipment. All instruments requiring an external power supply shall have an internal on/off switch.

G. Indicators, recorders, controllers, integrators, relays, and other receiving devices when operating in a loop shall be of a design such that a failure of an individual device shall not affect the operation and integrity of the remaining functions. All indicators, recorders, either remote or panel mounted, shall have an individual, internal on-off switch.

H. Electronic transmitting equipment shall provide loop power. True 2-wire transmitter may have its loop power supplied in the receiving instrument if available or by a plug-in power supply mounted in the receiving instrument panel.

I. All conductors running from the field to control panels or RTUs shall be of a single, continuous length, without splices, except at approved junction boxes. Special care shall be exercised to carry grounding lines through such junction boxes with the least possible resistance.

J. Multi-conductor cable may be used between junction boxes and control panels or RTUs except for electronic transmitting equipment.

K. All shielded cable shall be grounded at the control panel or RTU end only. Shields shall be carried through junction boxes with the least possible resistance and kept isolated from ground at these points. The field end of the shield shall be insulated to prevent grounding.

L. All indoor control panel located electronics shall be suitable for operation in ambient temperatures of 40 degrees F to 120 degrees F.

M. All field electronics and outdoor panel equipment shall be suitable for operation in ambient temperatures of -40 degrees F to 140 degrees F. All external connection points shall be made at terminal blocks with No 6-32 or larger screws.

N. Metal nameplates shall be provided on all field mounted transmitters, level relays, indicators, etc. Wording and sizing of nameplates shall be as specified for the Instrument Panel.

2.02 INSTRUMENT PANELS

A. Each instrument panel shall be classified as a single “manufactured product” as it relates to the Buy America Build America Act (BABA) requirements defined in Specification Section 00820G.

B. Instrument panels shall be completely assembled and wired at the factory. All equipment shall be designed to operate on a 60 Hertz alternating current power source of 105 to 135 volts, except as noted. All regulators and power supplies required for compliance with the above shall be provided between supply and interconnected instrument loop. Where equipment requires voltage regulation, constant voltage transformers shall be supplied. Materials and equipment used shall be UL approved wherever such approved equipment and materials are available. Materials incorporated into each instrument panel shall be defined as a “component” of the panel into which it is installed as it relates to BABA compliance defined in Specification Section 00820G.

C. Nameplates and Nametags. A nameplate shall be provided for instrument panel identification and shall be located at the top center of the panel. Size of nameplate shall be as required for proper visual identification. Nameplates shall be attached to panels by self-tapping stainless steel screws or rivets, and shall be approximately 1-inch by 3-inch constructed of black and white laminated, phenolic material having engraved letters approximately 3/8-inch high, extending through the black face into the white layer. Nametags shall be provided for all equipment located within the control panel. Each and every devices shall be tagged with embossing tape nametags with identification reference which shall correspond to all drawings and wiring diagrams for the system. The nametags shall be neatly installed and shall be clearly visible for service and maintenance of the equipment.

D. All panel equipment shall be mounted and wired within the cabinet. All wiring shall comply with local and National Electrical Code in open bundles wired to numbered terminals. Each cabinet shall have at least an additional 20 percent spare terminals. Cabinet layouts shall be submitted to the Engineer for review. Materials and equipment used shall be UL approved wherever such approved equipment and materials are available.

E. All equipment shall be designed and constructed so that in the event of a power interruption, the equipment specified hereunder shall resume normal operation without manual resetting when power is restored.

F. All interconnecting wire and wiring to terminals for external connections shall be not less than No. 16 AWG copper, insulated for not less than 600 volts with a moisture and heat resistant material and flame retardant nonmetallic covering. Terminal blocks for No. 12 AWG external connections shall be furnished complete with marking strip, covers, and pressure connectors similar to GE Company Type BB-6 terminal boards. All wiring shall be grouped or cabled and firmly supported to the panel.

All wiring shall be completely tagged and numbered throughout the panel. The number designation shall be the same throughout the panel and each wire shall be tagged with number strips at intervals of no less than twelve inches. Not less than 8-inch clearance shall be provided between the terminal strips and the base for conduit and wiring space. All instruments and devices shall be separately fused as required to protect the equipment. Shielded conductor pairs to control modules and analog equipment shall be brought directly to terminals provided.

G. Terminal strips shall be provided for the purpose of connecting all signal wiring. All terminal strips shall be completely labeled and numbered throughout for each and every unit. Direct inter-wiring between equipment will not be allowed.

H. The panel shall receive a 120 volt, 1 phase, 60 Hertz, 20 ampere electrical service and controls shall receive their power from the above mentioned power source. The panel equipment shall be provided with the required fuse protection. Provide a lug for grounding connection up to a No. 1/0 AWG conductor. Fuses shall not be in excess of 15 amperes.

I. Only one side of a terminal block row shall be used for internal wiring. The field wiring side of the terminal shall not be within 6 inches of the side panel or adjacent terminal. Wiring troughs shall not be filled to more than 60 percent visible fill. Wiring trough covers shall be match marked to identify placement. If component identification is shown on covers for visibility, the I.D. shall also appear on the mounting sub-panel.

J. Panel Enclosures
   1. The panel enclosure shall be of the type specified for the specific panel, with full height door(s). The final panel design shall require approval of the Engineer.
   2. Unless otherwise noted the panel shall be manufactured from cold rolled steel, except that:
      a. Panels located in areas subject to potential exposure to chemical leakage or spray shall be non-metallic and rated NEMA 4X.
      b. Panels located in outdoor areas shall be rated NEMA 4.
   3. The panel shall be free of dents or other defects.
   4. Fabricated panels shall be an angle frame. The frame and shell shall be welded construction.

5. The panels shall be properly sized to handle all internally mounted devices. This shall include timers, connection terminals, etc., and all other equipment described in this section and as shown on the drawings.
6. Provide ground lug sized as specified in this section.
7. Provide natural ventilation as required to properly maintain equipment operation and heat dissipation.
    a. Panels installed outdoors shall be furnished with thermostatically-controlled space heaters unless otherwise approved, dependent on the electronics contained within.
8. Print storage pockets shall be provided on the inside of panel and shall be sufficient size to hold all the prints required to service the equipment.
9. Panel enclosures shall be defined as a "component" of the instrument panel assembly as it relates to BABA compliance defined in Specification Section 00820G.

K. All miscellaneous components shall be heavy duty industrial type, or equal. Mounting hardware shall be stainless steel or cadmium plated. All welds shall be ground smooth and be deburred with no sharp edges. Welding on the panel face should be minimized. Adequate stiffness and support shall be provided to insure a rigid stable structure.

L. The finished enclosure shall be properly degreased, prime painted (2 coats) and finish painted (2 coats) in accordance with the paint manufacturer's instructions, prior to the installation of equipment. The final finish shall be smooth, free of runs, and uniform in tone and thickness. An unopened 1-quart container of each color used shall be supplied with the panel for field touch up.

Brushed anodized aluminum, stainless steel, and FRP panels with color gel coat will not require a paint finish.

2.03 EQUIPMENT

A. The INSTRUMENT LOOP DESCRIPTION and PROCESS & INSTRUMENTATION DRAWING indicate the intent of the process and interconnection between INSTRUMENTS. EQUIPMENT specified herein does not purport to cover all equipment that may be required to complete the process intent. Numbering identification is based on ISA standard. The instrument specifications summarize the system equipment and list their operating parameters. The specifications may not completely include all the required equipment necessary for a completely operational system. The instrumentation supplier shall provide all necessary equipment required in order to perform the function for the system.

B. Flow Elements:
1. The electromagnetic flow tubes shall be SITRANS FM as manufactured by Siemens or an approved equal. They shall have the following attributes:

a.	Sensor Housing	316 Stainless Steel
b.	Liner	Hard Rubber
c.	Electrodes	Hastelloy C4
d.	Protection Type	NEMA 4X
e.	Process Connection	150 lb ANSI/105 Steel
f.	Cable Entries	½" NPT
g.	Power Supply	120 VAC
h.	Signal Output	4-20mA
i.	Signal Conveter	8 digit LCD for flowrate, total, and HART/RS 485 interface

j. Housing Epoxy coated die-cast alum.
k. Grounding S.S. rings and assoc. wiring

Meter Tag	Line Size (inches)	Full Scale Setting (GPM)	Signal Converter Location
FE/FIT-100	12	0-1800	remote
FE/FIT-200	12	0-1800	remote
FE/FIT-300	6	0-450	remote
FE/FIT-400,410,420	6	0-700	integral
FE/FIT-500	8	0-1000	remote
FE/FIT-600	12	0-1800	remote
FE/FIT-700	4	0-300	integral
FE/FIT-800	12	0-1800	remote
FE/FIT-900	12	0-1800	integral

2. Flow elements shall be classified as a "manufactured product" as it relates to BABA compliance defined in Specification Section 00820G. Due to specific equipment requirements, a BABA waiver through the USEPA will be applied for by the Owner, and the contractor shall obtain standard equipment as included herein.

C. Pressure/Differential Pressure Transmitters:

1. The pressure transmitters (PIT-100, DP-100) shall be indicating, gauge pressure type, 2 wire, 4-20 mAdc output signal with non-interacting zero and span adjustments. The transmitter shall have an accuracy of $\pm$0.25% of calibrated span and $\pm$0.1% repeatability of maximum span. Transmitter range shall be:

Tag No.	Range (psi)
PIT-100	0-150
DP-100	0-20

2. Electric terminations shall be in a NEMA 4 enclosure provided with a terminal strip. All wetted parts shall be 316 SS. Indicating/transmitters shall be as Siemens, Rosemount, Foxboro, or approved equal. Provide dual valve manifolds for each pressure transmitter and 3-way valve manifolds for differential pressure transmitters, Anderson Greenwood or equal.

3. Pressure Transmitters shall be classified as a "manufactured product" as it relates to BABA compliance defined in Specification Section 00820G. Due to specific equipment requirements, a BABA waiver through the USEPA will be applied for by the Owner, and the contractor shall obtain standard equipment as included herein.

D. Liquid Level Monitoring Systems:

1. Chemical Bulk and Below-Grade Water Tank Level Monitoring

a. The level monitoring system at the NaOCl (LT-800 & 810), NaOH (LT-900 & 910), HFS (LT-700), phosphate (LT-600) bulk tanks; and the MIEX Effluent Intermediate Wetwell (LT-200), Spent Backwash Tank (LT-300), Backwash Supply Tank (LT-400), Clearwell (LT-500), and Brine Waste Tank (LT-1000) shall be non-contact, 2-wire radar sensor providing a 4-20mA output signal linear to tank level for level indication locally to the tanks, chemical transfer pump control panels, and SCADA monitoring. Transmitters for installation on the below-grade tanks and

bulk tanks shall be furnished with a 4" mounting flange for installation on flanged fittings. Units shall be furnished with the necessary length of shielded cable to accommodate the equipment layout.

b. The transmitter shall have a 49-foot measuring range. Supply voltage shall be 24 VDC with a 4-20mA output proportional to level.

1. Range	49 feet
2. Accuracy	+/- 2mm
2. Enclosure Material	PVDF
3. Enclosure Rating	IP66/IP68, NEMA 6P
4. Process Seal Material	FKM
5. Process Connection	Per Manufacturer

c. The indicator/transmitters for the below-grade tanks (LIT- 200, 300, 400, and 500) shall be housed in a wall-mounted NEMA 6P enclosure. Indicators for the chemical bulk tanks (LIT-600, 700, 800, 810, 900, and 910) shall be housed in the transfer pump control panel associated with each chemical as shown on the Drawings. Day tank transmitters at the transfer pump control panel shall allow for stoppage of the chemical transfer pump on high level. The transmitters shall be programmed and configured via a keypad. The units shall provide a 4-20mA output proportional to level. Indicator display shall be 5 digit LCD.

d. The level measurement systems shall operate on 24-VDC, loop-powered from the SCADA panel it is connected to, and shall have a resolution of ±0.1 percent of range, and an accuracy of ±0.25 percent of range.

e. The level monitoring systems shall be VEGAPULS C21 transmitter mated with VEGADIS 82 indicator/transmitter as manufactured by VEGA America, Inc., or approved equal.

f. Liquid Level Monitoring equipment shall be classified as a "manufactured product" as it relates to BABA compliance defined in Specification Section 00820G. Due to specific equipment requirements, a BABA waiver through the USEPA will be applied for by the Owner, and the contractor shall obtain standard equipment as included herein.

2. Day Tank Level Monitoring

a. The level monitoring system at the NaOCl (LS-820), NaOH (LS-920), HFS (LS-710) and phosphate (LS-610) day tanks shall be a combination non-contact, 2-wire ultrasonic transmitter providing a 4-20mA output signal linear to tank level for SCADA monitoring; and level switch with four (4) programmable relays for stoppage of the chemical transfer pump on high level. The unit shall consist of a transducer with megaphone and level indicating transmitter (LI-610, 710, 820, and 920) mounted at the respective chemical transfer pump control panel, and furnished with the necessary linear feet of shield cable to connect the level transducer to the indicator.

b. The transmitter shall be automatic temperature compensating and shall be configured utilizing free manufacturer's software and USB adaptor. Supply voltage shall be 24 VDC with a 4-20mA output proportional to level. The level monitoring system shall be DL14 or DL24 (dependent on day tank depth) as manufactured by Flowline or approved equal. Furnish one L99-1001 Web-Cal kit (USB FOB and software CD) for transmitter calibration.

1.-Range	49 inches (DL14) 9.8 feet (DU24)
2.-Accuracy	0.125 inches (DL14) ± 2% of range (DL24)
3.-Resolution	0.019 inches (DL14) 0.039 inches (Dl24)
4.-Enclosure Material	PC/ABS
5.-Enclosure Rating	6P
6.-Transmitter Material	PVDF Kynar
7. -Process Connection	1" NPT

c. Day Tank Level Monitoring equipment shall be classified as "manufactured products" as it relates to BABA compliance defined in Specification Section 00820G. Due to specific equipment requirements, a BABA waiver through the USEPA will be applied for by the Owner, and the contractor shall obtain standard equipment as included herein.

3. Submersible Level Sensors
   a. Well level monitoring shall be via a submersible sensing element of no more than 0.70-inches in diameter. Sending unit output shall be a direct acting 4-20mA signal. The well level monitoring system shall be a Micro-Bore manufactured by Keller America or approved equal. Each well basin level sensor shall be powered from the SCADA MCP.
   b. The transducer cable shall terminate within a NEMA 4X enclosure housing the required terminal strips, and a bellows on the sensing element air vent.
   c. The well sensor shall be furnished with integral surge protection mounted on the sensor, and additional surge protector for installation on the signal line terminus within the MCP.

Tag No.	Range (Feet)	Cable Length (feet)
East Basin (LT-100)	25	25
West Basin (LT-110)	25	25

4. Sump level switches (LS-500, 600, 700, 800, and 900)
   a. Sump Level switches shall consist of a Buna N float and 304 stainless steel stem. Float shall be contained within a see-thru slosh shield, suitable for wall mounting, which shall prevent interference by foreign material. Float switch shall be Gems Series LS-270, or Engineer approved equal
   b. Sump Level Switches shall be classified as "manufactured products" as it relates to BABA compliance defined in Specification Section 00820G. Due to specific equipment requirements, a BABA waiver through the USEPA will be applied for by the Owner, and the contractor shall obtain standard equipment as included herein.

5. MIEX Effluent Intermediate Wetwell (LS-100,110), Spent Backwash Tank (LS-200, 210), Backwash Supply Tank (LS-300, 310) tanks, Waste Brine Tank (LS-1000, 1001) and Clearwell (LS-400, 410) high and low level switches shall be float switches provided with N.O. or N.C. contacts as required. The float shall contain a mechanically activated snap-action switch in a polypropylene corrosion resistant float. A two conductor power cord (length to suit) with an attached weight shall be provided to allow the switch to be held at any desired level. Float

switches shall be Eco-Float Model G as manufactured by Anchor Scientific, Inc., or approved equal.

E. Exterior Fill Station Indicator Panels:

1. Level indicator panels (LI-601, 701, 801, 811, 901, 911, and 1001) at the outdoor fill stations shall each be equipped with a digital display, alarm horn and light, and alarm acknowledge button installed in a NEMA 4 enclosure with window for meter viewing.
2. Digital displays shall be LED type 14 mm high numbers with display in engineering units coordinated with input signals. Display shall be to one decimal point, and shall be Newport Electronics or equal. Displays shall be coordinated to indicate the level in gallons of the specific tank being measured.
3. The combination alarm horn and LED light shall be 120VAC, with a sound output of 100 decibels produced by electro-mechanical vibration of a diaphragm, and shall be equal to Allen-Bradley 855P. A manual alarm silence button shall be furnished to provide an alarm acknowledgement signal to the SCADA for horn silencing.
4. Enclosures shall be:
    a. Furnished with thermostatically controlled space heater.
    b. Shall be mounted above the respective chemical fill pipe.
    c. Shall have 3/4" high lamicoid label with the following information for each chemical:
        i. Chemical name
        ii. Chemical formula
        iii. UN number
5. Each Exterior fill station indicator panel shall be preassembled and tested prior to delivery to site.
6. Each Exterior fill station indicator panel shall be classified as a single "manufactured product" as it relates to the Buy America Build America Act (BABA) requirements defined in Specification Section 00820G.

F. Chemical Transfer Pump Control Panels:

1. Control panel shall be NEMA 4X. The panel shall be coordinated with the respective transfer pump to be provided and shall contain the motor starter and all indicators and controls required to perform the functions described under subsection 1.11.E.4 of the System Description.
2. In addition to pump controls, each panel shall contain the respective bulk and day tank level indicators, and for the systems with two bulk tanks, the panel shall contain the necessary tank selector switch for selecting which bulk tank from which to draw chemical.
3. Power supplies required for operation of the associated level indicators/sensors to be provided under this Section shall be provided and housed in the control panel. Power to the panel shall be 120-volt.
4. Level indicators shall be as specified for the exterior fill station panels in paragraph 2.03.E above.
5. Each Chemical Transfer Pump Control Panel shall be classified as a single "manufactured product" as it relates to the Buy America Build America Act (BABA) requirements defined in Specification Section 00820G.

G. Level Switch Relay Panels

1. Shall be NEMA 4 and shall receive 120-volt power. The panels shall contain the necessary number of relays for the shutdown of the respective pump motor starters on either high or low tank level as described under subsection 1.11.E.4 of the System Description.

2. Each Level Switch Relay Panel shall be classified as a single "manufactured product" as it relates to the Buy America Build America Act (BABA) requirements defined in Specification Section 00820G.

H. Water Quality Monitoring:

1. pH Analyzers

a. pH shall be monitored by a panel-mounted in-line pH sensor and controller suitable for wall mounting. The sensor shall incorporate a replaceable pH electrode. The sensor shall have a measurement range of 0-14 pH. The sensor shall incorporate a sensor for automatic temperature compensation and temperature measurement from -30-140°C. The sensor shall be insertion type, with flow cell designed to provide a constant flow as required for proper sensor measurement. The flow cell shall include a sample port with hose barb. The panel-mounted assembly shall be a Neon pR Part #70142011K as manufactured by Kuntze, or equal. Furnish a rotometer with needle valve on inlet line to analyzer sized to accommodate required minimum flow rate.

b. The pH controller shall be microprocessor-based control instruments, with measurement range of -2+16 pH units and -1500 to $\pm$1500 millivolts, and shall provide automatic temperature compensation and measurement from -30 to 140°C. Operator selectable functions for pH, millivolt, temperature, and alarm setpoint selection shall be provided by front-panel mounted, touch-sensitive switches. Measurements shall be displayed on a liquid crystal display (LCD). Two independent SPDT relays with dry contacts shall be provided for high and low alarm outputs, which shall be fully adjustable over the entire pH and millivolt ranges. 4-20 ma outputs shall be provided for pH and temperature. The pH controller shall be Neon pR manufactured by Kuntze, or equal, and shall operate on 120VAC, 60Hz.

c. The pH sensor and controller shall be of the same manufacturer. One spare pH sensor probe shall be provided for each pH analyzer furnished.

d. pH Analyzers shall be classified as a "manufactured product" as it relates to BABA compliance defined in Specification Section 00820G. Due to specific equipment requirements, a BABA waiver through the USEPA will be applied for by the Owner, and the contractor shall obtain standard equipment as included herein.

2. Free Chlorine and Combination pH/Temperature/Free Chlorine Monitoring

a. The free chlorine and combination pH, temperature, and free chlorine residual analyzer shall be a panel-mounted in-line unit comprised of the pH sensor, a residual chlorine sensor, and multi-channel controller suitable for wall mounting. A flow cell shall be provided for each sensor, plumbed in series, preceded by specified sample flow controller. The flow cell shall include a sample port with hose barb. Furnish a rotometer with needle valve on inlet line to analyzer sized to accommodate required minimum flow rate.

b. The pH sensor shall be as specified for the pH analyzer above.

c. The chlorine sensor shall be a three-electrode potentiostatic sensor immersed into an electrolyte medium, having a measurement range of 0-20 ppm chlorine with low limit of detection (LOD) of 0.04 ppm or better. Alternative methods of chlorine measurement such as two-electrode amperometric and amperometric requiring a flexible membrane plus electrolyte are not acceptable. Wetted materials shall be as follows:

Chlorine measuring cell: Acrylic

Chlorine sensor body Glass

d. The analyzer shall incorporate a sensor for automatic temperature compensation and temperature measurement from -30-140°C.

e. The controller shall be as specified for the pH analyzer above except that it shall be equipped with five independent SPDT relays with dry contacts, and five 4-20 ma outputs of which three will be programmed for chlorine residual, pH, and temperature. The panel-mounted assembly shall be a Krypton Multi Part #70153000K1 as manufactured by Kuntze, or equal, and shall operate on 120VAC, 60Hz.

f. Each analyzer shall be classified as a "manufactured product" as it relates to BABA compliance defined in Specification Section 00820G. Due to specific equipment requirements, a BABA waiver through the USEPA will be applied for by the Owner, and the contractor shall obtain standard equipment as included herein.

3. Fluoride Monitoring

a. The fluoride monitor shall be a panel-mounted in-line unit comprised of the fluoride sensor and flow cell assembly, sample flow control consisting of a rotometer and needle valve, and programmable digital display controller suitable for wall mounting.

b. The full scale operating range of the system may be selected by the user for 0-20.00 PPM, 0-200.0 PPM, or 0-2000 PPM. The analog output signal may be spanned for smaller ranges within the overall operating ranges.

c. The basic sensing element shall be a fluoride ion selective electrode (ISE) containing a lanthanum fluoride crystal that generates a voltage proportional to the activity of fluoride ion in solution. A silver/silver chloride reference electrode contained in the same sensor body shall provide the second half of the measurement cell.

d. The residual monitor shall display a residual concentration directly in parts-per-million (PPM) on a backlit LCD display. The display range shall be programmable for ranges 0-20.00 PPM, 0-200.0 PPM, or 0-2000 PPM using the keys on the front of the unit. A 4-20mA shall be provided for remote monitoring. All programming and calibration functions shall be performed through the front panel keys, and a keyboard software lock shall be included to avoid unauthorized tampering of monitor settings. The software shall allow to store the measured value in memory at the time a laboratory sample is taken. When the laboratory results are obtained, the calibration routine shall allow the stored value to be adjusted even if current measured value has changed. Once the stored value has been adjusted, the current value shall be adjusted accordingly.

e. The fluoride monitor shall be Series Q46FD as manufactured by Analytical Technology, Inc. or approved equal, and shall operate on 120VAC, 60Hz.

f. Each analyzer shall be classified as a "manufactured product" as it relates to BABA compliance defined in Specification Section 00820G. Due to specific equipment requirements, a BABA waiver through the USEPA will be applied for by the Owner, and the contractor shall obtain standard equipment as included herein.

4. Turbidimeters

a. Turbidimeters (TRB-100 and 300) shall be a continuous-reading, on-line instrument using the nephelometric method of measurement. An auto-ranging digital display shall read from 0-100 NTU, with an accuracy of $\pm$ 2

percent from 0-40 NTU and ± 5 percent from 40-100 NTU. The turbidimeter shall consist of turbidimeter body and control unit, both suitable for wall mounting.

b. The turbidimeter body shall be constructed of corrosion-resistant structural plastic, and shall be powered from the control unit. The control unit shall provide a 4-digit LED display and automatic decimal positioning, and shall provide a linear output signal which can be programmed to span all or any portion of the 0-100 NTU range. A 4-20 ma current output shall be provided. The control unit shall be housed in a NEMA 4X enclosure.

c. Turbidimeters shall be Model TU5300sc with sc4500 controller as manufactured by Hach Company, or equal. Power requirements shall be 120 VAC, 60 hertz.

d. Each turbidimeter shall be classified as a "manufactured product" as it relates to BABA compliance defined in Specification Section 00820G. Due to specific equipment requirements, a BABA waiver through the USEPA will be applied for by the Owner, and the contractor shall obtain standard equipment as included herein.

5. High-Range Turbidity/Suspended Solids Analyzer

a. The turbidity/suspended solids analyzer (TRB-200) shall consist of an inline insertion-type probe connected to an indicator/controller with the following performance requirements:

i. Measurement range
   a) Turbidity: 0.001 to 4000 NTU.
   b) Suspended solids: 0.001 to 50.000 mg/L or 0.000001 to 50.0 g/L (ts-line or inline), or 0.001 to 500.000 mg/L or 0.000001 to 500 g/L (hs-line or highline).

ii. Repeatability
   a) Turbidity: Less than 1% of reading.
   b) Suspended solids: Less than 3% of reading.

iii. Accuracy
   a) Turbidity: Less than 1% of reading or ±0.001 NTU, whichever is greater.
   b) Suspended solids: Less than 5% of reading.

iv. Detection limit
   a) Turbidity: 0.001 NTU.
   b) Suspended solids: 0.001 mg/L.

v. Units of measure
   a) Turbidity: User Selectable NTU, FNU, EBC, FTU and TE/F.
   b) Suspended Solids: User Selectable g/L, mg/L, ppm, or % solids.

b. Turbidimeter/suspended solids analyzer shall be Model Solitax hs-line sc (Product No. LXV424.99.00100) with sc4500 controller as manufactured by Hach Company, or equal. Power requirements shall be 120 VAC, 60 hertz.

c. Furnish installation kits Model No. LZX-936 and LZX-661.

d. Each turbidimeter shall be classified as a "manufactured product" as it relates to BABA compliance defined in Specification Section 00820G. Due to specific equipment requirements, a BABA waiver through the USEPA will be applied for by the Owner, and the contractor shall obtain standard equipment as included herein.

I. Flow Switches:

1. The flow switches (FS-100 thru 800) for installation on the water supply line to the emergency shower/eyewash units shall be a shuttle-type reed switch. Displacement of the shuttle by fluid flow actuates a hermetically sealed reed switch for flow alarm activation. The flow switch shall be Model FS-200 as manufactured by GEMS Sensors, or approved equal. The flow switch shall be of the same size as the piping to which it is to be installed and shall have an actuation flow less than the flowrate discharged through the eyewash portion of the units (typically 3/4 gpm).

J. Wall-mounted temperature transmitter (TT-100)

1. Shall be indicating, 2 wire, 4-20 mAdc output signal. Splash-proof front panel shall be of ABS plastic with polycarbonate window, with black anodized aluminum heat sink, furnished with rear gasket seal, mounted on PVC electrical outlet box. The transmitter shall have an accuracy of $\pm$0.5% of calibrated span. Display shall be 3-1/2 digit LED, 0.37" high numerals, 0-150 deg. F. The temperature indicator/transmitter shall be Model RTTI as manufactured by Devar, Inc. or approved equal.
2. Wall mounted temperature transmitters shall be classified as a "manufactured product" as it relates to BABA compliance defined in Specification Section 00820G. Due to specific equipment requirements, a BABA waiver through the USEPA will be applied for by the Owner, and the contractor shall obtain standard equipment as included herein.

K. Signal Isolators

1. 4-20mA signal isolators/splitters shall operate on 120V, with an accuracy of $\pm$0.5% of span. Isolation shall be 1500Vrms between input and output, with a response time of 100 msec maximum to 99% of output maximum. Adjustments shall be front panel pots, with a span of $\pm$10% and zero of $\pm$5%.
2. Signal splitters shall isolate the output from one transmitter, and send two identical, completely separate isolated outputs.
3. Signal isolators/splitters shall be ECT as manufactured by Moore Industries, or approved equal.
4. Signal isolators shall be defined as a "component" of the instrument panel into which it is installed as it relates to BABA compliance defined in Specification Section 00820G.

L. Power Supply

1. The Loop Diagrams and Descriptions indicate the requirements for power supplies for the different locations.
2. The final requirements and exact locations for the power supplies shall be the responsibility of the instrumentation system manufacturer. These units shall be provided and sized to handle all possible load conditions with sufficient capacity.
3. All power supplies shall be of the same manufacturer and of the same type.
4. All power supplies shall be regulated and shall be suitably protected during the operation of the unit and also incorporate protection to the equipment it serves.
5. Power Supplies shall be defined as a "component" of the instrument panel into which it is installed as it relates to BABA compliance defined in Specification Section 00820G.

M. Spare Parts

1. Spare parts shall be provided as a part of the start-up services during the initial plant start-up and phase-in period. These items shall include accessories such as

fuses, electrodes, membranes, fluids, lights, etc. required to start-up and operate the system for a period of 60 days. These items shall be packaged in separate containers and shipped to the job site with the instruments and shall be tagged "INSTRUMENT START-UP EQUIPMENT."

2. Spare parts and accessories above and beyond those being provided for start-up services shall be provided under this Section. All spare parts shall be packaged and shipped at one time. Separate shipment of spare parts shall not be acceptable. The Engineer shall be notified of the shipment release in writing indicatin7g that all items have been shipped. Each item shall be checked by the Engineer as being received and that all components have been provided as specified.
3. A one year supply of consumables and replacement parts required for all instruments and devices being furnished for the system including but not limited to circular charts, chart pens, analyzer membranes and electrolytes.
4. Two boxes of spare fuses of each type being supplied. A box shall consist of a minimum of 12 fuses.
5. Spare Parts shall be defined as “component” of the panel into which they are to be installed as it relates to BABA compliance defined in Specification Section 00820G.

N. Programmable Logic Controllers

1. For purposes of standardization with other PLCs currently in use by the Owner, all PLCs to be furnished under this contract shall be based on Allen-Bradley controllers.
2. The programmable logic controllers (PLCs) shall be Allen-Bradley Compactlogix or Control Logix controllers.
3. Interposing relays for control output shall be provided with a minimal contact rating of 10 amps at 120 VAC.
4. The PLCs shall be provided with two serial ports for communications with a portable computer and modem communication protocol.
5. Operates from DC power, which may vary from 12 to 30 Vdc. A 120 Vac source shall be the only power to the PLCs.
6. Digital I/O points shall be fully optically isolated and shall be 24 VDC. The number of digital I/O shall support the number required at each site plus 20 percent spare, or additional 4 of each, whichever is greater.
7. The PLC shall be capable of supporting the number of analog inputs and outputs required, plus a minimum 10 percent spare, or additional 4 of each, whichever is greater. Each analog input shall have 10-bit resolution, and shall be easily user configurable to support 0-1 Vdc, 0-10 Vdc, and a 4-20 mA. Input signal ranges, individually settable by channel. All analog inputs shall be fully isolated differential types, capable of rejecting electrical interference normally associated with industrial equipment including, but not limited to transformers, motor starters contactors and electrical heaters. The analog outputs shall be configured for current loop operation (0-20 mA/4-20 mA).
8. The PLC shall perform all on-line local control functions by means of a control program maintained within the unit’s memory. In the event of a system or communications failure, it shall continue to control its assigned process and shall store all necessary data for transmission when communication resumes. It shall also be capable of store and forward message functionality for radio telemetry applications.
9. The twelve (12) control panels to be furnished under this project are listed below. Equipment listed to be included in each panel is not intended to portray all

devices required for system operations as described within this section or as indicated on the drawings. These panels shall be in accordance with Section 13400.

a. One main control panel (MCP) shall include PLC with required I/O, operator interface terminal (OIT), power supplies, uninterruptable power supply (UPS), Ethernet switch, etc.

b. Four Remote input/output panels (RIOPs). These are RIOP-A, RIOP-B, and RIOP-C (one at each GreensandPlus filter in WTP and furnished by the GreensandPlus Filter Vendor), and RIOP-1 (in backwash and high-lift-pump room and furnished under Division 13). Each shall include required I/O cards, power supply, UPS, Ethernet switch, etc.

c. One filter control panel (FCP) furnished by the GreensandPlus Filter Vendor with PLC with required I/O, operator interface terminal (OIT), power supplies, uninterruptable power supply (UPS), Ethernet switch, etc.

d. Six MIEX control panels (all furnished by the MIEX vendor), including the main MIEX control panel (MMCP) and five MIEX local control panels (MLCPs).

e. Each control panel shall be classified as a single "manufactured product" as it relates to the But America Build America Act (BABA) requirements defined in Specification Section 00820G.

10. PLC and remote I/O components shall be defined as a "component" of the control or RIOP into which it is installed as it relates to BABA defined in Specification Section 00820G.

O. Operator Interface Terminals (OITs)

1. The display for the MCP to be furnished under this contract shall be manufactured by Allen-Bradley, and shall a be 15" Panelview Plus touchscreen display.

2. Each OIT shall be defined as a "component" of the panel into which it is installed as it relates to BABA defined in Specification Section 00820G.

P. Uninterruptible Power Supply (UPS)

1. UPSs shall be Model BN900M as manufactured by APC.

2. Each UPS shall be defined as a "component" of the panel into which it is installed as it relates to BABA defined in Specification Section 00820G.

PART 3 EXECUTION

3.01 INSTALLATION

A. Instrumentation and Accessory equipment shall be installed in accordance with the best field and shop practices.

B. The workmanship shall be in accordance with the best field and shop practices for the instrument and control systems.

C. All workmen shall be skilled in the work to which they are assigned, and all work shall be performed under an instrument foreman.

D. All wiring and piping shall be constructed perfectly plumb, square, level, and true to lines and surfaces indicated, in a neat, substantial and workmanlike manner, and in such a way

as to properly serve for the purpose intended. All members and parts, upon installation, shall be properly framed, secured together, and anchored in place. All cuts shall be deburred and immediately cleaned from opposite end before connecting.

E. All instruments shall be mounted, piped and connected in strict accordance with the manufacturer's instructions. All panels shall be mounted 5 feet above the floor, as measured to the center of the panel, or as directed by the Engineer.

F. All internal wiring of the panels shall be done by the panel manufacturer in accordance with the drawings, and instrument manufacturer's instructions.

G. The instrument specifications indicate the intent of the interconnections between and the type of individual instrument. The proposed equipment shall be complete with all mounting hardware and accessories to satisfy the functional requirements.

H. All work shall be executed in full accordance with codes and local rulings. Should any work be performed contrary to said rulings, ordinances and regulations, the Contractor shall bear full responsibility for such violations and assume all costs arising therefrom.

I. All piping to and from field instrumentation shall be provided with necessary unions, test tees and shut-offs.

J. Interfacing fixtures shall be compatible with the equipment to which they are attached and shall comply with the applicable specifications.

K. Coordination with the process and equipment in addition to standard quoted fixtures required to conform the instrumentation to the process shall be the responsibility of the Contractor. The instrument and control system supplier shall provide detail information on the fixtures being supplied and the extent of the field installation required.

L. Brackets and hangers required for mounting of equipment shall be provided as noted on drawings and/or as required. The brackets and hangers shall be installed in a workmanlike manner and shall not interfere with any other equipment.

M. The shield on each process instrumentation cable shall be grounded as directed by the manufacturer of the instrumentation equipment but in no case shall more than one ground be employed for each shield.

N. Maximum practical separation shall be maintained between signal (analog alarm, and status) conduits and power feeders and AC systems.

O. All field conductors shall terminate at the panel terminal board. Millivolt signal wires (i.e., thermocouple) may be connected direct to the input terminals of the receiving instrument if so specified.

P. All wire ends shall be terminated with hook fork type non-split compression lugs.

Q. All wire ends shall be identified at both ends with wire markers.

R. Entry to field enclosures shall be through the back, side, or bottom (not top) with weatherproof hubs. Wiring shall enter near the terminal point and not obstruct access to removal of components.

S. Lifting rings from cabinets/assemblies shall be removed. Hole plugs of the same color as the cabinet shall be provided for the holes.

3.02 START-UP

A. Prior to final connection to any of the instrument panels, the Contractor shall clean all work completed including the interior of all panels; and remove all dirt, trash, and foreign material. The outside of all instrument panelboards are to be cleaned, and damaged painted surfaces touched up as required to leave the equipment in an acceptable condition. This shall include all nameplates, tags, and identification of equipment and devices within or on the front of the panels.

B. No form of energy shall be turned on to any part of the instrumentation system prior to receipt by the Engineer of a certified statement of approval of the installation from the Contractor containing his supplier's authorization for turning on energy to the system.

C. It shall be the responsibility of the instrumentation system supplier to provide a factory trained and qualified serviceman from the manufacturer of the equipment to TEST AND CALIBRATE ALL EQUIPMENT and to INSTRUCT the Contractor on EQUIPMENT INSTALLATION and the OWNER on operation of the equipment.

D. No other instrumentation system manufacturer's personnel other than those persons directly from the service department of the manufacturer of the equipment shall be acceptable to perform this work.

E. The start-up services shall be performed by qualified personnel from the service department of the equipment manufacturer with a minimum of five years experience on the equipment being provided by this contract, or equal.

F. During the start-up, the Contractor shall provide sufficient personnel to aid with the start-up of the instrument and control equipment to be provided and installed by this Section and by this Contract. This shall include services to correct any faults and to make the necessary adjustments for the proper operation of the equipment and installation.

3.03 TESTING AND CALIBRATING

A. Testing and calibration of equipment shall be done in the presence of the Engineer.

B. Prior to electrical check out, all breakers, switches and similar disconnect devices shall be placed in the off position.

C. Visual inspection and continuity testing shall be made to verify that no damaging wiring errors occur between power and signal wiring.

D. The systems shall be checked for improper or accidental grounding.

E. Each system and component shall be energized and their inputs simulated. The output shall be checked to verify the proper calibration and interaction with associated hardware.

F. Hypotting shall not be permitted on instrument system unless specific instructions are given to safeguard electronic equipment from damage.

G. Prior to actuating a final control element (valve, level actuator, or variable speed drive) the Contractor shall obtain the permission of the Engineer and any other involved contractors to prevent damage to associated equipment.

H. The factory serviceman shall verify the calibration and direction of the final control element in accordance with the requirements for each portion of the system.

I. Instrument and control calibration and control loop checkout shall be the responsibility of the manufacturer of the equipment.

J. The Contractor shall arrange for and obtain the services of a factory trained service qualified engineer from the manufacturers of the equipment to perform the calibration and commissioning of the entire system.

K. Each instrument shall be calibrated at 10 percent, 50 percent, and 90 percent using test instruments that are rated to an accuracy of at least five times greater than the instrument being checked. The test instrument shall have its accuracy traceable to the National Bureau of Standards as applicable.

L. All chemical bulk and day tank level displays shall read in gallons. All distribution storage tank, well level, and below-grade water tank (clearwell, etc.) levels shall be displayed in feet.

M. Upon completion of the work, the Contractor shall demonstrate to the Engineer the proper operation of all equipment and systems.

N. The Contractor shall deliver to the Engineer all test data, inspection test certificates, manufacturers' warranties, certified calibration data, certified prints, manufacturer's installation, operation and maintenance manuals, electrical wiring and control diagrams with all noted field modification for an as-built record for the system, and required and suggested spare parts lists.

O. Upon completion and satisfactory performance, an approval notification shall be provided to this portion of the work for this Section. No equipment shall be allowed to be shipped from the factory without approval for this portion of the work.

3.04 MANUFACTURER'S SERVICES

A. The supervisory service of a factory-trained service engineer who is specifically trained on the type of equipment herein specified shall be provided for a period of not less than three (3) eight-hour days during construction to assist the Contractor in equipment installation; the location of sleeves; methods of installing conduit and special cable; mounting, piping, and wiring of one of each type of device; and the methods of protecting all of the equipment prior to placing it into service.

Upon completion of the installation, the services of the above service engineer shall be provided for a period of not less than three (3) eight-hour days for calibration.

The system supplier shall conduct a group training program on the operation and routine maintenance of the system. The training shall be conducted at the installation site and consist of two classroom and field training sessions, up to two eight (8)-hour training days during normal working hours. The text shall be the operation and maintenance manual and shall concentrate on the operation of the equipment as applied to this process.

The minimum days specified above do not relieve the manufacturer of providing sufficient service to place the system in satisfactory operation.

3.05 PRODUCT HANDLING

A. Upon completion of shop assembly and testing, all panels shall be enclosed in heavy duty polyethylene envelopes or secured sheeting to provide complete protection from dust and moisture. Dehumidifiers shall be placed inside the polyethylene coverings. The equipment shall then be skid-mounted for final transport. Lifting rings shall be provided for moving the equipment without removing protective covering. Boxed weights shall be shown on shipping tags together with instructions for unloading, transporting, storing and handling at the job site.

B. Special instructions for proper field handling and installation required by the manufacturer for proper protection, shall be securely attached to each piece of equipment prior to shipment.

C. Each package shall be tagged to identify its location, tag number, and function in the system. Identification shall be prominently displayed on the outside of the package.

D. A permanent stainless steel or other non-corrosive material tag firmly attached and permanently and indelibly marked with the instrument tag number, as given in the tabulation, shall be provided on each piece of equipment supplied under this section.

E. Equipment shall not be stored out-of-doors. Equipment shall be stored in dry permanent shelters and, including in-line equipment, shall be adequately protected against mechanical injury. If any apparatus has been damaged, such damage shall be repaired or the damaged equipment replaced by the Contractor at his own cost and expense. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such tests as directed by the Engineer. This shall be at the cost and expense of the Contractor, or the apparatus shall be replaced by the Contractor at his own expense.

END OF SECTION

SECTION 13400

SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA) SYSTEM

PART 1 GENERAL

1.01 SUMMARY

A. The work covered under this Section of the Specifications includes the furnishing of all plant, labor, equipment, appliances and materials, and in performing all operations in connection with the furnishing, installation, testing, and training for a computerized Supervisory Control and Data Acquisition (SCADA) system for the monitoring and control of the Wading River water treatment plant (WTP) constructed under this contract and Owner's existing water distribution system, complete in place, in accordance with the Drawings and Specifications.

B. The work involves the installation a new computerized SCADA system, consisting of a programmable logic controller (PLC) based main control panel (MCP) furnished by the Control System Supplier (CSS) and three personal computer (PC) workstations located at the new WTP, constructed under this contract. The work also involves installation of four new Remote I/O panels; RIOP-1 furnished by the CSS, and RIOP-A, RIOP-B, and RIOP-C (furnished by the GreensandPlus Filter Vendor); one filter control panel (FCP) furnished by the GreensandPlus Filter Vendor; and six MIEX control panels furnished by the MIEX Vendor. All PLC and SCADA programming, including SCADA software licensing will be provided by the Owner's SCADA Integrator, Woodard & Curran, Inc.

C. The system shall be installed with the necessary hardware and software to provide a remote access solution that aligns with the latest cybersecurity practices and standards set by leading authorities and experts, such as Instrument Society of America (ISA) IEC-62443, National Institute of Standards and Technology (NIST) NIST 800-82, and the Cybersecurity & Infrastructure Security Agency (CISA). All hardware, software, and configuration needed to integrate cybersecurity will be provided by the Owner's SCADA Integrator, Woodard & Curran, Inc.

D. The system shall be installed complete and ready to operate, including all necessary interconnections between field equipment and input/output cabinets and accessories as specified or as recommended for optimum operation for the equipment furnished. The SCADA system hardware shall be readily available. None of the hardware in the system shall be part of a discontinued line or classified as hardware which is on repair status only.

E. In general, the programmable logic controller (PLC) in the main control panel (MCP) shall be the central point for monitoring and controlling all instruments, signals, alarms and controls in the WTP constructed under this contract. All signals, alarms and controls shall either emanate from or terminate at the MCP located in the Electrical Room at the WTP. All process signals, alarms and controls shall also be monitored or controlled by the Supervisory Control and Data Acquisition (SCADA) system.

1.02 RELATED WORK

A. Documents affecting the work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
   1. Section 11610 Magnetic Ion Exchange (MIEX) Treatment System
   2. Section 11240 Horizontal Greensand Filters
   3. Section 11209 PFAS Removal Treatment System
   2. Section 11423 Chemical Feed Equipment
   3. Section 13100 Instrumentation and Controls
   4. Division 16 Electrical

1.03 RELATED WORK NOT INCLUDED

A. Providing piping, valves, fittings, flow tubes and appurtenances shall be covered under Division 15.

B. Providing pumps, drives and appurtenances shall be covered under Division 11.

C. Chemical metering pumps, tanks and appurtenances shall be provided under Section 11423.

D. Electrical conduit, wiring, relays, starters, motor control centers and appurtenances shall be provided under Division 16 of these specifications.

E. All electrical devices and panels furnished under this Section shall be installed under Division 16.

F. The MIEX system equipment shall be provided under Section 11610 with the MIEX Main Control Panel (MMCP) and five MIEX Local Control Panels (MLCPs) installed under Division 16.

G. The GreensandPlus filters shall be provided under Section 11240 with a Filter Control Panel (FCP) and three remote I/O panels (RIOP-A, RIOP-B, and RIOP-C) furnished under Section 11240 and installed under Division 16.

1.04 RESPONSIBILITY FOR EQUIPMENT

A. Scope of Work: Contractor shall furnish all required equipment and accessories necessary to provide a complete operating SCADA system. All equipment shall be furnished as indicated on the drawings and specified herein or as required to ensure proper system functioning.

B. Responsibility and Coordination: Contractor shall be responsible for coordination of the SCADA system with the MMCP and FCP and the instrumentation and controls system to ensure a complete, integrated and fully functional system. All signals, alarms and controls shall either emanate from or terminate at the MCP. All process signals, alarms and controls shall also be monitored or controlled by the SCADA system. Substitutions of operations or functions specified herein will not be acceptable.

C. Single Manufacturer: Contractor's attention is directed to the fact that the equipment specified herein shall, in so far as practical, be furnished by one manufacturer. All of the equipment shall be of the manufacturer's latest, most modern and proven design. Overall system and component accuracy shall be as guaranteed by the specified manufacturer.

D. Completed System: It shall be the responsibility of Contractor to coordinate the work of the SCADA system, the instrumentation and control systems, the MIEX, GreensandPlus, and PFAS systems, so as to furnish one complete and fully operational system for the supply, treatment, storage and distribution of water in Owner's water system. The drawings and specifications are intended to include all details of a complete equipment installation, but do not purport to cover all details entered into the design of the complete system. Contractor shall be responsible for all details which may be necessary to properly install, adjust and place in operation a complete instrumentation and control system. Contractor shall assume full responsibility for any and all additional costs which may result from any and all deviations or substitutions from the specifications.

1.05 SUBMITTALS

A. Submit the following in accordance with the Conditions of Contract and Division 1 Specification Sections.

B. Submittals shall include general software and hardware descriptions; customer list including name and telephone number of contact person(s); experience descriptions; manufacturers of each software and hardware item required, including model numbers, catalog data sheets, and such descriptive drawings and literature as may be required to fully describe the proposed software and its data base structure, and hardware, and its conformance with these specifications. The Supplier shall provide documentation verifying the continuing availability of the system hardware for full integration of the original hardware with future hardware improvements.

C. Operation and Maintenance Manuals:

1. The supplier shall furnish clear, typewritten easy-to-understand, tightly bound instruction manuals as specified in Division 1, for daily operation and maintenance of the system. Specifically, the manuals shall contain explicit instructions and well-diagramed procedures for system operations, display generation, report generation, and system maintenance. The instruction manuals shall include as a minimum the following information:
   a. Photographs and data sheets of major system components,
   b. Input/output terminal diagrams,
   c. Logic and block diagrams,
   d. Manufacturer-published operation and maintenance instructions on all equipment,
   e. Description of system operation, editing, and troubleshooting,
   f. Configuration language description,
   g. Configuration disks,
   h. Names, addresses, and telephone numbers of local software package representatives,
   i. Listing of expendable materials by form, stock, or model number (e.g., paper, magnetic discs, ribbons, etc.).
2. Manuals shall be provided for use by system operators and shall include as a minimum:

a. A simple pictorial presentation and description of the system,
b. A functional description of all operator interfaces at all levels of control should be described,
c. A description of each type of data format,
d. A description for each of operator controls, its tasks, and method of recognizing a response to operator manipulation. This description shall include all buttons and keyboards.
e. A glossary of terms,
f. Separate step-by-step procedure shall be provided for each action to be performed in operating the system. These procedures should include, but not be limited to, the following:
    1. Start/stop operation,
    2. Emergency procedures,
    3. Controls mode changes,
    4. All software housekeeping or caretaking operations changing date and time, point calibration, point activation, point deactivation, tuning parameter and setpoint changes,
    5. Software procedures that are beneficial to operator to determine that system is functioning properly,
    6. Procedures for changing paper, tape and other housekeeping operations,

3. These manuals shall be separately bound and shall contain all information required by the system operator to perform all functions related to this project. Manuals shall be available at the time of the operator's training course and shall be covered as part of the course material.

1.06 QUALITY ASSURANCE

A. The materials and equipment covered in this specification are intended to be standard materials and equipment of proven ability as manufactured by reputable concerns. The control and monitoring system shall be designed and constructed in accordance with the best practice of the industry and shall be installed in accordance with the manufacturer's recommendations and these Specifications. The Specifications call attention to certain features but do not purport to cover all details entering into the design and installation of the SCADA system.

1.07 WARRANTY

A. The SCADA system supplier shall guarantee that the materials and workmanship of the equipment and software be free from defects for a period of one (1) year from date of Substantial Completion, providing the equipment has been installed, operated, and maintained in accordance with the manufacturer's recommendations.

B. The SCADA system supplier shall provide, at the time of start-up, a letter certifying that the equipment has been installed properly, calibrated and is in working order suitable for operation.

C. The Supplier shall prepare detailed design information, procure, configure, prepare graphics, install, start-up, make ready for use, the complete instrumentation systems as indicated on the Drawings and in these Specifications. The Specifications and drawings include descriptions of functional operation and performance, as well as standards, but do

not necessarily enumerate detailed specifications for all components and devices, which are essential for system operation. However, all components and devices shall be furnished and installed as required to provide complete and operable systems for accomplishing the functions and meeting the performance set forth hereinafter.

D. The Supplier shall include in the bid an allowance for factory-trained service personnel (other than sales representatives) to supervise and install, adjust all the equipment until the system has been completely accepted. The Engineer shall approve the results of these tests. In addition, factory bench-test data shall be submitted to show that the manufacturer's proposed equipment has been tested in the specified arrangement and found to achieve specified accuracy.

PART 2 PRODUCTS

2.01 SYSTEM COMPONENTS

A. SCADA system shall be a standard system. Custom one of a kind application software and customized hardware components will not be accepted. A standard system is defined as one which is available, at time of bid, with fully tested hardware and software, full documentation, and prepared training classes such that no development must be done beyond system configuration.

B. Supplier shall be responsible for detailed engineering, manufacture, programming, test, start-up and demonstration of all equipment and software programs to provide a complete operating system.

C. The Supplier shall have been continuously involved in the design and manufacture of SCADA control systems for the past ten (10) years. The Supplier shall have successfully built and placed into operation, systems similar to the one proposed herein and will furnish a list of at least ten (10) operating installations upon request by the Engineer. Similar installations would be considered as systems utilizing a computer based supervisory system which supervises a minimum of 250 inputs and is linked to a SCADA System serving seven (7) or more stations. The Supplier shall have on staff at least five (5) qualified instrument technicians and shall maintain stock inventory of spare parts for all major components in the system.

D. The Supplier shall maintain a formal maintenance service program and shall include descriptive data on this program with its submittal data for approval. Supplier shall not subcontract system software preparation, application software preparation, or systems engineering.

E. All of the equipment listed herein shall be furnished by a single manufacturer. The Supplier shall meet or exceed the following qualifications.

1. In-house R&D department with responsibilities for board level design of microprocessor based equipment, TTL, ECL and MOS integrated circuitry. Complete in-house software development including the ability to modify industry standard operating systems to meet the specific needs of the Owner, applications software, and custom drivers for both special and industry standard communications protocols. In-house PC board assembly, test and burn-in

facilities. In-house Systems Engineering, Data Entry, Service and Project Management Groups.

F. The ability in-house to remotely dial into the Owner's system and perform the following:
1. System Diagnostics,
2. Complete upload and download of the Data Base,
3. Engineering configuration support to include Graphics, Logs, Reports, Trends,
4. Software maintenance, and upgrades,
5. Monitor systems operations, look for and correct anomalies,

G. A toll free phone number available 24 hours a day, seven days a week for customers to call in for technical support on both hardware and software.

H. All equipment supplied shall be of the most current and proven design at the time of delivery. Specification and drawings call attention to certain features, but do not purport to cover all details entering into the design of the completed telemetry system. The completed System and the equipment provided by the Supplier shall be compatible with the functions required and shall be a complete working System.

I. All electrical components of the System shall operate on 117 volt, single-phase, 60 Hertz current, except as otherwise noted in the specifications and on the drawings.

2.02 SCADA SOFTWARE AND HARDWARE

A. SCADA Software:
1. All SCADA software, including HMI, I/O drivers, alarm management, and remote access will be provided by the Owner's SCADA Integrator, Woodard & Curran, Inc.
2. SCADA software is defined as "not an integral part of the structure or permanently affixed to the infrastructure project" as described in the Office of Management and Budget's Memorandum M-22-11 and therefore not required to comply with the BABA requirements defined in Specification Section 00820G.

B. SCADA Hardware:
1. Main Control Panel:
a. One main control panel (MCP) including PLC, backup power supply and communication equipment dedicated to monitoring and control of Owner's entire water distribution system shall be furnished .
b. Shall be sized to contain the I/O points listed in on the instrumentation drawings, plus an additional 20% for use as spares and future expansion.
c. Shall installed with a 15" Allen-Bradley touch screen.
d. Shall be designed to be fed with 120VAC power.
e. Shall be capable of providing 24VDC loop power to analog transmitters.
f. Shall contain an ethernet switch.
g. Shall send I/O signals to MMCP, FCP, and RIOP-1 over ethernet.
h. Shall be a NEMA 12 Panel.
i. Shall be built in accordance with Section 13100 (Instrumentation and Controls).
j. Shall be fully assembled and factory tested prior to delivery to site,

k. The MCP shall be classified as a single "manufactured product" as it relates to the Build America Buy America (BABA) Act requirements defined in Specification Section 00820G.

2. SCADA Work Stations:
   a. Contractor shall provide SCADA computers in accordance with Paragraph 2.03.A.
   e. One UPS for each computer and related SCADA components - thirty minutes minimum.
   f. Data communication and interconnection wiring.
   g. Associated devices as required to provide complete, fully operational system.
   h. One of the three workstations will be deemed a developer workstation and shall have additional software and appropriate licesnses to be able to modify PLC code, HMI screens, and SCADA software.
   i. Location of the three terminals will be one located in the office on the first floor and two located in the control room in the mezzanine as shown on the Drawings.
   j. SCADA Workstations are to be defined as "not an integral part of the structure or permanently affixed to the infrastructure project" as described in the Office of Management and Budget's Memorandum M-22-11 and therefore not required to comply with the BABA requirements defined in Specification Section 00820G.

3. Remote I/O Panel-1 (RIOP-1):
   a. One remote I/O panel (RIOP-1) shall be provided in accordance with the drawings and specifications.
   b. RIOP shall be sized to contain the I/O points listed on the instrumentation drawings, plus an additional 20% for use as spares and future expansion.
   c. RIOP shall be designed based on Allen Bradley remote I/O modules to provide consistency with MCP design.
   d. RIOP shall be designed to be fed with 120VAC power.
   e. RIOP shall be capable of providing 24VDC loop power to analog transmitters.
   f. RIOP shall contain an ethernet switch.
   g. RIOP shall send I/O signals to the MCP over ethernet.
   h. RIOP shall be a NEMA 12 Panel.
   i. RIOP shall be built in accordance with Section 13100 (Instrumentation and Controls).
   j. Each RIOP shall be classified as a single "manufactured product" as it relates to the Build America Buy America (BABA) Act requirements defined in Specification Section 00820G.

2.03 SYSTEM HARDWARE

A. Workstation Computers:
   1. The three personal computers shall be furnished with all hardware, software and application programming, as required. The computers shall be multi-tasking capable of executing programs concurrently and shall be able to communicate to

MCP/RIOPs, remote computers, and associated peripherals for process control and data acquisition system.

2. The computers shall be Intel Xeon W-1250 or faster clock speed, and shall include the following features as a minimum:
   a. Intel Core i7 14th Gen 14700k (33 MB Cache, 20 cores, 28 threads, 3.4 GHz to 5.6 GHz, 125W)
   b. Window 11 Pro
   c. Precision 3680 Tower with 1000W (80 Plus Platinum) PSU, DAO
   d. 32GB 2x16GB DDR5 UDIMM non-ECC Memory
   e. C2: M.2 SSD Boot + Optional M.2 SSDs + Internal 3.5" SATA HDDs
   f. RAID 1 for M.2 NVMe SSD
   g. (2) 512 GB, M.2 2280, Gen 4 PCIe NVMe, SSD
   h. RAID 1 for SATA 3.5" HDD
   i. (2) 1TB 7200rpm SATA 3.5" HDD
   j. Intel Integrated Graphics
   k. 8x DVD-R/W 9.5mm Optical Disk Drive
   l. Dell Premier Color 6.0
   m. Dell Support Assist
   n. Basic onsite service (12 months)
   o. ProSupport and next day onsite service extension, 24 months
   p. ProSupport and next day onsite service initial, 12 months
   q. Dell KM636 keyboard and mouse set
   r. Dell P2719 – LED monitor – full HD
   s. Dell Speaker sound bar

   The computers shall be brand name products, and shall be manufactured by Dell, or Engineered approval.

3. Workstation Computers are to be defined as "not an integral part of the structure or permanently affixed to the infrastructure project" as described in the Office of Management and Budget's Memorandum M-22-11 and therefore not required to comply with the BABA requirements defined in Specification Section 00820G.

B. System Printers:

1. One printer shall be provided and designated as an alarm and event recorder and shall be used to provide a paper copy of all alarms and events. The printer shall meet the following minimum requirements:
   a. 24 pin, 120 CPS minimum in draft mode,
   b. 132 character line length,
   c. Full 128 ASCII character set,
   d. Top of form feed option implemented by a control tape or similar mechanism,
   e. Adjustable tractor feed mechanism to feed paper from 4- to 15-inches wide,
   f. External motor control with automatic or software controlled shutdown,
   g. Audible alarm on paper jam or out of paper,
   h. Indication to computer that unit is out of service or lost data,
   i. Special printing shall be red/black or other obvious means of distinguishing alarms from event messages,
   j. Motor control shall automatically shut off printer in absence of data output,
   k. Busy/ready status shall be returned to CPU to prevent loss of data,

l. All lines of printed information shall be visible for reading as soon as line is printed without a line feed command,
m. Paper restack tray,
n. Pedestal mounting where required,
o. Buffer minimum size of 20K bytes,
p. 120 VAC operating voltage.

2. A color inkjet printer shall be provided for periodic and demand report and graphics generation. The printer shall be a Hewlett-Packard Deskjet 1120C, or approved equal, and shall be provided with enough memory to print graphics.
3. Printers are to be defined as "not an integral part of the structure or permanently affixed to the infrastructure project" as described in the Office of Management and Budget's Memorandum M-22-11 and therefore not required to comply with the BABA requirements defined in Specification Section 00820G.

C. 55" LED-LCD Monitor
1. Physical
a. Screen Size: 55" Class
b. Type: LED Flat-Panel
c. Aspect Ratio: 16:9
d. Vertical Resolution: 1080P
e. Screen Refresh Rate: 120 Hz
f. 4,000,000:1 Dynamic contrast ratio
g. shall be intended for continuous use
2. Inputs/Outputs
a. One PC input
b. 4 HDMI inputs
c. 2 audio outputs
3. Required Accessories
a. Wall mount kit
b. All cables, cords and power supplies required for a complete and operational system.
4. Manufacturers
a. Samsung
b. Sony
c. Approved Equal
5. The 55" LED-LCD Monitor is to be defined as "not an integral part of the structure or permanently affixed to the infrastructure project" as described in the Office of Management and Budget's Memorandum M-22-11 and therefore not required to comply with the BABA requirements defined in Specification Section 00820G.

D. Uninterruptable Power Supplies:
1. Uninterruptable power supplies (UPS) providing a minimum 30 minutes of backup power shall be provided for each MCP/RIOP cabinets furnished under this contract, and the personal computers.
2. Uninterruptable power supplies are to be defined as "not an integral part of the structure or permanently affixed to the infrastructure project" as described in the Office of Management and Budget's Memorandum M-22-11 and therefore not required to comply with the BABA requirements defined in Specification Section 00820G.

E. Programmable Logic Controllers:

1. For purposes of designating type and quality of components specified in this Section, the specifications are based products manufactured by Allen-Bradley.
2. The MCP programmable logic controllers (PLCs) shall be Allen-Bradley Contrologix Series as required for the number input/output (I/O) signals and type of communications to be performed at the respective site.
3. Interposing relays for control output shall be provided with a minimal contact rating of 10 amps at 120 VAC.
4. The PLCs shall be provided with two serial ports for communications with a portable computer and modem communication protocol.
5. Operates from DC power, which may vary from 12 to 30 Vdc. A 120 Vac source shall be the only power to the PLCs.
6. Digital I/O points shall be fully optically isolated, and shall be 24 VDC. The number of digital I/O shall support the number required at each site plus 20 percent spare, or additional 4 of each, whichever is greater.
7. The PLC shall be capable of supporting the number of analog inputs and outputs required, plus a minimum 20 percent spare, or additional 4 of each, whichever is greater. Each analog input shall have 10-bit resolution, and shall be easily user configurable to support 0-1 Vdc, 0-10 Vdc, and a 4-20 mA. Input signal ranges, individually settable by channel. All analog inputs shall be fully isolated differential types, capable of rejecting electrical interference normally associated with industrial equipment including, but not limited to transformers, motor starters contactors and electrical heaters. The analog outputs shall be configured for current loop operation (0-20 mA/4-20 mA).
8. The PLC shall perform all on-line local control functions by means of a control program maintained within the unit's memory. In the event of a system or communications failure, it shall continue to control its assigned process and shall store all necessary data for transmission when communication resumes. It shall also be capable of store and forward message functionality for radio telemetry applications.
9. The MCP PLC shall function as the overall system coordinator, controller, telemetry master, and shall be provided with standard protocol for communication with remote units.
10. PLC and I/O cards shall be defined as "components" of the system into which they are installed as it relates to BABA compliance defined in Specification Section 00820G.

2.04 CYBERSECURITY

A. Cybersecurity Hardware and Software:

1. All cybersecurity hardware and software will be provided by the Owner's System Integrator.
2. Cybersecurity Hardware and Software shall be defined as "not an integral part of the structure or permanently affixed to the infrastructure project" as described in the Office of Management and Budget's Memorandum M-22-11 and therefore not required to comply with the BABA requirements defined in Specification Section 00820G.

PART 3 EXECUTION

3.01 INSTALLATION

A. The SCADA system shall be installed in accordance with the best field and shop practices.

B. The workmanship shall be in accordance with the best field and shop practices for the control systems.

C. All workmen shall be skilled in the work to which they are assigned, and all work shall be performed under a Supplier's foreman.

D. All instruments shall be mounted and connected in strict accordance with the manufacturer's instructions.

E. All internal wiring of the control console and MCP and RIOPs shall be done by the Control Panel manufacturer in accordance with the drawings, and instrument manufacturer's instructions.

F. All work shall be executed in full accordance with codes and local rulings. Should any work be performed contrary to said rulings, ordinances and regulations, the Contractor shall bear full responsibility for such violations and assume all costs arising therefrom.

G. Brackets and hangers required for mounting of equipment shall be provided as noted on and/or as required. The brackets and hangers shall be installed in a workmanlike manner and shall not interfere with any other equipment.

H. Maximum practical separation shall be maintained between signal (analog alarm, and status) conduits and power feeders.

I. All field conductors shall terminate at the MCP, FCP, MMCP, one of the four RIOP terminal boards, or one of the five MIEX local control panels.

J. All wire ends shall be terminated with hook fork type non-split compression lugs.

K. All wire ends shall be identified at both ends with wire markers.

L. Wiring shall enter near the terminal point and not obstruct access to removal of components.

3.02 START-UP

A. Prior to final connection to any of the control panels, the Contractor shall clean all work completed including the interior of all control panels; and remove all dirt, trash, and foreign material. The outside of all instrument panelboards are to be cleaned, and damaged painted surfaces touched up as required to leave the equipment in an acceptable condition. This shall include all nameplates, tags, and identification of equipment and devices within or on the front of the panels.

B. No form of energy shall be turned on to any part of the SCADA system prior to receipt by the Engineer of a certified statement of approval of the installation from the Contractor containing his supplier's authorization for turning on energy to the system.

C. It shall be the responsibility of the Contractor to provide a factory trained and qualified serviceman to test and calibrate all equipment and to instruct Contractor on equipment installation and the Owner and Engineer on operation of the equipment.

D. The Owner's System Integrator will provide support to the Contractor during startup to test I/O, manual operation of equipment, and automatic testing. Prior to the Owner's System Integrator arriving for startup, all equipment and instrumentation shall be installed, wired, and commissioned by the Contractor. .

E. During the start-up, the Contractor shall provide sufficient personnel to aid with the start-up of the instrument and control equipment to be provided and installed by this Section and by this Contract. This shall include services to correct any faults and to make the necessary adjustments for the proper operation of the equipment and installation.

3.03 TESTING AND CALIBRATING

A. Testing and calibration of equipment shall be done in the presence of the Engineer.

B. Prior to electrical check out, all breakers, switches and similar disconnect devices shall be placed in the off position.

C. Visual inspection and continuity testing shall be made to verify that no damaging wiring errors occur between power and signal wiring.

D. The systems shall be checked for improper or accidental grounding.

E. Each system and component shall be energized and their inputs simulated. The output shall be checked to verify the proper calibration and interaction with associated hardware.

F. Hypotting shall not be permitted on instrument system unless specific instructions are given to safeguard electronic equipment from damage.

G. Prior to actuating a final control element (valve, level actuator, or variable speed drive) the Contractor shall obtain the permission of the Engineer and any other involved contractors to prevent damage to associated equipment.

H. Instrument and control calibration and control loop checkout shall be the responsibility of the manufacturer of the equipment.

I. The Contractor shall arrange for and obtain the services of and the Owner's System Integrator for commissioning of the entire system.

J. Upon completion of the work, the Contractor shall demonstrate to the Engineer the proper operation of all equipment and systems.

K. The Contractor shall deliver to the Engineer all test data, inspection test certificates, manufacturers' warranties, certified calibration data, certified prints, manufacturer's installation, operation and maintenance manuals, electrical wiring and control diagrams with all noted field modification for an as-built record for the system, and required and suggested spare parts lists.

L. A factory test shall be scheduled by the instrumentation system manufacturer for the entire system. A simulated system layout, which shall include all equipment and interconnections, shall be arranged to perform all system functions. The testing shall be performed in the presence of the Engineer. A two week written notification shall be provided to the Engineer to allow for scheduling the testing.

M. Upon completion and satisfactory performance, an approval notification shall be provided to this portion of the work for this Section. No equipment shall be allowed to be shipped from the factory without approval for this portion of the work.

3.04 MANUFACTURER'S SERVICES

A. The supervisory service of a factory-trained service engineer who is specifically trained on the type of equipment herein specified shall be provided for a period of not less than five (5) 8-hour days during construction to assist the Contractor in equipment installation; the location of sleeves; methods of installing conduit and special cable; mounting, and wiring of each device; and the methods of protecting all of the equipment prior to placing it into service.

B. Upon completion of the installation, the services of the above service engineer shall be provided for a period of not less than five (5) 8-hour days for calibration.

3.05 PRODUCT HANDLING

A. Upon completion of shop assembly and testing, all control panels shall be enclosed in heavy duty polyethylene envelopes or secured sheeting to provide complete protection from dust and moisture. Dehumidifiers shall be placed inside the polyethylene coverings. The equipment shall then be skid-mounted for final transport. Lifting rings shall be provided for moving the equipment without removing protective covering. Boxed weights shall be shown on shipping tags together with instructions for unloading, transporting, storing and handling at the job site.

B. Special instructions for proper field handling and installation required by the manufacturer for proper protection, shall be securely attached to each piece of equipment prior to shipment.

C. Each package shall be tagged to identify its location, tag number, and function in the system. Identification shall be prominently displayed on the outside of the package.

D. Equipment shall not be stored out-of-doors. Equipment shall be stored in dry permanent shelters and shall be adequately protected against mechanical injury. If any apparatus has been damaged, such damage shall be repaired or the damaged equipment replaced by the Contractor at his own cost and expense. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such tests as directed by

the Engineer. This shall be at the cost and expense of the Contractor, or the Contractor at his own expense shall replace the apparatus.

3.06 TRAINING

A. The Supplier shall provide systems training for up to three (3) operations staff totaling no less than forty (40) hours. A software training course for up to three operations staff covering configuration, programming, and graphics development shall also be provided totaling no less than forty (40) hours.

B. All training shall be at the Owner's offices. All training shall consist of 8-hour days, and shall be on consecutive days unless otherwise agreed to by the Owner. Systems training shall be performed after satisfactory start-up of the equipment.

3.07 OPTIONAL SERVICE CONTRACTS

A. The SCADA system supplier shall provide to the Owner prior to the expiration of the one year warranty period, optional service contracts extensions for periods of one year and three years.

END OF SECTION

INDEX

DIVISION 14 CONVEYING SYSTEMS

SECTION 14300

HOISTING EQUIPMENT

PART 1 GENERAL

1.01 DESCRIPTION

A. Provide and test hoisting equipment, motors, gear reducers, controls and appurtenances as indicated and specified.
   1. Bridge Crane Supplier to design, furnish, and install runways and header beams on bearing plates provided by General Contractor, refer to structural drawings.

1.02 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Operating and Maintenance Manuals: Include manufacturer's instructions for equipment installation, start-up, operation, and maintenance, including parts lists for operation and maintenance manuals specified in Division 1.

C. Shop Drawings: Include illustrations, dimensions, materials, performance and wiring diagrams.

D. Certified Performance Test Reports: Submit certified report performance test requirements specified in Source Quality Control of this Section.

E. The equipment to be furnished under this section shall be coordinated with all applicable structural and mechanical process drawings, including addenda.
   1. If no changes are required, provide a statement that no changes are required.
   2. If changes are required, furnish marked up drawings or statement detailing the modifications necessary for the equipment proposed.
   3. Failure to include all drawings or a statement applicable to the equipment specified in this section will result in submittal return without review until a complete package is submitted.

F. A copy of this specification section with addenda, with each paragraph check-marked to indicate specification compliance or marked and indexed to indicate requested deviations and clarifications from the specified requirements.
   1. If deviations and clarifications form the specifications are indicated, therefore requested by the Contractor, provide a detailed written justification for each deviation and clarification.
   2. Failure to include a copy of the marked-up specification sections and or the detailed justifications for any requested deviation or clarification will result in submittal return without review until marked up specifications and justifications are submitted in a complete package.