

GRAYWATER TREATMENT SYSTEM - ADD ALTERNATE P-2

PART 1 - GENERAL**1.1 SUMMARY**

- A. Provide a packaged commercial water reclamation and delivery system for graywater.
 - 1. Filtration/ozone treatment system.
 - 2. Backwashing filters.
 - 3. Reclaimed water pressure booster system.
 - 4. Hydro-pneumatic tank.
 - 5. Bag filters.
 - 6. Graywater pressure booster system.
 - 7. Graywater break tank
 - 8. Tank overflow/transfer pumps.
 - 9. Chlorine and dye injection system.
 - 10. Master control panel.
 - 11. Fabricated skid mounting.

1.2 RELATED DOCUMENTS

- A. Section 22 05 01 - Plumbing General Provisions
- B. Section 22 05 13 - Electric Motors
- C. Section 22 05 14 - Variable Frequency Drives
- D. Section 22 08 00 - Commissioning of Plumbing Systems Section 22 11 23 - Plumbing Pumps
- E. Section 22 13 00 - Drainage Systems
- F. SFDPH Director's Rules and Regulations Regarding the Operation of Alternate Water Source System (January 6, 2014)

1.3 SUBMITTALS

- A. Manufacturer's technical data for the following:
 - 1. Pipe.
 - 2. Fittings.
 - 3. Valves.
 - 4. Hydro-Pneumatic Tank.
 - 5. Pumps including materials of construction and performance curves.
 - 6. Backwashing filter.
 - 7. Ozone generation system.
 - 8. Controls including VFD's, PLC, sensors, sequence of operation and enclosure type stating all door mounted items.
 - 9. Welding standards and procedures for piping and structural steel.
 - 10. Paint including primer and finish coat.
- B. Fabrication drawing in 3-D CAD and piping and instrumentation drawings.
- C. Engineering System Report for submitting to SFDPH.
- D. Shop Drawings: Include plans, sections, details (including dimensions and connection sizes), and attachments to other work.
 - 1. Wiring Diagrams: Power, signal, and external control wiring.
- E. Operation and maintenance data.

- F. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Systems shall be ETL approved for both US and Canada. All applicable electrical components shall be UL listed.
- B. Output Water Quality: Meets basic "Urban Reuse" reclaimed water quality levels as defined in 2004 USEPA document, "Guidelines for Water Reuse," table 4-13 (p. 167) and State of California Administrative Code Title 22 guidelines.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace equipment that fails in materials or workmanship within specified warranty period.
1. Limited Warranty Period: 2 years from date of system startup.

PART 2 - PRODUCTS

2.1 PACKAGED GRAYWATER TREATMENT SKID SYSTEM

- A. Experience: The manufacturer shall have more than five years' experience with water filtration, ozone generation, and pumping systems
- B. The design shall comply with all requirements of City and County of San Francisco Department of Public Health Environmental Health Requirements. The Contractor shall prepare the entire report and drawings including but not limited to SFDPH Directors Rules and Regulations.
- C. Acceptable Manufacturers: Subject to compliance with requirements, provide product by one of the following:
1. Water Control Corporation.
 2. CHC FlowTherm Systems.
 3. Siemens/US Filter.
 4. Approved equal.
- D. The same manufacturer shall be used for the complete system including ozone generator, filtration equipment, pumps, skid, tanks, and tank components.

2.2 FILTRATION/OZONE TREATMENT SYSTEM

- A. System Construction: The packaged commercial water reclamation and delivery system shall consist of enclosed 24g./hr ozone generation/injection equipment, duplex side-stream circulation loop pumps, 25 micron auto-clean basket filter in 150 psi rated stainless steel housing, 25 micron bag filter, 5 micron bag filter, chlorine and dye injector pumps and tank accessories, duplex pressure booster pumps, duplex "over-flow" pumps, disinfection/filtration control panel with local disconnect(s) and LED system status indicators in NEMA 3R enclosure, and booster/over-flow pump control panel with analog input for tank level control (by others).
- B. Mechanical Features: The water disinfection/filtration system shall disinfect stored water via side stream circulation and ozone injection. Water shall be circulated between the storage tank (by others) and the disinfection/filtration system by a duplex pumping system. Re-circulated water shall pass through duplex 25 micron bag filters and ozone shall be injected into the tank return flow. An ORP (Oxygen Reduction Potential) meter (located in tank) shall take constant tank oxidation measurements and cycle the ozone generation equipment and the pump as necessary in order to maintain tank ozone concentrations within a range of approximately 0.1 ppm – 0.5 ppm. Clean, disinfected water shall be supplied to fixtures and equipment from a packaged duplex booster system. Booster system shall deliver water to fixtures/equipment after flowing through duplex 5 micron bag filter and receiving a proportional dose of approximately 1 ppm residual injection of sodium hypochlorite and colored dye as prescribed.

- C. **Stainless Steel Connections:** All piping to and from cistern tanks and reclamation skid system shall be Schedule 80 PVC. Any pipe or fixtures conveying reclaimed water shall be properly marked and labeled per local code. See drawings for connection sizes and locations.
- D. **Controls and Fail-Safe Mechanisms:** System shall include on-board electronic controller in NEMA 3R enclosure, with LED system. Controller shall monitor at all times tank ORP levels, pump temperatures, and pressure differential through Auto clean filter(s) on skid. Should ORP levels in tank drop such that ozone concentrations have fallen to the equivalent of approximately, 0.1 mg/l, controller shall engage the ozone system on to rebuild concentrations. Should pressure differential through Auto clean exceed 9 psi, controller shall initiate backwashing of the Auto clean filter(s) using water from the cistern. An integral mechanical room air quality monitor shall shut down the ozone system, and activate an alarm should any ozone leakage occur. Should either the sodium hypochlorite or dye injection drums (supplied by others) run low, system shall activate alarm. Status of all fail-safe functions shall be clearly displayed on LED control panel. System controller shall include dry contacts for connection of any alarms and/or indicator lights to the master control panel.
- E. **Performance: Disinfection levels:** The system shall maintain and monitor tank water disinfection levels via ORP (oxygen reduction potential) meter. Tank ORP readings shall be displayed on system control panel. Ozone levels of approximately 0.1 ppm to 0.5 ppm (200 -300 mV ORP over untreated water levels) shall be maintained.
- F. **Temperature Requirements:** Ideal system operating temperatures shall be 50° - 75°F. Minimum operating temperature shall be 35°F. Maximum operating temperature shall be 100°F. System shall not be subjected to freezing temperatures.

2.3 BACKWASHING FILTERS

- A. Standalone duplex backwashing filter array shall include 25 micron, stainless steel backwashing filter for fine filtration of graywater fed into the cistern. Filter, control, and motorized valves shall be pre-plumbed and mounted on a skid. Filter backwash effluent shall be delivered to sludge interceptor barrel supplied with system skid.

2.4 RECYCLED WATER BOOSTER SYSTEM

Refer to Specification Section 221123.

2.5 BAG FILTERS

- A. Bag style filter with 304 stainless steel housing, clamped cover with Buna N rubber O-ring seal, 125 psig pressure rating, non-ASME code vessel, high and low side 1/4" NPT gauge ports, 10 micron nominal filter rating at design flow. Flow and nominal design pressure drop per equipment schedule.

2.6 GRAYWATER BREAK TANK (SHIPPED LOOSE)

- A. Furnish and install (2) vertical 6000 Atmospheric Break Tanks. Tank shall be all welded construction from ASTM A-36 carbon steel or fiber glass. Steel tank Interior to be coated with an FDA approved epoxy suitable for potable water service. Exterior to be coated with a red oxide primer ready for field painting by others. All accessories to be shipped loose and installed by contractor in the field. Accessories include High Water Alarm, Low Water Alarm, Electronic Float Assembly.

2.7 TANK OVER-FLOW/TRANSFER PUMP SYSTEM

- A. Over-flow pump package shall be UL Listed, and have all components frame mounted, piped, painted, wired and factory tested. Package shall include duplex pumps, suction/discharge manifolds, and control panel. Package shall have a single point 480 volt, 3 phase power connection and include a control voltage transformer.
- B. Pumps shall be horizontal end suction, close-coupled, cast iron/bronze fitted construction with mechanical seals as called out on the plans. Pumps casings shall include vent and drain ports at the top and the bottom of the casings.

- C. Pumps shall be rated with a maximum working pressure of 175 psig and 225°F continuous operating temperature. Manufacturer shall certify ratings.
- D. Pumps shall run without excessive noise or vibration.
- E. Pump motors shall meet the requirements of NEMA MG1 Sections V 31.4.4.2 for premium efficiency motors as called out in the equipment schedule. Motor shall have an ODP enclosure as called out in the equipment schedule.
- F. Each pump and motor to have nameplate listing manufacturer's name, pump serial number, capacity in GPM and feet of head at design conditions, motor horsepower, voltage, frequency, speed and full load current.
- G. Check valves shall be center guided or angle style silent type with resilient rubber seats and stainless steel spring.
- H. Provide isolation valves at inlet and outlet of each pump and union or flange connections. Valves shall be butterfly or ball valves.
- I. Pump manifold header piping shall be welded Schedule 10, 304 stainless steel. Header pipe size shall be designed for a maximum of 8 fps velocity. All pipe welds shall be performed by ASME Section IX certified welders and piping shall be welded to ASME/ANSI B 31-9 specifications. Connections to headers shall be grooved.
- J. The over-flow pump package shall be controlled by a skid mounted and factory wired, UL
- K. 508 listed control in a NEMA 4X enclosure with single point power connections and all the necessary components to allow for automatic operation pumps. The panel shall include the following components:
 - 1. Magnetic starter for each pump.
 - 2. Main power disconnect.
 - 3. Through the door circuit breaker disconnect for each pump.
 - 4. H-O-A selector switch for each pump.
 - 5. Control circuit transformer with protected secondary.
 - 6. Digital programmable logic controller with door mounted LED display with a minimum of three lines of text and keypad.
 - 7. Audio General Alarm – with push to silence button.
 - 8. Pump operation and status lights shall include as a minimum.
 - 9. Pump Run.
 - 10. Pump Out of Service.
 - 11. General Alarm.
 - 12. Provide a set of dry contacts, wired to a terminal strip in the control panel for transmission of general fault alarm to building automation system. A general fault shall include: pump fault, PLC fault, transducer failure, high system pressure, low suction pressure, overload and network failure. The PLC shall provide a data log including a date and time stamp of past 20 system faults. These faults shall be displayed in English text on the door mounted supervisory controller (HMI).

2.8 CHLORINE/DYE INJECTION SYSTEM

- A. Packaged skid system shall include two on-board chemical injector pump(s) and feed line each mounted on separate 30 gallon drum to inject a) 12% sodium hypochlorite solution at a concentration of 1 ppm and b) biodegradable and non-toxic blue dye into system output. Injection equipment shall include chemical tank float switch to activate alarm in cases of low tank levels. Injector pump shall accept a 4-20mA input signal from the booster pump control panel to modulate chemical and dye injection based on booster pump operating speed.

2.9 MASTER CONTROL PANEL

- A. Provide a Master Control panel to integrate the controls signals from all skid-mounted control panels and electronic control devices and provide a BacNet gateway interface to the building management system for control and monitoring of the system. The panel shall include the following:
1. Micro-processor based supervisory controller (HMI) shall be a panel door mounted unit with color graphic touch screen display. The HMI shall provide an easy to use operator interface to all system parameters and display those parameters in plain English and engineering units. Monitoring functions shall be available to all users, but access to parameters shall be restricted by two levels of password protection.
 2. Main power circuit breaker disconnect.
 3. Control circuit transformer with protected secondary.
 4. General Alarm with alarm horn and push to silence button.
 5. Provide a set of dry contacts, wired to a terminal strip in the control panel for transmission of general fault alarm to building automation system. The PLC shall provide a data log including a date and time stamp of past 20 system faults. These faults shall be displayed in English text on the door mounted supervisory controller (HMI).
 6. The PLC shall be capable of connection to a building management system (BMS) using
 7. Modbus, BACnet or Lonworks.
 8. Programmable logic controller.
 9. Analog static pressure cistern level sensor (shipped loose for field installation).
 10. Data points for monitoring and control to include the following as a minimum:
 - a. Water Control Corp model RW-OZ-100:
 - 1) Remote Enable/Disable (control DO)
 - 2) Operation mode – Auto/Off (monitor DI)
 - 3) Dirty Filters – Yes/No (monitor DI)
 - 4) Recirculation pump status – On/Off (monitor DI)
 - 5) Alarm Status – On/Off (monitor DI)
 - 6) ORP level – ppm (monitor AI)
 - b. Duplex Reclaimed Water Booster:
 - 1) Remote Enable/Disable (control DO)
 - 2) Pump Status (one per pump) – On/Off (monitor DI)
 - 3) Pump Failure (one per pump) – Normal/Alarm (monitor DI)
 - 4) Low Tank Level – Normal/Alarm (monitor DI)
 - 5) High Discharge Pressure – Normal/Alarm (monitor DI)
 - c. Duplex Overflow Pumps:
 - 1) Remote Enable/Disable (control DO)
 - 2) Pump Status (one per pump) – On/Off (monitor DI)
 - 3) Pump Failure (one per pump) – Normal/Alarm (monitor DI)
 - 4) Low Flow Shutdown – Normal/Alarm (monitor DI)
 - d. Backwashing Filters:
 - 1) Power – On/Off (monitor DI)
 - 2) Filter Status – Normal/Backwash (monitor DI)
 - e. Bag Filters:
 - 1) Differential Pressure – Normal/High (monitor DI)
 - f. Chlorine Injection:
 - 1) Pump Status – On/Off (monitor DI)
 - 2) Chlorine tank level – Normal/Low (monitor DI)
 - g. Dye Injection:
 - 1) Pump Status – On/Off (monitor DI)
 - 2) Chlorine tank level – Normal/Low (monitor DI)
 - h. Cistern:
 - 1) Low level domestic water makeup.

2.10 PACKAGED SKID MOUNTING

- A. The entire system shall be pre-assembled on a heavy structural steel frame. The frame shall be welded in accordance with AWS D 1.1 specifications. The steel frame shall have a zinc oxide primer and a machine enamel topcoat. All skid-mounted panels and electrical components will be pre-wired to a master control panel as specified.

2.11 ACCESSORIES

- A. Graywater storage tanks: Treated graywater tank shall be Fiber glass 6,000 gallons and shall be provided under a separate division. Treated graywater tank shall incorporate access hatches, as well as adequate tappings for emergency overflow to sanitary sewer, 2 suction outlets, water inlet, ORP fitting, vent, drain, and ozone recirculation return. Graywater tank shall incorporate top manhole(s), as well as adequate tappings for full-size graywater inlet, vent, and drain. Both tanks shall be watertight, and rated for potable water storage.
- B. Ultrasonic tank level sensors: System shall include ultrasonic tank level sensor system to monitor tank water levels. Ultrasonic tank level sensor system shall be designed to operate at a depth of up to 20'. Transducer type level sensors are also acceptable.
- C. Water flow sensor/totalizer: System shall include in-line flow sensor with digital display of both current GPM flow and total gallons used.
- D. Vortex downspout separator: System shall include model WFF 300 Vortex Fine Filter Downspout Separators, as manufactured by WISY AG, for filtration for dirt, moss, leaves, and insects from roof drain effluent. Each separator shall be capable of servicing 33,000 square feet of roof surface and 208 GPM flow.
- E. Sieving filters: System shall include Water Control model SBF100 sieving filters with 6 or 8 inch connections, capable of handling approximately 100 GPM flow. Sieving filters shall incorporate 350 micron parabolic mesh screens and be self-cleaning for filtration of hair and debris from raw graywater effluent.
- F. Domestic water makeup control valve.

2.12 PERFORMANCE

- A. Disinfection levels: The system shall maintain and monitor "clean" graywater tank water disinfection levels via ORP (oxygen reduction potential) meter. ORP levels shall be displayed digitally on system control panel. Ozone levels of approximately 0.1 ppm to 0.5 ppm shall be maintained.
- B. Tank water levels: The system shall monitor tank water levels, in both tanks, via ultrasonic tank level monitors. Tank levels shall not be allowed to drop to lower than suction inlets. If tank water level approaches suction inlet level in "dirty" graywater tank, sewage ejector pump and filtration system shall be deactivated until water levels are replenished. If tanks water level approaches suction inlet level in "clean" graywater tank, tank fill valve shall be opened (via air gap) in order to maintain suction pump prime.
- C. Pump temperatures: The system shall monitor pump operating temperatures. If pumps should overheat, system shall revert to standby mode with alarm and indicator light activated.
- D. Pressure loss through filters: The system shall monitor pressure differential across any on-board filter housings. If at any time, pressure differential should exceed 5 psig system shall be deactivated, until such time as filters have been backwashed or serviced.
- E. Temperature requirements: Ideal system operating temperatures shall be 50° - 75°F. Minimum operating temperature shall be 35°F. Maximum operating temperature shall be 100°F. System shall not be subjected to freezing temperatures. If system temperature reaches 36°F, activate all pumps for 15 minutes or until the system temperature rises to 38°F.

PART 3 EXECUTION**3.1 APPLICATIONS**

- A. Install graywater treatment reclamation system: Packaged treatment system with side-stream circulation/ozone injection system, on-board filtration, booster pump system, pressure tank with pressure switch, controls, fail-safe systems, cistern tanks, vortex downspout separator(s), sieving filter(s), pumps, tanks, stand-alone backwashing filter, domestic water fill mechanism, and accessories.

3.2 INSTALLATION

- A. Install graywater treatment system according to the drawings and the manufacturer's instructions. The installer shall be responsible for providing a functional system, installed in accordance with applicable national and local requirements.
- B. Install and secure storage tanks per manufacturers' instructions. Consult manufacturer to determine optimal inlet/outlet connection locations. Tanks shall be mounted on poured concrete base. Tank overflows shall run to sanitary sewer.
- C. Install filtration, sanitation, and re-pressurization system for treated graywater.
1. Separators/filters shall be affixed (in-line) to drainage pipes with factory supplied mount or adequate pipe hanger support. Direct vortex separator effluent to storm sewer and sieving filter effluent to sanitary sewer.
 2. Install skid system on concrete pad in mechanical room or other location providing protection from freezing and other harmful elements.
 3. Connect system to fixtures and/or equipment using properly marked (per local code) piping.
 4. Install strainer on system inlet connection from storage tank. Connection should be a minimum 6" from tank bottom, where possible.
 5. Connect circulation system suction inlet to suction strainer outlets and ozone circulation return outlet to cistern tank. Ozone circulation return line should be minimum 50' in length to ensure adequate oxidation.
 6. Install tank domestic water fill system per manufacturer's instructions.
 7. Install ORP meter in tank and wire to skid system using installation kit provided by manufacturer.
 8. Connect Auto-Clean filter effluent outlet to the sludge interceptor using 1" piping (both stand-alone unit and skid unit).
 9. Fill sodium hypochlorite (chlorine) and dye tanks to specified level.
 10. Connect sludge interceptor outlet to floor drain using 1-1/2 inch copper tubing.
- D. Electrical Connections and Grounding: System requires three (3) separate sources of power:
1. 230/460 Volts 3 Phase power for disinfection/filtration skid pump.
 2. 120 Volts single phase for the System Control and Disinfection apparatus.
 3. 230/460 Volts 3 phase for duplex pressure booster and overflow pumps.
 4. Power lines shall be supplied from a building service box, which includes proper connections and circuit breakers with quick disconnection mechanism, and sized according to system requirements (see drawings). Wiring shall conform to local electrical codes and requirements and must be performed by a licensed electrical contractor. Electrical inspection shall be performed, and inspection notice approved, by an authorized approval agency.
- E. Authorized factory representative shall perform final (on-site) system activation, calibration, and training.

3.3 FIELD QUALITY CONTROL

- A. Verification: Authorized factory representative shall provide final inspection and verification of system installation and operation. Provide Commissioning Authority with copies of all tests upon completion for review and commissioning documentation.
- B. Coordinate with Commissioning Authority for witnessing.

RAINWATER TREATMENT SYSTEM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work of this Section.

- B. SFDPH Director's Rules and Regulations Regarding the Operation of Alternate Water Source System (January 6, 2014)

1.2 SUMMARY

Specifications for the following rainwater harvesting system are based on a BRAE Rainwater Technologies complete water harvesting system. This system will integrate filtration, storage, distribution and treatment functions required by commercial facility end use applications, utilizing rainwater as source water. The rainwater system shall be the product of a single packaged system manufacturer. The intended use of rainwater in the project includes:

Irrigation

- A. This Section includes filtration, storage and a pre-piped rainset system control station system providing the following:
 - 1. Initial rainwater filtration
 - 2. Vertical turbine pump with Variable Frequency Drive
 - 3. Water Filtration and particle separator
 - 4. Rainwater system controller incorporating a PLC w/ touch screen HMI
- B. As described in this Section and as shown on drawings, the Contractor shall be responsible for equipment installation per directions of the Manufacturer. The Manufacturer shall be responsible for verification of system installation, start-up, testing and operation and maintenance training of the Owner's personnel.
- C. The non-potable/rainwater rainset shall be complete and operational with all control equipment and accessories as shown and specified. The system shall be capable of treating non-potable water harvested from roof areas and surface water runoff stored in above ground tanks for use in:

Irrigation
- D. These specifications are intended to give a general description of what is required, but do not cover all details that will vary in accordance with the requirements of the equipment application. It is however intended to cover the furnishing, shop testing, delivery, complete installation and field testing of all materials, equipment and all appurtenances required to complete the work of this Section whether specifically mentioned in this section or not.

1.3 EXPERIENCE

- A. Non-potable rainset control station system shall be supplied by a systems supplier/integrator with a minimum of 5 years experience in the design and assembly of skid mounted, pre-piped, pre-wired rainset control stations consisting of piping, equipment and controls, for filtering, pressure-boosting, storing and treating of collected rainwater and surface water for supply of non-potable cold water for building non-potable end use applications.
- B. System provider shall have designed and installed at least five similar systems in the past five (5) years, and be prepared to furnish documentation of same.
- C. All components used shall be new and of first quality.
- D. Cistern shall be installed by a trained and certified tank installation contractor. Proof of certification required prior to system delivery.

1.4 SUBMITTALS

- A. Product Data: For all equipment specified, include certified performance curves with operating points plotted on curves; and rated capacities of selected models, furnished specialties and accessories.
- B. LEED Submittals -As required

- C. Operating Manual – Manufacturer shall provide required copies of a detailed manual that shall include specific instructions for receiving and handling, assembly, wiring, installation, repair and service, troubleshooting and parts lists. These manuals shall be submitted for review, along with other general submittal information, including detailed drawings, brochures, cut sheets, motor data sheets as part of the approval process.
- D. Shop Drawings: For all equipment and accessories, include plans, elevations, sections, details and attachments to other work.
 - 1. Wiring Diagrams: Detail power, signal, and control wiring
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Plumbing process and instrumentation diagram (P&ID), including points of electrical and plumbing trade connection to the skid-mounted pre-piped system and control panel.
- E. All equipment for water harvesting system must be pre-approved by specifying engineer before contractor purchases system. All documents must be furnished a minimum of 10 business days prior to bid date for consideration as an equal. Late submittals will not be accepted
- F. Engineering System Report for submitting to SFDPH.

1.5 QUALITY ASSURANCE

- A. The equipment covered in this Section shall be the products of reputable, qualified and successful manufacturers who are of proven ability and have long experience in the production of such equipment.
- B. All packaged pump systems shall be factory tested for performance and hydrostatic tested to system design pressure. Verified Factory Performance Tests and Witness Factory Performance Tests for pumps shall be options provided by the rainwater system packaged pump system manufacturer.

1.6 DELIVERY

- A. Shipping flange protective covers, protective coatings and packaging shall be retained during shipment and delivery
- B. Bearing and couplings shall be protected against damage
- C. Manufacturer's written instructions for system delivery shall be followed.

1.7 COORDINATION

- A. Concrete form work, foundation dimensions, location and reinforcement shall be coordinated based on manufacturers written specifications prior to system delivery.
- B. The design shall comply with all requirements of City and County of San Francisco Department of Public Health Environmental Health Requirements. The Contractor shall prepare the entire report and drawings including but not limited to SFDPH Directors Rules and Regulations.

PART 2 PRODUCTS

2.1 INITIAL FILTRATION

Initial inlet filtration, to remove large debris, will be provided via one underground filtration comparable to the Graf Omnimax. Primary filtration of stored cistern water shall be a Sure Flow extractor with 2 inch dia. Discharge.

2.2 NON POTABLE COLD WATER RAINSET CONTROL STATION

- A. GENERAL DESCRIPTION: The rainset control station (BRAE model number: ETO-FSTS-01-03-0-0.75-00-01-01-100-25-00-00-02-00-00) shall be designed and manufactured to treat and distribute rainwater stored in above ground water storage tank. Rainwater shall be pumped from tanks via one flooded suction vertical turbine pump to the rainset control station. The rainset control station for the system (located inside the building on a skid in the mechanical room) will then pressurize water through the filtration and water treatment system to the feed points at a rate of 25 GPM at 80 PSI. The rainset control station will pump water from its designated cistern via dedicated vertical turbine pump. The supply pumps shall be operated with a constant pressure controls and a VFD. Upon pressure drop in the system, the pumps will automatically start to maintain the system set point pressure. A common PLC control panel with touch screen user interface shall be mounted in the mechanical room. Single point service disconnect on the control panel shall be provided with a 230 VAC, 3 phase power supply by Electrical Contractor. The rainset control stations shall have the ability to control the use of makeup water when needed due to lack of rainfall. The Plumbing Contractor shall provide all non-potable cold water system piping to the points of connection to the rainset control station located, skid mounted indoors.
- B. Basis of Design: The system shall be an FSTS Series system manufactured by BRAE Rainwater Technologies (1-800-772-1958).
- C. Rainset Control Station Equipment:
1. Vertical Turbine Pump (installed on skid)
 - a. Condition of service: Pumps shall deliver 25 gallons per minute at 80 psi discharge pressure maximum, when supplied with adequate water and 230VAC 3 phase power of sufficient amperage from a dedicated electrical circuit, in compliance with all local building codes.
 - b. Pump shall be vertical turbine and approved by manufacturer for vertical oriented installation and operation, constructed of stainless steel metal parts, FDA compliant non-metallic glass filled engineered composites and Buna rubber check valve seat, with urethane bearing and fluted design for free passage of abrasives.
 - c. Pump suction shall be filtered through a coarse metal filter as part of the floating extractor assembly.
 - d. Capacity and Characteristics for system:
 - 1) System Capacity: 25 GPM
 - 2) Number of Pumps: One
 - 3) Each Pump:
 - a) Capacity: 25 gpm.
 - b) Total Dynamic Head: 100 feet.
 - c) Speed: 3450 rpm.
 - d) Discharge Pipe Size: 2-inch NPS.
 - e) Motor Horsepower:
 - f) Electrical Characteristics:
 - i) Volts: 230
 - ii) Phases: 3
 - iii) Hertz: 60
 2. Hydro pneumatic Tank: 34 Gallons (at system pressure difference from 100 PSI to 40PSI) Welded carbon steel, rated for 150-psig working pressure and maximum operating temperature per systems. Separate air charge from system water to maintain design expansion capacity by a flexible bladder securely sealed into tank. Includes drain fitting and taps for pressure gage and air-charging fitting.
 3. 100 25 Micron bag filter in carbon steel housing. Filter Comparable to BRAE model FMBH-CS-100 FMBH-CS-25
 4. Flow meter: Discharge shall be metered and provide analog output.
 5. System components other than system control panel are to be factory mounted and plumbed inside of common vandal proof, stainless steel enclosure.
 6. Electrical conduit shall be corrosion resistant PVC with Polytuff flexible conduit.
 7. Relief Valves: Adjustable, pressure relief type on pump discharge shall be provided for each system discharge rated at a 100PSI factory setting.
 8. Local electrical disconnect box to be located at cistern sump for each pump shall be NEMA 4X rated and be provided by Electrical Contractor.
 9. Sensors: Cistern Level Sensors: Equivalent to BRAE Model: BPT-XX-00-20 Series 700 4-20mA SS submersible pressure transmitter length to suit cistern depth.

10. Control Panel: Factory installed and connected as an integral part of unit with constant-speed operation, load control and protection functions.
 - a. Enclosure: NEMA 3R (minimum)
 - b. Motor Controller: Full-voltage, combination-magnetic type with under voltage release feature, motor-circuit-protector-type disconnect, and short-circuit protection
 - c. Control Voltage: 120-V ac, with integral control power transformer.
 - d. Motor Overload Protection: Overload relay in each phase.
 - e. Starting Devices: Hand-off-automatic selector switch in cover of control panel, plus pilot device for automatic control.
 - f. Instrumentation: Unit discharge pressure gages.
 - g. Lights: Running light for each pump.
 - h. High-discharge pressure cutout.
 - i. Remote signal contacts
 - j. Rainset control station controller shall be an application controller for the rainset control station equipment that adequately covers the operation of all devices as described in the control sequence. Controller shall include input, output and self-contained logic program as needed for complete control of equipment and operate as a stand-alone controller.
 - k. Enclosures
 - 1) All controllers, power supplies and relays shall be mounted in enclosures.
 - 2) Enclosures shall be NEMA 3R (minimum)
11. Enclosures shall have hinged, locking doors.

PART 3 EXECUTION

3.1 PREPARATION

- A. Examine roughing-in for equipment to verify actual locations of connections before installation.
- B. Examine the plans and specifications for the water storage tank and rainset. Coordinate with rainset supplier of clearances required to install the skid-mounted pre-piped system.
- C. Design of the rainset control skid shall be fully coordinated with the tank and pad dimensions and intended method of fabrication as specified in the project contract documents.
- D. Design of the rainset control skid system shall be fully coordinated with all connecting trades.
- E. Design of the rainset control station shall be fully coordinated with and accommodate the space requirements.

3.2 INSTALLATION

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Coordinate rainset control station installation with tank and assembly phasing.

3.3 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform the following startup service:
 1. Complete installation and startup checks according to manufacturer's written instructions. Submit a manufacturer approved commissioning check list to document startup service.
 2. Check piping connections for tightness.
 3. Clean strainers if any.
 4. Verify that pump controls are correct for required application.
- B. Perform the following startup checks for each pump in the rainset before starting:
 1. Verify pump rotation
 2. Prime pumps by opening suction valves and closing discharge valves, and prepare pumps for operation.
 3. Start motors.

- 4. Open discharge valves, slowly.
 - 5. Adjust settings.
- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting packaged booster pumps to suit actual occupied conditions. Provide up to one visit to Project outside normal occupancy hours for this purpose.

3.4 LABELING AND IDENTIFICATION

- A. Install identifying equipment markers and equipment signs on system equipment. Labeling and identification materials shall be typical for "Mechanical Identification" and codes for non-potable water systems.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain rainset, water treatment equipment and rainset system controls.
- B. System Maintenance: Manufacturer shall be capable of providing a maintenance and service agreement with the system owner should the owner wish to enter into such an agreement.

END OF SECTION 22 36 00

SPECIFICATION ISSUE LOG

Revision	Date