ADDENDUM NO. THREE (3)

to the

CONTRACT DOCUMENTS, TECHNICAL SPECIFICATIONS, AND CONSTRUCTION DRAWINGS

for construction of

WASTEWATER TREATMENT PLANT EXPANSION TO 1.5 MGD

for

WILBARGER CREEK MUNICIPAL UTILITY DISTRICT NO. 2

TRAVIS COUNTY, TEXAS

November 12, 2026

Addendum No. Three (3) covers the following changes to the contract documents, technical specifications, and construction drawings:

CONTRACT DOCUMENTS

No changes.

TECHNICAL SPECIFICATIONS

1. SPECIFICATION 13300 – INSTRUMENTATION AND CONTROLS - GENERAL PROVISIONS

Remove and replace with the attached and revised Specification 13300 – Instrumentation and Controls – General Provisions. Notable revisions include:

a. Revised Specification 13300 with the addition of 1.1.F

2. SPECIFICATION 13315 - HMI SYSTEM SOFTWARE

Remove and replace with the attached and revised Specification 13315 – HMI System Software. Notable revisions include:

a. Revised Specification 13315 with the following additions: 2.1.C, 2.1D, 2.3.F.
b. Removed 13315.2.2 “Third Party Reporting Software” as Ignition Reporting Module will govern.
c. Removed 13315.2.4 “Virtualization Software” as this will not be required.

3. SPECIFICATION 13320 – CONTROL AND DATA NETWORK EQUIPMENT

Remove and replace with the attached and revised Specification 13320 – Control and Data Network Equipment. Notable revisions include:

a. Revised Specification 13320 with the following additions: 2.6.A, 2.8.A.9.
b. Removed portions dealing with SIEM. SIEM is not existing onsite.

4. SPECIFICATION 13340 – INSTRUMENTS

Remove and replace with the attached and revised Specification 13340 – Instruments.
Notable revisions include:

a. FIT-14A-101 is vendor supplied.

5. SPECIFICATION 13441 – PROCESS CONTROL NARRATIVES

Remove and replace with the attached and revised Specification 13441 – Process Control Narratives.
Notable revisions include:

a. The Headworks local control station will be supplied by the vendor.

CONSTRUCTION DRAWINGS

1. SHEET 0-E-17 – NETWORK ARCHITECTURE

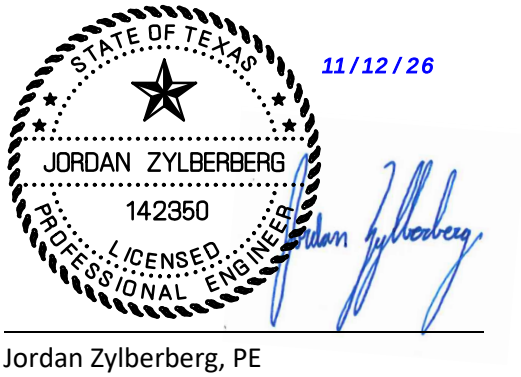
Remove and replace with the attached and revised Sheet 0-E-17 – Network Architecture.
Notable revisions include:

a. Revised Sheet 0-E-17 to show LIT-02-101 and FIT-05-101 thru FIT-05-202 as existing.

2. SHEET 4-I-17 – PEAK SHAVING BASIN P&ID

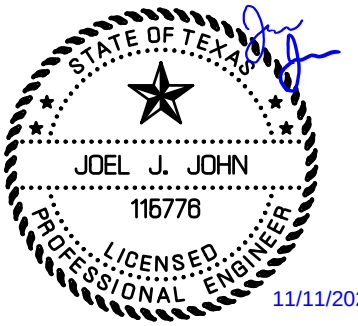
Remove and replace with the attached and revised Sheet 4-I-1 – Peak Shaving Basin P&ID.
Notable revisions include:

a. Revised motor horsepower.



Jordan Zylberberg, PE
Quiddity Engineering, LLC
TBPE Firm No. F-23290

END OF ADDENDUM NO. 3



SECTION 13300
INSTRUMENTATION AND CONTROLS - GENERAL PROVISIONS

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall procure the services of a Process Control System Supplier (PCSS) to furnish and install all materials, equipment, labor and services, required to achieve a fully integrated and operational system as specified herein, in the Specification Sections listed below, and in related drawings, except for those services and materials specifically noted.

1. Section No Title

13302	Testing
13303	Training
13306	Application Engineering Services
13310	Computer System Hardware
13311	PLC Hardware and Software
13315	HMI System Software
13320	Control and Data Network Equipment
13321	Fiber Optic Cabling and Equipment
13330	Control Panels and Panel Mounted Equipment
13335	Uninterruptible Power Supply (1 Phase)
13340	Instruments
13441	Process Control Narrative

B. Auxiliary and accessory devices necessary for system operation or performance, such as transducers, relays, signal amplifiers, intrinsic safety barriers, signal isolators, software, and drivers to interface with existing equipment or equipment provided by others under other Sections of these specifications, shall be included whether they are shown on the Drawings or not.

C. All equipment and installations shall satisfy applicable Federal, State and local codes.

D. Use the equipment, instrument, and loop numbering scheme shown on the Drawings and specifications in the development of the submittals. Do not deviate from or modify the numbering scheme without the Engineer's approval.

E. An Application Engineer System Supplier (AESS) shall be selected by the Contractor to provide all PLC and HMI software programming and engineering not provided by equipment vendors. The PCSS, and not the AESS, shall procure all required PLC and HMI hardware, software and licenses.

F. The existing DFS system is to be retired. The PCSS shall decommission the DFS system after the new PLC-12-101 and the Ignition system have passed site acceptance testing; DFS shall remain in service until then. Existing conductors in conduit 12-I-100 carry DFS I/O and shall be field verified for type.

G. Fiber optic cabling is specified in Section 13321.

H. Relevant equipment Sections in Divisions 11, 13, and 15.

I. For the migration of the chemical system controls, the PCSS shall coordinate with the owner to ensure chemical dosage based on the plant's effluent flow is not disturbed but is continued through the project's construction phase. This could be executed using temporary controls, the existing control cabinet IO signals or by using devices such as 4-20mA splitters.

1.2 SUBMITTALS

1. General Requirements:
   2. Refer to [Section 01300] for general submittal requirements.
   3. Shop drawings shall demonstrate that the equipment and services to be furnished comply with the provisions of these specifications and shall provide a complete record of the equipment as manufactured and delivered.
   4. Submittals shall be complete; giving equipment specifications, details of connections, wiring, ranges, installation requirements, and specific dimensions. Submittals consisting of only general sales literature shall not be acceptable.
   5. Substitutions on functions or type of equipment specified shall not be acceptable unless specifically noted.
   6. Separate submittals shall be made for each submittal listed below.
   7. In case of specified equipment being discontinued within eighteen (18) months of submittal, notify and submit manufacturer suggested equivalent replacement.

B. Qualifications Submittal:
   1. Submit, within 30 calendar days after Notice to Proceed, detailed information on staff and organization to show compliance with the Quality Assurance requirements of this Section. The Qualifications submittal shall be submitted and approved before any further submittals will be accepted. Failure to meet the minimum requirements shall be grounds for rejection as a PCSS. The Qualifications Submittal shall, as a minimum, contain the following:
   2. Copies of ISA CCST Level 1 certificates for all field technicians or resumes demonstrating field experience.
   3. Notarized statement from the firm's financial institution demonstrating ability for the firm to meet the obligations necessary for the performance of the work.
   4. Copy of UL-508 certificate for panel fabrication facilities.
   5. Project references for water or wastewater projects as defined in the Quality Assurance paragraphs.
   6. Documentation to demonstrate the ability to complete this project including: resumes of key staff, financial capacities, details on engineering, design, fabrication, and field service capacity, and location of staff responsible for responding to the site within four hours to resolve startup issues.

C. Project Plan, Deviation List, and Schedule Submittal:
   1. Submit, within 45 calendar days after Notice to Proceed, a Project plan. The Project Plan shall be submitted and approved before further submittals shall be accepted. The Project Plan shall, at a minimum, contain the following:
   2. Overview of the proposed control system describing the understanding of the project work, a preliminary system architecture drawing, interfaces to other systems, schedule, startup, and coordination. A discussion of startup, replacement of existing equipment with new, switchover (Maintaining Plant Operations during system transition), approach to testing and training, and other tasks as required by these specifications shall be included as applicable.
   3. Preliminary list of HMI software, PLC software, and PLC hardware, including version numbers, solely to determine compliance with the requirements of the Contract Documents prior to beginning development of system programming. Review and approval of software and hardware systems as part of this Project Plan stage shall not relieve the PCSS of meeting all the functional and performance requirements of the system as specified herein. Substitution of manufacturer or model of these systems after the submittal is approved is not allowed without Engineer approval.

4. Project personnel and organization including the PCSS project manager, project engineer, and lead project technicians. Include resumes of each these individuals and specify in writing their commitment to this project. These do not need to be submitted again if already submitted in the Qualification submittal.
5. Sample formats of the shop drawings to be submitted and in conformance with the requirements of the Specifications. At a minimum include samples of panel fabrication drawings, loop, and I/O wiring diagrams.
6. Exceptions to the Specifications or Drawings shall be clearly defined in a Deviation List. The Deviation List shall consist of a paragraph by paragraph review of the Specifications indicating acceptance or any proposed deviations, the reason for exception, the exact nature of the exception and the proposed substitution so that an evaluation may be made by the Engineer. If no exceptions are taken to the specifications or drawings the PCSS shall make a statement as such. If there is no statement by the PCSS, then it is acknowledged that no exceptions are taken.
7. Project schedule shall be prepared in Gantt chart format clearly showing task linkages for all tasks and identifying critical path elements. PCSS schedule must be based on the General Contractor schedule and must meet all field installation, testing, and start-up milestones in that schedule. The project schedule shall illustrate I&C related major project milestones including the following:
    a. Schedule for all subsequent project submittals. Include the time required for Contractor submittal preparation, Engineer's review time, and a minimum of two complete review cycles.
    b. Proposed dates for all project coordination meetings.
    c. Hardware purchasing, fabrication, and assembly (following approval of related submittals).
    d. Software purchasing and configuration (following approval of related submittals).
    e. Shipment of instrument and control system equipment.
    f. Installation of instrument and control system equipment.
    g. Testing: Schedule for all testing.
    h. Schedule for system cutover, startup, and/or going on-line for each major system. At a minimum include the schedule for each process controller and HMI server/workstation provided under this Contract.
    i. Schedule for all training including submittal and approval of O&M manuals, factory training, and site training.
    j. Incorporate time constraints for AESS activities as defined in [Section 13306].

D. Input/Output (I/O) List Submittal:
1. Submit, within 60 days after Notice to Proceed, a complete system Input/Output (I/O) address list for equipment connected to the control system under this Contract.
2. I/O list shall be based on the P&ID's, the Drawings, the design I/O list (if included), and requirements in the Specifications.
3. The I/O list shall be submitted in both a Microsoft Excel readable electronic file format and an 8-1/2 inch by 11-inch hard copy.
4. The I/O list shall reflect all active and spare I/O points. Add points to accommodate spare I/O as required in the specifications.
5. The I/O list shall be arranged such that each control panel has a dedicated worksheet. At a minimum, I/O worksheet shall include the following information:

    TAG NUMBER(S): As indicated on the Drawings, the identifier assigned to a device that performs a function in the control system. As part of this information, the loop number of the tag shall be broken out to allow for sorting by loop.

    DESCRIPTION: A description of the function of the device (text that includes signal source, control function, etc.) Include the text "Spare Points" for all I/O module points that are not connected to equipment.

    PHYSICAL LOCATION: The Control Panel designation of where the I/O point is wired to.

    Physical POINT ADDRESS: Rack, Slot, and Point (or Channel) assignment for each I/O point.

    I/O TYPE: use DO - Discrete Output, DI - Discrete Input, AO - Analog Output, AI - Analog Input, PI - Pulse Input, or PO - Pulse Output.

RANGE/STATE: The range in engineering units corresponding to an analog 4-20 mA signal, or, the state at which the value of the discrete points are "1."
ENGINEERING UNITS: The engineering units associated with the Analog I/O.
ALARM LIMITS: Include alarm limits based on the control descriptions and the Drawings.
P&ID - the P&ID or drawing where the I/O point appears on. Mark as "NA" (Not Applicable) if the I/O point is derived from a specification requirement and is not on the P&IDs.

6. The I/O list shall be sorted in order by:
   Physical location.
   I/O Type.
   Loop Number.
   Device Tag.
7. Once the I/O list is approved, the PLC I/O addresses shall not be modified without approval by the Engineer.
8. For I/O layout requirements, see the PLC Section 13311.

E. Field Instruments Submittal:
1. Refer to the Instruments section for submittal requirements.

F. Hardware and Software Packages Submittal:
1. Refer to the sections below for specific Hardware and Software Packages submittal requirements:
   a. 13311 - PLC Hardware and Software.
   b. 13315 - HMI System Software.
   c. 13320 - Control and Data Network Equipment.
   d. 13321 - Fiber Optic Cabling and Equipment.
   e. 13330 - Control Panels and Panel Mounted Equipment.
2. For each hardware and software packages component specified in the sections above, submit a cover page that lists, at a minimum, date, specification number, product name, manufacturer, model number, Location(s), and power required. Preferred format for the cover page is ISA-TR20.00.01-2001 (updated in 2004-2006), general data sheet; however, other formats will be acceptable provided they contain all required information.
3. The purpose of this submittal is to review the control panel and wiring diagrams. This could be combined with other submittals like the "Hardware and Software Submittal" if project is small enough.

G. Panel Layout Drawings and Wiring Diagrams Submittal:
1. Refer to the Control Panels section for submittal requirements.

H. Testing Plan Submittals:
1. Refer to Section 13302 - Testing for specific testing submittal requirements.

I. Training Plan Submittals:
1. Refer to Section 13303 for specific training requirements.

J. Spares, Expendables, and Test Equipment Lists Submittal:
1. Submit a list of, and descriptive literature for, spares, expendables, and test equipment.
2. Submit a list of, and descriptive literature for, additional spares, expendables, and test equipment recommended by the manufacturer.
3. Submit unit and total costs for the additional spare items specified or recommended for each subsystem.

K. Operations and Maintenance (O&M) Manuals:
1. Submit in accordance with Section 01300.
2. Furnish O&M manuals as specified herein. If the PCSS is performing the AE work, provide AE Manuals as specified in Section 13306.

3. The operations and maintenance manuals shall, at a minimum, contain the following information:
   a. Table of Contents:
      i. A Table of Contents shall be provided for the entire manual with the specific contents of each volume clearly listed. The complete Table of Contents shall appear in each volume.
   b. Instrument and Equipment Lists:
      i. The following lists shall be developed in Microsoft Excel format and provided not only as a hardcopy in O&M but also electronically on a CD.
      ii. An instrument list for all devices supplied including tag number, description, specification section and paragraph number, manufacturer, model number, serial number, range, span, location, manufacturer phone number, local supplier name, local supplier phone number, completion year replacement cost, and any other pertinent data.
      iii. An equipment list for all non-instrument devices supplied listing description, specification section and paragraph number, manufacturer, model number, serial number, location, manufacturer phone number, local supplier name, local supplier phone number, completion year replacement cost, and any other pertinent data.
   c. Equipment Operations and Maintenance Information:
      i. ISA-TR20.00.01-2001(updated in 2004-2006) data sheets shall be provided for all field instruments. For non-field instrumentation devices, provide a cover page for each device, piece of equipment, and OEM software that lists date, specification number, product name, manufacturer, model number, Location(s), and power required. Preferred format for the cover page is ISA-TR20.00.01-2001(updated in 2004-2006), general data sheet; however, other formats will be acceptable provided they contain all required information.
      ii. Vendor O&M documentation for each device, piece of equipment, or OEM software shall be either new documentation written specifically for this project, or modified standard vendor documentation. All standard vendor documentation furnished shall have all portions that apply clearly indicated with arrows or circles. All portions that do not apply shall be neatly lined out or crossed out. Groups of pages that do not apply at all to the specific model supplied shall be removed.
      iii. Provide the record documentation of the system audit as specified in Section 13302 - Testing.
      iv. Include the calibration forms developed as specified in Section 13302 - Testing.
   d. As-Built Drawings:
      i. Complete as-built drawings, including all drawings and diagrams specified in this section under the "Submittals" section. These drawings shall include all termination points on all equipment the system is connected to, including terminal points of equipment not supplied by the PCSS.
      ii. As built documentation shall include information from submittals, as described in this Specification, updated to reflect the as-built system. Errors in or modifications to the system resulting from the Factory and/or Functional Acceptance Tests shall be incorporated in this documentation.
   e. Original Licensed Software:
      i. Submit original software diskettes 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 and related information. 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:

i. In addition to the hard copy of O&M data, provide an electronic version of all equipment manuals and data sheets, along with any software back-up of configuration files, on CDROM or DVD. Electronic documents shall be supplied in Adobe Acrobat format.
ii. Provide electronic files for all custom-developed manuals including training manuals. Text shall be supplied in both Microsoft Office format and Adobe Acrobat format.
iii. Provide electronic files for all drawings produced. Drawings shall be in AutoCAD ".dwg" format and in Adobe Acrobat format. Drawings shall be provided using the AutoCAD eTransmit feature to bind external references, pen/line styles, fonts, and the drawing file into individual zip files.
iv. Each computer system hardware device shall be backed up onto CDROM or DVD after Substantial Completion and shall be turned over to the Owner.
v. If specified in the training section, provide digital copies of all training videos. Videos shall be in a format that is readable by standard DVD players and by standard PC DVD drives. Format shall be a minimum of 800 by 600 pixels and shall include sound.

4. The cover and edge of each volume shall contain the information as specified in Section [01340].

1.3 COORDINATION MEETINGS

A. Schedule the mandatory coordination meetings as described herein. The meetings shall be held at the Owner's designated location and shall include attendance by the Owner, the Engineer, the Contractor, the PCSS's Project Engineer, and the AESS Project Engineer, if applicable. Other Division 13 specifications may require additional meetings. Prepare and distribute an agenda for this meeting a minimum of one week before the scheduled meeting date. Meeting shall be scheduled a minimum of one week before the requested meeting date.

1. A project kickoff coordination meeting shall be held within two weeks after submitting the Project Plan. The purpose of the meeting shall be to discuss the PCSS's Project Plan, to summarize the PCSS's understanding of the project; discuss any proposed substitutions or alternatives; schedule testing and delivery deadline dates; provide a forum to coordinate hardware and software related issues; and request any additional information required from the Owner. The meeting will last up to one business day.
2. A submittal review coordination meeting shall be held after the Hardware, Panel Drawing, and Loop Drawing Submittal package has been reviewed by the Engineer and returned to the PCSS. The purpose of this meeting shall be to review comments made on the submittal package; to refine scheduled deadline dates; coordinate equipment installation activities; and provide a forum for any further required coordination between the PCSS and AESS. The meeting will last up to one business day.
3. Regular on-site meetings when the PCSS staff is at the plant site.

1.4 REFERENCE STANDARDS

A. Publications are referred to in the text by basic designation only. Where a date is given for reference standards, that edition shall be used. Where no date is given for reference standards, the latest edition in effect at the time of bid opening shall apply.

B. International Society of Automation (ISA):

1. ISA S5.2, Binary Logic Diagrams for Process Operations.
2. ISA S5.3, Graphic Symbols for Distributed Control/Shared Display Instrumentation Logic and Computer Systems.
3. ISA S5.4, Instrument Loop Diagrams.
4. ISA S20, Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves.
5. ISA RP60.3, Human Engineering for Control Centers.
6. ISA RP60.6, Nameplates, Labels, and Tags for Control Centers.
7. ISA-99, Industrial Automation and Control Systems Security.

C. National Electrical Manufacturers Association (NEMA).

D. National Fire Protection Agency (NFPA):
1. NFPA 70, National Electrical Code (NEC).
2. NFPA 79, Industrial Control Equipment.

E. Underwriters Laboratories, Inc. (UL):
1. UL 508 - Industrial Control Equipment - for custom fabricated equipment.
2. A nationally recognized testing laboratory, as approved by the Authority having jurisdiction, may substitute for UL listing on commercial off the shelf products.

1.5 QUALITY ASSURANCE

A. The Process Control System Supplier (PCSS) shall be a "systems integrator" regularly engaged in the design and the installation of instrumentation systems and their associated subsystems as they are applied to the municipal water and wastewater industry. For the purposes of this Specification Section, a "systems integrator" shall be interpreted to mean 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 and configuration and implementation of the specific programmable controllers, computers, and software proposed for this project. Key personnel shall hold ISA CCST Level 1 certification or have a minimum of 10 years of verifiable plant startup experience. Key personnel shall include, as a minimum, the lead field technician.
2. Has successfully completed work of similar or greater complexity on at least three previous projects within the last five years. Successful completion shall be defined as a finished project completed on time, without any outstanding claims or litigation involving the PCSS. Potential references shall be for projects where the PCSS's contract was of similar size to this project.
3. Has been actively engaged in the type of work specified in this Section for a minimum of five years.

B. The PCSS shall maintain a permanent, fully staffed and equipped service facility within 200 miles of the project site with full time employees capable of designing, fabricating, installing, calibrating, and testing the systems specified herein. At a minimum, the PCSS shall be capable of responding to on-site problems within 12 hours of notice. Provide an on-site response within 4 hours of notification starting at two months before scheduled start up to two months after startup completion.

C. PCSS shall hold a valid UL-508 certification for their panel fabrication facility.

D. Actual installation of the instrumentation system need not be performed by the PCSS's employees; however, the PCSS as a minimum shall be responsible for the technical supervision of the installation by providing on site supervision to the installers of the various components.

E. The selected PCSS shall be one of the following:
1. Prime Controls
2. Ace Controls
3. Texas Industrial Controls Manufacturing (TCIM)
4. ControlPanels USA
5. Weimar Manufacturing
6. or equal. If not listed, the contractor is required to submit the qualifications submittal for consideration.

F. Being listed in this specification does not relieve any potential PCSS from meeting the qualifications specified in this Section.

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery, storage, and handling shall be in accordance with Section [01600].

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 field handling, storage and installation required for 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 means of protection.
3. None of the HMI control and monitoring equipment shall be shipped to the site until the control room areas comply with specified ambient temperature and humidity. Have qualified personnel accept the equipment on delivery and supervise unloading within the control room areas.
4. If any apparatus has been damaged, such damage shall be repaired at no additional cost to the Owner.

1.7 NOMENCLATURE AND IDENTIFICATION

A. Field Instrument Tags:
1. See Section 13340.

B. Panel Nameplates:
1. See Section 13330.

1.8 WARRANTY

A. Provide warranty per Warranties and Bonds, and as specified herein.

1.9 MAINTENANCE CONTRACT

A. A written proposal for a maintenance contract executed by the PCSS shall be provided to the Owner for on-site preventive maintenance services related to the Instrumentation and Control system. The cost of this maintenance contract shall not be included in the Contract Price.

B. This proposal shall be provided within 30 days after final acceptance for the purpose of entering a contract for annual maintenance subsequent to the first year of maintenance. Standard per diem rates for providing breakdown service shall be set forth in the contract. Such rates shall be fair and reasonable and reflect the lowest rates offered to most favored customers. The fee quoted shall be firm for a minimum of 90 days from date of issue.

C. This maintenance contract shall include all labor, parts, and emergency calls providing on-site response within 24 hours, to provide complete system maintenance for a period of one year after the date of Substantial Completion of the system for all equipment and software provided as part of the PCSS scope of work.

D. Provide software updates throughout the maintenance contract period. Provide latest official released version for all software provided under this Contract. Owner shall have the latest software releases at the end of the maintenance contract period.

E. The maintenance contract shall also include a minimum of 4 preventive maintenance visits by qualified service personnel of the Supplier who is familiar with the type of equipment provided for this project. Each preventive maintenance visit shall include routine adjustment, calibration, cleaning and lubrication of system equipment and verification of correct operation.

F. Visits to the sites to correct deficiencies under warranty shall not be included in this preventive maintenance service contract.

G. Emergency maintenance procedures or plant visits may coincide with a preventive maintenance visit, however, they shall not replace the work intended to be performed during a preventive maintenance visit. The Supplier shall have full responsibility for the system hardware preventive and corrective maintenance.

H. During the one-year maintenance period, observation of maintenance operations by plant personnel and the instruction of said personnel in the details of the maintenance work being performed, shall be provided.

1.10 PROJECT/SITE REQUIREMENTS

A. Environmental Requirements. Refer to Section [16000] and Electrical Drawings 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 operate between -30 to 50 C degrees ambient.
2. Equipment located in indoor locations shall operate between 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 operate between 20 to 95 percent relative, non-condensing humidity. All other equipment shall operate between 5 to 100 percent relative, condensing humidity.

PART 2 – PRODUCTS

2.1 GENERAL

A. All instrumentation and electronic equipment shall be of the manufacturer's latest design, utilizing printed circuitry and epoxy or equal coating to prevent contamination by dust, moisture and fungus. The field mounted equipment and system components shall be designed for installation in dusty, humid and slightly corrosive service conditions.

B. All instruments shall be provided with mounting hardware and floor stands, wall brackets, or instrument racks unless otherwise noted. Fasteners for securing control panels and enclosures to walls and floors shall be either hot-dipped galvanized after fabrication or stainless steel. Provide stainless steel fasteners only in corrosive areas rated NEMA 4X on the Drawings or as defined under Division 16. Provide minimum size anchor of 3/8-inch.

C. All indicators shall be linear in process units, unless otherwise noted. All transmitters shall be provided with indicators in process units, accurate to two percent or better.

D. All equipment, cabinets and devices furnished shall be heavy-duty type, designed for continuous industrial service. The system shall contain similar products of a single manufacturer, and shall consist of equipment models, which

are currently in production. All equipment provided shall be of modular construction and shall be capable of field expansion.

E. All electronic/digital equipment shall be provided with radio frequency interference protection.

F. Electrical:

1. Equipment shall operate on a 60 Hertz alternating current power source at a nominal 120 volts, plus or minus 10 percent, except where specifically noted. Regulators and power supplies required for compliance with the above shall be provided between power supply and interconnected instrument loop. Where equipment requires voltage regulation, constant voltage transformers shall be supplied.
2. With the exception for field device network connected devices, all electronic instrumentation shall utilize linear transmission signals of isolated 4 to 20 mA DC (milliampere direct current) capable of driving a load up to 750 ohms, unless specified otherwise. However, signals between instruments within the same panel or cabinet may be 1-5 VDC (volts direct current).
3. Outputs of equipment that are not of the standard signals as outlined, shall have the output immediately raised and/or converted to compatible standard signals for remote transmission. No zero based signals will be allowed.
4. All switches shall have double-pole, double-throw contacts rated at a minimum of 600 VA, unless noted otherwise.
5. Switches and/or signals indicating an alarm, failure or upset condition shall be wired in a fail-safe manner. A fail-safe condition is an open circuit when in an alarm state.
6. Materials and equipment shall be UL approved whenever such approved equipment and materials are available.
7. All equipment furnished shall be designed and constructed so that in the event of power interruption, the systems specified herein shall go through an orderly shutdown with no loss of memory, and shall resume normal operation without manual resetting when power is restored, unless otherwise noted.

2.2 ELECTRICAL SURGE PROTECTION

A. General - Surge protection shall be provided to protect the electronic instrumentation system from induced surges propagating along the signal and power supply lines from lightning, utility, or the plant electrical system. The protection systems shall be such that the protective level shall not interfere with normal operation, but shall be lower than the instrument surge withstand level. Protection shall be maintenance free and self-restoring. Devices shall have a response time of less than 50 nanoseconds and be capable of handling a discharge surge current (at an 8x20µs impulse waveform) of at least 8 kA. Ground wires for all instrumentation device surge protectors shall be connected to a low resistance ground.

B. Provide protection of all analog signal (4-20 mA) circuits where any part of the circuit is outside of the building envelope. Circuits shall be protected at both the transmitter and the control system end of the circuit. Protection devices located near the transmitter shall be mounted in a separate NEMA 4X stainless steel enclosure (plastic is not acceptable) or conduit mounted, and shall be Phoenix Contact PT Series, MTL Surge Technologies (Telematic) TP48, Citel TSP-10 series, or equal. Substitution of a single device to protect both 120 VAC and 4-20 mA wires to an instrument is acceptable. Protection devices in control panels shall be MTL Surge Technologies (Telematic) SD Series, Phoenix Contact PT Series, Citel DLA series, or equal.

C. Provide protection of all 120 VAC power feeds into control panels, instruments, and control room equipment. Surge arresters shall be Transtector ACP-100BW Series, Phoenix Contact "Mains-PlugTrab", MCG Surge Protection 400 Series, Citel DS40 series, or equal.

D. Non-Fiber Based Data Highway or Communications Circuits - Provide protection on all communication and data highway circuits that leave a building or are routed external to a building. Circuit protection shall be provided at

both ends of the line. Surge protection devices shall be Phoenix Contact PlugTrab Series, Transtector FSP Series, MTL Surge Technologies (Telematic) NP Series, Citel DLA series or MJ8 series, or equal.

E. RF Coaxial Cable - Provide protection on communication cables between radios and antennas, mounted either inside the panel, or in the wall of the enclosure in accordance with NEMA and UL standards. Surge protection devices shall be Citel P8AX series, Polyphaser, or equal.

F. Inductive Loads - Provide coil surge suppression devices, such as varistors or interposing relays, on all process controller outputs or switches rated 120 VA or less that drive solenoid, coil, or motor loads.

G. Telephone Circuits - At a minimum, provide Telephone Company approved line protection units for all telephone lines used for telemetry or SCADA system use under this Contract.

2.3 SPARE PARTS

A. All spare parts shall be wrapped in bubble wrap, sealed in a polyethylene bag complete with dehumidifier, then packed in cartons and labeled with indelible markings. Complete ordering information including manufacturer's contact information (address and phone number), part name, part number, part ordering information, and equipment name and number(s) for which the part is to be used shall be supplied with the required spare parts. The spare parts shall be delivered and stored in a location directed by the Owner or Engineer.

B. Furnish one of each type of installed Surge protection devices.

C. Other spare parts are specified in each section. An overview follows:
1. Devices within Control Panels - See the control panels section.
2. Computer Hardware and Software spare parts - See the Computer System Hardware section.
3. PLC spare parts - See the PLC section.
4. Network and Communications System - See the Control and Data Network Equipment section.
5. Instrument related Spare Parts - see the Instrument section(s).

PART 3 – EXECUTION

3.1 GENERAL INSTALLATION

A. Instrumentation and accessory equipment shall be installed in accordance with manufacturer instructions. The indicated locations of equipment, transmitters, alarms and similar devices indicated are approximate only. Exact locations of all devices shall be as approved by the Engineer during construction. Obtain in the field, all information relevant to the placing of process control equipment and in case of interference with other work, proceed as directed by the Engineer and furnish all labor and materials necessary to complete the work in an approved manner at no additional cost to the Owner.

B. Provide brackets and hangers required for mounting of equipment.

C. The shield on each process instrumentation cable shall be continuous from source to destination and be grounded at only one ground point for each shield.

D. Investigate each space in the building through which equipment must pass to reach its final location. If necessary, ship material in sections sized to permit passing through restricted areas in the building. Provide on-site service to oversee the installation, the placing and location of system components, their connections to the process

equipment panels, cabinets and devices, subject to the Engineer's approval. Certify that field wiring associated with the equipment is installed in accordance with best industry practice. Coordinate work under this Section with that of the electrical work specified under applicable sections of Division 16.

E. Provide sunshades for equipment mounted outdoors in direct sunlight. Sunshades shall include standoffs to allow air circulation around the cabinet. Orient equipment outdoors to face to the North or as required to minimize the impact of glare and ultraviolet exposure on digital readouts.

3.2 TESTING

A. Refer to Section 13302.

3.3 TRAINING

A. Refer to Section 13303.

3.4 PROCESS CONTROLLER INPUT/OUTPUT (I/O) SCHEDULE

A. See attachment 13300A.

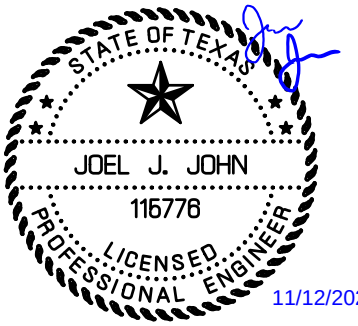
END OF SECTION

APPENDIX 13300-A

CONTROL SYSTEM INPUT/OUTPUT (I/O) SCHEDULE

This I/O Schedule is included for reference only. The determination of the exact number and type of I/O points shall be the responsibility of the PCSS based on the Drawings, the Specifications, Process Control Loop Descriptions (Section [13341]), auxiliary device requirements, and spare requirements.

Lift Station PLC Panel (CP-02-001)											
Area Code	Description	Type	Low Limit	High Limit	Low Alarm	High Alarm	Engr Unit	Off State	On State	Alarm State	Comments
02	LIT-02-001 Lift Station Wet Well Level	AI	-	-	-	476.75	ft.	-	-	LOW/HIGH	From Ultrasonic Transducer
02	SP-02-101 in HAND	DI	-	-	-	-	-	OFF	HAND	-	From H-O-A Switch
02	SP-02-101 in AUTO	DI	-	-	-	-	-	OFF	AUTO	-	From H-O-A Switch
02	SP-02-101 Seal Fail Alarm	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From Pump Protection Module
02	SP-02-101 Over Temp Alarm	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From Pump Protection Module
02	SP-02-101 Overload Alarm	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From MCC - Motor Starter
02	SP-02-101 Running	DI	-	-	-	-	-	OFF	RUNNING	-	From MCC - Motor Starter
02	SP-02-201 in HAND	DI	-	-	-	-	-	OFF	HAND	-	From H-O-A Switch
02	SP-02-201 in AUTO	DI	-	-	-	-	-	OFF	AUTO	-	From H-O-A Switch
02	SP-02-201 Seal Fail Alarm	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From Pump Protection Module
02	SP-02-201 Over Temp Alarm	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From Pump Protection Module
02	SP-02-201 Overload Alarm	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From MCC - Motor Starter
02	SP-02-201 Running	DI	-	-	-	-	-	OFF	RUNNING	-	From MCC - Motor Starter
02	SP-02-301 in HAND	DI	-	-	-	-	-	OFF	HAND	-	From H-O-A Switch
02	SP-02-301 in AUTO	DI	-	-	-	-	-	OFF	AUTO	-	From H-O-A Switch
02	SP-02-301 Seal Fail Alarm	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From Pump Protection Module
02	SP-02-301 Over Temp Alarm	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From Pump Protection Module
02	SP-02-301 Overload Alarm	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From MCC - Motor Starter
02	SP-02-301 Running	DI	-	-	-	-	-	OFF	RUNNING	-	From MCC - Motor Starter
02	SP-02-401 in HAND	DI	-	-	-	-	-	OFF	HAND	-	From H-O-A Switch
02	SP-02-401 in AUTO	DI	-	-	-	-	-	OFF	AUTO	-	From H-O-A Switch
02	SP-02-401 Seal Fail Alarm	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From Pump Protection Module
02	SP-02-401 Over Temp Alarm	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From Pump Protection Module
02	SP-02-401 Overload Alarm	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From MCC - Motor Starter
02	SP-02-401 Running	DI	-	-	-	-	-	OFF	RUNNING	-	From MCC - Motor Starter
02	CP-02-001 Lift Station Wet Well High Level Alarm	DI	-	-	-	476.75	ft.	NORMAL	FAILURE	HIGH	From Float Switch System
02	CP-02-001 Lift Station Wet Well Low Level Alarm	DI	-	-	-	-	-	NORMAL	FAILURE	LOW	From Float Switch System
02	CP-02-001 Pumps On Backup Control	DI	-	-	-	-	-	OFF	ON	BACKUP	From Existing Lift Station Local Panel
02	LSH-04-001 Peak High Level	DI	-	-	-	-	-	NORMAL	HIGH	HIGH	From Peak Shaving Basin Control Panel (CP-04-001)
02	LSL-02-001 Low Float (All Pumps Off)	DI	-	-	-	-	-	NORMAL	LOW	LOW	From Existing Lift Station Local Panel
02	LS-02-001 Lead Float	DI	-	-	-	-	-	NORMAL	CALL	-	From Existing Lift Station Local Panel
02	LS-02-001 Lag 1 Float	DI	-	-	-	-	-	NORMAL	CALL	-	From Existing Lift Station Local Panel
02	LS-02-001 Lag 2 Float (Peak Shaving)	DI	-	-	-	-	-	NORMAL	CALL	-	From Existing Lift Station Local Panel
02	LS-02-001 Lag 3 Float	DI	-	-	-	-	-	NORMAL	CALL	-	From Existing Lift Station Local Panel
02	LSH-02-001 High Float (Transducer Fail)	DI	-	-	-	-	-	NORMAL	HIGH	HIGH	From Existing Lift Station Local Panel
02	CP-02-001 Phase Fail	DI	-	-	-	-	-	FAILURE	NORMAL	OFF	From Existing Lift Station Local Panel
02	CP-02-001 Control Power Fail	DI	-	-	-	-	-	FAILURE	NORMAL	OFF	From Existing Lift Station Local Panel
02	CP-02-001 Common Spare Peak Shaving Basin Selector Switch Status	DI	-	-	-	-	-	HEADWORKS	PEAK SHAVING	-	From Selector Switch
02	CP-02-001 Headworks/Peak Shaving Basin Valve Selector	DI	-	-	-	-	-	HEADWORKS	PEAK SHAVING	-	From CR77
02	CP-02-001 PLC Fail (Watchdog)	DO	-	-	-	-	-	FAILURE	NORMAL	OFF	To Existing Lift Station Local Panel
02	SP-02-101 Call	DO	-	-	-	-	-	OFF	CALL	-	To Existing Lift Station Control Panel
02	SP-02-201 Call	DO	-	-	-	-	-	OFF	CALL	-	To Existing Lift Station Control Panel
02	SP-02-301 Call	DO	-	-	-	-	-	OFF	CALL	-	To Existing Lift Station Control Panel
02	SP-02-401 Call	DO	-	-	-	-	-	OFF	CALL	-	To Existing Lift Station Control Panel
02	SP-02-101 Fail	DO	-	-	-	-	-	NORMAL	FAILURE	ON	To SCADA
02	SP-02-201 Fail	DO	-	-	-	-	-	NORMAL	FAILURE	ON	To SCADA
02	SP-02-301 Fail	DO	-	-	-	-	-	NORMAL	FAILURE	ON	To SCADA
02	SP-02-401 Fail	DO	-	-	-	-	-	NORMAL	FAILURE	ON	To SCADA



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Secondary Headworks Control Panels (CP-03-001, CP-03-002)											
Area Code	Description	Type	Low Limit	High Limit	Low Alarm	High Alarm	Engr Unit	Off State	On State	Alarm State	Comments
03	MFS-03-101 Upstream Level	AI	-	-	-	-	in.	-	-	HIGH	From CP-03-002, To Level Transmitter (LIT-03-101)
03	MFS-03-101 Downstream Level	AI	-	-	-	-	in.	-	-	HIGH	From CP-03-002, To Level Transmitter (LIT-03-101)
03	MFS-03-301 Upstream Level	AI	-	-	-	-	in.	-	-	HIGH	From CP-03-001, To Level Transmitter (LIT-03-302)
03	MFS-03-301 Downstream Level	AI	-	-	-	-	in.	-	-	HIGH	From CP-03-001, To Level Transmitter (LIT-03-302)
03	CP-03-001 Control Panel Power	DI	-	-	-	-	-	FAILURE	NORMAL	OFF	From CP-03-001
03	CP-03-001 Phase Fail	DI	-	-	-	-	-	FAILURE	NORMAL	OFF	From CP-03-001
03	CP-03-001 System Reset	DI	-	-	-	-	-	FAILURE	RESET	-	From CP-03-001
03	CP-03-002 Control Panel Power	DI	-	-	-	-	-	FAILURE	NORMAL	OFF	From CP-03-002
03	CP-03-002 Phase Fail	DI	-	-	-	-	-	FAILURE	NORMAL	OFF	From CP-03-002
03	CP-03-002 System Reset	DI	-	-	-	-	-	FAILURE	RESET	-	From CP-03-002
03	LSH-03-001 Headworks High Level Alarm	DI	-	-	-	-	-	NORMAL	FAILURE	HIGH	From Level Switch (LSH-03-001)
03	LSH-03-301 Headworks High Level Alarm	DI	-	-	-	-	-	NORMAL	FAILURE	HIGH	From Level Switch (LSH-03-301)
03	MFS-03-101 Screen/Brush in HAND	DI	-	-	-	-	-	OFF	HAND	-	From CP-03-001 H-O-A Switch HS-03-101
03	MFS-03-101 Screen/Brush in AUTO	DI	-	-	-	-	-	OFF	AUTO	-	From CP-03-001 H-O-A Switch HS-03-101
03	MFS-03-101 Screen Running	DI	-	-	-	-	-	OFF	RUNNING	-	From CP-03-001
03	MFS-03-101 Brush Running	DI	-	-	-	-	-	OFF	RUNNING	-	From CP-03-001
03	MFS-03-101 Screen Fail	DI	-	-	-	-	-	NORMAL	FAIL	ON	From CP-03-001
03	MFS-03-101 Brush Fail	DI	-	-	-	-	-	NORMAL	FAIL	ON	From CP-03-001
03	MFS-03-101 Screen Spray in HAND	DI	-	-	-	-	-	OFF	HAND	-	From CP-03-001
03	MFS-03-101 Screen Spray in AUTO	DI	-	-	-	-	-	OFF	AUTO	-	From CP-03-001
03	MFS-03-301 Screen/Brush in HAND	DI	-	-	-	-	-	OFF	HAND	-	From CP-03-002 H-O-A Switch HS-03-301B
03	MFS-03-301 Screen/Brush in AUTO	DI	-	-	-	-	-	OFF	AUTO	-	From CP-03-002 H-O-A Switch HS-03-301B
03	MFS-03-301 Screen Running	DI	-	-	-	-	-	OFF	RUNNING	-	From CP-03-002
03	MFS-03-301 Brush Running	DI	-	-	-	-	-	OFF	RUNNING	-	From CP-03-002
03	MFS-03-301 Screen Fail	DI	-	-	-	-	-	NORMAL	FAIL	ON	From CP-03-002
03	MFS-03-301 Brush Fail	DI	-	-	-	-	-	NORMAL	FAIL	ON	From CP-03-002
03	MFS-03-301 Screen Spray in HAND	DI	-	-	-	-	-	OFF	HAND	-	From CP-03-002
03	MFS-03-301 Screen Spray in AUTO	DI	-	-	-	-	-	OFF	AUTO	-	From CP-03-002
03	VMP-03-001 Booster Pump in HAND	DI	-	-	-	-	-	NORMAL	HAND	-	From CP-03-001 H-O-A Switch HS-03-001D
03	VMP-03-001 Booster Pump in AUTO	DI	-	-	-	-	-	NORMAL	AUTO	-	From CP-03-001 H-O-A Switch HS-03-001D
03	VMP-03-001 Booster Pump Running	DI	-	-	-	-	-	OFF	RUNNING	-	From CP-03-001
03	VMP-03-001 Booster Pump Fail	DI	-	-	-	-	-	NORMAL	FAIL	ON	From CP-03-001
03	WC-03-101 Compactor in HAND	DI	-	-	-	-	-	OFF	HAND	-	From CP-03-001 H-O-A Switch HS-03-001B
03	WC-03-101 Compactor in AUTO	DI	-	-	-	-	-	OFF	AUTO	-	From CP-03-001 H-O-A Switch HS-03-001B
03	WC-03-101 Compactor in FWD	DI	-	-	-	-	-	OFF	FORWARD	-	From CP-03-001
03	WC-03-101 Compactor in REV	DI	-	-	-	-	-	OFF	REVERSE	-	From CP-03-001
03	WC-03-101 Compactor Running	DI	-	-	-	-	-	OFF	RUNNING	-	From CP-03-001
03	WC-03-001 Compactor Fail	DI	-	-	-	-	-	NORMAL	FAIL	ON	From CP-03-001
03	WC-03-101 Comp Spray in HAND	DI	-	-	-	-	-	OFF	HAND	-	From CP-03-001
03	WC-03-101 Comp Spray in AUTO	DI	-	-	-	-	-	OFF	AUTO	-	From CP-03-001
03	WC-03-001 E-Stop Switch	DI	-	-	-	-	-	NORMAL	E-STOP	ESTOP	From E-Stop Switch (PB-03-001)
03	MFS-03-101 E-Stop Switch	DI	-	-	-	-	-	NORMAL	E-STOP	ESTOP	From E-Stop Switch (PB-03-101)
03	MFS-03-101 E-Stop Switch	DI	-	-	-	-	-	NORMAL	E-STOP	ESTOP	From E-Stop Switch (PB-03-101A)
03	MFS-03-301 E-Stop Switch	DI	-	-	-	-	-	NORMAL	E-STOP	ESTOP	From E-Stop Switch (PB-03-301)
03	MFS-03-101 Screen/Brush Call	DO	-	-	-	-	-	OFF	CALLED	-	From CP-03-001
03	MFS-03-301 Screen/Brush Call	DO	-	-	-	-	-	OFF	CALLED	-	From CP-03-001
03	MFS-03-301 Screen Spray Call to Open	DO	-	-	-	-	-	CLOSE	OPEN	-	From CP-03-002
03	VMP-03-001 Booster Pump Call	DO	-	-	-	-	-	OFF	CALL	-	From CP-03-001
03	WC-03-101 Compactor Call FWD	DO	-	-	-	-	-	OFF	CALL FWD	-	From CP-03-001
03	WC-03-101 Compactor Call REV	DO	-	-	-	-	-	OFF	CALL REV	-	From CP-03-001
03	WC-03-301 Comp Spray Call to Open	DO	-	-	-	-	-	CLOSE	OPEN	-	From CP-03-002
03	SV-03-101 Solenoid Valve No. 1 Open/Close	DO	-	-	-	-	-	CLOSE	OPEN	-	CP-03-001, To Solenoid Valve No. 1 (SV-03-101)
03	SV-03-001 Solenoid Valve No. 1 Open/Close	DO	-	-	-	-	-	CLOSE	OPEN	-	CP-03-002, To Solenoid Valve No. 1 (SV-03-001)
03	SV-03-302 Solenoid Valve No. 2 Open/Close	DO	-	-	-	-	-	CLOSE	OPEN	-	CP-03-002, To Solenoid Valve No. 2 (SV-03-302)

Perforated Plate Screen Control Panels are vendor provided. The PCSS shall coordinate with the vendor for additional I/O tags and IP addresses.

Peak Shaving Basin Control Panel (CP-04-001)											
Area Code	Description	Type	Low Limit	High Limit	Low Alarm	High Alarm	Engr Unit	Off State	On State	Alarm State	Comments
04	CP-04-001 Control Power Fail	DI	-	-	-	-	-	FAILURE	NORMAL	OFF	From CP-04-001 Control Power Relay
04	CP-04-001 Phase Fail	DI	-	-	-	-	-	FAILURE	NORMAL	OFF	From CP-04-001 Phase Fail Relay
04	CP-04-001 Pumps on Backup	DI	-	-	-	-	-	PRIMARY	BACKUP	BACKUP	From CP-04-001 Backup Control Relay
04	CP-04-001 System Reset	DI	-	-	-	-	-	FAILURE	RESET	-	To CP-04-001 Reset Relay
04	LSL-04-001 Peak Shaving Basin Low Level	DI	-	-	-	-	-	NORMAL	LOW	LOW	From Low Level Float Switch
04	SPP-04-101 Running	DI	-	-	-	-	-	OFF	RUNNING	-	From CP-04-001 Motor Starter Aux
04	SPP-04-101 Overload	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From CP-04-001 Motor Starter OL
04	SPP-04-101 in HAND	DI	-	-	-	-	-	OFF	HAND	-	From CP-04-001, HS-04-101 H-O-A Switch
04	SPP-04-101 in AUTO	DI	-	-	-	-	-	OFF	AUTO	-	From CP-04-001, HS-04-101 H-O-A Switch
04	SPP-04-201 Running	DI	-	-	-	-	-	OFF	RUNNING	-	From CP-04-001 Motor Starter Aux
04	SPP-04-201 Overload	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From CP-04-001 Motor Starter OL
04	SPP-04-201 in HAND	DI	-	-	-	-	-	OFF	HAND	-	From CP-04-001, HS-04-201 H-O-A Switch
04	SPP-04-201 in AUTO	DI	-	-	-	-	-	OFF	AUTO	-	From CP-04-001, HS-04-201 H-O-A Switch
04	SPP-04-301 Running	DI	-	-	-	-	-	OFF	RUNNING	-	From CP-04-001 Motor Starter Aux
04	SPP-04-301 Overload	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From CP-04-001 Motor Starter OL
04	SPP-04-301 in HAND	DI	-	-	-	-	-	OFF	HAND	-	From CP-04-001, HS-04-301 H-O-A Switch
04	SPP-04-301 in AUTO	DI	-	-	-	-	-	OFF	AUTO	-	From CP-04-001, HS-04-301 H-O-A Switch
04	CP-04-001 PLC Fail (Watchdog)	DO	-	-	-	-	-	FAILURE	NORMAL	OFF	From PLC -04-001
04	SPP-04-101 Call	DO	-	-	-	-	-	OFF	CALL	-	To CP-04-001 Motor Starter Coil
04	SPP-04-201 Call	DO	-	-	-	-	-	OFF	CALL	-	To CP-04-001 Motor Starter Coil
04	SPP-04-301 Call	DO	-	-	-	-	-	OFF	CALL	-	To CP-04-001 Motor Starter Coil

Aeration Basin to Central Plant PLC (CP-12-001)											
Area Code	Description	Type	Low Limit	High Limit	Low Alarm	High Alarm	Engr Unit	Off State	On State	Alarm State	Comments
05	FIT-05-101 RAS Air Lift Flow	AI	-	-	-	-	SCFM	-	-	LOW/HIGH	From Train No. 1 RAS Air Lift Flow No. 1
05	FIT-05-102 RAS Air Lift Flow	AI	-	-	-	-	SCFM	-	-	LOW/HIGH	From Train No. 1 RAS Air Lift Flow No. 2
05	FIT-05-201 RAS Air Lift Flow	AI	-	-	-	-	SCFM	-	-	LOW/HIGH	From Train No. 2 RAS Air Lift Flow No. 1
05	FIT-05-202 RAS Air Lift Flow	AI	-	-	-	-	SCFM	-	-	LOW/HIGH	From Train No. 2 RAS Air Lift Flow No. 2
05	FIT-05-301 RAS Air Lift Flow	AI	-	-	-	-	SCFM	-	-	LOW/HIGH	From Train No. 3 RAS Air Lift Flow No. 1
05	FIT-05-302 RAS Air Lift Flow	AI	-	-	-	-	SCFM	-	-	LOW/HIGH	From Train No. 3 RAS Air Lift Flow No. 2
05	AIT-05-101 Analytic Transmitter	AI	-	-	-	-	-	-	-	LOW/HIGH	From Train No. 1 Analalytic Transmitter
05	AE-05-101 Dissolved Oxygen Probe	-	-	-	-	-	mg/L	-	-		
05	AE-05-102 Mixed Liquor Suspended Solids Probe	-	-	-	-	-	mg/L	-	-		
05	AIT-05-201 Analytic Transmitter	AI	-	-	-	-	-	-	-	LOW/HIGH	From Train No. 2 Analalytic Transmitter
05	AE-05-201 Dissolved Oxygen Probe	-	-	-	-	-	mg/L	-	-		
05	AE-05-202 Mixed Liquor Suspended Solids Probe	-	-	-	-	-	mg/L	-	-		
05	AIT-05-301 Analytic Transmitter	AI	-	-	-	-	-	-	-	LOW/HIGH	From Train No. 3 Analalytic Transmitter
05	AE-05-301 Dissolved Oxygen Probe	-	-	-	-	-	mg/L	-	-		
05	AE-05-302 Mixed Liquor Suspended Solids Probe	-	-	-	-	-	mg/L	-	-		
05											
05											
05											
05											
05											
05											

Clarifier No. 3 Control Panel (CP-06-301) to Central Plant PLC (CP-12-101)									
Area Code	Description	Type	Low Limit	High Limit	Engr Unit	Off State	On State	ALarm State	Comments
06	CP-06-101 Control Power Fail	DI	-	-	-	NORMAL	FAILURE	OFF	From CP-06-101 Control Power Fail Relay
06	CP-06-101 Phase Fail	DI	-	-	-	NORMAL	FAILURE	OFF	From CP-06-101 Phase Fail Relay
06	SC-06-101 Running	DI	-	-	-	OFF	RUNNING	OFF	From CP-06-101 Motor Starter Aux
06	SC-06-101 Shear Pin Fail Shutdown	DI	-	-	-	NORMAL	FAILURE	ON	From SC-06-101 Torque Limit Sensor
06	SC-06-101 High Torque Alarm	DI	-	-	-	NORMAL	FAILURE	ON	From SC-06-101 Torque Limit Sensor
06	SC-06-101 High Torque Shutdown	DI	-	-	-	NORMAL	FAILURE	ON	From SC-06-101 Torque Limit Sensor
06	SC-06-101 Motor Overload	DI	-	-	-	NORMAL	FAILURE	ON	From CP-06-101 Motor Starter OL
06	SC-06-101 Motor Protection Relay	DI	-	-	-	NORMAL	FAILURE	ON	From CP-06-101 Motor Protection Relay
06	CP-06-201 Control Power Fail	DI	-	-	-	NORMAL	FAILURE	OFF	From CP-06-201 Control Power Fail Relay
06	CP-06-201 Phase Fail	DI	-	-	-	NORMAL	FAILURE	OFF	From CP-06-201 Phase Fail Relay
06	SC-06-201 Running	DI	-	-	-	OFF	RUNNING	OFF	From CP-06-201 Motor Starter Aux
06	SC-06-201 Shear Pin Fail Shutdown	DI	-	-	-	NORMAL	FAILURE	ON	From SC-06-201 Torque Limit Sensor
06	SC-06-201 High Torque Alarm	DI	-	-	-	NORMAL	FAILURE	ON	From SC-06-201 Torque Limit Sensor
06	SC-06-201 High Torque Shutdown	DI	-	-	-	NORMAL	FAILURE	ON	From SC-06-201 Torque Limit Sensor
06	SC-06-201 Motor Overload	DI	-	-	-	NORMAL	FAILURE	ON	From CP-06-201 Motor Starter OL
06	SC-06-201 Motor Protection Relay	DI	-	-	-	NORMAL	FAILURE	ON	From CP-06-201 Motor Protection Relay
06	CP-06-301 Control Power Fail	DI	-	-	-	NORMAL	FAILURE	OFF	From CP-06-301 Control Power Fail Relay
06	CP-06-301 Phase Fail	DI	-	-	-	NORMAL	FAILURE	OFF	From CP-06-301 Phase Fail Relay
06	SC-06-301 Running	DI	-	-	-	OFF	RUNNING	OFF	From CP-06-301 Motor Starter Aux
06	SC-06-301 Shear Pin Fail Shutdown	DI	-	-	-	NORMAL	FAILURE	ON	From SC-06-301 Torque Limit Sensor
06	SC-06-301 High Torque Alarm	DI	-	-	-	NORMAL	FAILURE	ON	From SC-06-301 Torque Limit Sensor
06	SC-06-301 High Torque Shutdown	DI	-	-	-	NORMAL	FAILURE	ON	From SC-06-301 Torque Limit Sensor
06	SC-06-301 Motor Overload	DI	-	-	-	NORMAL	FAILURE	ON	From CP-06-301 Motor Starter OL
06	SC-06-301 Motor Protection Relay	DI	-	-	-	NORMAL	FAILURE	ON	From CP-06-301 Motor Protection Relay

Area Code	Description	Type	Low Limit	High Limit	Low Alarm	High Alarm	Engr Unit	Off State	On State	Alarm State	Comments
Tertiary Filter Basin No. 1 Control Panel (CP-07-001)											
07	AIT-07-101 Analytic Transmitter	AI					NTU	-	-		Basin No. 1 Turbidity Level
07	FIT-07-101 Flow	AI					GPM	-	-		Basin No. 1 Backwash System Flow
07	LE-07-101 Level Sensor	AI					ft.	-	-		Basin No. 1 Tank Level
07	PIT-07-101 Pressure	AI					PSIA	-	-		Basin No. 1 Backwash Pump No. 1 Suction Vaccum Pressure
07	PIT-07-102 Pressure	AI					PSIA	-	-		Basin No. 1 Backwash Pump No. 1 Discharge Vacuum Sensor
07	PIT-07-103 Pressure	AI					PSIA	-	-		Basin No. 1 Backwash Pump No. 2 Suction Vacuum Pressure
07	PIT-07-104 Pressure	AI					PSIA	-	-		Basin No. 1 Backwash Pump No. 2 Discharge Vacuum Pressure
07	PSH-07-101 High Pressure Alarm	AI					PSIA	-	-		Basin No. 1 Turbidimeter Pump No. High Discharge Pressure
07	SPP-07-101 Speed Command	AO			-	-	Hz	-	-	-	Basin No. 1 Backwash/Waste Pump No. 1 Speed Command
07	SPP-07-102 Speed Command	AO			-	-	Hz	-	-	-	Basin No. 1 Backwash/Waste Pump No. 2 Speed Command
07	CP-07-101 Control Power On	DI	-	-	-	-	-	FAILURE	NORMAL	OFF	Basin No. 1 Control Power Okay
07	CP-07-101 Phase Fail	DI	-	-	-	-	-	FAILURE	NORMAL	OFF	Basin No. 1 Phase Fail Relay
07	DF-07-101 in Hand	DI	-	-	-	-	-	OFF	HAND	-	Basin No. 1 in Hand
07	DF-07-101 in Auto	DI	-	-	-	-	-	OFF	AUTO	-	Basin No. 1 in Auto
07	DF-07-101 Running	DI	-	-	-	-	-	STOPPED	RUNNING	-	Basin No. 1 Status
07	DF-07-101 Fail	DI						NORMAL	FAILURE	ON	Basin No. 1 Fault Status
07	SPP-07-101 in Hand	DI	-	-	-	-	-	OFF	HAND	-	Basin No. 1 Backwash Pump No. 1 in Hand
07	SPP-07-101 in Auto	DI	-	-	-	-	-	OFF	AUTO	-	Basin No. 1 Backwash Pump No. 1 in Auto
07	SPP-07-101 Running	DI	-	-	-	-	-	STOPPED	RUNNING	-	Basin No. 1 Backwash Pump No. 1 Status
07	SPP-07-101 Fail	DI						NORMAL	FAILURE	ON	Basin No. 1 Backwash Pump No. 1 Fault Status
07	SPP-07-102 in Hand	DI	-	-	-	-	-	OFF	HAND	-	Basin No. 1 Backwash Pump No. 2 in Hand
07	SPP-07-102 in Auto	DI	-	-	-	-	-	OFF	AUTO	-	Basin No. 1 Backwash Pump No. 2 in Auto
07	SPP-07-102 Running	DI	-	-	-	-	-	STOPPED	RUNNING	-	Basin No. 1 Backwash Pump No. 2 Status
07	SPP-07-102 Fail	DI						NORMAL	FAILURE	ON	Basin No. 1 Backwash Pump No. 2 Fault Status
07	LSH-07-101 High Level Alarm	DI	-	-	-	-	-	NORMAL	HIGH	HIGH	Basin No. 1 High Level Alarm
07	BV-07-101 Open Status	DI	-	-	-	-	-	CLOSED	OPEN	-	Basin No. 1 Backwash Solids Waste Valve No. 2
07	BV-07-101 Close Status	DI	-	-	-	-	-	OPEN	CLOSED	-	Basin No. 1 Backwash Solids Waste Valve No. 2
07	BV-07-102 Open Status	DI	-	-	-	-	-	CLOSED	OPEN	-	Basin No. 1 Backwash Crossover Valve
07	BV-07-102 Close Status	DI	-	-	-	-	-	OPEN	CLOSED	-	Basin No. 1 Backwash Crossover Valve
07	BV-07-103 Open Status	DI	-	-	-	-	-	CLOSED	OPEN	-	Basin No. 1 Backwash Valve No. 2
07	BV-07-103 Close Status	DI	-	-	-	-	-	OPEN	CLOSED	-	Basin No. 1 Backwash Valve No. 2
07	BV-07-104 Open Status	DI	-	-	-	-	-	CLOSED	OPEN	-	Basin No. 1 Backwash Valve No. 1
07	BV-07-104 Close Status	DI	-	-	-	-	-	OPEN	CLOSED	-	Basin No. 1 Backwash Valve No. 1
07	BV-07-105 Open Status	DI	-	-	-	-	-	CLOSED	OPEN	-	Basin No. 1 Backwash Solids Waste Valve No. 1
07	BV-07-105 Close Status	DI	-	-	-	-	-	OPEN	CLOSED	-	Basin No. 1 Backwash Solids Waste Valve No. 1
07	BV-07-106 Open Status	DI	-	-	-	-	-	CLOSED	OPEN	-	Basin No. 1 Backwash Pump No. 1 Suction Valve
07	BV-07-106 Close Status	DI	-	-	-	-	-	OPEN	CLOSED	-	Basin No. 1 Backwash Pump No. 1 Suction Valve
07	BV-07-107 Open Status	DI	-	-	-	-	-	CLOSED	OPEN	-	Basin No. 1 Backwash Pump No. 1 Discharge Valve
07	BV-07-107 Close Status	DI	-	-	-	-	-	OPEN	CLOSED	-	Basin No. 1 Backwash Pump No. 1 Discharge Valve
07	BV-07-109 Open Status	DI	-	-	-	-	-	CLOSED	OPEN	-	Basin No. 1 Backwash Pump No. 2 Suction Valve
07	BV-07-109 Close Status	DI	-	-	-	-	-	OPEN	CLOSED	-	Basin No. 1 Backwash Pump No. 2 Suction Valve
07	BV-07-110 Open Status	DI	-	-	-	-	-	CLOSED	OPEN	-	Basin No. 1 Backwash Pump No. 2 Discharge Valve
07	BV-07-110 Close Status	DI	-	-	-	-	-	OPEN	CLOSED	-	Basin No. 1 Backwash Pump No. 2 Discharge Valve
07	BV-07-120 Open Status	DI	-	-	-	-	-	CLOSED	OPEN	-	Basin No. 1 Backwash Valve No. 3
07	BV-07-120 Close Status	DI	-	-	-	-	-	OPEN	CLOSED	-	Basin No. 1 Backwash Valve No. 3
07	CP-07-101 PLC Fail (Watchdog)	DO	-	-	-	-	-	FAILURE	NORMAL	OFF	Basin No. 1 PLC Okay
07	DF-07-101 Call	DO	-	-	-	-	-	OFF	CALL	-	Basin No. 1 Call to Run
07	SPP-07-101 Call	DO	-	-	-	-	-	OFF	CALL	-	Basin No. 1 Backwash Pump No. 1 Call to Run
07	SPP-07-102 Call	DO	-	-	-	-	-	OFF	CALL	-	Basin No. 1 Backwash Pump No. 2 Call to Run
07	BV-07-101 Open/Close	DO	-	-	-	-	-	CLOSED	OPEN	-	Basin No. 1 Backwash Solids Waste Valve No. 2
07	BV-07-102 Open/Close	DO	-	-	-	-	-	CLOSED	OPEN	-	Basin No. 1 Backwash Crossover Valve
07	BV-07-103 Open/Close	DO	-	-	-	-	-	CLOSED	OPEN	-	Basin No. 1 Backwash Valve No. 2
07	BV-07-104 Open/Close	DO	-	-	-	-	-	CLOSED	OPEN	-	Basin No. 1 Backwash Valve No. 1
07	BV-07-105 Open/Close	DO	-	-	-	-	-	CLOSED	OPEN	-	Basin No. 1 Backwash Solids Waste Valve No. 1
07	BV-07-106 Open/Close	DO	-	-	-	-	-	CLOSED	OPEN	-	Basin No. 1 Backwash Pump No. 1 Suction Valve
07	BV-07-107 Open/Close	DO	-	-	-	-	-	CLOSED	OPEN	-	Basin No. 1 Backwash Pump No. 1 Discharge Valve
07	BV-07-109 Open/Close	DO	-	-	-	-	-	CLOSED	OPEN	-	Basin No. 1 Backwash Pump No. 2 Suction Valve
07	BV-07-110 Open/Close	DO	-	-	-	-	-	CLOSED	OPEN	-	Basin No. 1 Backwash Pump No. 2 Discharge Valve
07	BV-07-120 Open/Close	DO	-	-	-	-	-	CLOSED	OPEN	-	Basin No. 1 Backwash Valve No. 3
Tertiary Filter Basin No. 2 Control Panel (CP-07-002)											
07	AIT-07-201 Analytic Transmitter	AI					NTU	-	-		Basin No. 2 Turbidity Level
07	FIT-07-201 Flow	AI					GPM	-	-		Basin No. 2 Backwash System Flow
07	LE-07-201 Level Sensor	AI					ft.	-	-		Basin No. 2 Tank Level
07	PIT-07-201 Pressure	AI					PSIA	-	-		Basin No. 2 Backwash Pump No. 1 Suction Vaccum Pressure
07	PIT-07-202 Pressure	AI					PSIA	-	-		Basin No. 2 Backwash Pump No. 1 Discharge Vacuum Sensor
07	PIT-07-203 Pressure	AI					PSIA	-	-		Basin No. 2 Backwash Pump No. 2 Suction Vacuum Pressure
07	PIT-07-204 Pressure	AI					PSIA	-	-		Basin No. 2 Backwash Pump No. 2 Discharge Vacuum Pressure
07	PSH-07-201 High Pressure Alarm	AI					PSIA	-	-		Basin No. 2 turbidimeter Pump No. High Discharge Pressure
07	SPP-07-201 Speed Command	AO					Hz	-	-	-	Basin No. 2 Backwash/Waste Pump No. 1 Speed Command
07	SPP-07-202 Speed Command	AO					Hz	-	-	-	Basin No. 2 Backwash/Waste Pump No. 2 Speed Command
07	CP-07-201 Control Power On	DI	-	-			-	FAILURE	NORMAL	OFF	Basin No. 2 Control Power Okay
07	CP-07-201 Phase Fail	DI	-	-			-	FAILURE	NORMAL	OFF	Basin No. 2 Phase Fail Relay
07	DF-07-201 in Hand	DI	-	-			-	OFF	HAND	-	Basin No. 2 in Hand
07	DF-07-201 in Auto	DI	-	-			-	OFF	AUTO	-	Basin No. 2 in Auto
07	DF-07-201 Running	DI	-	-			-	STOPPED	RUNNING	-	Basin No. 2 Status
07	DF-07-201 Fail	DI						NORMAL	FAILURE	ON	Basin No. 2 Fault Status
07	SPP-07-201 in Hand	DI	-	-			-	OFF	HAND	-	Basin No. 2 Backwash Pump No. 1 in Hand
07	SPP-07-201 in Auto	DI	-	-			-	OFF	AUTO	-	Basin No. 2 Backwash Pump No. 1 in Auto
07	SPP-07-201 Running	DI	-	-			-	STOPPED	RUNNING	-	Basin No. 2 Backwash Pump No. 1 Status
07	SPP-07-201 Fail	DI						NORMAL	FAILURE	ON	Basin No. 2 Backwash Pump No. 1 Fault Status
07	SPP-07-202 in Hand	DI	-	-			-	OFF	HAND	-	Basin No. 2 Backwash Pump No. 2 in Hand
07	SPP-07-202 in Auto	DI	-	-			-	OFF	AUTO	-	Basin No. 2 Backwash Pump No. 2 in Auto
07	SPP-07-202 Running	DI	-	-			-	STOPPED	RUNNING	-	Basin No. 2 Backwash Pump No. 2 Status
07	SPP-07-202 Fail	DI						NORMAL	FAILURE	ON	Basin No. 2 Backwash Pump No. 2 Fault Status
07	LSH-07-201 High Level Alarm	DI	-	-			-	NORMAL	HIGH	HIGH	Basin No. 2 High Level Alarm
07	BV-07-201 Open Status	DI	-	-			-	CLOSED	OPEN	-	Basin No. 2 Backwash Solids Waste Valve No. 2
07	BV-07-201 Close Status	DI	-	-			-	OPEN	CLOSED	-	Basin No. 2 Backwash Solids Waste Valve No. 2
07	BV-07-202 Open Status	DI	-	-			-	CLOSED	OPEN	-	Basin No. 2 Backwash Crossover Valve
07	BV-07-202 Close Status	DI	-	-			-	OPEN	CLOSED	-	Basin No. 2 Backwash Crossover Valve
07	BV-07-203 Open Status	DI	-	-			-	CLOSED	OPEN	-	Basin No. 2 Backwash Valve No. 2
07	BV-07-203 Close Status	DI	-	-			-	OPEN	CLOSED	-	Basin No. 2 Backwash Valve No. 2
07	BV-07-204 Open Status	DI	-	-			-	CLOSED	OPEN	-	Basin No. 2 Backwash Valve No. 1
07	BV-07-204 Close Status	DI	-	-			-	OPEN	CLOSED	-	Basin No. 2 Backwash Valve No. 1
07	BV-07-205 Open Status	DI	-	-			-	CLOSED	OPEN	-	Basin No. 2 Backwash Solids Waste Valve No. 1
07	BV-07-205 Close Status	DI	-	-			-	OPEN	CLOSED	-	Basin No. 2 Backwash Solids Waste Valve No. 1
07	BV-07-206 Open Status	DI	-	-			-	CLOSED	OPEN	-	Basin No. 2 Backwash Pump No. 1 Suction Valve
07	BV-07-206 Close Status	DI	-	-			-	OPEN	CLOSED	-	Basin No. 2 Backwash Pump No. 1 Suction Valve
07	BV-07-207 Open Status	DI	-	-			-	CLOSED	OPEN	-	Basin No. 2 Backwash Pump No. 1 Discharge Valve
07	BV-07-207 Close Status	DI	-	-			-	OPEN	CLOSED	-	Basin No. 2 Backwash Pump No. 1 Discharge Valve
07	BV-07-209 Open Status	DI	-	-			-	CLOSED	OPEN	-	Basin No. 2 Backwash Pump No. 2 Suction Valve
07	BV-07-209 Close Status	DI	-	-			-	OPEN	CLOSED	-	Basin No. 2 Backwash Pump No. 2 Suction Valve
07	BV-07-210 Open Status	DI	-	-			-	CLOSED	OPEN	-	Basin No. 2 Backwash Pump No. 2 Discharge Valve
07	BV-07-210 Close Status	DI	-	-			-	OPEN	CLOSED	-	Basin No. 2 Backwash Pump No. 2 Discharge Valve
07	BV-07-220 Open Status	DI	-	-			-	CLOSED	OPEN	-	Basin No. 2 Backwash Valve No. 3
07	BV-07-220 Close Status	DI	-	-			-	OPEN	CLOSED	-	Basin No. 2 Backwash Valve No. 3
07	CP-07-201 PLC Fail (Watchdog)	DO	-	-			-	FAILURE	NORMAL	OFF	Basin No. 2 PLC Okay
07	DF-07-201 Call	DO	-	-			-	OFF	CALL	-	Basin No. 2 Call to Run
07	SPP-07-201 Call	DO	-	-			-	OFF	CALL	-	Basin No. 2 Backwash Pump No. 1 Call to Run

07	SPP-07-202 Call	DO	-	-			-	OFF	CALL	-	Basin No. 2 Backwash Pump No. 2 Call to Run
07	BV-07-201 Open/Close	DO	-	-			-	CLOSED	OPEN	-	Basin No. 2 Backwash Solids Waste Valve No. 2
07	BV-07-202 Open/Close	DO	-	-			-	CLOSED	OPEN	-	Basin No. 2 Backwash Crossover Valve
07	BV-07-203 Open/Close	DO	-	-			-	CLOSED	OPEN	-	Basin No. 2 Backwash Valve No. 2
07	BV-07-204 Open/Close	DO	-	-			-	CLOSED	OPEN	-	Basin No. 2 Backwash Valve No. 1
07	BV-07-205 Open/Close	DO	-	-			-	CLOSED	OPEN	-	Basin No. 2 Backwash Solids Waste Valve No. 1
07	BV-07-206 Open/Close	DO	-	-			-	CLOSED	OPEN	-	Basin No. 2 Backwash Pump No. 1 Suction Valve
07	BV-07-207 Open/Close	DO	-	-			-	CLOSED	OPEN	-	Basin No. 2 Backwash Pump No. 1 Discharge Valve
07	BV-07-209 Open/Close	DO	-	-			-	CLOSED	OPEN	-	Basin No. 2 Backwash Pump No. 2 Suction Valve
07	BV-07-210 Open/Close	DO	-	-			-	CLOSED	OPEN	-	Basin No. 2 Backwash Pump No. 2 Discharge Valve
07	BV-07-220 Open/Close	DO	-	-			-	CLOSED	OPEN	-	Basin No. 2 Backwash Valve No. 3

Sodium Hypochlorite Mixer Control Panel No. 1 (CP-08-101) to Central Plant PLC (CP-12-001)									
Area Code	Description	Type	Low Limit	High Limit	Engr Unit	Off State	On State	Alarm State	Comments
08	CP-08-101 Control Power Fail	DI	-	-	-	FAILURE	NORMAL	OFF	From CP-08-101 Control Power Relay
08	CP-08-101 Phase Fail	DI	-	-	-	FAILURE	NORMAL	OFF	From CP-08-101 Phase Fail Relay
08	SM-08-101 Running	DI	-	-	-	OFF	RUNNING	OFF	From CP-08-101 Motor Starter Aux
08	SM-08-101 Seal Fail	DI	-	-	-	NORMAL	FAILURE	ON	From CP-08-101 Motor Protection Relay
08	SM-08-101 Motor Overload	DI	-	-	-	NORMAL	FAILURE	ON	From CP-08-101 Motor Starter OL
08	SM-08-101 in HAND	DI	-	-	-	NORMAL	FAILURE	-	From CP-08-101 H-O-A Switch
08	SM-08-101 in AUTO	DI	-	-	-	NORMAL	FAILURE	-	From CP-08-101 H-O-A Switch
08	SM-08-102 Running	DI	-	-	-	OFF	RUNNING	OFF	From CP-08-101 Motor Starter Aux
08	SM-08-102 Seal Fail	DI	-	-	-	NORMAL	FAILURE	ON	From CP-08-101 Motor Protection Relay
08	SM-08-102 Motor Overload	DI	-	-	-	NORMAL	FAILURE	ON	From CP-08-101 Motor Starter OL
08	SM-08-102 in HAND	DI	-	-	-	OFF	HAND	-	From CP-08-101 H-O-A Switch
08	SM-08-102 in AUTO	DI	-	-	-	OFF	AUTO	-	From CP-08-101 H-O-A Switch
08	SM-08-101 Call	DO				STOPPED	CALLED	-	To CP-08-101 HOA AUTO
08	SM-08-102 Call	DO	-	-	-	STOPPED	CALLED	-	To CP-08-101 HOA AUTO
Sodium Bisulfite Mixer Control Panel No. 2 (CP-08-201) to Central Plant PLC (CP-12-001)									
Area Code	Description	Type	Low Limit	High Limit	Engr Unit	Off State	On State	Alarm State	Comments
08	CP-08-201 Control Power Fail	DI	-	-	-	FAILURE	NORMAL	OFF	From CP-08-201 Control Power Relay
08	CP-08-201 Phase Fail	DI	-	-	-	FAILURE	NORMAL	OFF	From CP-08-201 Phase Fail Relay
08	SM-08-201 Running	DI	-	-	-	OFF	RUNNING	OFF	From CP-08-201 Motor Starter Aux
08	SM-08-201 Seal Fail	DI	-	-	-	NORMAL	FAILURE	ON	From CP-08-201 Motor Protection Relay
08	SM-08-201 Motor Overload	DI	-	-	-	NORMAL	FAILURE	ON	From CP-08-201 Motor Starter OL
08	SM-08-201 in HAND	DI	-	-	-	NORMAL	FAILURE	-	From CP-08-201 H-O-A Switch
08	SM-08-201 in AUTO	DI	-	-	-	NORMAL	FAILURE	-	From CP-08-201 H-O-A Switch
08	SM-08-202 Running	DI	-	-	-	OFF	RUNNING	OFF	From CP-08-201 Motor Starter Aux
08	SM-08-202 Seal Fail	DI	-	-	-	NORMAL	FAILURE	ON	From CP-08-201 Motor Protection Relay
08	SM-08-202 Motor Overload	DI	-	-	-	NORMAL	FAILURE	ON	From CP-08-201 Motor Starter OL
08	SM-08-202 in HAND	DI	-	-	-	OFF	HAND	-	From CP-08-201 H-O-A Switch
08	SM-08-202 in AUTO	DI	-	-	-	OFF	AUTO	-	From CP-08-201 H-O-A Switch
08	SM-08-201 Call	DO				STOPPED	CALLED	-	To CP-08-201 HOA AUTO
08	SM-08-202 Call	DO	-	-	-	STOPPED	CALLED	-	To CP-08-201 HOA AUTO
Automatic Sampler									
08	Auto Sampler General Fail Alarm	DI	-	-	-	NORMAL	FAILURE	ON	From Auto Sampler

MSB-09-101 to 601 to Central Plant PLC (CP-12-001), I/O Shown on MCC/SCADA (Typ. For all 6 Blowers)											
Area Code	Description	Type	Low Limit	High Limit	Low Alarm	High Alarm	Engr Unit	Off State	On State	Alarm State	Comments
09	MSB-09-101 Running	DI	-	-	-	-	-	OFF	RUNNING	-	
09	MSB-09-101 E-Stop Engaged	DI	-	-	-	-	-	NORMAL	ESTOP	ESTOP	From E-Stop Switch
09	MSB-09-101 SSRV Fail	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From MCC
09	MSB-09-101 Surge Shutdown	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From Local Blower Panel (MSB-09-101)
09	MSB-09-101 Overload Shutdown	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From Local Blower Panel (MSB-09-101)
09	MSB-09-101 in HAND	DI	-	-	-	-	-	OFF	HAND	-	From H-O-A Switch
09	MSB-09-101 in AUTO	DI	-	-	-	-	-	OFF	AUTO	-	From H-O-A Switch
09	MSB-09-201 Running	DI	-	-	-	-	-	OFF	RUNNING	-	
09	MSB-09-201 E-Stop Engaged	DI	-	-	-	-	-	NORMAL	ESTOP	ESTOP	From E-Stop Switch
09	MSB-09-201 SSRV Fail	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From MCC
09	MSB-09-201 Surge Shutdown	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From Local Blower Panel (MSB-09-201)
09	MSB-09-201 Overload Shutdown	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From Local Blower Panel (MSB-09-201)
09	MSB-09-201 in HAND	DI	-	-	-	-	-	OFF	HAND	-	From H-O-A Switch
09	MSB-09-201 in AUTO	DI	-	-	-	-	-	OFF	AUTO	-	From H-O-A Switch
09	MSB-09-301 Running	DI	-	-	-	-	-	OFF	RUNNING	-	
09	MSB-09-301 E-Stop Engaged	DI	-	-	-	-	-	NORMAL	ESTOP	ESTOP	From E-Stop Switch
09	MSB-09-301 SSRV Fail	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From MCC
09	MSB-09-301 Surge Shutdown	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From Local Blower Panel (MSB-09-301)
09	MSB-09-301 Overload Shutdown	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From Local Blower Panel (MSB-09-301)
09	MSB-09-301 in HAND	DI	-	-	-	-	-	OFF	HAND	-	From H-O-A Switch
09	MSB-09-301 in AUTO	DI	-	-	-	-	-	OFF	AUTO	-	From H-O-A Switch
09	MSB-09-401 Running	DI	-	-	-	-	-	OFF	RUNNING	-	
09	MSB-09-401 E-Stop Engaged	DI	-	-	-	-	-	NORMAL	ESTOP	ESTOP	From E-Stop Switch
09	MSB-09-401 SSRV Fail	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From MCC
09	MSB-09-401 Surge Shutdown	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From Local Blower Panel (MSB-09-401)
09	MSB-09-401 Overload Shutdown	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From Local Blower Panel (MSB-09-401)
09	MSB-09-401 in HAND	DI	-	-	-	-	-	OFF	HAND	-	From H-O-A Switch
09	MSB-09-401 in AUTO	DI	-	-	-	-	-	OFF	AUTO	-	From H-O-A Switch
09	MSB-09-501 Running	DI	-	-	-	-	-	OFF	RUNNING	-	
09	MSB-09-501 E-Stop Engaged	DI	-	-	-	-	-	NORMAL	ESTOP	ESTOP	From E-Stop Switch
09	MSB-09-501 SSRV Fail	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From MCC
09	MSB-09-501 Surge Shutdown	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From Local Blower Panel (MSB-09-501)
09	MSB-09-501 Overload Shutdown	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From Local Blower Panel (MSB-09-501)
09	MSB-09-501 in HAND	DI	-	-	-	-	-	OFF	HAND	-	From H-O-A Switch
09	MSB-09-501 in AUTO	DI	-	-	-	-	-	OFF	AUTO	-	From H-O-A Switch
09	MSB-09-601 Running	DI	-	-	-	-	-	OFF	RUNNING	-	
09	MSB-09-601 E-Stop Engaged	DI	-	-	-	-	-	NORMAL	ESTOP	ESTOP	From E-Stop Switch
09	MSB-09-601 SSRV Fail	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From MCC
09	MSB-09-601 Surge Shutdown	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From Local Blower Panel (MSB-09-601)
09	MSB-09-601 Overload Shutdown	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From Local Blower Panel (MSB-09-601)
09	MSB-09-601 in HAND	DI	-	-	-	-	-	OFF	HAND	-	From H-O-A Switch
09	MSB-09-601 in AUTO	DI	-	-	-	-	-	OFF	AUTO	-	From H-O-A Switch
09	PSL-09-001 Blower Header Low Pressure No. 1	DI	-	-	-	-	PSIG	NORMAL	FAILURE	LOW	From Pressure Switch (PSL-09-001)
09	PSL-09-002 Blower Header Low Pressure No. 2	DI	-	-	-	-	PSIG	NORMAL	FAILURE	LOW	From Pressure Switch (PSL-09-002)
09	PSL-09-003 Blower Header Low Pressure No. 3	DI	-	-	-	-	PSIG	NORMAL	FAILURE	LOW	From Pressure Switch (PSL-09-003)

Blower Surge Panels are vendor provided. The PCSS shall coordinate with the vendor for additional I/O tags and IP addresses.

NPW Pumps Control Panel (CP-10-001) to Central Plant PLC (CP-12-001)											
Area Code	Description	Type	Low Limit	High Limit	Low Alarm	High Alarm	Engr Unit	Off State	On State	Alarm State	Comments
10	SPP-10-101 Speed Feedback	AI						-	-	-	
10	SPP-10-201 Speed Feedback	AI						-	-	-	
10	PIT-10-001 NPW System Pressure	AI	-	-			PSI	-	-	-	From Pressure Transmitter (PIT-10-001)
10	FIT-10-001 NPW System Flow	AI	-	-			GPM	-	-	-	From Flow Transmitter (FIT-10-001)
10	SFAN-14-01 Differential Pressure	AI	-	-			PSI	-	-	-	From fan vendor instrument
10	SFAN-14-02 Differential Pressure	AI	-	-			PSI	-	-	-	From fan vendor instrument
10	SFAN-14-03 Differential Pressure	AI	-	-			PSI	-	-	-	From fan vendor instrument
10	SFAN-14-04 Differential Pressure	AI	-	-			PSI	-	-	-	From fan vendor instrument
10	SPP-10-101 Speed Control Reference	AO						-	-	-	
10	SPP-10-201 Speed Control Reference	AO						-	-	-	
10	CP-10-001 Control Power Failure	DI	-	-			-	NORMAL	FAILURE		CP-10-001
10	SPP-10-101 in HAND	DI	-	-			-	OFF	HAND		From H-O-A Switch
10	SPP-10-101 in AUTO	DI	-	-			-	OFF	AUTO		From H-O-A Switch
10	SPP-10-101 Running	DI	-	-			-	OFF	RUNNING		
10	SPP-10-101 Overload Alarm	DI	-	-			-	NORMAL	FAILURE		
10	SPP-10-101 VFD Fail	DI	-	-			-	NORMAL	FAILURE		
10	SPP-10-201 in HAND	DI	-	-			-	OFF	HAND		From H-O-A Switch
10	SPP-10-201 in AUTO	DI	-	-			-	OFF	AUTO		From H-O-A Switch
10	SPP-10-201 Running	DI	-	-			-	OFF	RUNNING		
10	SPP-10-201 Overload Alarm	DI	-	-			-	NORMAL	FAILURE		
10	SPP-10-201 VFD Fail	DI	-	-			-	NORMAL	FAILURE		
10	PSL-10-001 NPW System Low Pressure Alarm	DI	-	-			-	NORMAL	LOW		From Pressure Switch (PS-10-001)
10	PSH-10-002 NPW System High Pressure Alarm	DI	-	-			-	NORMAL	HIGH		From Pressure Switch (PS-10-002)
10	LSL-08-001 Chlorine Contact Basin Low Level Lockout	DI	-	-			-	NORMAL	FAILURE		From Chlorine Contact Basin
10	LSL-08-001 Chlorine Contact Basin Low Level Lockout	DO	-	-			-	NORMAL	FAILURE		To NPW Booster Pumps
10	LSL-08-001 Chlorine Contact Basin Low Level Lockout	DO	-	-			-	NORMAL	FAILURE		To Dewatering NPW Pumps
10	SPP-10-101 Call	DO	-	-			-	-	-	-	CP-10-001
10	SPP-10-201 Call	DO	-	-			-	-	-	-	CP-10-002
10	Exahust Fan Strobe Light On/Off	DO	-	-			-	-	-	-	
10	CP-10-001 PLC Fail (Watchdog)	DO	-	-			-	-	-	-	CP-10-001

Exhaust Fan Control Panel to NPW Pumps Control Panel (CP-10-001)											
Area Code	Description	Type	Low Limit	High Limit	Low Alarm	High Alarm	Engr Unit	Off State	On State	Alarm State	Comments
14	SFAN-14-01 Run Status	DI	-	-			-	OFF	CALL		
14	SFAN-14-02 Run Status	DI	-	-			-	OFF	CALL		
14	SFAN-14-03 Run Status	DI	-	-			-	OFF	CALL		
14	SFAN-14-04 Run Status	DI	-	-			-	OFF	CALL		
14	SFAN-14-05 Run Status	DI	-	-			-	OFF	CALL		
14	SFAN-14-01 Overload	DI	-	-			-	OFF	OVERLOAD		
14	SFAN-14-02 Overload	DI	-	-			-	OFF	OVERLOAD		
14	SFAN-14-03 Overload	DI	-	-			-	OFF	OVERLOAD		
14	SFAN-14-04 Overload	DI	-	-			-	OFF	OVERLOAD		
14	SFAN-14-05 Overload	DI	-	-			-	OFF	OVERLOAD		

Chemical System PLC Panel (CP-11-001)

Area Code	Description	Type	Low Limit	High Limit	Low Alarm	High Alarm	Engr Unit	Off State	On State	Alarm State	Comments
11	FIT-08-001 Plant Effluent Flow	AI	-	-			GPM	-	-		From FIT-08-001
11	FIT-10-001 NPW Flow	AI	-	-			GPM	-	-		From FIT-10-001
11	PSP-11A-101 Feedback Rate	AI	-	-			GPH	-	-		From Peristaltic Pump PSP-11A-101
11	LIT-11A-101 Level	AI	-	-			Ft	-	-		
11	PSP-11A-201 Feedback Rate	AI	-	-			GPH	-	-		From Peristaltic Pump PSP-11A-201
11	LIT-11A-201 Level	AI	-	-			Ft	-	-		
11	PSP-11B-101 Feedback Rate	AI	-	-			GPH	-	-		From Peristaltic Pump PSP-11B-101
11	LIT-11B-101 Level	AI	-	-			Ft	-	-		From LIT-11B-101
11	PSP-11B-201 Feedback Rate	AI	-	-			GPH	-	-		From Peristaltic Pump PSP-11B-201
11	LIT-11B-201 Level	AI	-	-			Ft	-	-		From LIT-11B-101
11	LIT-11C-101 Level	AI	-	-			Ft	-	-		From LIT-11C-101
11	LIT-11C-201 Level	AI	-	-			Ft	-	-		From LIT-11C-201
11	LIT-11C-301 Level	AI	-	-			Ft				From LIT-11C-301
11	PSP-11C-101 Feedback Rate	AI	-	-			-	-	-		From Peristaltic Pump PSP-11C-101
11	PSP-11C-201 Feedback Rate	AI	-	-			-	-	-		From Peristaltic Pump PSP-11C-201
11	PSP-11C-301 Feedback Rate	AI	-	-			-	-	-		From Peristaltic Pump PSP-11C-301
11	PSP-11A-101 Flow Pacing Signal	AO	-	-			-	-	-		From CP-11-001, To PSP-11A-101
11	PSP-11A-201 Flow Pacing Signal	AO	-	-			-	-	-		From CP-11-001, To PSP-11A-201
11	PSP-11B-101 Flow Pacing Signal	AO	-	-			-	-	-		From CP-11-001, To PSP-11B-101
11	PSP-11B-201 Flow Pacing Signal	AO	-	-			-	-	-		From CP-11-001, To PSP-11B-201
11	PSP-11C-101 Flow Pacing Signal	AO	-	-			-	-	-		From CP-11-001, To PSP-11C-101
11	PSP-11C-201 Flow Pacing Signal	AO	-	-			-	-	-		From CP-11-001, To PSP-11C-201
11	PSP-11C-301 Flow Pacing Signal	AO	-	-			-	-	-		From CP-11-001, To PSP-11C-301
11	PSP-11A-101 Fail	DI	-	-			-	NORMAL	FAILURE		From Peristaltic Pump PSP-11A-102
11	PSP-11A-101 Low Pressure	DI	-	-			-	NORMAL	FAILURE		
11	PSP-11A-101 High Pressure	DI	-	-			-	NORMAL	FAILURE		
11	LIT-11A-101 Low Level Alarm	DI	-	-			-	NORMAL	FAILURE		
11	PSP-11A-201 Fail	DI	-	-			-	NORMAL	FAILURE		From Peristaltic Pump PSP-11A-202
11	PSP-11A-201 Low Pressure	DI	-	-			-	NORMAL	FAILURE		
11	PSP-11A-201 High Pressure	DI	-	-			-	NORMAL	FAILURE		
11	LIT-11A-201 Low Level Alarm	DI	-	-			-	NORMAL	FAILURE		
11	FS-11A-001 Emergency Eyewash Station	DI	-	-			-	NORMAL	FAILURE		From EWS-11A-001
11	LS-11A-001 Leak Detected	DI	-	-			-	NORMAL	FAILURE		From LS-11A-001
11	PSP-11B-101 Fail	DI	-	-			-	NORMAL	FAILURE		From Peristaltic Pump PSP-11B-102
11	PSP-11B-101 Low Pressure	DI	-	-			-	NORMAL	FAILURE		
11	PSP-11B-101 High Pressure	DI	-	-			-	NORMAL	FAILURE		
11	LIT-11B-101 Low Level Alarm	DI	-	-			-	NORMAL	FAILURE		From LIT-11B-101
11	PSP-11B-201 Fail	DI	-	-			-	NORMAL	FAILURE		From Peristaltic Pump PSP-11B-202
11	PSP-11B-201 Low Pressure	DI	-	-			-	NORMAL	FAILURE		
11	PSP-11B-201 High Pressure	DI	-	-			-	NORMAL	FAILURE		
11	LIT-11B-201 Low Level Alarm	DI	-	-			-	NORMAL	FAILURE		From LIT-11B-101
11	FS-11B-001 Emergency Eyewash Station	DI	-	-			-	NORMAL	FAILURE		From EWS-11B-001
11	LS-11B-001 Leak Detected	DI	-	-			-	NORMAL	FAILURE		From LS-11B-001
11	LIT-11C-101 Low Level Alarm	DI	-	-			-	NORMAL	FAILURE		From LIT-11C-101
11	LIT-11C-201 Low Level Alarm	DI	-	-			-	NORMAL	FAILURE		From LIT-11C-201
11	LIT-11C-301 Low Level Alarm	DI	-	-			-	NORMAL	FAILURE		From LIT-11C-301
11	PSP-11C-101 High Pressure	DI	-	-			-	NORMAL	FAILURE		From PSH-11C-101
11	PSP-11C-101 Fail	DI	-	-			-	NORMAL	FAILURE		From Peristaltic Pump PSP-11C-102
11	PSP-11C-201 High Pressure	DI	-	-			-	NORMAL	FAILURE		From PSH-11C-201
11	PSP-11C-201 Fail	DI	-	-			-	NORMAL	FAILURE		From Peristaltic Pump PSP-11C-202
11	PSP-11C-301 High Pressure	DI	-	-			-	NORMAL	FAILURE		From PSH-11C-301
11	PSP-11C-301 Fail	DI	-	-			-	NORMAL	FAILURE		From Peristaltic Pump PSP-11C-302
11	FS-11C-101 Emergency Eyewash Station	DI	-	-			-	NORMAL	FAILURE		From EWS-11C-101
11	LS-11C-001 Leak Detected	DI	-	-			-	NORMAL	FAILURE		From LS-11C-001
11	LS-11C-002 Leak Detected	DI	-	-			-	NORMAL	FAILURE		From LS-11C-002
11	PSP-11A-101 Start Command	DO	-	-			-	OFF	CALL		From Peristaltic Pump PSP-11A-103
11	PSP-11A-201 Start Command	DO	-	-			-	OFF	CALL		From Peristaltic Pump PSP-11A-203
11	PSP-11B-101 Start Command	DO	-	-			-	OFF	CALL		From Peristaltic Pump PSP-11B-103
11	PSP-11B-201 Start Command	DO	-	-			-	OFF	CALL		From Peristaltic Pump PSP-11B-203
11	PSP-11C-101 Start Command	DO	-	-			-	OFF	CALL		From Peristaltic Pump PSP-11C-103
11	PSP-11C-201 Start Command	DO	-	-			-	OFF	CALL		From Peristaltic Pump PSP-11C-203
11	PSP-11C-301 Start Command	DO	-	-			-	OFF	CALL		From Peristaltic Pump PSP-11C-303

Exhaust Fan Control Panel

Area Code	Description	Type	Low Limit	High Limit	Low Alarm	High Alarm	Engr Unit	Off State	On State	Alarm State	Comments
11	SFAN-11-01 Run Status	DI	-	-			-	OFF	CALL		
11	SFAN-11-02 Run Status	DI	-	-			-	OFF	CALL		
11	SFAN-11-01 Overload Fail	DI	-	-			-	OFF	OVERLOAD		
11	SFAN-11-02 Overload Fail	DI	-	-			-	OFF	OVERLOAD		

Peristaltic Pumps vendor provided. The PCSS shall coordinate with the vendor for additional I/O tags and IP addresses.

Sludge Holding Tanks to SCADA Panel IO											
Area Code	Description	Type	Low Limit	High Limit	Low Alarm	High Alarm	Engr Unit	Off State	On State	Alarm State	Comments
13	Sludge Holding Tank Train No. 1 WAS Air Lift No. 1 Flow	AI	-	-			SCFM	-	-	-	
13	Sludge Holding Tank Train No. 1 WAS Air Lift No. 2 Flow	AI	-	-			SCFM	-	-		
13	Sludge Holding Tank Train No. 2 WAS Air Lift No. 1 Flow	AI	-	-			SCFM	-	-		
13	Sludge Holding Tank Train No. 2 WAS Air Lift No. 2 Flow	AI	-	-			SCFM	-	-		
13	Sludge Holding Tank Train No. 3 WAS Air Lift No. 1 Flow	AI	-	-			SCFM	-	-		
13	Sludge Holding Tank Train No. 3 WAS Air Lift No. 2 Flow	AI	-	-			SCFM	-	-		
13	SV-13-101 Air Lift Solenoid Valve No. 1 Open/Close Status	DI	-	-			-	CLOSE	OPEN		
13	SV-13-201 Air Lift Solenoid Valve No. 2 Open/Close Status	DI	-	-			-	CLOSE	OPEN		
13	SV-13-301 Air Lift Solenoid Valve No. 3 Open/Close Status	DI	-	-			-	CLOSE	OPEN		
13	LSH-13-001 Sludge Holding Tank High Level Alarm	DI	-	-			-	NORMAL	HIGH		From Level Switch (LSH-13-001)

Dewatering NPW Pumps Control Panel (CP-14B-001) to Volute Press Control Panel (CP-14D-101)

Area Code	Description	Type	Low Limit	High Limit	Low Alarm	High Alarm	Engr Unit	Off State	On State	Alarm State	Comments
14	Chlorine Contact Basin Low Level Lockout	DI	-	-			-	NORMAL	LOW	LOW	From CCB Level Switch (LSL-08-001)
14	CP-14B-001 Control Power On	DI	-	-			-	FAILURE	NORMAL	OFF	From CP-14B-001 Control Power Relay
14	CP-14B-001 Phase Fail	DI	-	-			-	FAILURE	NORMAL	OFF	From CP-14B-001 Phase Fail Relay
14	VMP-14B-101 Low Pressure	DI	-	-			-	NORMAL	LOW	LOW	From Pressure Switch (PS-14B-101)
14	VMP-14B-101 High Pressure	DI	-	-			-	NORMAL	HIGH	HIGH	From Pressure Switch (PS-14B-101)
14	VMP-14B-201 Low Pressure	DI	-	-			-	NORMAL	LOW	LOW	From Pressure Switch (PS-14B-201)
14	VMP-14B-201 High Pressure	DI	-	-			-	NORMAL	HIGH	HIGH	From Pressure Switch (PS-14B-201)
14	VMP-14B-101 in HAND	DI	-	-			-	OFF	HAND	-	From CP-14B-001 H-O-A Switch
14	VMP-14B-101 in AUTO	DI	-	-			-	OFF	AUTO	-	From CP-14B-001 H-O-A Switch
14	VMP-14B-101 Running	DI	-	-			-	OFF	RUNNING	-	From CP-14B-001 Motor Starter Aux
14	VMP-14B-101 Fail	DI	-	-			-	NORMAL	FAILURE	ON	From CP-14B-001 Fail Relay
14	VMP-14B-201 in HAND	DI	-	-			-	OFF	HAND	-	From CP-14B-001 H-O-A Switch
14	VMP-14B-201 in AUTO	DI	-	-			-	OFF	AUTO	-	From CP-14B-001 H-O-A Switch
14	VMP-14B-201 Running	DI	-	-			-	OFF	RUNNING	-	From CP-14B-001 Motor Starter Aux
14	VMP-14B-201 Fail	DI	-	-			-	NORMAL	FAILURE	ON	From CP-14B-001 Fail Relay

Polymer Blend Unit No. 1 Local Control Panel (PBU-14C-101) to Volute Press Control Panel (CP-14D-101)

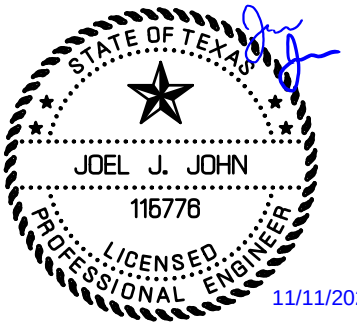
Area Code	Description	Type	Low Limit	High Limit	Low Alarm	High Alarm	Engr Unit	Off State	On State	Alarm State	Comments
14	PBU-14C-101 Flow Pacing	AI	-	-			-	-	-		From CP-14D-001 to Polymer Blend Unit No. 1
14	PBU-14C-101 Call	DI	-	-			-	OFF	CALL		From CP-14D-001 to Polymer Blend Unit No. 1
14	PBU-14C-101 Low Pressure	DO	-	-			-	NORMAL	FAILURE		From CP-14D-001 to Polymer Blend Unit No. 1
14	PBU-14C-101 Low Flow	DO	-	-			-	NORMAL	FAILURE		From CP-14D-001 to Polymer Blend Unit No. 1

Polymer Blend Unit No. 2 Local Control Panel (PBU-14C-201) to Volute Press Control Panel (CP-14D-101)

Area Code	Description	Type	Low Limit	High Limit	Low Alarm	High Alarm	Engr Unit	Off State	On State	Alarm State	Comments
14	PBU-14C-201 Flow Pacing	AI	-	-			-	-	-		From CP-14D-001 to Polymer Blend Unit No. 2
14	PBU-14C-201 Call	DI	-	-			-	OFF	CALL		From CP-14D-001 to Polymer Blend Unit No. 2
14	PBU-14C-201 Low Pressure	DO	-	-			-	NORMAL	FAILURE		From CP-14D-001 to Polymer Blend Unit No. 2
14	PBU-14C-201 Low Flow	DO	-	-			-	NORMAL	FAILURE		From CP-14D-001 to Polymer Blend Unit No. 2

Volute Press Control Panel (CP-14D-101)

Area Code	Description	Type	Low Limit	High Limit	Low Alarm	High Alarm	Engr Unit	Off State	On State	Alarm State	Comments
14	LIT-14D-101 Level	AI	-	-			Ft	-	-		From Flocc Tank Level (LIT-14D-101)
14	FIT-14A-201 Sludge Flow	AI					GPM	-	-	LOW/HIGH	From FIT-14A-101 WAS Flow Meter
14	DDP-14A-101 Speed Feedback	AI	40	60	-	-	Hz	-	-		From CP-14D-001 VFD (DDP-14A-101)
14	DDP-14A-201 Speed Feedback	AI	40	60	-	-	Hz	-	-		From CP-14D-001 VFD (DDP-14A-201)
14	DDP-14A-101 Speed Command Reference	AO	40	60	-	-	Hz	-	-		To CP-14D-001 VFD (DDP-14A-101)
14	DDP-14A-201 Speed Command Reference	AO	40	60	-	-	Hz	-	-		To CP-14D-001 VFD (DDP-14A-201)
14	PBU-14C-101 Flow Pacing	AO	-	-			-	-	-		To Polymer Blend Unit No. 1 Control Panel
14	PBU-14C-201 Flow Pacing	AO	-	-			-	-	-		To Polymer Blend Unit No. 2 Control Panel
13	LSL-13-001 Sludge Holding Tank Low Level Cut-Off	DI	-	-	-	-	-	NORMAL	LOW	LOW	From Level Switch (LSL-13-001)
13	LSL-13-002 Sludge Holding Tank Low Level Cut-Off	DI	-	-	-	-	-	NORMAL	LOW	LOW	From Level Switch (LSL-13-002)
14	DDP-14A-101 Running	DI	-	-	-	-	-	OFF	RUNNING	-	From CP-14D-001 VFD (DDP-14A-101)
14	DDP-14A-101 VFD Fail	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From CP-14D-001 VFD (DDP-14A-101)
14	DDP-14A-101 in HAND	DI	-	-	-	-	-	OFF	HAND	-	From CP-14A-001 H-O-A Switch
14	DDP-14A-101 in AUTO	DI	-	-	-	-	-	OFF	AUTO	-	From CP-14A-001 H-O-A Switch
14	DDP-14A-201 Running	DI	-	-	-	-	-	OFF	RUNNING	-	From CP-14D-001 VFD (DDP-14A-201)
14	DDP-14A-201 VFD Fail	DI	-	-	-	-	-	NORMAL	FAILURE	ON	From CP-14D-001 VFD (DDP-14A-201)
14	DDP-14A-201 in HAND	DI	-	-	-	-	-	OFF	HAND	-	From CP-14A-001 H-O-A Switch
14	DDP-14A-201 in AUTO	DI	-	-	-	-	-	OFF	AUTO	-	From CP-14A-001 H-O-A Switch
14	PSL-14A-101 Press Feed Pump No. 1 Pressure Switch Low	DI	-	-	-	-	-	NORMAL	FAILURE	LOW	From Pressure Switch (PSL-14A-101)
14	PSH-14A-101 Press Feed Pump No. 1 Pressure Switch High	DI	-	-	-	-	-	NORMAL	FAILURE	HIGH	From Pressure Switch (PSH-14A-101)
14	PSL-14A-201 Press Feed Pump No. 1 Pressure Switch Low	DI	-	-	-	-	-	NORMAL	FAILURE	LOW	From Pressure Switch (PSL-14A-201)
14	PSH-14A-201 Press Feed Pump No. 1 Pressure Switch High	DI	-	-	-	-	-	NORMAL	FAILURE	HIGH	From Pressure Switch (PSH-14A-201)
14	CP-14D-001 Phase Fail	DI	-	-			-	FAILURE	NORMAL		From CP-14D-101 Phase Fail Relay
14	PBU-14C-101 Low Pressure	DI	-	-			-	NORMAL	FAILURE		To Polymer Blend Unit No. 1 Control Panel
14	PBU-14C-101 Low Flow	DI	-	-			-	NORMAL	FAILURE		To Polymer Blend Unit No. 1 Control Panel
14	PBU-14C-201 Low Pressure	DI	-	-			-	NORMAL	FAILURE		To Polymer Blend Unit No. 2 Control Panel
14	PBU-14C-201 Low Flow	DI	-	-			-	NORMAL	FAILURE		To Polymer Blend Unit No. 2 Control Panel
14	LSH-14D-101 Mixer Tank High Level	DI	-	-			-	NORMAL	FAILURE		From Flocc Tank Level Switch (LSH-14D-101)
14	SV-14D-101 Solenoid Valve No. 1 Open/Close	DI	-	-			-	CLOSE	OPEN		From Solenoid Valve No. 1 (SV-14D-101)
14	SV-14D-102 Solenoid Valve No. 2 Open/Close	DI	-	-			-	CLOSE	OPEN		From Solenoid Valve No. 2 (SV-14D-201)
14	SV-14D-103 Solenoid Valve No. 3 Open/Close	DI	-	-			-	CLOSE	OPEN		From Solenoid Valve No. 3 (SV-14D-301)
14	SV-14D-104 Solenoid Valve No. 4 Open/Close	DI	-	-			-	CLOSE	OPEN		From Solenoid Valve No. 4 (SV-14D-401)
14	SV-14D-105 Solenoid Valve No. 5 Open/Close	DI	-	-			-	CLOSE	OPEN		From Solenoid Valve No. 5 (SV-14D-501)
14	SV-14D-106 Solenoid Valve No. 6 Open/Close	DI	-	-			-	CLOSE	OPEN		From Solenoid Valve No. 6 (SV-14D-601)
14	VP-14D-101 Running	DI						OFF	RUNNING		From CP-14D-101 Volute Press VFD
14	VP-14D-101 Fail	DI						NORMAL	FAILURE		From CP-14D-101 Volute Press VFD
14	VP-14-101 Emergency Stop	DI	-	-			-	NORMAL	ESTOP	ESTOP	From CP-14D-101 E-Stop Switch
14	SCC-14D-101 Running	DI						OFF	RUNNING		From CP-14D-101 Horizontal Conveyor VFD
14	SCC-14D-101 Fail	DI						NORMAL	FAILURE		From CP-14D-101 Horizontal Conveyor VFD
14	SCC-14D-101 Emergency Stop	DI	-	-			-	NORMAL	ESTOP	ESTOP	From E-Stop Switch
14	SCC-14D-102 Running	DI						OFF	RUNNING		From CP-14D-101 Incline Conveyor VFD
14	SCC-14D-102 Fail	DI						NORMAL	FAILURE		From CP-14D-101 Incline Conveyor VFD
14	SCC-14D-102 Emergency Stop	DI	-	-			-	NORMAL	ESTOP	ESTOP	From E-Stop Switch
14	VMP-14B-101 Fail	DI	-	-			-	NORMAL	FAILURE		From CP-14B-001 Dewatering NPW Booster Fail
14	VMP-14B-201 Fail	DI	-	-			-	NORMAL	FAILURE		From CP-14B-001 Dewatering NPW Booster Fail
14	DDP-14A-101 Call	DO	-	-			-	OFF	CALL		To CP-14A-001 Dewatering Press Feed Pumps
14	DDP-14A-201 Call	DO	-	-			-	OFF	CALL		To CP-14A-001 Dewatering Press Feed Pumps
14	VMP-14B-101 Call	DO	-	-			-	OFF	CALL		To CP-14B-001 Dewatering NPW Booster Pumps
14	VMP-14B-201 Call	DO	-	-			-	OFF	CALL		To CP-14B-001 Dewatering NPW Booster Pumps
14	PBU-14C-101 Call	DO	-	-			-	OFF	CALL		To Polymer Blend Unit No. 1 Control Panel
14	PBU-14C-201 Call	DO	-	-			-	OFF	CALL		To Polymer Blend Unit No. 2 Control Panel



SECTION 13315
HMI SYSTEM SOFTWARE

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Refer to Section [13300].

B. Furnish and install a Human Machine Interface (HMI) system as shown on the Drawings and as specified herein.

1.2 RELATED WORK.

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

B. Section [13310] “Computer System Hardware.”

1.3 SUBMITTALS

A. Refer to Section [13300].

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

C. Complete bill of materials for the equipment.

D. Any deviation of the hardware or software systems from the preliminary submittal included in the Project Plan shall be described in detail.

E. Spare parts list.

1.4 WARRANTY

A. Refer to Section [13300].

1.5 MANUFACTURER SUPPORT

A. Provide a written proposal for a manufacturer support agreement for all products specified herein for a minimum of 12 months starting at final completion of the project. The cost of this manufacturer support agreement shall not be included in the Contract Price. The support agreement shall be executed in the name of, and for the benefit of, the Owner. At a minimum, this agreement shall provide the Owner with:
   1. 8 AM to 5 PM, 5 day per week manufacturer telephone support.
   2. Access to the manufacturer's technical support website.

3. Software updates.

PART 2 – PRODUCTS

2.1 HUMAN MACHINE INTERFACE (HMI) SOFTWARE REQUIREMENTS

A. General Requirements:

1. HMI software shall be the latest version at time of project plan submittal of one of the following packages and shall be compatible with the operating system supplied with the computers:
   a. Ignition by Inductive Automation
   b. No acceptable Alternative.
2. SCADA software shall be commercially available off-the shelf and shall be non-proprietary, such that independent systems integrators are able to provide configuration and maintenance services as required.
3. Software shall be a Client/Server architecture. No Microsoft Client Access Licenses (CAL) or Terminal Services shall be required for full installation (thick) or browser-based (thin) clients.
4. Software shall be developed in an environment certified to be in compliance with IEC 62443 Security for Industrial Automation and Control Systems, Part 4-1.
5. Software shall offer options for unlimited, concurrent Thin Client connections for connectivity of common mobile device operating systems.
6. Software shall support running in a virtualized server environment.
7. Software shall support installation on a Storage Area Network (SAN) or Network-Attached Storage (NAS).
8. Software shall provide native support for multi-monitor applications.
9. Software shall support IPv6 addressing and be able to run on networks that support IPv4, IPv6 or both.
10. Software licenses shall be upgradable for an annual fee such that the client is able to download and install the current version of the product.
11. Software shall be tag-based and have an integrated development environment for creation of all aspects of the application.
12. Software shall be compatible with commercially available, off-the shelf PC hardware running Microsoft Windows client and server operating systems currently available at the time of installation.
13. Software shall not require dedicated server-level PC hardware for any individual system components.
14. Software shall support any computer running a thick copy of the software performing as both an application server and a user interface. Software shall support automatic server failover to an unlimited number of servers.
15. Software shall support running as a Microsoft Windows® service.
16. Software shall support development from a thin client.
17. Software shall include the following integrated components available as standard components or for an optional add-on price. These components shall not require 3rd party software. However, the system shall allow 3rd party components to be used if required.
    a. Online application development environment with version control.
    b. I/O drivers for a wide selection of communication protocols.
    c. Alarms management and alarms/events history.
    d. Fully integrated historian.

e. Real-time and historical data trending and tabular views.
f. Report generation.
g. Security management.
h. Unlimited operator logbooks.
i. Support for networked applications.
j. Support for server redundancy.
k. Native High Performance / HMI widgets.
l. Support for master applications, which can monitor multiple independent subordinate applications.
m. An object-oriented scripting language with a function selection dialog for expression development and debugging tools.
n. Browser-based thin clients for PCs and Mobile devices.
o. Alarm notification to off-site operators (email, text message, and voice.)
p. Interfaces for 3rd party software programs to access data and alarms from the SCADA software via ODBC/SQL, ODBC using a REST interface, OPC, SNMP.
q. Drivers to read OPC-UA, MQTT, JSON, SQL, and XML data sources.
r. MQTT driver to support the Sparkplug B protocol.
s. Support for translating the user interface into any language.
t. Support for an integrated web browser window, configurable within any user interface screen.
u. Support for monitoring the video feed from network-connected video cameras where the feed is provided as a motion JPEG.

18. Software shall automatically compensate for deploying the same application simultaneously on a variety of monitor resolutions, while maintaining the aspect ratios of all displays.
19. Software shall protect against file corruption in the event of an unexpected loss of power or hardware failure. Software shall support an automatic, orderly shutdown when power levels drop to a user defined setpoint.
20. Software shall support automatic startup upon computer restart, to full operation without user intervention.
21. Software shall provide a mechanism to backup and restore the entire application configuration.
22. Software shall include an integrated security system supporting an unlimited number of user accounts, roles, and privileges. System users with appropriate account privileges shall be capable of changing the application configuration without requiring the software supplier's assistance. No lockout mechanisms or passwords shall be withheld from the final customer.
23. Software shall support recipe and batch processing.
24. Integrated software help manuals shall be provided to assist operators and maintenance personnel with operational and configuration tasks.
25. HMI software shall support alarm synchronization between all server and client nodes. All HMI Client nodes shall display and update the master database held on the SCADA servers and shall display the same alarm information at the same time. It shall not be necessary to acknowledge any alarm at more than one HMI workstation. The system shall have the ability such that acknowledging an alarm at any workstation shall acknowledge that alarm at all workstations.

26. No HMI client shall communicate directly with the field devices. Data for client display nodes shall be collected from the currently online SCADA server. The runtime client nodes shall include full read/write and supervisory control capabilities. The number of client licenses (both thick and thin) shall be as shown on System Architecture Drawing.
27. Software package shall include an I/O driver capable of performing all scanning of PLC data tables for transferring analog and discrete data to and from the PLC. Scan periods shall be adjustable to ensure that the PC/PLC communications is scanning at the fastest possible time increment, without data degradation. All communications between the PLCs and the operator interface software shall use the Local Area Network (LAN) directly.
28. HMI software shall permit manual data entry through any of the terminals. This data shall consist of laboratory inputs and entering or changing such things as alarm limits, setpoints, or constants. Confirmation shall be required via the respective display prior to actual entry into the process memory. Data entry and confirmation shall be available without using a keyboard.
29. HMI software shall provide an open architecture that allows interaction with other programs. It shall provide a mechanism for other programs to access individual data elements and fields within the database in real time. File transfer mechanisms are not acceptable; the access shall be direct to the memory-resident databases held on the SCADA Servers.

B. Virtual Servers
1. Ignition will run on any hypervisor that properly emulates hardware and an Operating System. When Ignition is running on a local VM, contractor shall utilize VMWare.
   a. AWS or MS Azure shall be used for all cloud based services..
2. CPU and memory allocation for small to medium systems shall be at minimum 4 vCPUs with 8GB of RAM. Very large systems shall be at minimum 32 vCPUs with 64+GB of RAM. All VMs shall have dedicated vCPUs and memory.
3. It is best practice to maximize Ignition's performance by configuring the Ignition service to have its max heap set to 66% of the max memory on a Windows system.

C. Licensing Requirements:
1. Wilbarger Creek MUD No. 2 will own the cloud Ignition server. The cloud hosting account (AWS or Azure) shall be established in the Owner's name at the start of the project, with the PCSS given administrative access. The Contractor shall include cloud hosting costs through the end of the warranty period. The PCSS is responsible for setup of the cloud server and Ignition gateway installation. Ignition Cloud Edition is not acceptable. Provide the following Ignition 8.3 (or later) licenses:
   a. Cloud Production gateway: standard Ignition with Perspective, Tag Historian, Reporting, Alarm Notification, SMS Notification, and Voice Notification modules
   b. Cloud Backup gateway: redundancy license matching Production, deployed in a separate availability zone
   c. Cloud Test/Development gateway
   d. PPC-12-101: Ignition Edge Panel

e. PPC-12-101 shall connect to the cloud Production gateway over the Ignition gateway network with Edge Sync Services, using an outbound-only connection. Client licenses are not required.

2. Provide a HMI thin client license for each connected thin operator workstation as shown on Drawings and specified herein. The license shall allow viewing of unlimited I/O points. The license shall allow an unlimited number of graphic displays.
3. SCADA Software License Requirements
   a. Provide at minimum the following licenses:
4. License Type
   a. Ignition Platform
      1) Tag Limit: Unlimited
      2) Designer Clients: Unlimited
   b. Perspective or Vision Visualization (Client Preference)
   c. Additional Components
      1) Industrial Historian Solution Suite
      2) Reporting Module
      3) Alarm Notification Module
         a) Voice Notification Module
         b) SMS Notification Module
   d. OPC Comm Module (If required to talk to existing devices)

D. Gateway Architecture
1. A dedicated Ignition Gateway shall be provided for production, backup, and testing/development in the cloud, plus Edge on the PPC.
   a. One outbound TLS-encrypted Ignition Gateway Network connection (TCP 8060) from the PPC to the central Ignition Gateway for Edge Sync Services communication shall be configured for data synchronization.

2. Gateway redundancy shall be implemented where system availability is critical.

3. The Gateway shall host:
   a. Tag Providers
   b. Alarm Pipelines
   c. Scripting resources
   d. Database connections

E. Database Connectivity
1. All database connections shall be configured at the Gateway level.

2. Named Queries shall be used for all database access.

3. Inline SQL in components or scripts shall not be permitted.

4. Database credentials shall not be hard-coded.

F. Historian

1. Historian shall support logging of all the SCADA system data, including real-time, historical, transactions, alarms, and events, regardless of the number of tags in the system. For example, a 25,000 tag system shall support historical data storage for 25,000 tags, plus alarms and events.
2. Software shall include an integrated Historian and historical data storage at no additional cost, but may optionally use [Oracle,] [MySQL,] [Microsoft SQL Server,] [SQLLite,] [PostgreSQL] as the database.
3. The Historian and its historical data storage shall not require dedicated server computers; however, dedicated servers may be used if preferred by the customer.
4. Historian shall be capable of logging up to 4,000 values per second.
5. A synchronization scheme shall be included such that a copy of all historical data storage resides on all designated computers. Data shall be synchronized in real-time.
6. Any historical database that has been offline must be automatically resynchronized with the historian holding the most recent data. Software shall be capable of synchronizing 100,000+ values per second between databases. This process shall occur in parallel with runtime SCADA processes and shall be designed to minimize interference.
7. Distributed Historian architecture shall be supported. For example, two plants (A and B) may be responsible for historical storage for locally collected data, while a central facility (C) may be responsible for redundant historical storage for both A's and B's data. This architecture shall be scalable to support the addition of future plants.
8. Historian shall support SQL queries of logged historical data. Queries of historical data may be for raw data or summary (value at beginning, average, max, min, delta) over a period.
9. Historian shall support named SQL views of pre-selected tags and data attributes.
10. Historian shall support SQL queries through a REST interface, using either GET or POST requests.
11. Historian shall be able to import collected data that was not available to be logged in real-time.
12. System shall provide for archival of all historical data. Data shall be archived for long-term storage and retrieval. The long-term historical data to be archived shall be stored in an OBDC compliant file format to facilitate access to operator activity, system events, alarm messages, and point values using relational-database compatible software for data analysis, reporting and archiving. Short- term historical data (less than 90 days) may be stored in a format readily accessible to the HMI software.
13. System shall be capable of logging all system activity such as command and macro usage, operator comments, system errors, system messages, and communication network errors, if selected by the operator/system administrator.
14. System shall provide for automatic purging of short-term historical data files.
15. Data Quality: Data Quality flags shall be provided to indicate the quality of all data points stored in any data archive.
16. Manual Input Data Handling: This data shall consist of additional values not obtainable by the SCADA system such as laboratory analysis for use in reports. All manually entered data shall be entered and stored in the appropriate engineering units.

G. Transaction Data

1. System shall provide a means to reliably collect and log (to historical data storage) transaction data from a field device. Transaction data is defined as a data set of related values stored with the same timestamp.
2. The transaction data capture process must include error checking.

H. Historical Data Display (trend plots and tabular)

1. Software shall display historical and real-time data in both plot and tabular format.
2. Software shall allow users to generate ad-hoc plots of historical data by clicking on each of the values to be trended. Selected groups shall be recordable for future recall.
3. Software shall support ad-hoc and preconfigured trend plots of real-time and historical data as integrated elements of graphical process displays. Historical and real-time plotted values shall be shown in a continuous, uninterrupted, scrolling fashion. The display shall support:
    a. An unlimited number of pens (i.e., tag values), including both analog and digital values. Name and description of each tag shall be provided.
    b. Analog pens can be viewed as either layered or as stacked individual plots.
    c. Time frame selectable from one second to five years.
    d. Scaling for each pen as high/low values or graduated divisions.
    e. Value of each tag at the date/time of the mouse location.
    f. Statistical data, including average, minimum and maximum values, for each plot.
    g. Annotating trends
    h. Stop/pause scrolling.
    i. Zoom in/out on the time (x) and value (y) axis'.
    j. Pan/Scroll along the time axis or select a date to display.
    k. Move analog tag plots vertically (in the value (y) axis), either individually or as a group.
    l. Print displayed plot data.
    m. Annotate a moment in time on the plot.
    n. Display alarm setpoints that are associated with the tag(s) as continuous marker lines across the plot.
    o. Export plotted data to comma separated value (.csv) file or directly to a database, for use by 3rd party data analysis software.
    p. Display plot data on a dedicated page, or as a component of a process display page.
    q. Allow configuration of the plot display characteristics.
4. For tabular data, means shall be provided for the following.
    a. An unlimited number of pens (i.e. tag values), including both analog and digital values. Name and description of each tag shall be provided.
    b. Time frame selectable from one second to five years.
    c. Stop/pause scrolling.
    d. Show raw data.
    e. Show summary data for a duration sampled at consistent periods (e.g. average, minimum, or maximum value every 15 min for past 8 hours).
    f. Export plotted data to comma separated value (.csv) file or directly to a database, for use by 3rd party data analysis software.

I. Protocols and Scripting

1. HMI software shall support Open Database Connectivity (ODBC) for sharing data from its database to any other ODBC compliant database through SQL queries, via an ODBC dynamic-link library (DLL) driver for real-

time data and alarm information. At a minimum the database shall support communication with Microsoft Access, SQL Server, and Oracle.

2. OLE for Process Control (OPC). The HMI software shall be support OPC clients for communicating to any OPC complaint server as well as an OPC server to serve data to any OPC complaint client.
3. HMI software shall support real-time SQL database connectivity.

J. I/O Drivers (Field Device Communications)

1. A software driver shall be supplied to communicate with every type of device shown on the systems architecture drawings. The communications driver shall be configurable on-line.
2. Use of Microsoft OPC 2.0 or later shall be supported. The OPC Server shall have the capability to be used for PLC communication.
3. Device communications program shall perform error checking on messages such as lost response (time-out) and data error (checksum, LRC, CRC, etc.). If communications errors are detected, the software shall automatically indicate that the data (on graphic displays, in historical files, etc.) is no longer valid. The invalid data shall be replaced with user-defined characters or pre-defined text. The HMI software shall automatically attempt to re-establish communications, and, if successful, shall then replace the characters with valid data. These capabilities shall be built-in to the software and shall not require any user programming or other actions to implement. Failover to a user-configurable back-up port shall be provided as a function of the driver.
4. Software driver shall include a diagnostic program capable of running on-line or off-line that can monitor message rates from the communication program. The diagnostic program shall display the number of new messages, retries, time-outs, any occurrences of error, and the specific error code. Software shall support an unlimited number of field devices and different I/O drivers in the same application.
5. Software shall include support for communications over TCP/IP including but not limited to OPC UA, MODBUS TCP, EtherNet/IP, and DNP3.
6. Software shall be capable of importing tags from Rockwell Ethernet I/P (CIP) devices.
7. Software shall support the development of additional I/O drivers where necessary.
8. Software shall support multiple communications protocols over a single communications port.
9. I/O drivers shall support redundant failover to one of more server computers. Software shall support redundant physical links to any field device, such as primary connectivity via Ethernet and redundant connectivity via serial port. Redundant links shall support similar or different protocols.
10. Software shall provide tools for polling telemetry devices (e.g. RTUs) directly. Software shall allow real-time tuning of each device's polling frequency without interrupting the polling cycle or restarting the application. To optimize I/O communications for telemetry applications, the polling order shall be configurable, and polling shall be asynchronous (if permitted by the remote telemetry unit.)
11. Software shall be capable of pooling modems connected to one or more servers, for use in I/O communications.
12. Tools shall include methods for monitoring communication statistics and reporting errors for each I/O driver. Software shall support radio diagnostics monitoring for radio modems (e.g. Dataradio/Calamp, MDS.)
13. Software shall support writing to multiple output tags via a single write request. This shall allow writing a set of default values to a set group of field device registers.

14. Software shall support rewriting the last written value to an output.

K. Tag Database

1. A browser shall be provided for tag creation, modification and deletion. The tag browser shall include a summary of all tags' current addresses and values.
2. A tag export/import utility shall be provided to allow bulk tag changes using Microsoft Office tools.
3. Software shall support the creation of template tag structures to represent a typical piece of equipment (e.g. a pump, an engine.)
4. Tag configuration shall support the use of expressions that can set configuration parameters based on developer-defined rules.
5. Template tag structures shall be copied and pasted to create any number of equipment instances having similar structures but differing configuration.
6. The contractor shall use fully-qualified tag paths in the project, especially with visualization templates and screens. A fully-qualified path allows Ignition to know exactly where the tag is, including the tag provider name. For example, a non-fully-qualified tag path looks like the following: Path/to/my/tag
7. With that path, the tag provider is unknown. An Ignition project will use the project’s default tag provider, which is only one provider.
8. A fully-qualified tag path looks like the following: [TagProviderName]Path/to/my/tag

L. Configuration Management

1. Software shall be capable of on-line configuration. That is, changes to most aspects of the application (e.g. tags, displays, calculations, reports, trends, server lists) can be deployed in real-time without recompiling or restarting the application or restarting computers.
2. Software shall be capable of offline configuration, such that changes to most aspects of the application can be imported and deployed without recompiling or restarting the application or restarting computers.
3. Software shall be capable of testing configuration changes to tags and displays in the runtime environment before changes are deployed.
4. Users shall be able to deploy a set of changes either automatically or manually, with the option to select and deploy specific changes.
5. Software shall allow multiple users to configure an application simultaneously.
6. Any shut down client shall automatically download newly deployed changes from the server when the client is restarted.
7. All application servers and clients shall automatically synchronize with the primary application server. No manual file duplication shall be required

M. Application Version Control

1. The software shall have an integrated version control system that automatically logs application configuration changes to an encrypted repository. Versions shall be auto-numbered. No manual changes to the repository shall be permitted.

2. A chronologically ordered summary of versions shall display the time and date when the version was created, the user who created the version and any comments entered by the user when deploying the version.
3. It shall be possible to determine which version is currently deployed on each client and server station.
4. The version history shall allow review of all changes applied within each version.
5. The version control system shall allow the following version management methods.
6. Switch (aka rollback) to a previous version of the application.
7. Reverse changes applied during a specific version.
8. Merge changes made local to a specific workstation.
9. Option to include or exclude security changes made between the current revision and the target revision when switching.

N. Multi-Plant Application Support

1. Software shall allow centralized configuration, security management and monitoring of multiple sub-applications by one master application. The sub-applications may be connected via either LAN or WAN.
2. Tags viewed in both the sub-application and the master application shall not be counted twice.
3. The master application shall be capable of monitoring all tags, pages, alarms, etc. in all sub-applications.
4. Data logging shall be managed by each sub-application, but the master application shall be able to generate reports using any sub-application's data.
5. Each of the sub-applications must be capable of running autonomously in the event of network unavailability.
6. Software shall allow users to be authorized for access to information from one or more sub-applications, or all sub-applications, of the large application.
7. Software shall support limiting the sub-applications that can be accessed from a specific SCADA node.

O. Site Lists and Mapping

1. Software shall allow for the creation of "sites" which are collections of I/O tags, with an optional location that can be represented using Latitude and Longitude coordinates.
2. Sites shall be user-definable to store and provide a configuration interface for any user-specified data.
3. Sites shall be user-configurable to control whether and how they are to be displayed in Site Lists.
4. Sites shall be user-configurable to control whether they will open a pre-defined screen showing the associated collection of I/O tag data or open a user-selected display screen.
5. Software shall include an integrated map display with zoom and pan features such that remote assets can be automatically mapped based on latitude and longitude coordinates.
6. Software shall be compatible with map providers using either .PNG or .JPG format tiles.
7. Software shall support user-selection of the map style to use, including night-time and day-time modes.
8. Software shall allow for user creation and selection of the icons used to represent sites on the map.
9. Software shall allow users to navigate the map including zoom and pan features.
10. Icons used to represent sites on the map shall be capable of displaying information about the site including current connection status and presence or absence of active alarms within the site.
11. Icons used to represent sites on the map shall include a built-in navigational link to either an automatically generated page displaying all I/O tags within the site, or to a user-selected page.

12. Software shall provide a means to define and display pipes or other connections between sites.
13. Pipes or other connections between sites shall be user-configurable to include any relevant information about the connection

P. Integrated Development Environment and Graphic Displays:

1. An intuitive graphical development environment with drag and drop tools shall be used for configuration of application displays. A ribbon bar along the top of the display, as common to Microsoft office tools, is preferred.
2. Displays shall support zoom and pan actions.
3. A large library of static and animated graphics including High Performance / HMI tools shall be provided with the software. Software shall support dragging and dropping additional graphics into the library.
4. Standard features shall be included for the following;
    a. Analog and digital inputs and outputs.
    b. Retentive counters. Values will persist if power is lost and subsequently restored or if failing over to a backup server.
    c. Retentive totalizers. Values will persist if power is lost and subsequently restored or if failing over to a backup server.
    d. Historical calculations (e.g. average flow over last hour.)
5. Software shall include pre-built displays for standard user interfaces. The following pre-built displays shall be provided as a minimum;
6. Alarm display that can be filtered by name and includes current, unacknowledged, disabled, shelved and history.
7. Trending and tabular viewing of historical data.
8. Report creator.
9. Operator notebook.
10. Site map.
11. Site list.
12. Software shall allow calculations to be associated with each graphic object to facilitate movement, visibility, sizing and rotation.
13. Software shall allow multiple objects to be saved as a template graphic. The following template capabilities shall be supported:
    a. A template may be associated with a tag structure.
    b. Each new instance of the template will inherit the properties of the template, such that changes to the template will automatically update all instances created from it.
    c. The template may have any number of parameters, including tags and text values, which can be used to animate objects within the template. Each new object created from the template may include different parameters.
    d. Templates may be imported from other projects.
    e. Copy/paste/rename/delete for any template.
    f. Ungrouping of any instance of the template.
14. Software shall support the creation of template displays. The following capabilities shall be supported:
    a. A template display may be associated with a tag structure.

b. Each new instance of the template will inherit the properties of the template, such that changes to the template will automatically update all instances created from it.
c. The template may have any number of parameters, including tags and text values, which can be used to animate objects within the template. Each new object created from the template may include different parameters.
d. Templates may be imported from other projects.
e. Copy/paste/rename/delete for any template.

15. There shall be no limit to the number of animated graphics that can be used to represent the same tag value.
16. Software shall support background bitmaps on graphical pages.
17. Users shall be able to select all or a subset of the graphics on any display and see a list of the associated tags. The list of tags shall be modifiable individually or using search and replace tools.
18. Graphic display package shall provide a means of creating and displaying color object-oriented graphic displays that will be used by the operator to monitor and control the process. Real-time values being read from the field devices shall be capable of being displayed in a variety of user-configurable formats.
19. Graphic displays shall be standard Microsoft Windows files and shall be able to be stored on the system disk, removable media, or file server, based on user-entered selections. There shall be no limit (other than physical disk size) to the number of displays that can be developed and accessed on-line.
20. Support for displays larger than the size of the monitor shall be provided. If used, graphics should be dynamically re-sized or scroll bars shall be provided to allow the user to move to other areas of the display. Also, support for using Multi Display Screens for viewing graphics shall also be available without any complex configurations or with minimal programming.
21. If the HMI manufacturer offers a specialized water/wastewater package that includes unique symbols and functions to improve graphics development, the package shall be provided.
22. Graphic display package shall be capable of importing graphics from other drawing packages such as CorelDRAW and AutoCAD.
23. Graphic display package shall be capable of importing graphics from Microsoft Windows clipboard.
24. Graphic editor shall be menu driven, and contain standard geometric symbols such as lines, circles, rectangles, etc., making creation, modification and copying of graphics a simple task. The graphic editor shall be provided with "wizards" and other scripting functions to reduce screen development time.
25. Animation connections shall be constructed using an intuitive Point and Click interface for point configuration without additional user configuration.
26. Graphic editor shall have capability of multiple dynamics of differing type to be applied to the same object (e.g., a size dynamic, and a color dynamic both added to a rectangle).
27. A method shall be provided for allowing graphics objects or groups of objects to be re-used easily. It shall allow the developer to insert native language prompts that request appropriate tag or other animation information whenever the object or grouped object is reused in another graphic display. These objects, either single or grouped, shall be intelligent, Windows wizard-like objects, so that it is possible to have a single prompt request and substitution. A method shall be provided to update all these wizards used in the application if the Master object from the library is updated.

Q. Alarm and Event System:

1. Software package shall perform alarm monitoring of discrete and analog inputs/outputs. Alarms shall be capable of being assigned to one of three severity categories with each category producing a distinct sound via the System speaker.
2. In order to logically divide a process into smaller units, the system shall allow for named individual alarm areas to be defined. These alarm areas shall be definable on an individual tag level. All alarm areas shall be accessible by each tag.
3. Alarm condition shall be specified as a discrete input or output change of state, analog values above and below limits, high or low analog rate-of-changes as defined in the database, or failed communication link.
4. System shall print a descriptive message with a time stamp and user ID on the alarm printer or to an alarm file whenever any of the following events occur:
    a. Alarm.
    b. Alarm acknowledgment.
    c. Data entry into a tag.
    d. Restarting the HMI software.
5. Software shall include alarms and events management tools consist with implementation of the ANSI/ISA 18.2-2009 Management of Alarm Systems for the Process Industries standard.
6. Software shall include a predefined alarms and events management interface. The interface shall provide the following operational tools.
    a. Lists of Current, Unacknowledged, Disabled, Active, Configured Historical and Shelved alarms and events.
    b. Tools for searching and filtering lists.
    c. Add a blog-style note to any alarm.
    d. Notes may not be edited after saving, but comments may be added.
    e. Day and night view toggle.
    f. Acknowledgement of individual alarms or all visible alarms.
    g. Option to require confirmation before acknowledging all alarms in the list.
    h. Option to require that a note be created when alarms are acknowledged.
    i. Font size adjustment for visually impaired users.
    j. Representation of alarm priorities using shape, color and numeric priority level for enhanced operational awareness.
    k. Option to plot data associated with an alarm.
    l. Option to open a process display where the alarm is currently shown.
    m. Option to have a relevant process display open automatically if there is no operator action for a defined period following the triggering of that alarm.
    n. Alarm mute and silence.
    o. Alarm shelving options for a defined period or indefinitely. Shelved alarms shall still be recorded to the alarms history but shall not announce or require acknowledgement.
    p. Option to include or exclude shelved alarms in the list of Current, Unacknowledged, and Active alarms. Shelved alarms to be visible at all times in lists of Historical alarms and events, Configured alarms and Shelved alarms.
7. Alarm acknowledgement shall immediately be propagated to all networked stations.

8. A full redundant copy of alarm and event history shall be stored on every workstation, allowing that workstation to continue to process local alarms if it becomes isolated from the network. History to be automatically synchronized when the workstation is reconnected to other servers.
9. Software shall allow the creation of multiple alarm databases for load distribution in large or distributed applications.
10. Software shall allow direct assignment of alarms to alarm databases.
11. Software shall allow alarms to be associated with functional areas, such that a user need only deal with alarms in his/her functional area(s).
12. Alarm occurrence, acknowledgement, clear, disable and shelve actions shall be recorded.
13. Alarm disabling to be provided only as a configuration option, not as an operational action.
14. Software shall provide user-configurable settings for deadband on analog alarms and delay on analog and digital alarms.
15. Alarms and events records shall include:
    a. Time/Date stamp.
    b. The name and description of the alarm tag.
    c. Priority.
    d. Status of Alarm (i.e. Active, Acknowledged, Cleared). Alarm Acknowledgement records shall include the name of the user who acknowledged the alarm.
    e. The value of the associated tag at the time of alarm occurrence.
    f. The value of the alarm setpoint at the time of alarm occurrence.
16. Software shall support an unlimited number of alarm priorities and shall allow unique annunciation sounds, shapes, and colors for each.
17. Alarm annunciation shall be configurable to use alarm tones, text to speech descriptions, sound files or popup displays.
18. Users must be notified, both visibly and audibly, of the occurrence of an alarm, regardless which display is presently being viewed.

R. Alarm System Auditing and Reporting
1. Software shall support printing of alarms/events created over a range of dates/times.
2. Software shall provide a means to identify frequently occurring alarms (e.g. nuisance alarms.
3. Software shall provide a means to identify and analyze alarm flood conditions.
4. Software shall provide a summary of alarm percentages by priority, for comparison with generally accepted percentages as defined in the ANSI/ISA 18.2-2009 Management of Alarm Systems for the Process Industries standard.

S. Alarm Notification System (for remote users)
1. The Alarm Notification System shall support alarm notification via dial-out over voice modem (using text-to-speech), VOIP (voice over Internet protocol), an Internet service such as Twilio®, SMS text message, email and alphanumeric pager. Alarm acknowledgement shall be supported during voice calls and via email and text message.
2. The Alarm Notification System shall allow status retrieval and alarm acknowledgement via dial-in over voice modem (using text-to-speech.)

3. The Alarm Notification System shall be an integrated feature of the SCADA systems and shall not require a separate tag database and security system.
4. Email messages shall support outgoing mail with transport layer security (e.g. Gmail, Yahoo Mail, or corporate email server.)
5. The Alarm Notification System shall be capable of annunciating alarms to rosters of users with up to 39 contacts per roster. An unlimited number of rosters shall be supported. The system shall support associating rosters with functional areas, such that alarms in these functional areas will activate notification to the appropriate contacts.
6. The Alarm Notification System shall allow the configuration of delays between, and repeats of, any individual contact or group of contacts in a contact list.
7. Security rights to edit a roster shall be controlled by a dedicated privilege, not dependent on any other tag-modification privileges.
8. System shall support an API allowing user-defined views of roster contact lists.
9. System shall support a means of disabling or enabling a contact in a roster without needing to open or edit the contact list.

T. Error Detection, Recovery, and Diagnostics:
1. Software driver shall provide on-line diagnostics that display the current status and operation of the local area network and its nodes. The diagnostic display shall include the LAN adapter status for the machine showing the display, as well as the current number of messages, errors and retries.
2. HMI software shall automatically detect and recover from any network condition or software problem that results in a failure of communications between the HMI client and the SCADA server(s) or between the SCADA server and I/O devices. It shall be possible to log all connection/disconnection events of sessions between the SCADA server and clients.
3. If network communications errors are detected, the software shall automatically indicate that the data (on graphic displays, in historical files, etc.) is no longer valid and shall replace the invalid data with user defined characters or pre-defined status text. The HMI software shall automatically attempt to re-establish communications, and, if successful, shall then replace the characters with valid data. This capability shall be built-in to the software and shall not require any user programming or other user-dependent actions to implement.

U. Report Generation and Printing:
1. Operator interface software shall support at least one alarm/event printer and one report printer. Printers shall support both USB and/or parallel ports for printing.
2. Authenticated operators shall, in the runtime environment, be able to produce reports including any analog, digital or calculated tag data from the historical database.
3. Data format options shall be as follows:
    a. To screen.
    b. To a comma separated value (.csv) file.
    c. To a text file.
    d. To an ODBC-compliant database.
    e. To any direct-connected or networked printer.

f. To a 3rd party software (e.g. Microsoft Excel) template for advanced data analysis and formatting.
g. To e-mail if an external email server is provided.

4. Reports may be created for one-time use or saved for reuse.
5. Report generation shall be invoked either on demand, by a monitored event, or on a scheduled basis.
6. For reports that are created on a scheduled basis, a mechanism shall be provided to allow operators to re-create the last scheduled report.
7. Software shall support ODBC and OPC connections for use by third-party report generation programs such as XLReporter and DreamReports.
8. Software shall supply a data-query add-in tool for Microsoft Excel®, thereby allowing reports to be generated in that program.
9. Software shall support a REST interface for development of web-based query tools.

V. Electronic Operator Notebooks

1. System shall support operator logbooks for recording ad-hoc notes or predefined notes as threads, in that notes can have associated comments.
2. Notebooks shall be searchable by keyword, user account and time/date.
3. Notebooks shall be color-coded for easy identification.
4. System shall support creation of an unlimited number of notebooks for association with system elements, such as equipment and trended pen groups.
5. All notes shall be encrypted and include the name of the user's account and the time/date of creation. All notes entered into the notebook shall be immediately viewable from all clients and servers.
6. System shall not allow editing or deleting notes once created, to prevent tampering.
7. System shall support the addition of comments to existing notes.
8. System shall support the option of requiring operator authentication as part of the note creation process.
9. System shall support printing of notes by range of dates/times.
10. System shall support the export of notes for a selected range of dates, to a format that can be easily viewed / printed from any workstation without the need for a (HTML)

W. Security:

1. Software shall include a security system with privilege and role-based user accounts. Level-based access shall not be acceptable.
2. All output controls shall be locked automatically when no user is signed in. After a predetermined time of no operator activity, which is adjustable by the system administrator, the operator workstation shall default to the lowest system security.
3. Security system shall support an unlimited number of user accounts and roles. System shall allow creation of an unlimited number of additional security privileges where necessary.
4. User passwords must be configurable to require a minimum length, contain a combination of letters, numbers, and special characters, and expire after a pre-set period. User passwords shall be stored in an encrypted format.
5. System shall allow changes to user accounts, roles, and privileges while the application is running. Changes shall become effective immediately.

6. System shall provide a mechanism to suspend a user account. Suspending an account shall cause a user to be signed out immediately.
7. Operator interface functions such as commands, macros, graphic displays, OLE objects, and point IDs shall be capable of each being assigned a separate security level.
8. Software package shall provide the ability to "lock" a user into the runtime graphics environment. Specifically, disabling any combination of the following shall be supported:
    a. Starting other applications.
    b. Switching to other applications that may be running.
    c. Exiting from the software package.
    d. Keystrokes (i.e., <Ctrl><Alt><Delete>, <Alt><Tab>).
    e. Switching to graphics configuration mode.
9. User sign-in and sign-out activity shall be recorded in the application event log. Disabling accounts after X failed attempts within Y seconds shall be supported where X and Y are configurable options.
10. System shall provide a mechanism to limit client access to specific IP addresses.
11. System shall support authentication of user accounts via a Windows domain and authorizing SCADA user roles from domain security groups.
12. System shall provide an Active Directory Query utility to assist security managers by confirming group names assigned to user accounts.
13. When running as a Windows service, system shall support the use of Smart Cards as a form of two-factor authentication.
14. System shall support the use of proximity cards/readers.
15. System shall support the use of OAuth 2.0 authorization for integration with Google™ or Microsoft 365™ email systems.
16. The integrated version control system shall allow the option of including or excluding security-related changes if returning the application to an earlier configuration state.
17. System shall support the use of Open-ID Connect for authentication of users connecting via thin clients.
18. System shall support the creation of read-only workstations that provide operators with view-only access.
19. System shall support privilege masking on read-only workstations that will override any connected user's assigned privileges.

X. Product Upgrades, Support and Training

1. Software must have a history of allowing applications that have been deployed on current technology (operating systems and PC hardware) to be upgradable to new technology with minimal change to the application.
2. Software must have a history of allowing applications that have been deployed on one version of the product to be upgradable to a new version with minimal change to the application.
3. Software manufacturers shall offer product support via phone, email, user forum and remote access methods (e.g. Remote Desktop.)
4. Software training shall be available from the manufacturer via classroom courses and self-directed study (e.g. workbooks and tutorials online.)

2.3 SCADA THIN CLIENT MANAGEMENT SOFTWARE

A. General

1. Thin client hardware is specified in Section [13310]. The software shall be compatible with the thin client hardware.
2. Software is not a substitution for any required HMI thin client licenses or Microsoft Remote Desktop Services Client Access Licenses required for fully operation SCADA system.

B. Thick (full-installation) Client User Interface

1. Software licensing shall not limit the number of application display pages allowed.
2. Software shall support the following navigation methods:
3. A menu for navigating from one display to another. Menu shall be configurable to allow logical grouping of displays.
4. Tiled view of any number of displays concurrently, all tiles showing real-time data or pictures of displays (user-selectable). Selecting one of the tiles will switch to the full-screen view of that display.
5. Mouse-over selectable hot box for navigating to a specific display.
6. Button for navigating to a specific display.
7. Browser-like forward and reverse buttons to scroll through previously viewed displays.
8. A list of previously viewed displays with the option to navigate to a selection from the list.
9. A mapped view of assets with the option to navigate to an application display by selecting any asset from the map.
10. Application displays shall be event-driven, in that data will be delivered to client computers by the server immediately upon receipt. Client computers will not poll the server for new data.
11. Means shall be provided to allow the operator to print graphical displays.
12. Software shall support flagging tags as ‘questionable data’ (i.e., not commissioned or value is in question.) These values will continue to display the incoming values. These flags shall be removable by users with sufficient privileges.

C. Thin (browser-based) Clients

1. Software shall offer an optional zero-footprint thin client for use with HTML5-compatible browsers running on operating system variants, including
    a. Windows
    b. Linux
    c. Apple
    d. Android
2. Server for thin clients shall be an integral feature of the SCADA software. Use of the thin client shall not require a 3rd party Internet server software (e.g., Microsoft IIS, Apache).
3. Thin client shall not rely on an RDP (remote desktop protocol) connection. Network traffic required by the thin client shall not exceed 1/8th of the bandwidth of similar systems that do use RDP connections.
4. System shall support [two] [three][four][other] levels of server redundancy for thin client connectivity, with automatic failover and client load sharing.

5. System shall support cyber security measures including Firewalls, Virtual Private Networks (VPN) and Secure Socket Layer (SSL.)
6. OpenID Connect shall be supported for secure thin client logons.
7. Thin client connections shall be concurrent. Tools shall be provided to monitor client connectivity and to disconnect users or switch them to alternate servers on demand.
8. The thin client shall share the same security accounts as the rest of the SCADA Software. A separate privilege shall be required for browser client access. Revocation of this privilege will immediately terminate the user's client connection.
9. Thin Client displays shall be generated automatically, requiring no additional configuration.
10. Online configuration changes shall be deployed immediately to all thin client interfaces without requiring the client interface to be restarted or refreshed.
11. An authorized user on a thin client connection shall be able to perform configuration changes.
12. Thin clients shall provide support for multiple-monitor configurations.
13. The Thin Client user interface shall be offered in two variants, the choice of which to use being user-selectable.
    a. Graphical (preferred for large user interfaces) – A user experience mirroring (graphically and operationally) that of the Thick Client.
    b. Text-based (preferred for mobile phone interfaces) – Simplified lists of monitored values, with support for control actions, alarms management, trending and mapped asset view.

D. Window Layout and Navigation

1. 1.1 Title Bar
    a. The system shall implement a persistent title bar using a Perspective fixed view or Vision docked template.
    b. The title bar shall display:
        1) Project name and facility name
        2) Environment indicator (PRODUCTION / TEST / DEVELOPMENT)
        3) Gateway-synchronized system date and time
        4) Logged-in username and assigned security roles
        5) The title bar shall include visual indication of system health, including:
            a) Gateway connectivity
            b) PLC or Tag Provider heartbeat
2. 1.2 Navigation Strategy
    a. The system shall use a hierarchical navigation structure.
    b. Navigation shall be implemented using reusable components (Perspective embedded views or Vision templates).
    c. The navigation hierarchy shall follow these levels:
        1) Level 1: Plant Overview
        2) Level 2: Area Overview
        3) Level 3: Unit Process
        4) Level 4: Equipment Detail / Faceplate
    d. No operator function shall require more than three navigation actions.
3. 1.3 At-a-Glance Alarm Display
    a. A persistent alarm banner shall be visible on all primary screens.
    b. The banner shall display:
        1) Highest active alarm priority
        2) Number of active alarms
        3) Number of unacknowledged alarms
    c. Alarm animation and color shall comply with the project alarm philosophy.
    d. Decorative or non-alarm flashing shall not be used.
4. 1.4 Project Branding
    a. Project branding shall be implemented using shared style classes or templates.
    b. Branding elements shall not obscure alarms, process values, or controls.

E. Visual Design (High Performance HMI)

1. 2.1 Color Usage
    a. Normal operating conditions shall be displayed using neutral grayscale colors.
    b. Color shall be reserved exclusively for abnormal, alarm, warning, or manual states.
    c. Gradients, textures, and 3D effects shall not be used.
2. 2.2 Text and Fonts
    a. A single sans-serif font family shall be used project-wide.
    b. Minimum font sizes shall be:

1) Titles: 16–20 px
2) Labels: 12–14 px
3) Values: 14–16 px

c. Terminology and capitalization shall be consistent across all screens.

F. Ignition Architecture Requirements

1. 3.1 Gateway Architecture
   a. A dedicated Ignition Gateway shall be provided for each environment (Production, Test, Development).
   b. Gateway redundancy shall be implemented where system availability is critical.
   c. Loss-of-site alarm. The cloud gateway shall be alarmed on loss of the PPC connection (heartbeat/tag quality).
   d. The Gateway shall host:
      1) Tag Providers
      2) Alarm Pipelines
      3) Scripting resources
      4) Database connections
2. 3.2 Security
   a. Role-Based Access Control (RBAC) shall be enforced for all operator and administrative actions.
   b. Integration with Active Directory or identity providers shall be implemented where available.
   c. The principle of least privilege shall be applied.
   d. Security auditing shall be enabled for:
      1) Logins and logouts
      2) Alarm acknowledgments
      3) Tag writes and control actions
3. 3.3 Database Connectivity
   a. All database connections shall be configured at the Gateway level.
   b. Named Queries shall be used for all database access.
   c. Inline SQL in components or scripts shall not be permitted.
   d. Database credentials shall not be hard-coded.
   e. All device connections shall be documented with addressing, scan rates, and timeout behavior.

G. Operator Interface Requirements

1. 4.1 Color and State Indication
   a. Equipment states shall be visually distinguishable.
   b. The following color meanings shall be enforced:
      1) Normal: grayscale
      2) Warning: amber/yellow
      3) Alarm/Fault: red
      4) Manual or Maintenance: blue or gray-blue
2. 4.2 Interlocks and Permissives
   a. All interlocks and permissives shall be implemented in PLC logic.

b. The HMI shall provide visibility of active interlocks and failed permissives.
c. Operator-friendly descriptions shall be provided.

3. 4.3 Alarms
   a. All alarms shall be implemented using Ignition tag-based alarming.
   b. Alarm priorities shall be defined as:
      1) High (Priority 3–4)
      2) Medium (Priority 2)
      3) Low (Priority 0–1)
      4) Each alarm shall include clear text, setpoint or condition, and operator guidance.
4. 4.4 Graphics and Faceplates
   a. Process graphics shall be 2D and schematic in nature.
   b. Reusable equipment faceplates shall be implemented using embedded views or templates.

H. Alarm Philosophy (Project-Wide)
1. A single alarm philosophy document shall govern the project.
2. Alarm performance targets shall be:
   a. Average alarm rate: less than 1 alarm per 10 minutes
   b. Peak upset rate: less than 10 alarms in 10 minutes
   c. Alarm shelving, suppression, and state-based alarming shall be implemented.
   d. Alarm rationalization shall be completed prior to commissioning.

I. Tag Management
1. 6.1 Tag Naming
   a. Tags shall use structured paths including area, unit, equipment, and signal.
   b. Spaces and special characters shall not be used.
2. 6.2 User Defined Types (UDTs)
   a. UDTs shall be used for all repeatable equipment.
   b. UDTs shall include status, commands, alarms, and runtime data.
3. 6.3 Folder Structure
   a. Tag folders shall mirror process areas, navigation structure, and historian organization.

J. Historian Requirements
1. Ignition Tag Historian shall be used for all historical data.
2. Sample rates and deadbands shall be configured based on process requirements.
3. Non-critical or static tags shall not be historized.

K. Analytics and Trending
1. Predefined trends shall be provided for key process and equipment metrics.
2. Trend views shall use standardized time ranges and scaling.

L. Reporting
1. The Ignition Reporting Module shall be used for operational and compliance reports.

2. Reports shall support scheduled and on-demand execution.
3. Reports shall export to PDF and CSV formats.

M. Ignition Module Requirements
1. The following Ignition modules shall be provided unless otherwise approved:
2. Vision Module (if desktop clients are required)
3. Perspective Module (for web and mobile clients)
4. Tag Historian Module
5. Alarm Notification Module
6. Reporting Module
7. The following optional modules shall be implemented when applicable:
    a. Gateway Redundancy Module – for high-availability systems
    b. Enterprise Administration Module (EAM) – for multi-site management
    c. MQTT Transmission / Engine Modules – for IIoT architectures
    d. Sepasoft MES Modules – when production tracking or OEE is required

N. Governance, Submittals, and Change Management
1. 11.1 Bid Compliance
    a. Bidders shall acknowledge this specification in their proposal.
    b. Any deviation from this specification shall be clearly identified in a written exception list.
    c. Failure to disclose deviations shall be grounds for rejection or corrective action at no additional cost to the Owner.
2. 11.2 Required Submittals
    a. The successful bidder shall provide the following deliverables:
        1) Ignition system architecture diagram
        2) Module list with license counts
        3) Alarm philosophy acknowledgment and alarm priority mapping
        4) Tag naming and UDT structure documentation
        5) Sample screen hierarchy and navigation map
        6) Example equipment faceplate (pump or valve)
        7) Security role matrix
        8) Database schema or reporting data flow diagram
3. 11.3 Factory Acceptance Testing (FAT)
    a. A formal FAT shall be conducted prior to site deployment.
    b. FAT shall verify:
        1) Navigation structure compliance
        2) Alarm functionality and priorities
        3) Interlock visibility
        4) Historian logging
        5) Reporting execution
    c. FAT results shall be documented and approved by the Owner.
4. 11.4 Site Acceptance Testing (SAT)

a. A SAT shall be conducted after installation and commissioning.
b. SAT shall confirm full compliance with this specification.
c. Any deficiencies shall be corrected prior to final acceptance.

5. 11.5 Training and Documentation
   a. The Contractor shall provide operator training and administrator training.
   b. Training materials shall be submitted in electronic format.
   c. Final documentation shall include:
      1) Gateway backup
      2) Final project files
      3) As-built screen captures
      4) Final alarm database export

6. Change Management
   a. All changes after award shall follow a formal change management process.
   b. Scope changes shall not be implemented without written Owner approval.
   c. Unauthorized deviations shall be corrected at the Contractor's expense.

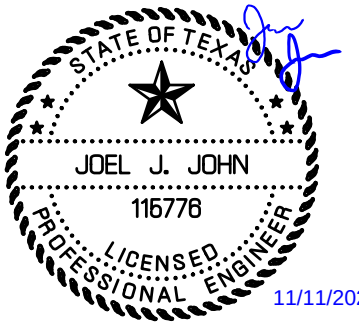
O. Acceptance and Warranty
1. Final system acceptance shall occur only after successful SAT completion.
2. The Contractor shall warrant the Ignition system for a minimum of one (1) year after acceptance.
3. Warranty shall include defect correction and configuration support related to this specification.

PART 3 – EXECUTION

3.1 GENERAL

A. Refer to Section [13300].

END OF SECTION



11/11/2026

SECTION 13320
CONTROL AND DATA NETWORK EQUIPMENT

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Furnish the labor and materials required to install and bring into operation the control and data network as shown on the Drawings and specified herein.

B. The network shall be capable of supporting communications between all servers, operator workstations, PLCs, RTUs, and other communication devices as shown on the system architecture block diagram(s). Furnish all necessary cables, face plates, connectors, modems, transceivers, repeaters, modules; splice kits, etc. required for a complete and operational network. The system architecture diagram(s) are for network understanding only. Some communication devices maybe required for network operation, which may not be explicitly shown on the Drawings. The system shall be designed to accommodate an increase of 100 percent of network nodes.

C. Furnish and install a complete Remote Input/Output (RIO) data highway capable of supporting communications between all PLCs as shown on the system architecture block diagram. Furnish all necessary cables, face plates, connectors, modems, transceivers, repeaters, modules; splice kits, etc. required for a complete and operational RIO data highway.

D. The control and data network shall include all nodes on the network. Communication between nodes may be via Ethernet, serial, fieldbus, or other method as shown on the drawings.

E. The Owner does not have a SIEM. SIEM integration is not required

1.2 RELATED WORK

A. Refer to Division 16 Sections.

B. Refer to the E-sheets in the Drawing package.

C. Refer to Section 13300 “I&C - General Provisions.”

D. Refer to Section 13321 “Fiber Optic Cabling and Equipment.”

E. Refer to System Architecture drawing.

1.3 SUBMITTALS

A. Refer to Section 13300.

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

C. Complete bill of materials for the equipment.

D. Spare parts list.

E. Complete system architecture diagram showing in schematic form, the interconnections between major hardware components including control centers, panels, power supplies, consoles, computer and peripheral devices, networking equipment, processors, I/O modules, local operator interfaces, process equipment vendor controllers, and like equipment. The system architecture shall be complete and shall depict all required cables, media type between components, network protocol used at each network level, details on connection requirements such as cable pin-outs, port numbers, and rack slot numbers. The intent of this specification requirement is to develop a diagram that is complete in every aspect to allow purchase of all required equipment by part number, and to allow a qualified technician to interconnect all equipment without having to refer to additional manuals or literature. Sheet size shall be 11"x17" and using more than one sheet is acceptable.

F. Submit details of I/O level networks, including field instrument, valve, power monitoring, and field device digital networks. Submittal shall include details of the field device digital networks technology including type, wiring requirements, configuration details, device addressing, and interface to the process control system. Include details of the field device digital network configuration for each field level digital network and subnetwork.

1.4 REFERENCE STANDARDS

A. Refer to Section 13300.

1.5 QUALITY ASSURANCE

A. Refer to Section 13300.

1.6 SYSTEM DESCRIPTION

A. System Responsibility:
1. The Drawings and specifications depict a control and data network, which shall function as one unit. This network may be comprised of multiple communication protocols over various media

1.7 DELIVERY, STORAGE AND HANDLING

A. Refer to Section 13300.

1.8 PROJECT/SITE REQUIREMENTS

A. Refer to Section 13300.

1.9 MAINTENANCE

A. Refer to Section 13300.

1.10 WARRANTY

A. Refer to Section 13300.

1.11 NOMENCLATURE AND IDENTIFICATION

A. Refer to Section 13300.

ART 2 – PRODUCTS

2.1 INDUSTRIAL MANAGED ETHERNET SWITCH

A. General
1. Provide an industrial managed Ethernet switch for connection to the control network backbone as shown in the Drawings and specified herein.

B. Physical Features
1. Minimum fiber uplinks: 2 x 100/1000 SFP ports
2. Minimum fiber Ports: Two (2) Gigabit Ethernet ports shall be hot pluggable into the SFP uplink. Ports shall be duplex LCE and operate at a wavelength of 850 nm over multimode cable.
3. Minimum copper ports: 16 x 10/100 TX RJ45 ports
4. Operating temperature: 0 to 130 °F
5. Power: 24 VDC redundant power supply inputs
6. Enclosure: Metal case, DIN-rail mountable
7. Rating: UL Class 1, Division 2 Groups A, B, C, and D

C. Network Features
1. Fault tolerant for use in a ring topology if shown on drawings. The switch shall be able to detect a blocked port and redirect data flow in the opposite direction within 30ms.
2. Layer 2 switching
3. Full duplex on all port
4. Auto negotiation and manual configurable speed and duplex
5. Wire speed switching fabric
6. IEEE 802.1w Rapid Spanning Tree Protocol
7. IGMP snooping
8. IGMP filtering
9. Configuration password protected
10. Configuration backup capability required
11. SNMP V3
12. Lock port function for blocking unauthorized access based on MAC address.

D. Additional Features
1. The switch shall come equipped with a dry contact rated for 120 VAC 5A that shall be used for common trouble alarm. The alarm shall be programmable. If the contact cannot use 120 VAC 5A, provide the necessary 24 VDC power from the PLC panel and provide interposing relays in the PLC panel.

E. Manufacturers
1. Stratix
2. Moxa
3. Hirschmann
4. N-Tron
5. Or equal

2.2 INDUSTRIAL UNMANAGED ETHERNET SWITCH

A. General

1. Provide an unmanaged Ethernet switch for connection to the control network backbone as shown in the Drawings and specified herein.
2. Physical Features
3. Minimum copper ports: 4 – 10/100 TX RJ45 ports
4. Operating temperature: 0 to 130 °F
5. Power: 24 VDC
6. Enclosure: Metal case, DIN-rail mountable
7. Rating: UL Class 1, Division 2 Groups A, B, C, and D

B. Network Features
1. Auto sensing duplex and speed
2. LED link/activity status indication

C. Additional Features
1. The switch shall come equipped with a dry contact rated for 120 VAC 5A that shall be used for common trouble alarm. The alarm shall be programmable. If the contact cannot use 120 VAC 5A, provide the necessary 24 VDC power from the PLC panel and provide interposing relays in the PLC panel.

D. Acceptable Manufacturers
1. Phoenix contact
2. N-Tron
3. Moxa
4. Or equal

2.4 ETHERNET MEDIA CONVERTER

A. General
1. Provide an Ethernet media converter as shown in the Drawings and specified herein.

B. Physical Features
1. RJ45 port: 10/100/1000BaseTX to 1000BaseTX
2. Fiber uplink: 100BaseTX to 100BaseFX (ST/SC connectors)
3. Fiber optics: Multi- or single-mode capability as shown in the Drawings
4. Operating temperature: 0 to 130 °F
5. Power: 24 VDC
6. Enclosure: DIN-rail mountable

C. Additional Features
1. The converter shall come equipped with a dry contact rated for 120 VAC 5A that shall be used for common trouble alarm. The alarm shall be programmable. If the contact cannot use 120 VAC 5A, provide the necessary 24 VDC power from the PLC panel and provide interposing relays in the PLC panel.

D. Acceptable Manufacturers
1. Phoenix Contact
2. N-Tron
3. Moxa
4. Or Equal

2.5 WIRES AND CONNECTORS

A. Ethernet 10/100/1000 BASE-T/TX Cable.

1. The unshielded twisted pair cable shall be designed for use with a high speed (10/100/1000 Mbps) Ethernet 10/100/1000 BASE-T/TX communications network. The twisted pair cable shall have a nominal impedance 100 ohms at one MHz, a maximum attenuation of 8 dB per 1000 feet at one MHz. The twisted pair cable must have frequency tested up to 250 MHz or more. The twisted pair cable shall be plenum rated and shall have a minimum of four 23 AWG solid copper conductor pairs. All 10/100/1000 BASE-T/TX (RJ-45) terminations on the twisted pair cable shall be done in a professional and workman like manner. Terminations shall provide for proper strain relief on the cable jacket. Strain relief on the wire and/or wire insulation shall not be acceptable.

B. RIO Data Highway Cable

1. The RIO data highway cable shall be plenum rated cable of the type as recommended by the PLC manufacturer. All terminations shall be done in a professional and workman like manner. Terminations shall provide for proper strain relief on the cable jacket. Strain relief on the wire and/or wire insulation shall not be acceptable.

2.6 NETWORK FIREWALL

A. General

1. Provide one firewall as shown on Sheet 0-E-17. The firewall shall pass only the outbound connection from PPC-12-101 to the cloud Ignition gateway; no inbound connections shall be permitted.
   a. The firewall shall retain local logs for at least 90 days and be syslog-capable for future use
   b. Remote users shall access the system through the cloud Ignition gateway, Remote access to PLCs is not required

2. This specification defines the minimum functional, performance, security, management, environmental, and testing requirements for a hardware firewall appliance used to enforce segmentation, access control, and secure remote connectivity for the wastewater plant SCADA/OT network. Device will be deployed at zone boundaries (OT↔IT, OT DMZs, and remote access gateways).

3. The firewall shall retain local logs for at least 90 days and be syslog-capable for future use. Remote users shall access the system through the cloud Ignition gateway; remote access to PLCs is not required

4. The PCSS shall setup and configure the network firewall to establish a secure connection between the Ignition Panel PC and the Cloud-Based Virtual Ignition SCADA server.
   a. The Virtual Ignition SCADA server shall be accessible on Owner devices such as the proposed rugged tablets.
   b. The network firewall shall connect to the Owner's existing internet connection located in the Electrical Building's Control Room.

B. Physical Requirements

1. Panel Din Rail Mountable
2. Dual redundant, power inputs
3. Operating temp: 0–50°C; humidity ≤95% non-condensing.
4. MTBF data provided; lifecycle ≥5 years.
5. ISA/IEC 62443 certified components.

C. Functional Requirements

1. Stateful packet inspection for IPv4/IPv6, application-aware filtering.
2. Deny-by-default zone policies and VLAN-aware routing.
3. VPN: IPsec/IKEv2 and TLS, AES-256 encryption, certificate-based authentication.
4. Integrated IDS/IPS with signature and anomaly detection.
5. RBAC for administrators, MFA support, RADIUS/TACACS+ integration.
6. Traffic shaping and QoS for SCADA-critical flows.
7. Fail-safe behavior configurable (fail-open vs fail-closed).

D. Minimum Performance & Capacity Requirements
1. Baseline: ≥1 Gbps IMIX, ≥500,000 concurrent sessions, ≥200 VPN tunnels, ≥300 Mbps IPS.

E. Cryptography and Key Management
1. FIPS 140-2/3 validated modules preferred.
2. TLS 1.2 minimum, TLS 1.3 preferred. Disable legacy ciphers.
3. Support for certificate revocation (CRL/OCSP).
4. Secure key storage (TPM or equivalent).

F. Integration & Compatibility
1. REST API for configuration/monitoring.
2. Support configuration templates for automation.

G. Supply Chain & Firmware Management
1. Signed firmware images with secure update process.
2. Vendor provides SBOM on request.
3. Patch support lifecycle ≥5 years.

H. Support, Maintenance, & Licensing
1. 24x7 technical support with defined SLA (≤4h for critical).
2. Transparent licensing model.
3. Annual cost estimates for threat feeds and subscriptions.

I. Management & Administrative Controls
1. RBAC, unique accounts, no shared admin accounts.
2. Session timeout defaults (≤15 min idle).
3. MFA required for admin access.
4. Configuration backup/restore with integrity validation.

J. Privacy & Logging Retention
1. Local logs retained ≥90 days.

K. Safety & Operational Retention
1. Support detection-only IDS/IPS mode for testing.
2. Documented rollback procedures for changes.
3. Runbooks for common operations provided.

L. Procurement / Specification Summary Table
1. Firewall throughput baseline ≥1 Gbps IMIX.
2. Concurrent sessions ≥500,000 (baseline).
3. VPN tunnels ≥50 (baseline).
4. Industrial protocol awareness required.

5. Syslog TLS and SIEM integration required.
6. Dual PSUs mandatory.
7. Support lifecycle ≥5 years.

M. Manufacturers
1. Cisco (Firepower Next-Gen Firewalls)
2. Fortinet (Fortigate Rugged Series)
3. Palo Alto (PA-series Firewalls)
4. Check Point (Quantum Security Gateways)
5. Approved Equal

2.7 VIRTUAL PRIVATE NETWORK (VPN) FOR SCADA/OT ACCESS

A. General
1. This specification defines the minimum security, performance, management, and operational requirements for a Virtual Private Network (VPN) solution providing secure remote access into the wastewater plant's SCADA/OT network.

B. Physical Requirements
1. Hardware or virtual VPN appliance (enterprise-grade, FIPS validated)
2. Baseline capacity: ≥ 200 concurrent tunnels, ≥ 500 Mbps encrypted throughput
3. Mandatory feature:
   a. MFA
   b. TLS 1.3
   c. FIPS cryptography

C. Functional Requirements
1. Must support site-to-site VPN (OT↔IT, OT↔remote plant) and remote-access VPN (users, vendors).
2. Protocol support: IPsec/IKEv2 and TLS 1.2/1.3.
3. Enforce strong encryption: AES-256-GCM (minimum), SHA-2 hashing, DH Group ≥14.
4. Support multi-factor authentication (MFA) for all remote users.
5. Certificate-based authentication (X.509, PKI integration).
6. Ability to restrict user access based on least privilege and role-based policies (per network zone, protocol, or device).
7. Full support for split tunneling disabled (all traffic forced through VPN, except where explicitly authorized).
8. Must integrate with existing firewall appliances for policy enforcement.
9. Automatic session timeout and re-authentication after inactivity.
10. Centralized monitoring/logging of VPN sessions.

D. Performance & Capacity Requirements
1. Concurrent VPN tunnels (baseline): ≥200
2. Throughput (encrypted traffic): ≥500 Mbps baseline, scalable to ≥2 Gbps for larger sites.
3. Maximum latency overhead: ≤50 ms for SCADA HMI/PLC traffic.

E. Security & Cryptography
1. VPN must use FIPS 140-2/3 validated cryptographic libraries.
2. Must support TLS 1.3 (preferred) with modern cipher suites only.
3. Session key re-negotiation interval ≤ 8 hours (configurable).
4. Support for hardware security modules (HSM) or TPM for secure key storage.

F. Authentication & Access Control
1. Support for RADIUS/TACACS+ integration.
2. Enforce MFA (smartcard, OTP, or authenticator app).
3. Prohibit shared accounts — unique IDs per user.
4. Ability to restrict vendor VPN accounts to specific times or windows (e.g., maintenance periods only).

G. Monitoring & Logging
1. Log all VPN session activity:
2. Username, IP address, device ID, login/logout time, duration, data volume.
3. Support alerting for failed logins, unusual access times, and high traffic anomalies.

H. Device Security
1. VPN client software must support Windows, Linux, and hardened industrial laptops.
2. Ensure endpoint posture check:
   a. Device must have up-to-date patches
   b. AV/EDR running
   c. Disk encryption enabled
3. Restrict connections from unmanaged and non-compliant devices.

I. Integration
1. Must integrate seamlessly with firewall (perimeter/OT segmentation)
2. VPN Gateway should support REST API for configuration and monitoring
3. Centralized management console with role-based admin access.

J. Operational requirements
1. Vendor must supply documented hardening guide.
2. Support lifecycle (firmware and patches) ≥ 5 years.

K. Acceptance & Commissioning
1. Verify AES-256/TLS 1.3 encryption in active tunnels
2. Verify MFA enforcement
3. Simulate unauthorized access attempts and validate alerts
4. Validate throughput ≥ 500 Mbps under load

L. Documentation & Deliverables
1. VPN deployment and configuration guide.
2. Secure baseline configuration guide.
3. Firmware lifecycle and patch support policy.
4. Escalation/support contact information

M. Manufacturers
1. Windows 11 IoT Enterprise LTSC
2. Approved Equal

2.8 PANEL PC

A. General
1. Provide a panel PC as shown in the Drawings and specified herein.
2. Panel PC is referred to as “PPC” on the system architecture drawing.
3. The Panel PC shall be setup as an Ignition Gateway.

4. All Panel PC configuration, networking and setup shall be provided by the PCSS
5. The Panel PC shall interface with all SCADA PLCs and hardware.
6. The Panel PC shall connect to Wilbarger's existing internet connection via the PCSS furnished firewall.
7. The Panel PC via its HMI Ignition application shall be configured to network with the virtual Cloud-based Ignition Server.
8. The virtual Cloud-based Ignition Server shall be configured by the PCSS to be an Ignition data gateway responsible for interfacing with remote HMI clients.
9. Panel PC PPC-12-101 is intended to be a data aggregator at the plant (Ignition Edge Device). It polls all plant PLCs and devices over the plant network and pushes the data to a cloud Ignition installation. The cloud gateway serves the tablets and remote clients, the historian, reporting, and alarm notification. The plant firewall only has to pass the PPC's outbound connection to the cloud.
    a. PPC-12-101 shall run Ignition Edge Panel. This product is the aggregator plus a local HMI on the touchscreen. It has unlimited tags and devices and should sync history, alarms and audit logs to the cloud.

B. Performance Specifications
1. Processor:
    a. High Performance Intel Core i5/i7 CPU or equal
2. Memory:
    a. Capable of providing multitasking functions and the use of resource intensive applications
    b. 16 to 32GB DDR4 or DDR5 RAM
3. Storage:
    a. Solid State Drives (SSDs) with a minimum of 1TB capacity
4. Operating System:
    a. Windows 11
5. Display
    a. Screen Resolution options shall be provided to automatically scale and adjust as required to satisfy Ignition HMI requirements.
    b. Displays shall be touch-screen compliant and shall respond to operator requests
    c. Screen shall be a minimum 1200 NIT screen.
6. Environmental
    a. Panel PC shall be IP rated for indoor use only
    b. Temperature range: -4DegF to 140DegF
7. Construction
    a. Rugged aluminum or Stainless Steel
    b. Shall be built to withstand vibrations and shocks
8. Connectivity
    a. Panel PC shall be capable of connection via multiple network connections including, Ethernet, Modbus/TCP, RS232, etc.

C. Manufacturers
1. Cisco
2. Fortinet
3. Palo Alto
4. Approved Equal

2.8 SPARE PARTS

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

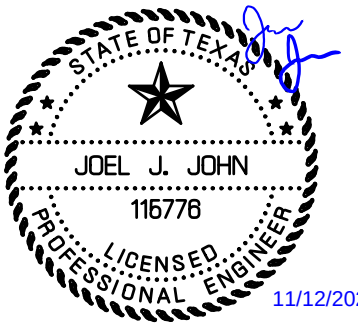
B. The following Network and Communications System spare parts shall be furnished
   1. One switch of each type provided.
   2. One media converter of each type provided
   3. Manufacturer's cables - one of each type installed.
   4. Five-10ft CAT 6 cables with connectors installed

PART 3 – EXECUTION

3.1 ESTABLISHING COMMUNICATIONS

A. The PCSS is responsible for establishing all Remote site communications, RIO communications, PLC to PLC communications, and PLC to HMI communications and all other network and communication systems shown on the Drawings. The PCSS is shall perform the following tasks in order to ensure this communications is achieved:
   1. Coordinating with contractor at beginning of project in order to determine which vendor packages are provided with PLCs. The PCSS shall submit the listing of these PLCs as part of their Hardware Submittal for review by the Engineer.
   2. Identifying any additional hardware or software required to ensure communications as part of the PCSS hardware submittal.
   3. During factory testing and field testing, the PCSS shall demonstrate communications to the Engineer. Burden of proof of communications is the transfer on 1 analog and 1 discrete register in both directions. The PCSS shall turn over all configuration files and programming to the AESS upon successful testing.
   4. Assistance during field testing by being on-site when AESS is testing communications with their software.

END OF SECTION



SECTION 13340
INSTRUMENTS

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. This Section covers the furnishing, installation, and services for instruments.

1.2 RELATED WORK

A. Refer to Section 13300 “I & C - General Provisions.”

1.3 SUBMITTALS

A. Submit complete documentation of all field instruments using ISA-TR20.00.01-2001 (updated in 2004-2006) data sheet formats. Submit a complete Bill of Materials (BOM) or Index that lists all instrumentation equipment. The list shall be sorted by Loop Number.

B. Submit separate data sheets for each instrument including:
1. Plant Equipment Number and ISA tag number per the Drawings.
2. Product (item) name used herein and on the Drawings.
3. Manufacturer's complete model number.
4. Location of the device.
5. Input - output characteristics.
6. Range, size, and graduations in engineering units.
7. Physical size with dimensions, enclosure NEMA classification and mounting details in sufficient detail to determine compliance with requirements.
8. Materials of construction for enclosure and wetted parts.
9. Instrument or control device sizing calculations where applicable.
10. Certified calibration data for all flow metering devices.
11. Two-wire or four-wire device type as applicable.

C. Submit catalog cuts for all instruments. Submit descriptive literature for each hardware component, which fully describes the units being provided.

D. Submit index and data sheets in electronic format as well as hard copies on 8-1/2" x 11" formats. Electronic format shall be in Microsoft Excel or Word. Submit electronic copy on CD-ROM or DVD disk.

1.4 MAINTENANCE

A. Refer to Section 13300.

1.5 INSTRUMENT TAGS

A. 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 and related sections. Equipment shall be tagged before shipping to the site.

B. Provide 1/8-in by 3/8-in, Type 316 stainless steel button head machine screws.

C. All supplied instrument transmitters and 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.

1.6 MANUFACTURERS' START-UP AND TRAINING SERVICES

A. If indicated in the individual instrumentation paragraphs, the instrument manufacturer or manufacturer's certified service representative shall provide start-up and training services. This work shall not be done by the PCSS or AESS contractor.

B. The start-up services shall be to calibrate, oversee the installations of the sensor, and start-up the sensor/transmitter in order to provide reliable measurement at the instrument and to a remote system. The vendor shall work with the PCSS and AESS to verify the transmitter sends correct information to the remote system (i.e., that the scaling and units are the same at the instrument and on the remote operator interface).

C. While the instrument manufacturer or manufacturer's certified service representative is starting up the instrumentation, training shall be provided to the Owner's instrumentation technicians. The training shall be in how to calibrate, install, troubleshoot, read the diagnostics, and maintain the sensor and transmitter.

PART 2 – PRODUCTS

2.1 MAGNETIC FLOWMETER

A. Flow Element
   1. Type:
      a. Pulsed DC type.
   2. Function/Performance:
      a. Operating Temperature: Process liquid temperatures of 0 to 140 degrees F or greater dependent upon liner and an ambient of minus 30 to 150 degrees F.
      b. Radio Frequency Interference (RFI) protection: RFI protection shall be provided as recommended by the manufacturer.
      c. Pressure rating: Equal to piping system where meter is installed.
      d. Additional: Meter shall be capable of running empty indefinitely without damage to any component.
   3. Physical:
      a. Flanges: ANSI 150 lb. or DIN PN 16 carbon steel, as required by the piping system, unless otherwise indicated.
      b. Liner: Polyurethane or composite elastomer unless otherwise indicated on the Drawings or in the Instrument Device Schedule.
      c. Electrodes: Type 316 stainless steel standard minimum requirements. All electrodes to be compatible with process fluid as indicated on the Drawings or electrodes to be supplied as listed in the Instrument Device Schedule.
      d. For sludge, polymer, or any slurry application where the electrodes will be coated, a self-cleaning or a removable electrode option must be provided with that meter.
      e. Housing: For meters with remote mounted transmitters, meters below grade shall be suitable for submergence for up to 48 hours to a depth of 30 ft. (9m). Meters above grade shall be NEMA

4X (IP65). Where hazardous areas are indicated on the Drawings, the equipment shall be rated for that area.

f. Finish: All external surfaces shall have a chemical and corrosion resistant finish.

4. Power Requirements:
   a. Meter shall be 24 VDC powered instrument, receiving its power from transmitter.
5. Accessories/Documentation Required:
   a. Factory calibration: All meters shall be factory calibrated. A copy of the calibration report shall be included in the O&M manual.
   b. Grounding: Meter shall be grounded in accordance with the manufacturer's recommendation. Provide ground ring, ground wires, gaskets, etc., as required. All materials shall be suitable for the liquid being measured and must be compatible with process fluid and with the process pipe.
   c. For meters with remote mounted transmitters, signal cable for installation between the flow tube and the transmitter. Length shall be as required by installation as indicated on the Drawings.

B. Flow Converter/Transmitter
1. Type:
   a. Micro-processor based, intelligent transmitter compatible with flow tube provided.
   b. Integral mount or mounted remote from the flow tube as shown on the drawings or as required by the physical location.
2. Functional/Performance:
   a. Accuracy (including flow tube): Plus/minus 0.5 percent of flow rate or better.
   b. Operating Temperature: –20 to 140 degrees F.
   c. 4-20mA and Ethernet/IP communication.
   d. Output: Isolated 4-20 mA with HART protocol. Current output adjustable over the full range of the instrument. Provide a dry contact to indicate reverse flow.
   e. Diagnostics: Self diagnostics with on screen display of faults.
   f. Display: Digital indicator displaying flow in engineering units indicated in the Instrument Device Schedule.
   g. Totalizer: A fully configurable totalizer integral to the transmitter. Totalized flow shall be displayed.
   h. Empty Tube Zero: The transmitter shall include a feature that will lock the output at zero when no flow is detected. The empty tube zero feature shall be enabled automatically when the transmitter detects no flow or manually through a contact input.
   i. Provide electrode cleaning unit to match flow element requirements.
3. Physical:
   a. Transmitter shall be suitable for surface or pipe stand mounting.
   b. Enclosure shall be NEMA 4X (IP65).
   c. Transmitter shall include protective screen cover to shield against solar damage.
4. Power Requirements:
   a. The transmitter shall be 120 VAC powered instrument.
5. Accessories/ Required:
   a. Keypad where required for transmitter configuration.
6. Manufacturer:
   a. Endress + Hauser Promag W 400 (EtherNet/IP)
   b. ABB Instruments WaterMaster.
   c. Rosemount Series 8705W Meter and 8732E Transmitter for remote mounted transmitter, or 8700M meter/transmitter for integral mounted. NOTE: Copy and paste instrument paragraphs you need from [Section 13341] through [section 13346] or refer back to listing in [13300] of listing of individual instrumentation specifications used on your project.

2.2 THERMAL DISPERSION MASS FLOWMETER

A. Flow Element
1. Type:
a. Thermal dispersion sensor with integral electronics enclosure.
b. In line with flow body type as indicated on the Drawings.
2. Function/Performance:
a. Flow Velocity Range: 200 ft/s (60.96 m/s) maximum.
b. Process Operating Temperature: -40-to-350-degree F.
c. Operating Temperature for Electronics: 0 to 140 degree F.
3. Physical:
a. Inline flow bodies to be flanged and fabricated of Type 316 stainless steel. Sensor to be factory mounted in the flow body. Flanges shall be compatible with flanges of the piping system where the meters are installed.
b. Wetted parts to be Type 316 stainless steel.
c. Electronics head to be NEMA 4X (IP65) for non-hazardous process gases and explosion proof approved for Class 1, Division 1, Groups C and D (EEx d IIC) for hazardous process gases or where located in a hazardous area.
4. Power Requirements:
a. Transducer shall receive its power from the remote transmitter
5. Accessories Required:
a. Cable as supplied or recommended by the manufacturer for connection of sensor to transmitter. Length as required by installation indicated on the Drawings.
b. For insertion type flow elements a hot tap assembly including a ball valve and packing gland that will allow removal of the sensor without shutdown of the process, shall be provided. The hot tap assembly shall be installed in a welded fitting on the pipe.

B. Transmitter
1. Type:
a. Remotely mounted micro-processor based, intelligent transmitter compatible with flow element provided.
2. Function/Performance:
a. Accuracy (including flow element): ±1.5 percent of reading, +0.5 percent of full scale.
b. Repeatability (including flow element): ±0.5 percent of reading.
c. Turn Down: 100:1 within specified flow range.
d. Operating Temperature: 0 to 140 degrees F.
e. Output: One isolated 4-20 mA output and two alarm contacts rated 2 A at 230 VAC, adjustable over the full instrument range.
f. Diagnostics: On screen instructions and display of self-diagnostics.
g. Totalizer: A fully configurable totalizer integral to the transmitter. Totalized flow shall be displayed.
h. Display: Digital indicator displaying flow in engineering units indicated on the Drawings or in the Instrument Device Schedule.

C. Physical:
1. Transmitter shall be suitable for surface mounting.
2. Enclosure shall be NEMA 4X (IP65) when installed in non-hazardous areas and explosion proof approved for Class 1, Division 1, Groups C and D (EEx d IIC) when installed in hazardous areas.

D. Power Requirements:

1. Transmitter shall be 120 VAC powered instrument. Power supply for the instrument shall be from the PLC.

E. Manufacturer(s):
1. Fluid Components International ST80L.
2. approved equal.

2.3 VANE ACTUATED FLOW SWITCH

A. Type:
1. Vane or disc actuated flow switch.
2. Switch magnetically linked to vane or disc actuated mechanism.

B. Function/Performance:
1. Output: Form 2C (DPDT) snap action, hermetically sealed switch, rated for 10 amps, 125/250 volts AC.

C. Physical:
1. Switches for pipe sizes of 3/4 to 1-1/2 inches (19 to 40 mm) shall be provided with a flow body. Switches for pipe sizes greater than 1-1/2 inches (40 mm) shall be for installation directly in the field piping.
2. Flow body and all wetted parts shall be Type 316 stainless steel.
3. Switch housing shall be NEMA 4X (IP65) and where installed in hazardous areas, shall be approved for Class I, Division 1, Groups C and D (EEx d IIC T6).

D. Manufacturer(s):
1. Magnetrol F50 and F10.
2. Dwyer Series V4
3. Equal.

2.4 ULTRASONIC LEVEL/DIFFERENTIAL LEVEL METER

A. Transducer
1. Type
   a. Non-contact, ultrasonic level transducer.
2. Function/Performance
   a. Measuring Range: Transducer range shall be suitable for the installation indicated on the Drawings, up to 50 ft. (15m).
   b. Temperature Range: –20 to 60 degrees C.
   c. Relative Humidity: Zero to 100 percent.
   d. Temperature Compensation: Transducers shall be provided with integral temperature sensors for temperature compensation at above temperature ranges.
3. Physical
   a. Transducers shall be potted/encapsulated in a Kynar or other chemical and corrosion-resistant housing. Where indicated on the Drawings, transducers shall be approved for installation in Class I, Division 1, Groups C and D (Zone 0) environments.
   b. The surface of transducers shall be Teflon-coated where mounted on chemical tanks and exposed to vapors in the tanks that are not compatible with the transducer material.
   c. Transducers shall be capable of being completely submerged without damage.
   d. Transducers shall be suitable for surface, pipe, or flange mounting as indicated on the Drawings or Instrument Device Schedule. Appropriate mounting hardwired shall be provided. Flanges shall be six inch (150 mm) and resistant to attack by the medium being metered or, where required, shall be protected by corrosion- resistant coatings and facings.

4. Options/Accessories Required
   a. Transducers located in areas where freezing condensation may occur shall be provided with special heaters or other type of transducer protection designed to prevent sensor icing.
   b. Signal cable as recommended by the manufacturer, for installation between the transducer(s) and the transmitter. Length, up to 1000 feet (300 m), shall be as required by installation indicated on the Drawings.
5. Manufacturer(s)
   a. Siemens XPS-10
   b. Endress+Hauser Prosonic
   c. Or Equal.

B. Transmitter/Converter
1. Type
   a. Microprocessor based compatible with the transducer(s) provided.
2. Functional/Performance
   a. Resolution (including transducer): Plus or minus 0.1 percent of range or 0.08 inches (2 mm), whichever is greater.
   b. Accuracy (including transducer): Plus or minus 0.25 percent of range or 0.24 inches (6 mm).
   c. Range: As required by the installation indicated on the Drawings.
   d. Temperature Range: -20 to 50 degrees C.
   e. Output: Minimum one isolated 4-20 mA output and minimum four alarm contacts (number of contacts above 4 required of each device to be determined by signals required as shown on the drawings adjustable to trip at any point in the instrument range. Output contacts shall be rated 5 A at 230 VAC.
   f. Temperature Compensation: Compensation over the temperature range of the sensor.
   g. Display: Digital indicator displaying level/differential level or volume in engineering units or percent as indicated on the Drawings or in the Instrument Device Schedule.
   h. Diagnostics: On-screen instructions and display of self-diagnostics.
   i. Loss of Signal: Transmitter shall ignore momentary loss-of-echo signals and shall indicate loss of echo on the transmitter unit.
   j. Configuration Protection: Programmable parameters shall be protected using E2PROM. Battery backup protection is not acceptable.
3. Physical
   a. Transmitter shall be suitable for surface or pipe stand mounting.
   b. Enclosure shall be NEMA 4X (IP65).
   c. A/C power will be as specified in Section 13300.
4. Accessories Required
   a. Hand-held programmer where required for configuration and calibration of the instrument.
5. Manufacturer(s)
   a. Siemens Echomax Transducers and HydroRanger/MultiRanger 200.
   b. Endress & Hauser Micropilot FMU series Transducers and Prosonics FMA90
   c. Equal.

2.5 LEVEL SWITCHES (FLOATS)

A. Type
1. Mercury free ball float switch.

B. Function/Performance
1. Differential: Less than 8 inch.

2. Switch Rating: 1 amps at 120 VAC or 100 VA @ 120 VAC
3. Provide NO or NC type contact for fail-safe operation per Section 13300, Paragraph 2.01.F or as shown on the Drawings.

C. Physical
1. Float: Type 316 stainless steel, Teflon or non-stick coating, minimum 5 in diameter.
2. Totally encapsulated switch.
3. Cable shall be heavy-duty, PVC or equivalent jacketed integral to float.
4. Provide stainless cable hanger for proper installation

D. Options/Accessories Required
1. Provide stainless steel hardware.
2. Lead wire shall be a waterproof cable of sufficient length so that no splice or junction box is required in the vault.
3. Provide cast-aluminum weatherproof junction box outside the sump pit with terminals for all floats and tapped as required for conduit connections.

E. Manufacturer(s)
1. Siemens Water Technologies Model 9G-EF.
2. Contegra FS 90
3. Or equal.

2.6 FLOOD LEVEL SWITCH

A. Type: Float operated, liquid level control for floor level sumps or troughs. Single snap-action dry contact switch mechanism.

B. Performance Requirements:
1. Single-Pole Double-Throw contact rated @120VAC.
2. 3/4" level differential for off-on control/alarm.

C. Construction Features:
1. NEMA 4X, 6, 7/9 cast aluminum submersible enclosure.
2. +250°F maximum ambient temperature.

D. Manufacturers:
1. Magnetrol Model FLS.
2. Or equal.

2.7 PROCESS TAPS, SENSING LINES, AND ACCESSORIES

A. Water Pressure Sensing Lines and Accessories for Flow and Pressure Transmitters:
1. Material: Copper Water Tube, ASTM B-88, Type L, drawn temper or annealed.
2. Pressure Rating: 150 psi.
3. Size: 1/2-inch O.D. for water.
4. Connections: Brass Compression Type, "Swagelok" by Crawford, or equal.
5. Shut-off Valves:
   a. Type: Ball.
   b. Pressure Rating: 150 psi.
   c. Body, Ball and Stern: Brass.

d. Packing: High Density TFE.
e. Handle: Nylon with metal travel stops.
f. Support Rings: TFE coated brass.
g. End Connections: Removable "Swagelok", or equal.
h. Model: Whitey 45 Series for water, or equal.

6. Manifolds:
   a. Type: 5-valve and 3-valve meter manifolds.
   b. Materials: Type 316 stainless steel body, bonnets and stems; delrin seats; teflon packing.
   c. Products and Manufacturers: Provide one of the following:
      i. Anderson-Greenwood.
      ii. Or equal.

B. Air Pressure Sensing Lines and Accessories for Air Flow/Pressure Transmitters:
1. Material: Type 316 stainless steel tubing, ASTM A269, medium wall thickness.
2. Pressure Rating: 150 psi.
3. Size: 3/8-inch O.D. for air.
4. Connections: Type 316 stainless steel compression type, “Swagelok" by Crawford or equal.
5. Shut-off Valves:
   a. Type: Ball.
   b. Pressure Rating: 150 psi.
   c. Body, Ball and Stem: Type 316 stainless steel.
   d. Packing: High density TFE.
   e. Handle: Nylon with metal travel stops.
   f. Support Rings: TFE coated Type 316 stainless steel.
   g. End Connections: Removable "Swagelok", or equal.
   h. Products and Manufacturers: Provide one of the following:
      i. 43 Series, as manufactured by Whitey.
      ii. Or equal.
6. Manifolds:
   a. Type: 5-valve and 3-valve meter manifolds.
   b. Materials: Type 316 stainless steel body, bonnets and stems; delrin seats; Teflon packing.
   c. Products and Manufacturers: Provide one of the following:
      i. Anderson-Greenwood.
      ii. Or equal.

C. Pressure Tap Sensing Lines and Accessories for Pressure Gauges and Pressure Switches:
1. For Process Sensing Taps in Ductile Iron, Steel and Stainless Steel Piping Systems:
   a. Material and Fittings: Type 304 stainless steel pipe (ASTM A 312) and threaded fittings and adapters (ASTM A 403).
   b. Sizes: 1/2-inch minimum for main sensing piping and 1/4-inch gauge and switch connections.
   c. Pressure Rating: Equal to or greater than the applicable system test pressure as specified in the Piping Schedule in Section 15600.
   d. Accessories:
      i. For applications not requiring diaphragm seals, provide separate 1/2-inch Type 316 stainless steel threaded ball valve for each gauge and switch.
      ii. For applications requiring diaphragm seals, provide a separate 1/2- inch threaded Type 316 stainless steel ball valve for seal process side shutoff.
2. For Process Sensing Taps in Copper and Thermoplastic Piping Systems:
   a. Pipe Material and Fittings: Use same type of pipe material and fittings as that used in the process piping system. PVC pipe and fittings shall be provided in accordance with the requirements of

Section 15600, Plant Piping.

b. Sizes: 1/2-inch minimum for main process sensing piping and 1/4-inch for gauge and switch connections.

c. Pressure Rating: Equal to or greater than the applicable system test pressure as specified in Section 15600, Plant Piping.

d. Accessories:

i. For copper piping system taps with or without seals, provide a separate 1/2-inch minimum threaded brass or bronze ball valve for each gauge and switch.

ii. For PVC piping systems with or without diaphragm seals, provide a separate 1/2-inch threaded ball valve for process sensing line shutoff.

2.8 PRESSURE GAUGES

A. Type: Bourdon Tube Pressure Element Type, Liquid Filled Gauge (for pressure ranges of 15 psi and greater and vacuum ranges to 30-inches Hg):

B. Performance Requirements:

1. Range: As specified in the Instrument Index.
2. Accuracy: ±0.5 percent of span (ANSI B40.1 Grade 2A).

C. Construction Features:

1. Case:
   a. Solid front design constructed of glass filled polyester.
   b. Color: Black.
2. Size: 4-1/2-inch.
3. Ring: Threaded, glass filled polyester.
4. Window: Glass.
5. Dial: White with black markings.
6. Filling Liquid: See Article 1.8.
7. Overpressure protection: Full blowout back.
8. Bourdon Tube and Socket:
   a. Type 316 stainless steel.
   b. Heliarc welded, unless otherwise specified.
9. Movement:
   a. Type 300 series stainless steel.
   b. Rotary geared with Teflon S coating, or cam and roller type.
   c. Built-in overload and underload movement stops.
10. Connection: 1/4-inch male NPT, bottom.
11. Mounting: Stem Mount.
12. Calibration:
    a. Adjustable pointer.
    b. Externally accessible zero adjustment.

D. Accessories:

1. Pressure Snubber: Sintered stainless steel snubber threaded into gauge socket or in external stainless steel housing with 1/4-inch NPT male and female connections.
2. Process Isolation: Provide ball valves for process isolation in accordance with the requirements of Article 2.1, above.
3. Process Isolation: Wetted parts that might come in contact with sewage, sludge, or any other wastewater shall have a stainless steel diaphragm or be provided an isolation ring to prevent corrosion and damage to

the gauge's internals.

E. Products and Manufacturers: Provide one of the following:
1. Ashcroft, Duragage 1279 Series.
2. Helicoid, Series 900.
3. Wika EN 837.
4. Or equal.

2.9 PRESSURE INDICATING TRANSMITTER

1. Type:
   a. Microprocessor based, intelligent type.

2. Function/Performance:
   a. Range: Range of the transmitter shall be the standard range of the manufacturer closest to the pressure range to be metered.
   b. Accuracy: 0.075 percent of span.
   c. Operating Temperature: -20 to 80 degrees C.
   d. Temperature Effect: Combined temperature effects shall be less than 0.2 percent of maximum span per 28 degrees C temperature change.
   e. Output: 4-20 mA DC linear with pressure or level, with HART protocol. Zero adjustable over the range of the instrument provided calibrated span is greater than the minimum calibrated span.
   f. Stability: 0.05 percent of upper range limit for 1 year.
   g. Display: Digital indicator displaying pressure or level in the engineering units indicated in the Instrument Device Schedule.
   h. Diagnostics:
      i. Self-diagnostics with transmitter failure driving output to above or below out of range limits.
      ii. Simulation capability for inputs and loop outputs.
      iii. Test terminals available to ease connection for test equipment without opening the loop.
      iv. Registers to record minimum and maximum pressure and temperatures transmitter has been exposed to shall be available.
      v. Run-time clock available to determine usage for warranty purposes. 5-year warranty on this clock reading is included.
      vi. Over Range Protection: Provide positive over range protection to 150 percent of the maximum pressure of the system being monitored by the instrument.
   i. If required to meet the range or suppression/elevation requirements, a differential pressure transmitter shall be provided.

3. Physical:
   a. Enclosure: NEMA 4X (IP66), explosion proof, approved for Class I, Division 1, Groups C and D (EEx d IIC T5).
   b. Process Wetted Parts: Isolating diaphragm and other wetted metal parts shall be Type 316L stainless steel, unless otherwise indicated in the device schedule. Gaskets and O rings shall be Teflon.
   c. Power Supply: 24 VDC loop power.
   d. Sensor Fill Fluid: Silicone.

4. Accessories Required:
    a. Provide span and zero adjustment at each transmitter and through the handheld programming unit.
        i. Configuration of the transmitter may be accomplished using the local display and pushbuttons without the use of an external programming device.
    b. For each transmitter provide a Type 316 stainless steel block & bleed shut off valve. Valves may be mounted directly to the instrument or separately mounted. Valves shall be by the instrument manufacturer or by D/A Manufacturing or Anderson Greenwood.

5. Manufacturer(s):
    a. Rosemount 3051TG Series.
    b. Siemens Sitrans P
    c. Foxboro IAP05S.
    d. Pre-approved equal.

2.10 PRESSURE SWITCH

A. Type:
    1. Diaphragm actuated, dual-setpoint.

B. Function/Performance:
    1. Repeatability: Better than 1 percent of full scale.
    2. Setpoints: Field adjustable dual setpoints, capable of being set anywhere within adjustable range.
    3. Dead Band: Fixed unless adjustable dead band requirement is noted in the Instrument Device Schedule.
    4. Reset: Unit shall be of the automatic reset type unless noted otherwise in the Instrument Device Schedule.
    5. Over Range Protection: Over range protection to 150 percent of the maximum process line pressure.
    6. Output: Dual single pole double throw (SPDT) or dual double pole double throw (DPDT) switches as shown on the instrument device schedule. Switch rating shall be min 10 A at 230 VAC.

C. Physical:
    1. Housing: NEMA 4X (IP65) for non-hazardous areas. For installation in hazardous areas, housing shall be explosion proof approved for Class 1, Division 1, Groups C and D (EEx d IIB).
    2. Switch Assemblies: Hermetically sealed switches.
    3. Wetted Parts: Type 316L stainless steel diaphragm, viton seals, Type 316 stainless steel connection port.

D. Accessories/Options Required:
    1. Shutoff Valve: Provide a Type 316 stainless steel shutoff valve. Valve shall be by D/A Manufacturing, Anderson Greenwood, or Equal.
    2. Where indicate on the instrument device schedule, provide a Type 316 stainless steel snubber for pulsation dampening.

E. Manufacturer(s):
    1. Ashcroft
    2. DwyerOmega
    3. Wika
    4. Pre-approved equal.

2.11 DO/MLSS SENSOR

A. Dissolved Oxygen Sensor
1. Type
a. Polymetron amperometric sensor and cable.

2. Function/Performance
a. Measurement range
i. 0 to 2,000 ppb DO
b. Repeatability
i. ± 0.5 ppb or ± 5%, whichever is greater
c. Sensitivity
i. < 0.5 ppb
d. Detection Limit
i. <1 ppb
e. Temperature range
i. 0–45 °C (32–113 °F)
f. Temperature accuracy
i. ± 0.5 °C
g. Temperature repeatability
i. ±0.2 °C
3. Environmental Requirements
a. Operating Temperature: -4.0 to 140.0 °F (-20.0 to 60.0 °C)
b. Storage Temperature: 32 to 140 °F (0 to 60°C)
c. Relative humidity: 10 to 95%, non-condensing
4. Physical
a. Sensor consists of a sensor contained in stainless steel or PVC, depending on model, with a silicon wiper blade and integral cable.
b. 10-meter integral cable.
5. Options/Accessories Required
a. Compatibility with Hach Model sc4500 controllers.
6. Manufacturer(s)
a. Hach Model LDO Dissolved Oxygen Sensor

B. Mixed Liquor Suspended Solid Sensor
1. Type
a. Probe with a dual-beam infrared/scattered light photometer. Infrared Duo scattered light technique for color-independent turbidity measurement. Turbidity in accordance with DIN EN ISO 7027 / TSS equivalent DIN 38414
2. Function/Performance
a. Measurement range
i. Turbidity: 0.001 to 4000 NTU
ii. Suspended solids: 0.001 to 5000.0 mg/L or 0.001 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)
b. Accuracy
i. Turbidity: Less than 1% of reading or ±0.001 NTU, whichever is greater
ii. Suspended solids: Less than 5% of reading (depends on homogeneity of municipal activated sludge)
c. Repeatability
i. Turbidity: Less than 1% of reading

ii. Suspended solids: Less than 3% of reading (depends on homogeneity of municipal activated sludge)
d. Detection limit
i. Turbidity: 0.001 NTU
ii. Suspended solids: 0.001 mg/L
e. Response time: Initial response 1 second
f. Signal Averaging Time: User selectable ranging from 1 to 300 seconds
g. Units of measure:
i. Turbidity: User Selectable NTU, FNU, EBC, FTU and TE/F
ii. Suspended Solids: User Selectable g/L, mg/L, ppm, or % solids
3. Environmental Requirements
a. Sample flow velocity: 3 m/s (9.8 ft./s) maximum
b. Sample pressure: 6 bar (87 psi) maximum
c. Sample temperature: 0 to 40 degrees C
d. Operating temperature: 0 to 40 degrees C
4. Physical
a. Sensor consists of a sensor contained in stainless steel or PVC, depending on model, with a silicon wiper blade and integral cable.10-meter integral cable.
5. Options/Accessories Required
a. Compatibility with Hach Model sc4500 controllers.
6. Manufacturer(s)
a. Hach Solitax Series

2.12 DO/MLSS ANALYZER

A. Probe/Sensor Controller
1. Type:
a. Microprocessor-based sensor controller that works with digital sensors.
b. The controller accepts up to eight (8) sensor inputs.
2. Functional/Performance:
a. The controller is equipped with a real-time clock.
b. The controller is equipped with two security levels.
c. The controller is equipped with a data logger that can output to a storage card or directly to a computer hard drive.
d. The controller can be equipped with an SD card reader for data download and controller software upload.
e. The controller can have software updated through a direct network connection
f. Four electromechanical, UL rated, SPDT relays (Form C) can be installed for user-configurable contacts rated 100 to 250 Vac, 5 Amp at 30 VDC resistive maximum.
g. The following can be programmed:
h. The controller can be equipped with up to twelve 0/4-20mA outputs with a maximum impedance of 500 ohms per probe module.
i. The probe module can be equipped with the following forms of communication:
i. Ethernet
3. Physical:
a. Controller enclosure shall be IP65 rated. The controller shall be installed in a NEMA 4X enclosure with a view window and Shade Aide attachment for UV protection. The Shade Aide shall be sized accordingly in respect to the view window.
4. Environmental Requirements
a. Operational Criteria

i. Operating temperature: -4 to 131 °F (-20 to 55°C)
ii. Storage Temperature: -4 to 158 °F (-20 to 70°C)
iii. Humidity Requirements: 0 to 95% relative humidity, non-condensing

5. Power Requirements:
   a. The transmitter shall be 120 VAC powered instrument.
6. Manufacturer:
   a. Hach Model SC4500 Controller

2.13 SOLENOID VALVES

A. Solenoid valves shall be electrically operated, have a 304 stainless steel body and bonnet, ¾" NPT connection (modify per vendor supplied equipment package), and packless construction, without packing box or sliding seal.

B. Solenoid coils shall be either 24 VDC or 120 VAC dependent on control wiring characteristics, normally closed, encapsulated, Class H, for continuous duty at rated voltage and 40 degrees Celsius ambient in a NEMA 4 enclosure.

C. Solenoid valves shall be ASCO Redhat General Service 8210 series valves. Coordinate with manufacturer or vendor packaged system on size and type of valve needed. Provide manual bypass valves and piping for all solenoid valves installed.

2.14 SPARE PARTS AND ACCESSORIES

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

B. Furnish following field Instrument related Spare Parts:
1. One flow indicating transmitter for each type of flow element provided.
2. One level indicating transmitter for each type of level element provided.
3. One temperature transmitter for each type provided.
4. One pressure transmitter for each type provided.
5. One spare ultrasonic level switch for each type provided.
6. One spare float type level switch for each type provided.
7. One spare gas detection system sample pump module for each type provided.
8. Miscellaneous: One year supply of items recommended by the manufacturer of the equipment including all reagents, pH probes, batteries, chart paper, calibration standards as needed to operate and maintain the furnished equipment.

C. Furnish following Accessories:
1. All mounting hardware required for pipe stand, surface, or other mounting.
2. Each instrument shall be provided with a manufacturer installed stainless steel tag identifying the instrument tag number.

PART 3 – EXECUTION

3.1 GENERAL

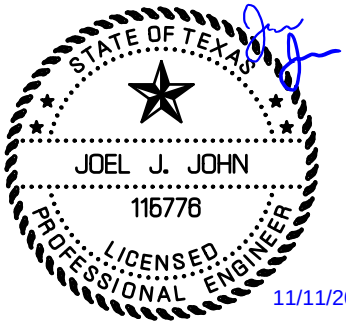
A. See execution requirements in Section 13300.

B. Unless specifically indicated, direct reading or electrical transmitting instrumentation shall not be mounted on process piping. Instrumentation shall be mounted on instrument racks or stands. All instrumentation connections shall be provided with shutoff and drain valves. For differential pressure transmitters, 5-valve manifolds for

calibration, testing and blow down service shall also be provided. For chemical or corrosive fluids, diaphragm seals with flushing connections shall be provided.

END OF SECTION

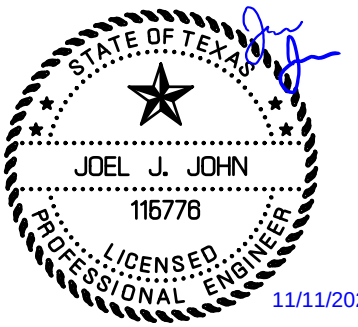
WILBARGER WWTP Expansion to 1.5 MGD - Instrumentation List							
Tag No.	**Description**	**Type**	**P&ID Sheet Ref.**	**Range/Setpoint**	**Units**	**Spec. Reference**	**Provider**
HEADWORKS							
LIT-03-301	MCS-03-301 Differential Level	Transducer Transmitter	3-I-1	0-36	in.	11221	Vendor
LE-03-301	MCS-03-301 Upstream Level	Ultrasonic Transducer	3-I-1	0-72	in.		
LE-03-302	MCS-03-301 Downstream Level	Ultrasonic Transducer	3-I-1	0-72	in.		
LSH-03-301	MCS-03-301 High Level Alarm	Level Switch	3-I-1	Refer to Drawings	N/A	13340	Contractor
PEAK SHAVING BASIN							
PI-04-001	Peak Shaving Basin Air Header Pressure	Pressure Gauge	4-I-1	0-15	psig	13340	Contractor
AERATION BASIN							
FIT-05-301	Aeration Basin No. 3 Air Lift Flow No. 1	Thermal Mass Flow Meter	5-I-1	0-250	scfm	13340	Contractor
FIT-05-302	Aeration Basin No. 3 Air Lift Flow No. 2	Thermal Mass Flow Meter	5-I-1	0-250	scfm		
AIT-05-101	Aeration Basin No. 1 Analytic Transmitter	Analytic Transmitter	5-I-1		-		
AE-05-101	Aeration Basin No.1 Dissolved Oxygen Probe	Analytic Element	5-I-1	0-15	mg/L		
AE-05-102	Aeration Basin No.1 Mixed Liquor Suspended Solids Probe	Analytic Element	5-I-1	0-50000	mg/L		
AIT-05-201	Aeration Basin No. 2 Analytic Transmitter	Analytic Transmitter	5-I-1		-		
AE-05-201	Aeration Basin No.1 Dissolved Oxygen Probe	Analytic Element	5-I-1	0-15	mg/L		
AE-05-202	Aeration Basin No.1 Mixed Liquor Suspended Solids Probe	Analytic Element	5-I-1	0-50000	mg/L		
AIT-05-301	Aeration Basin No. 3 Analytic Transmitter	Analytic Transmitter	5-I-1		-		
AE-05-301	Aeration Basin No.1 Dissolved Oxygen Probe	Analytic Element	5-I-1	0-15	mg/L		
AE-05-302	Aeration Basin No.1 Mixed Liquor Suspended Solids Probe	Analytic Element	5-I-1	0-50000	mg/L		
PI-05-301	Aeration Basin No. 3 Pressure Gauge No. 1	Pressure Gauge	5-I-1	0-15	psig		
PI-05-302	Aeration Basin No. 3 Pressure Gauge No. 2	Pressure Gauge	5-I-1	0-15	psig		
PI-05-303	Aeration Basin No. 3 Pressure Gauge No. 3	Pressure Gauge	5-I-1	0-15	psig		
BLOWER							
PI-09-601	MSB-09-601 Suction Pressure Gauge	Differential Pressure Gauge	9-I-1	0-25	inH20	13340	Contractor
PI-09-602	MSB-09-601 Discharge Pressure Gauge	Pressure Gauge	9-I-1	0-15	psig		
PSL-09-003	Blower Header Low Pressure No. 3	Pressure Switch	9-I-1	5	psig		
NPW SYSTEM							
PIT-10-001	NPW System Pressure	Pressure Transmitter	10-I-1	0-150	psig	13340	Contractor
FIT-10-001	NPW System Flow	Flow Transmitter: Provide Sun Shield Cover	10-I-1	Existing	Existing	13340	Contractor to supply a sun shield cover for transmitter display
SODIUM HYPOCHLORITE SYSTEM							
LE-11A-101	Sodium Hypochlorite Tank No. 1 Level	Ultrasonic Transducer	11A-I-1		ft-in	13340	Contractor
LIT-11A-101	Sodium Hypochlorite Tank No. 1 Level Transmitter	Transducer Transmitter	11A-I-1		ft-in		Contractor
LE-11A-201	Sodium Hypochlorite Tank No. 2 Level	Ultrasonic Transducer	11A-I-1		ft-in	13340	Contractor
LIT-11A-201	Sodium Hypochlorite Tank No. 2 Level Transmitter	Transducer Transmitter	11A-I-1		ft-in		Contractor
PI-11A-101	PSP-11A-101 Pressure Gauge	Pressure Gauge	11A-I-1		psig	13340	Contractor
PI-11A-201	PSP-11A-201 Pressure Gauge	Pressure Gauge	11A-I-1		psig	13340	Contractor
PSH-11A-101	PSP-11A-101 High Pressure	Pressure Switch	11A-I-1		psig	13340	Contractor
PSH-11A-201	PSP-11A-201 High Pressure	Pressure Switch	11A-I-1		psig		Contractor
FS-11A-001	Emergency Eyewash Station (EWS-11A-001) Flow Confirmation	Flow Switch	11A-I-1		-	15413	Vendor
LSL-11A-001	Sodium Hypochlorite Leak Detected Level Switch	Level Switch	11A-I-1		-	13340	Contractor
SODIUM BISULFITE SYSTEM							
LE-11B-101	Sodium Bisulfite Tank No. 1 Level	Ultrasonic Transducer	11A-I-1		ft-in	13340	Contractor
LIT-11B-101	Sodium Bisulfite Tank No. 1 Level Transmitter	Transducer Transmitter	11A-I-1		ft-in		Contractor
LE-11B-201	Sodium Bisulfite Tank No. 2 Level	Ultrasonic Transducer	11A-I-1		ft-in	13340	Contractor
LIT-11B-201	Sodium Bisulfite Tank No. 2 Level Transmitter	Transducer Transmitter	11A-I-1		ft-in		Contractor
PI-11B-101	PSP-11B-101 Pressure Gauge	Pressure Gauge	11B-I-1		psig	13340	Contractor
PI-11B-201	PSP-11B-201 Pressure Gauge	Pressure Gauge	11B-I-1		psig	13340	Contractor
PSH-11B-101	PSP-11B-101 High Pressure	Pressure Switch	11B-I-1		psig	13340	Contractor
PSH-11B-102	PSP-11B-201 High Pressure	Pressure Switch	11B-I-1		psig		Contractor
FS-11B-001	Emergency Eyewash Station (EWS-11B-001) Flow Confirmation	Flow Switch	11B-I-1		-	15413	Vendor
LSL-11B-001	Sodium Bisulfite Leak Detected Level Switch	Level Switch	11B-I-1		-	13340	Contractor
ALUM SYSTEM							
LE-11C-101	Alum Tank No. 1 Level	Ultrasonic Transducer	11C-I-1		ft-in	13340	Contractor
LIT-11C-101	Alum Tank No. 1 Level Transmitter	Transducer Transmitter	11C-I-1		ft-in	13340	Contractor
LE-11C-201	Alum Tank No. 2 Level	Ultrasonic Transducer	11C-I-1		ft-in	13340	Contractor
LIT-11C-201	Alum Tank No. 2 Level Transmitter	Transducer Transmitter	11C-I-1		ft-in	13340	Contractor
LE-11C-301	Alum Tank No. 3 Level	Ultrasonic Transducer	11C-I-1		ft-in	13340	Contractor
LIT-11C-301	Alum Tank No. 3 Level Transmitter	Transducer Transmitter	11C-I-1		ft-in	13340	Contractor
PI-11C-101	PSP-11C-101 Pressure Gauge	Pressure Gauge	11C-I-1		psig		Contractor
PSH-11C-101	PSP-11C-101 High Pressure	Pressure Switch	11C-I-1		psig	13340	Contractor
PI-11C-201	PSP-11C-201 Pressure Gauge	Pressure Gauge	11C-I-1		psig	13340	Contractor
PSH-11C-201	PSP-11C-201 High Pressure	Pressure Switch	11C-I-1		psig	13340	Contractor
PI-11C-301	PSP-11C-301 Pressure Gauge	Pressure Gauge	11C-I-1		psig	13340	Contractor
PSH-11C-301	PSP-11C-301 High Pressure	Pressure Switch	11C-I-1		psig	13340	Contractor
FS-11C-101	Emergency Eyewash Station (EWS-11C-101) Flow Confirmation	Flow Switch	11C-I-1		-	15413	Vendor
FS-11C-201	Emergency Eyewash Station (EWS-11C-201) Flow Confirmation	Flow Switch	11C-I-1		-		Vendor
LSL-11C-001	Alum Feed Leak Detected Level Switch	Level Switch	11C-I-1		-	13340	Contractor
LSL-11C-002	Alum Feed Leak Detected Level Switch	Level Switch	11C-I-1		-		Contractor
SLUDGE HOLDING TANK							
FIT-13-301	Sludge Holding Tank No. 3 WAS Flow No. 1	Thermal Mass Flow Meter	13-I-1	0-250	scfm	13340	Contractor
FIT-13-302	Sludge Holding Tank No. 3 WAS Flow No. 2	Thermal Mass Flow Meter	13-I-1	0-250	scfm		
SV-13-301	Train No. 3 WAS Air Lift Solenoid Valve	Solenoid Valve	13-I-1	N/A	-		
LSL-13-001	Sludge Holding Tank Low Level Alarm	Level Switch	13-I-1	Refer to Drawings	-		
LSL-13-002	Sludge Holding Tank Low Level Alarm	Level Switch	13-I-1		-		



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DEWATERING PRESS FEED PUMP							
FIT-14A-101	WAS Flow	Flow Transmitter	14A-I-1		gpm	13340	Vendor
PI-14A-101	DDP-14A-101 Pressure Gauge	Pressure Gauge	14A-I-1	0-100	psig	13340	Contractor
PI-14A-201	DDP-14A-201 Pressure Gauge	Pressure Gauge	14A-I-1	0-100	psig		
VSH-14A-101	DDP-14A-101 High Vacuum	Vacuum Switch	14A-I-1		psia		
VSH-14A-201	DDP-14A-201 High Vacuum	Vacuum Switch	14A-I-1		psia		
PSL-14A-101	DDP-14A-101 Low Pressure Alarm	Pressure Switch	14A-I-1		psig		
PSL-14A-201	DDP-14A-201 Low Pressure Alarm	Pressure Switch	14A-I-1		psig		
PSH-14A-101	DDP-14A-101 High Pressure Alarm	Pressure Switch	14A-I-1		psig		
PSH-14A-201	DDP-14A-201 High Pressure Alarm	Pressure Switch	14A-I-1		psig		
DPI-14-001	SFAN-14-001 Differentital Pressure Transmitter	Differential Pressure Transmitter			psig	15831	Exhaust Fan Vendor PCSS shall supply required tubing between fan and vendor DP instrumen
DPI-14-002	SFAN-14-002 Differentital Pressure Transmitter	Differential Pressure Transmitter			psig	15831	Exhaust Fan Vendor PCSS shall supply required tubing between fan and vendor DP instrumen
DPI-14-003	SFAN-14-003 Differentital Pressure Transmitter	Differential Pressure Transmitter			psig	15831	Exhaust Fan Vendor PCSS shall supply required tubing between fan and vendor DP instrumen
DPI-14-004	SFAN-14-004 Differentital Pressure Transmitter	Differential Pressure Transmitter			psig	15831	Exhaust Fan Vendor PCSS shall supply required tubing between fan and vendor DP instrumen
DEWATERING NPW BOOSTER PUMPS							
PI-14B-001	NPW System Pressure Gauge	Pressure Gauge	14B-I-1	0-100	psig	13340	Contractor
PI-14B-101	VMP-14B-101 Pressure Gauge	Pressure Gauge	14B-I-1	0-100	psig		
PI-14B-201	VMP-14B-201 Pressure Gauge	Pressure Gauge	14B-I-1	0-100	psig		
PS-14B-101	VMP-14B-101 Low/High Pressure Alarm	Pressure Switch	14B-I-1		psig		
PS-14B-201	VMP-14B-201 Low/High Pressure Alarm	Pressure Switch	14B-I-1		psig		
POLYMER SYSTEM							
PI-14C-101	NPW System Pressure Gauge	Pressure Gauge	14C-I-1	0-100	psig	13340	Contractor
VOLUTE PRESS							
SV-14D-101	Washwater Solenoid Valve No. 1	Solenoid Valve	14D-I-1	N/A	-	-	Vendor
SV-14D-102	Washwater Solenoid Valve No. 2	Solenoid Valve	14D-I-1	N/A	-	-	
SV-14D-104	Washwater Solenoid Valve No. 3	Solenoid Valve	14D-I-1	N/A	-	-	
SV-14D-105	Washwater Solenoid Valve No. 4	Solenoid Valve	14D-I-1	N/A	-	-	
SV-14D-106	Washwater Solenoid Valve No. 5	Solenoid Valve	14D-I-1	N/A	-	-	
LIT-14D-101	Flocculation Tank Level Transmitter	Level Transmitter	14D-I-1		ft-in	13340	Contractor
LSH-14D-101	Flocculation Tank High Level Alarm	Level Switch	14D-I-1		ft-in	13340	Contractor
FIRE RESPONSE SYSTEM							
LI-15-001	Fire Tank Altitude Gauge	Level Gauge	N/A	0-14.25	ft	Div 11.	Vendor



SECTION 13441
PROCESS CONTROL NARRATIVES

PART 1 - GENERAL

1.1 SCOPE

This section includes process control narratives including all functions, interlocks, and required alarms, for all proposed equipment, components, and controls at the facility.

1.2 RELATED WORK

A. Division 1 – General Requirements.

B. Division 15 - Mechanical.

C. Division 16 - Electrical.

1.3 SUBMITTALS

A. Shop Drawings. Submit all shop drawings in accordance with the requirements in Division 1, General Requirements. For each piece of equipment, submit for review, detailed drawings and descriptive literature on the associated components, signals, controls and alarms including the source and destination of each signal and alarm. The submittal can be made for the facility as a whole in lieu of with each piece of equipment if preferred by the Contractor. The process and instrumentation diagrams in the construction drawings may not be replicated for shop files.

B. Operation and Maintenance Instructions. Submit operating and maintenance instructions and service manuals in accordance with specification 01300, as a condition of substantial completion.

C. Start-Up Report. Upon completion of installation, the Contractor shall provide a test of all signals, controls and alarms in the presence of the Engineer to show all systems functioning properly. All systems must operate in manual and automatic modes as specified. This shall be complete and a signed written report submitted to the Engineer for approval as a condition of substantial completion.

1.4 QUALITY ASSURANCE

A. Reference Standard – WEF Manual of Practice No. 21 – Automation of Wastewater Treatment Facilities.

B. Provide a qualified technical representative of the manufacturer to inspect the completed equipment and controls installation, make all the adjustments necessary to place the equipment and controls in trouble-free operation, and to instruct operating personnel in the proper care and operation of the equipment furnished.

1.5 GUARANTEE

For a period of 12 months from substantial completion, the Contractor shall warrant that the controls and programming shall operate as specified and be free of defects and operating deficiencies under normal use and service and when properly installed. The Contractor shall provide repair, modify, or replace controls and associated components and provide programming corrections from a qualified programmer during this period.

1.6 CONTROL FUNCTION DEFINITIONS AND GENERAL CRITERIA

A. The control narratives in the following sections shall be used in conjunction with all project drawings. Logic descriptions are provided for both the HMI and PLC software required under this contract.

B. For all controlled devices such as pumps, valves, etc., if the device is commanded to Start or Stop, Raise or Lower, or Open or Close) by the PLC, and the device feedback state does not match the commanded state within a preset time, an Equipment Discrepancy Alarm shall be generated by the PLC for display and alarming at the HMI and the device shall be commanded to Stop (valves and gates shall remain in the last state unless otherwise noted in the control description). If a duty pump, or system, is commanded to start and does not start within the preset time, an alarm shall be generated at the PLC and annunciated at the HMI. The operator shall then determine whether or not to start the standby pump or system unless otherwise noted in the control description. Also, if a device feedback state does not match the commanded state at any time, excluding the change of state described above, an equipment Failure Alarm is generated by the PLC for display and alarming at the HMI and the device is commanded to Stop (valves and gates shall remain in the last state unless otherwise noted in the control description). After a Discrepancy Alarm occurs the device cannot be started again until the Operator at the HMI has issued a Reset. All controlled devices with feedback shall indicate Failure alarms on the associated process graphic displays even if not shown on the loop drawings.

C. For all controlled devices such as pumps, valves, etc. if the device is shut down due to an interlock such as high discharge pressure, an alarm shall be generated at the PLC and annunciated at the HMI. Certain critical device failures, stated in control description or set at a later time during a coordination meeting between the Owner/Operator and the PCSS, shall generator an automatic call out to the operator.

D. All analog alarms generated (such as a high level alarm) shall be generated as follows. If the analog point's value exceeds or drops below the alarm limit value, then an alarm shall be generated. To eliminate excessive alarm reporting, the analog point shall remain in alarm until the analog point's value returns beyond the limit set by the analog limit deadband.

E. For all analog points (such as level, flow, pressure, etc.), if the value of the analog point is below a value of 2 mA since the last time the analog point was scanned, a Loss-of-Signal shall be alarmed at the HMI. The alarms shall remain in effect until it is logged at the HMI and the value is within the normal signal range (4-20 mA) the next time the analog point is scanned. All analog points shall indicate a Loss-of-Signal Alarm on the associated process graphic displays even if not shown on the loop drawings.

F. For all analog points (such as level, flow, pressure, etc.), if the value of the analog point is above or below the transmitter range, Out-Of-Range shall be alarmed at the HMI (if applicable).

G. For all analog points such as level, flow, pressure, etc. there shall be Low-Low, Low, High, and High-High alarm setpoints entered by the Operator for each instrument measurement. All process analog inputs are displayed historically collected and trended. Alarms shall be generated as follows: If the analog point value exceeds or drops below the alarm limit value then an alarm shall be generated. To eliminate excessive alarm reporting the analog point shall remain in alarm until the analog points value returns beyond the limit set by the analog limit deadband setpoint. Nuisance alarms such as low turbidity shall be inhibited. Authorized supervisors shall have the capability to turn off alarm functions when not needed. When valve is closed or pump is not running an analog flow signal associated with that valve or pump shall not generator low flow alarm and it shall be forced to zero value.

H. All alarm and control setpoints shall be adjustable by the Operator at the HMI unless specifically stated otherwise, even if not shown on the drawings. These setpoints shall be password protected to allow access by only the Operators who are given clearance by the Owner. Some alarms and/or setpoints shall be hard coded in the PLC and not adjustable by the Operator. Generally, hard coded values will be alarms and/or set points that are not anticipated to change.

I. Preclusion logic shall be added to all applicable alarms. This logic will prevent secondary alarms that are a direct result of a primary alarm from being annunciated. For example, station power failure should not cause a circuit breaker-tripped alarm to be annunciated.

J. Runtimes for all motorized equipment shall be totalized in the PLC and indicated at the HMI with 0.1 tenth hour resolution even if not shown on the drawings. Two runtimes shall be calculated. One shall be an overall accumulated runtime and the other shall have the capability to be reset by the user via the HMI. Security will be configured such that only supervisory level user will be able to perform this reset function.

K. All RAS/WAS and combined effluent (including NPW) flows shall be totalized in the PLC as daily totals or cumulative totals even if not shown on the loop drawings. Daily totals will be reset at midnight and then displayed as "Yesterday's Total Flow" at the HMI. Flow rates and flow totals shall be indicated and recorded at the HMI. When a valve is closed or a pump is not running, the flow totalizer shall not accumulate values caused by noise or errors in calibration.

L. All software adjustable alarm set points accessible from the HMI shall have adjustable deadbands unless specifically noted otherwise.

M. Plant personnel must acknowledge all alarms before they can be cleared. No alarm shall clear automatically until it has been acknowledged.

N. For all variable speed pumps if the pump is commanded to run at specific speed and the speed feedback signal deviates from the commanded speed by preset deadband for preset time period speed deviation alarm is generated by the PLC for display and alarming at the HMI.

O. For all analog modulating valves if the valve is commanded to open or close to specific position and the position feedback signal deviates from the commanded position by preset deadband for preset time period, a valve deviation alarm is generated by the PLC for display and alarming at the HMI.

P. All tuning parameters for each PLC software PID controller are entered at the HMI Tuning trends are provided to tune and monitor each PID operation. Tuning parameters settings are password protected.

Q. All HMI to PLC communications paths shall be monitored by the PLC and HMI for disruptions in communication. In the event that PLC communications path is lost the HMI communications alarm shall be generated. Data collected from the PLCs shall be attributed as having bad quality. When the communications path is restored and the data is updated it shall be attributed as valid.

R. All PLC-to-PLC communications paths shall be monitored by each participating PLC for disruptions in communication. In the event that communications path is lost, Software failure or hardware failure and data shared between the PLCs shall be attributed as having bad quality. When the communications path is restored and the data is updated it shall be attributed as valid.

S. All communications paths between facilities shall be monitored by the PLC for disruptions in communication. In the event that communications path is lost, Software failure or hardware failure communications alarm shall be

generated. Any data shared between the PLCs from the facility shall be attributed as having bad quality. When the communications path is restored and the data is updated it shall be attributed as valid.

T. All alarms shall remain in effect until it is logged at the HMI Historian.

U. All process system areas shall have a graphical overhead layout similar as shown on the P&IDs. Vendor supplied systems shall be shown similarly to vendor submitted screens while conforming to overall Facility standard scheme.

PART 2 - PROCESS CONTROL NARRATIVES

2.1 LIFT STATION

Process Description:	**General** Four (4) submersible pumps shall be installed in the existing lift station wet well to provide raw sewage flow to the peak shaving basin and the existing headworks.

	• Under normal operation (normal mode):
	  o One (1) pump (SP-02-101) shall be dedicated to pump raw sewage to the existing peak shaving basin.
	  o Three (3) pumps (SP-02-201, SP-02-301, and SP-02-401) shall be dedicated to pumping raw sewage to the existing headworks. Pumps will operate based on an alternating lead/lag level scheme.
	• For peak shaving basin operations when SP-02-101 is out of service (backup mode):
	  o HS-02-001E located on Lift Station Control Panel (CP-02-101) should be set to assign SP-02-201. Once ON, the PLC will remove this pump from the HW pump lead/lag alternation.
	  o Manually position PV-02-002 and PV-02-003, located on the lift station discharge header, divert SP-02-201 to the Peak Shaving Basin. Operators are required to ensure the valves are manually set for the common spare to flow to the peak shaving basin.
	• Full peak shaving basin conveyance operations (all four (4) pumps convey flow to the peak shaving basin – all pumps mode):
	  o HS-02-001F located on Lift Station Control Panel (CP-02-101) should be set by operations to assign all pumps to the peak shaving basin.
	  o Once HS-02-001F is enabled, the PLC will automatically command valve PV-03-006 to close to the headworks and command valve PV-03-005 to open to the peak shaving basin.
	  ▪ PV-03-005 and PV-03-006 are automatic control valves located on the raw sewage discharge piping at the headworks. These valves shall be electrically interlocked such that neither valve can be opened unless the other valve is closed.
	  ▪ Peak shaving basin High Level (LSH-04-001) shall generate an alarm and interlock these valves, diverting flow back to the headworks returning the system to normal operation. Lift station pumps SP-02-101 and SP-02-201 will be commanded to stop as well should a high peak shaving basin level be present.

Pump Control Modes

Mode	Normal	Backup	All Pumps
Description	Normal Operation	Backup Operation: *SP-02-101 as not in service*	All four wet well pumps to peak shaving basin
SP-02-101	Peak Shaving	Peak Shaving	Peak Shaving
SP-02-201	Headworks	Peak Shaving	Peak Shaving
SP-02-301	Headworks	Headworks	Peak Shaving
SP-02-401	Headworks	Headworks	Peak Shaving
PV-02-002	Opened	Closed	Opened
PV-02-003	Closed	Opened	Opened
HS-02-001E	OFF	ON	OFF
HS-02-001F	OFF	OFF	ON
PV-03-005	Closed	Closed	Opened
PV-03-006	Opened	Opened	Closed

Level Control

The pumps shall be operated based on the wet well level received by the existing level instrumentation LIT-02-001.

- The pumps shall alternate which pump is the lead and which pumps are the lag pumps.
- Seven (7) new float switches shall be utilized as backup for measuring water levels for the pump operation.
- A high level detected by High Level Float LSH-02-001 will latch control into float backup mode.
    - Float backup will have to be manually reset once the alarm condition has cleared.
- LSL-02-001 shall be set at a very low level, beyond the OFF-Float point, and shall interlock all pumps to prevent cavitation from pumping below the pumps' suction.
- The pumps shall be called based on the pump elevations listed on sheet 2-M-4

P&ID:	1-I-1 Lift Station P&ID
Controlled Devices:	SP-01-101 Lift Pump No. 1 SP-01-201 Lift Pump No. 2 (Common Spare) SP-01-301 Lift Pump No. 3 SP-01-401 Lift Pump No. 4

Instrumentation Devices:	Existing LIT-02-001 Level Indicating Transmitter Proposed: LSL-02-001 Low Level Float (All Pumps Off Float) LS-02-001 Off Float LS-02-002 Lead Pump Float LS-02-003 Lag Pump No. 1 Float LS-02-004 Lag Pump No. 2 Float (Common Spare) LS-02-005 Lag Pump No. 3 Float (Peak Shaving Basin Float) LSH-02-001 High Level Alarm
Local Functions:	Local Control Panel: The existing local control panel contains the following for each pump: • H-O-A Switch o Provide pump control • Green Pilot Light o Indicate the pump running status. • Red Pilot Lights o Indicate Overload, Overtemp, and Seal Fail conditions • Elapsed Time Meter o Indicate pump runtime • Reset Push Button o Reset Pump Monitor Relay The local control panel shall be modified to accommodate the following: • Lift Station/Peak Shaving Selector o Place the common spare in lift station rotation o Select the common spare as the peak shaving basin pump • Headworks/Peak Shaving Basin Valve Selector o Divert flow from Headworks to Peak Shaving Basin o Return flow from the Peak Shaving Basin to Headworks In the HAND position, each pump shall operate continuously if the interlocks for the pump listed in the INTERLOCKS section below are not active. PCSS shall install a nameplate on CP-02-001 next to HS-02-001E instructing operations to open/close plug valve associated with flow to the Peak Shaving Basin.
MCC Functions:	Each MCC section has a motor starter and solid-state overloads that provide status and fault indication to the PLC.
HMI Functions:	None
PLC Functions:	PLC Control Panel: A PLC Control Panel shall be installed for the primary control of the lift station. In the AUTO position, the PLC shall call the pumps to run if the interlocks for the pump listed in the INTERLOCKS section below are not active.

	The signal from the existing submersible wet well level transmitter shall be sent to the PLC and the lift station pumps shall operate based on operator adjustable level setpoints. PLC functions shall be, at minimum, the following:
	
	• Level monitoring:
	  o Display real-time wet well levels
	  o adjustable High Level alarm
	  o adjustable Low Level alarm
	• Pump operation:
	  o Call the pumps based on lead-lag sequence
	  o Alternate pumps after each pump off cycle.
	  o All pump call setpoints shall be operator adjustable.
	  o The PLC shall receive the following pump statuses:
	  ▪ In Hand
	  ▪ In Auto,
	  ▪ Running,
	  ▪ Overload
	  ▪ Overtemperature
	  ▪ Seal Fail
	  o If an alarm is active, the PLC shall inhibit the corresponding pump and exclude it from the call sequence until the alarm is reset.
	• Headworks/Peak Shaving Basin Selection
	  o Remove SP-02-201 (Common Spare) from the headworks pump rotation when Peak Shaving Basin Mode has been selected.
	  o Display Headworks/Peak Shaving Basin Valve status
	  o When valve is diverted to Peak Shaving Basin, all four pumps will be under lead/lag PLC control and four pump alternation.
	  o On Peak Shaving Basin High Level Alarm, or upon switching the valve selection back to Headworks, SP-02-301 and SP-02-401 shall be returned to normal lead/lag operation and pump rotation. If the common spare, SP-02-301, is not selected to run on Peak Shaving Basin pump control, it will be placed in the rotation pumping to the Headworks.
	• PLC/Backup control:
	  o A physical selector on the local control panel allows the operator to switch between PLC control and Backup control. In PLC control (Primary), the lift stations shall be operated by the PLC as a single lift station system. In Backup control, the lift station shall be operated by float control, and the PLC call signals shall be bypassed.

SCADA Functions	<u>Lift Station Overview</u>: SCADA screen shall show the Lift Station in a graphical layout similar to the P&IDs. The Lift Station shall show the current water level and setpoints for the lead and lag pump calls. <u>Lift Station Alarms:</u> The SCADA alarm screen shall list all Lift Station alarms with red/green indication for each alarm activity. Each alarm shall display a timestamp and date of the most recent activity.
Interlocks:	<u>Interlocks below are hardwired:</u> CP-02-001 Phase Failure/Control Power Failure

	SP-02-101 Over Temp SP-02-201 Over Temp SP-02-301 Over Temp SP-02-401 Over Temp SP-02-101 Seal Failure SP-02-201 Seal Failure SP-02-301 Seal Failure SP-02-401 Seal Failure SP-02-101 Overload SP-02-201 Overload SP-02-301 Overload SP-02-401 Overload LSL-02-001 Wet Well Low-Level Lockout LSH-04-001 Peak Shaving Basin High Level <u>Interlocks below are programmed:</u> CP-02-001 Phase Failure/Control Power Failure SP-02-101 Over Temp SP-02-201 Over Temp SP-02-301 Over Temp SP-02-401 Over Temp SP-02-101 Seal Failure SP-02-201 Seal Failure SP-02-301 Seal Failure SP-02-401 Seal Failure LSL-02-001 Wet Well Low-Level Lockout LSH-04-001 Peak Shaving Basin High Level
Alarms and Indications:	<u>Alarms Indicated on SCADA:</u> CP-02-001 Phase Failure/Control Power Failure CP-02-001 Pumps on Float Backup SP-02-101 Temp Failure SP-02-101 Seal Failure SP-02-101 Overload Fail SP-02-201 Temp Failure SP-02-201 Seal Failure SP-02-201 Overload Fail SP-02-301 Temp Failure SP-02-301 Seal Failure SP-02-301 Overload Fail SP-02-401 Temp Failure SP-02-401 Seal Failure SP-02-401 Overload Fail LSH-02-001 Wet Well High Level Alarm LSL-02-001 Wet Well Low Level Alarm LSH-04-001 Peak Shaving Basin High Level Alarm See IO list for a complete list of alarms and status indications

2.2 MECHANICAL SCREEN & WASH PRESS

Process Description:	One (1) in-channel mechanical perforated plate screen and one (1) washer compactor shall be installed in the existing headworks alongside one (1) existing mechanical perforated plate screen and a bypass channel containing a manual bar screen. The proposed and existing mechanical perforated plate screens shall screen raw influent and discharge screenings to the proposed washer compactor. The washer compactor shall collect and compact the screenings and convey the compacted screenings into a dumpster at the base of the existing headworks. The proposed screen shall be operated through a proposed vendor supplied local control panel. The system shall monitor the liquid levels in the screen channel via ultrasonic transducers located on the upstream and downstream sides of the channel and operate the screen based on differential level setpoints. A proposed high-level float switch shall be installed to serve as backup, operating the screen and sending an alarm, should the transducer fail. Additionally, the screen shall operate when a user-adjustable time has passed without operation. The washer compactor shall be called from the existing control panel and operated on a time delay based on the screen's operation. The existing panel shall also provide washer compacter running and fault status. The proposed control panel shall send a run call to the NPW booster pump controls, located in the existing panel. The existing panel controls shall call the NPW Booster Pump motor starter to run and energize (open) solenoid valves at the Wash water connections providing wash water for the mechanical screen and the washer compactor while the equipment is running. The existing panel shall also provide the NPW booster pump running and fault status. A high level alarm shall be triggered when either of the ultrasonic transducers detects that the level in the channel has reached the high level setpoint, or the high-level float switch is activated. A high level alarm in either channel shall call both systems to begin their cycle. The mechanical perforated plate screen and washer compactor shall be vendor supplied and controlled by the vendor supplied control panel (CP-03-002 Secondary Headworks Control Panel). See Specification Sections 11221 – Perforated Plate Screen and 11700 – Screenings Washer Compactor.
P&ID:	3-I-1 Elevated Headworks P&ID
Controlled Devices:	<u>Existing</u> VMP-03-001 Headworks Wash Water Pump No. 1 MFS-03-101 Mechanical Screen No. 1 <u>Proposed</u> MFS-03-301 Mechanical Screen No. 2 WC-03-001 Washer Compactor No. 1

Instrumentation Devices:	Existing LE-03-101 MFS-03-101 Upstream Level Element LE-03-102 MFS-03-101 Downstream Level Element LIT-03-101 MFS-03-101 Differential Level Indicating Transmitter LSH-03-001 Headworks Level High SV-03-101 Wash Water Solenoid Valve No. 1 Proposed LE-03-301 MFS-03-301 Upstream Level Element LE-03-302 MFS-03-301 Downstream Level Element LIT-03-301 MFS-03-301- Differential Level Indicating Transmitter SV-03-001 Wash Water Solenoid Valve No. 1 SV-03-302 Wash Water Solenoid Valve No. 2 LSH-03-301 Headworks Level High ZS-03-301 Inspection Door Safety Lockout
Local Functions:	Manufacturer Supplied Local Control Panel, Reference Section 11221 – Perforated Plate Screen. The Vendor shall supply a single local hand station that provides the following at a minimum. MFS-03-101 HOA MFS-03-301 HOA WC-03-001 HOA WC-02-001 F/O/R All equipment E-Stop
MCC Functions:	None
HMI Functions:	None
PLC Functions:	None
SCADA Functions:	Mechanical Screen and Wash Press Overview: The SCADA screens shall show the mechanical screens and wash compactors in a graphical overhead layout similar to the P&IDs. This screen shall show at a minimum, screen running, forward/reverse status, and fault status, the current upstream, downstream, and differential water level for each channel and provide adjustable setpoints for the screen call and system timers. This screen shall also show the Headworks NPW booster pump and Wash Compactor running and fail statuses The PCSS shall coordinate with the vendor for I/O tags and IP addresses. Mechanical Screen and Wash Press Alarms: SCADA alarm screen shall list all alarms with red/green indication for each alarm activity. Each alarm shall display a timestamp and date of the most recent activity
Interlocks:	Refer to Manufacturer Specification 11221 – Perforated Plate Screen for interlock details

Alarms and Indications:	Alarms Indicated on SCADA: CP-03-001 Control Power Fail CP-03-001 Phase Failure CP-03-002 Control Power Fail CP-03-002 Phase Failure MFS-03-101 Brush Overload MFS-03-101 Screen Overload MFS-03-101 Fault Headworks Level High Alarm MFS-03-301 Brush Overload MFS-03-301 Screen Overload MFS-03-301 Fault WC-03-001 Motor Overload VMP-03-001 Motor Overload VMP-03-001 Fault See IO list and specification 11221 – Perforated Plate Screen for a complete list of alarms and status indications

2.3 PEAK SHAVING BASIN SELF PRIMING PUMPS

Process Description:	Three (3) self-priming pumps (two existing, one proposed) shall pump raw sewage from the peak shaving basin to the elevated headworks. The pumps (two duty, one spare) shall operate based on a PLC control to allow the pumps to only operate at nighttime. A new photocell located at the peak shaving basin control panel shall provide backup control in the event of PLC failure. One (1) existing float switch (LSH-04-001) shall be used to lock out the lift station submersible pumps sending flow to the peak shaving basin. A second existing float (LSL-04-001) shall be utilized to lock out the self-priming pumps sending flow from the peak shaving basin to the elevated headworks. A user adjustable time delay shall allow the peak shaving basin pumps to operate after the low level float has been activated.
P&ID:	4-I-1 Peak Shaving Basin P&ID
Controlled Devices:	Existing SPP-04-101 Peak Shaving Basin Pump No. 1 SPP-04-201 Peak Shaving Basin Pump No. 2 Proposed SPP-04-301 Peak Shaving Basin Pump No. 3
Instrumentation Devices:	Proposed PI-04-001 - Peak Shaving Basin Air Header Pressure Existing LSL-04-001 – Low Level (All Pumps Off) Float LSH-04-001 – High Level Float

Local Functions:	<u>Local Control Panel:</u>
	One (1) Proposed peak shaving basin pump control panel shall be installed at the peak shaving basin to replace the existing pump control panel. This proposed panel shall house all local pump control, monitoring and pump alternation. The supplied control panel shall house the controls for all three (3) peak shaving basin pumps and provide at a minimum:
	
	• Hand-Off-Auto Switch:
	  o Provides control of the pumps.
	• Phase Failure Bypass switch:
	  o Allow operators to bypass Phase Fail relay.
	• White Pilot Light:
	  o Control Power On status.
	• Pilot Lights:
	  o pilot light shall indicate a pump running and fault status.
	• Elapsed Time Meter:
	  o An elapsed time meter shall measure pump runtime.
	• Push Button:
	  o An Alarm Test pushbutton shall allow testing of panel and SCADA alarms.
	• Reset pushbutton shall send a reset signal to the PLC and reset the solid-state overloads on the motor contactors as well as any fault relays.
	
	In the Hand position, the pump shall operate continuously if the interlocks for the pump listed in the INTERLOCKS section below are not active. In the Off position, the local control panel shall not call the pump to run.

MCC Functions:	None
HMI Functions:	None
PLC Functions:	In the AUTO position, the peak shaving basin pumps shall operate upon receiving a call signal from the PLC. PLC logic shall alternate the peak shaving basin pump operations to maintain equal runtime on all three pumps. The PLC shall call the pumps based on an operator adjustable time, set through SCADA. A backup photocell indicator shall only allow the pumps to operate at night in the event of PLC failure. User adjustable timers shall provide operators with the ability to delay the backup system start of the peak shaving basin pumps as required. Peak shaving basin Low Level (LSL-04-101) shall interlock SPP-04-101, SPP-04-201 and SPP-04-301 from pumping to the headworks. Peak shaving basin High Level (LSH-04-101) shall interlock lift station pumps SP-02-301 and SP-02-401 from pumping to the peak shaving basin. Lift station pumps SP-02-101 and SP-02-102 do not pump to the peak shaving basin.
SCADA Functions:	<u>Peak Shaving Basin Overview:</u> SCADA screen(s) shall show the Peak Shaving Basin system in a graphical layout similar to the P&IDs. The screen shall show the running and fault status of three pumps, float switch status, and shall provide setpoints for the pump call and system timers.

	Peak Shaving Basin Alarms: The SCADA alarm screen shall list all alarms with red/green indication for each alarm activity. Each alarm shall display a timestamp and date of the most recent activation.
Interlocks:	All interlocks below are hardwired: SPP-04-101 Overload SPP-04-201 Overload SPP-04-301 Overload LSL-04-001 Peak Shaving Basin Low Level – Peak shaving basin self-priming pumps lockout LSH-04-001 Peak Shaving Basin High Level – Lift station submersible pump (SP-02-301 and SP-02-401) lockout
Alarms and Indications:	Alarms Indicated on SCADA: SPP-04-101 Overload SPP-04-201 Overload SPP-04-301 Overload LSL-04-001 Peak Shaving Basin Low Level Alarm LSH-04-001 Peak Shaving Basin High Level Alarm See IO list for a complete list of alarms and status indications.

2.4 RAS AIR LIFTS

Process Description:	Four (4) existing RAS air lift pumps and two (2) proposed RAS air lift pumps shall be operated continuously with only manual control adjustments made through turning a ball valve on the air supply line. Air flow to each air lift shall be totalized using thermal mass flowmeters and a flow totalizing PLC panel programmed to calculate the RAS flow rate based on the manufacturer provided pump curves. Each air lift shall have a dedicated air flow measurement system. Flow meters shall provide read outs from each air lift pump to the operator.
P&ID:	5-I-1 Aeration Basin No. 3 P&ID
Controlled Devices:	Existing AL-05-101 RAS Air Lift No. 1 AL-05-102 RAS Air Lift No. 2 AL-05-201 RAS Air Lift No. 3 AL-05-202 RAS Air Lift No. 4

	Proposed AL-05-301 RAS Air Lift No. 5 AL-05-302 RAS Air Lift No. 6 Manual valves shall be provided to isolate each airlift pump along with its thermal flow meter and shall be used to throttle the air supply to control the RAS pumping rate.
Instrumentation Devices:	Existing FIT-05-101 Air Lift No. 1 Flow Meter FIT-0-5102 Air Lift No. 2 Flow Meter FIT-05-201 Air Lift No. 3 Flow Meter FIT-05-202 Air Lift No. 4 Flow Meter Proposed FIT-05-301 Air Lift No. 5 Flow Meter FIT-05-302 Air Lift No. 6 Flow Meter
Local Functions:	Air Lift Flow Monitoring
MCC Functions:	None
HMI Functions:	None
PLC Functions:	Air Lift vendor shall provide Air Lift flow calculations curve (SCFM vs GPM). PLC shall use the curve for instantaneous calculation of RAS flow. Flow signals from each of the thermal mass flow measurement systems on each air lift shall be sent to the PLC for calculation and totalization. Each air lift shall have a dedicated air flow measurement system.
SCADA Functions:	RAS System Overview: SCADA screen shall show Rapid Mix Basins in a graphical layout similar to the P&IDs. The RAS screen shall show all RAS individual flows and totalized flows. Air flow rates shall be displayed in SCFM. The calculated instantaneous RAS flow rates shall be displayed in GPM for each air lift. This screen shall also display the total RAS flow rate for each treatment train, and the totalized flows for the day, rolling total, and all-time totals for the entire treatment unit. SCADA shall also indicate RAS Flowmeter's loss of signal. RAS System Alarms: All alarms shall have red/green indication for each alarm activity. Each alarm shall display a timestamp and date of most recent activation.
Interlocks:	None
Alarms and Indications:	Alarms and Indications on SCADA: FIT-05-101 Loss of Signal FIT-05-102 Loss of Signal FIT-05-201 Loss of Signal FIT-05-202 Loss of Signal FIT-05-301 Loss of Signal

	FIT-05-302 Loss of Signal See IO list for a complete list of alarms and status indications

2.5 AERATION BASINS

Process Description:	Dissolved Oxygen (DO) and Mixed Liquor Suspended Solids (MLSS) probes shall be installed at the two existing aeration basins and the proposed aeration basin. The probes shall transmit to SCADA.
P&ID:	5-I-1 Aeration Basin No. 3 P&ID
Controlled Devices:	None
Instrumentation Devices:	AIT-05-101 Analytical Indicating Transmitter AIT-05-201 Analytical Indicating Transmitter AIT-05-301 Analytical Indicating Transmitter AE-05-101 Dissolved Oxygen Probe AE-05-201 Dissolved Oxygen Probe AE-05-301 Dissolved Oxygen Probe AE-05-102 Mixed Liquor Suspended Solids Probe AE-05-202 Mixed Liquor Suspended Solids Probe AE-05-302 Mixed Liquor Suspended Solids Probe
Local Functions:	Dissolved Oxygen Monitoring MLSS Monitoring
MCC Functions:	None
PLC Functions:	None
SCADA Functions:	Aeration Basin Overview: This SCADA screen shall display each aeration basin in a graphical layout similar to the P&ID. Indication shall be provided for Dissolved Oxygen values and Mixed Liquor Suspended Solids values for monitoring and historical trending. Aeration Basin Alarms: All alarms shall have red/green indication for each alarm activity. Each alarm shall display a timestamp and date of most recent activation.
Interlocks:	None
Alarms and Indications:	See IO list for a complete list of alarms and status indications

2.6 WAS AIR LIFTS (SLUDGE HOLDING TANK)

Process Description:	Four (4) existing WAS air lift pumps and two (2) proposed WAS air lift pumps shall be operated continuously with automatic control provided by solenoid valves, or by opening proposed solenoid valves on the bypass air supply line. Timers set by the Operator shall operate one (1) solenoid valve that controls the air flow to the air lift pumps. The solenoid valve shall also be utilized to shut off air flow to the air lift pumps in the event of a high-level alarm, determined by the existing float switch. Two (2) additional float switches shall be added to Sludge Holding Tank No. 1 and Sludge Holding Tank No. 2 with signals routed to the Dewatering System Control Panel controlling the press feed pumps, that draw from the sludge tanks. Air flow to each air lift pump shall be totalized using thermal mass flowmeters and a flow totalizing PLC panel programmed to calculate the WAS flow rate based on the manufacturer provided pump curves. Flow meters shall provide read outs from each air lift pump to the Operator.
P&ID:	13-I-1 Sludge Holding Tank P&ID
Controlled Devices:	<u>Existing</u> SV-13-101 WAS Pit No. 1 Solenoid Valve SV-13-201 WAS Pit No. 2 Solenoid Valve <u>Proposed</u> SV-13-301 WAS Pit No. 3 Solenoid Valve SV-13-102 – WAS Pit No. 1 Bypass Solenoid Valve SV-13-202 – WAS Pit No. 2 Bypass Solenoid Valve SV-13-302 – WAS Pit No. 3 Bypass Solenoid Valve
Instrumentation Devices:	<u>Existing</u> FIT-13-101 WAS Train No. 1 Air Lift No. 1 Flow Meter FIT-13-102 WAS Train No. 1 Air Lift No. 2 Flow Meter FIT-13-201 WAS Train No. 2 Air Lift No. 1 Flow Meter FIT-13-202 WAS Train No. 2 Air Lift No. 2 Flow Meter LSH-13-001 Sludge Holding Tank High Level Float Switch <u>Proposed</u> FIT-13-301 – Train No. 3 Air Lift No. 1 Flow Meter FIT-13-302 – Train No. 3 Air Lift No. 2 Flow Meter LSL-13-001 – Sludge Holding Tank No. 1 Low Level Float Switch LSL-13-002 – Sludge Holding Tank No. 2 Low Level Float Switch
Local Functions:	Air Lift Flow Monitoring A proposed control panel shall be installed to provide an operator interface for the solenoid valve bypass controls. Each WAS train will have an individual selector switch to bypass its respective flow to the air lifts pumps.
MCC Functions:	None
PLC Functions:	The solenoid valves shall open/close based on a user adjustable timer programmed at the PLC if the interlocks in the INTERLOCKS section below are not active.

	Sludge Flow Calculation: Air lift vendor shall provide air lift flow calculations curve (SCFM vs GPM). PLC shall use the curve for instantaneous calculation of sludge flow. Flow signals from each of the thermal mass flow measurement systems on each air lift shall be sent to the PLC for calculation and totalization. Each air lift shall have a dedicated air flow measurement system.
SCADA Functions:	Sludge Holding Tank Overview: This screen shall show the Sludge Holding Tank in a graphical layout similar to the P&IDs. The screen shall show all WAS individual flows and totalized flows. Air flow rates shall be displayed in SCFM. The calculated instantaneous WAS flow rates shall be displayed in GPM for each air lift. This screen shall also display the total WAS flow rate, and the totalized flows for the day, rolling total, and all-time totals for the entire treatment unit. SCADA shall also indicate WAS Flowmeter's loss of signal. Sludge Holding Tank Alarms: All alarms shall have red/green indication for each alarm activity. Each alarm shall display a timestamp and date of most recent activation.
Interlocks:	Interlocks below are hardwired: LSH-13-001 – Existing Sludge Holding Tank High Level Float Switch LSL-13-001 – Sludge Holding Tank No. 1 Low Level Float Switch LSL-13-002 – Sludge Holding Tank No. 2 Low Level Float Switch
Alarms and Indications:	Alarms Indicated on SCADA: LSH-13-001 Existing Sludge Holding Tank Level Switch High LSL-13-001 Sludge Holding Tank No. 1 Level Switch Low LSL-13-002 Sludge Holding Tank No. 2 Level Switch Low FIT-13-101 Loss of Signal FIT-13-102 Loss of Signal FIT-13-201 Loss of Signal FIT-13-202 Loss of Signal FIT-13-301 Loss of Signal FIT-13-302 Loss of Signal See IO list for a complete list of alarms and status indications

2.7 SECONDARY CLARIFIERS

Process Description:	Two (2) existing and one (1) proposed secondary clarifiers shall be utilized to separate clear water from solids. The clarifiers shall be operated continuously at a constant speed. The clarifier system shall be vendor supplied and controlled by the vendor supplied control panel. See Specification Section 11320 – Clarifier.
P&ID:	6-I-1 Secondary Clarifier No. 3 P&ID
Controlled Devices:	Existing SC-06-101 Clarifier No. 1 SC-06-201 Clarifier No. 2 Proposed SC-06-301 Clarifier No. 3
Instrumentation Devices:	Existing SC-06-101 Clarifier No. 1 Torque Limit Switch SC-06-201 Clarifier No. 2 Torque Limit Switch Proposed SC-06-301 Clarifier No. 3 Torque Limit Switch
Local Functions:	See Specification Section 11320 – Clarifier.
MCC Functions:	None
PLC Functions:	None
HMI Functions:	None
SCADA Functions:	Secondary Clarifiers Overview: SCADA screen shall show the secondary clarifiers in a graphical layout similar to the P&IDs. This screen shall show the clarifiers ON/OFF and fault status. . Secondary Clarifiers Alarms: All alarms shall have red/green indication for each alarm activity. Each alarm shall display a timestamp and date of most recent activation.
Interlocks:	Interlocks below are hardwired:

	SC-06-101 Phase Fail SC-06-201 Phase Fail SC-06-301 Phase Fail SC-06-101 Overload SC-06-201 Overload SC-06-301 Overload SC-06-101 Motor Protection Relay SC-06-201 Motor Protection Relay SC-06-301 Motor Protection Relay SC-06-101 High Torque Alarm SC-06-201 High Torque Alarm SC-06-301 High Torque Alarm SC-06-101 High Torque Shutdown SC-06-201 High Torque Shutdown SC-06-301 High Torque Shutdown SC-06-101 Shear Pin Fail Shutdown SC-06-201 Shear Pin Fail Shutdown SC-06-301 Shear Pin Fail Shutdown
Alarms and Indications:	<u>Alarms Indicated on SCADA</u> CP-06-101 Control Power Fail CP-06-101 Phase Fail SC-06-101 Not Running SC-06-101 Shear Pin Fail Shutdown SC-06-101 High Torque Alarm SC-06-101 High Torque Shutdown SC-06-101 Motor Overload SC-06-101 Motor Protection Relay CP-06-201 Control Power Fail CP-06-201 Phase Fail SC-06-201 Not Running SC-06-201 Shear Pin Fail Shutdown SC-06-201 High Torque Alarm SC-06-201 High Torque Shutdown SC-06-201 Motor Overload SC-06-201 Motor Protection Relay CP-06-301 Control Power Fail CP-06-301 Phase Fail SC-06-301 Not Running SC-06-301 Shear Pin Fail Shutdown SC-06-301 High Torque Alarm SC-06-301 High Torque Shutdown SC-06-301 Motor Overload SC-06-301 Motor Protection Relay See IO list for a complete list of alarms and status indications

2.8 CHLORINE CONTACT BASIN

Process Description:	Flow information collected from the proposed 12" Parshall Flume shall be sent to the chemical system PLC. The summed total of the Parshall Flume and NPW flows shall then be used in calculations to determine the dosing rate and output a signal to pace the operation speed of the chemical pumps.
P&ID:	8-I-1 Chlorine Contact Basin P&ID
Controlled Devices:	Existing: SM-08-101 Sodium Hypochlorite Mixer 101 SM-08-102 Sodium Hypochlorite Mixer 102 SM-08-201 Sodium Bisulfite Mixer 201 SM-08-202 Sodium Bisulfite Mixer 202 Proposed: PF-08-001 12" Parshall Flume
Instrumentation Devices:	Existing: FIT-08-001 12" Parshall Flume Flow Indication LSL-08-001 Basin Low Level Switch
Local Functions:	The existing FIT-08-001 shall send Parshall flume flow information to SCADA via the proposed PLC-11-001, located in CP-11C-001. CP-08-101 Existing Sodium Hypochlorite Mixer control panel shall provide local control and monitoring of mixers SM-08-101 and SM-08-102. CP-08-201 Existing Sodium Bisulfite Mixer control panel shall provide local control and monitoring of mixers SM-08-201 and SM-08-202.
MCC Functions:	None
HMI Functions:	None
PLC Functions:	The chemical system PLC shall use the Parshall Flume flow and NPW flows in its calculations to determine the chemical feed rates for Sodium Hypochlorite, Sodium Bisulfite, and Alum.
SCADA Functions:	Current flow, single day total, 30-day rolling total, and all-time totals shall be shown on the Plant SCADA system for display and historical trending.
Interlocks:	None
Alarms and Indications:	Alarms on SCADA: FIT-08-001 Loss of Signal CP-08-101 Control Power Fail CP-08-101 Phase Fail SM-08-101 Not Running SM-08-102 Not Running SM-08-101 Seal Fail SM-08-102 Seal Fail SM-08-101 Overload

	SM-08-102 Overload SM-08-101 Pump Monitor Fail SM-08-102 Pump Monitor Fail CP-08-201 Control Power Fail CP-08-201 Phase Fail SM-08-201 Not Running SM-08-202 Not Running SM-08-201 Seal Fail SM-08-202 Seal Fail SM-08-201 Pump Monitor Fail SM-08-202 Pump Monitor Fail SM-08-201 Overload SM-08-202 Overload See IO list for a complete list of alarms and status indications

2.9 MULTI-STAGE CENTRIFUGAL BLOWERS

Process Description:	Five (5) existing and one (1) proposed multistage centrifugal blowers shall supply air from the to a common air header and air system at the blower slab. Three blowers supply air to the secondary processes, chlorine contact basin, scum pump stations, and RAS/WAS pump stations (Air Header No. 2), Two blowers shall be dedicated to the sludge holding tanks (Air Header No. 1), and one blower shall be a common spare. The blowers shall be operated continuously at a constant speed. Each blower shall have a local protection panel (Vendor Provided) and local padlock-able Lock-Stop Switch (By Contractor). Three low pressure switches, one on each branch of the air header, shall send an alarm when the pressure drops below a set point. See Specification Section - 11171 – Multi-Stage Centrifugal Blowers
P&ID:	9-I-1 Blowers P&ID
Controlled Devices:	<u>Existing</u> MSB-09-101 Multistage Blower No. 1 MSB-09-201 Multistage Blower No. 2 MSB-09-301 Multistage Blower No. 3 MSB-09-401 Multistage Blower No. 4 MSB-09-501 Multistage Blower No. 5 <u>Proposed</u> MSB-09-601 Multistage Blower No. 6
Instrumentation Devices:	<u>Existing</u> PSL-09-001 Blower Header Low Pressure No. 1 PSL-09-002 Blower Header Low Pressure No. 2

	Proposed PSL-09-003 Blower Header Low Pressure No. 3
Local Functions:	See Specification Section - 11171 – Multi-Stage Centrifugal Blowers
MCC Functions:	See Specification Section - 11171 – Multi-Stage Centrifugal Blowers
HMI Functions:	See Specification Section - 11171 – Multi-Stage Centrifugal Blowers
PLC Functions:	See Specification Section - 11171 – Multi-Stage Centrifugal Blowers
SCADA Functions:	Blowers Overview: SCADA screen shall show the blowers in a graphical layout similar to the P&IDs. This screen shall show the blowers' ON/OFF and fault status. The operator interface allows to start/stop blowers from SCADA. Blower Surge Panels are vendor provided panels, PCSS shall coordinate with the vendor for I/O tags and IP addresses. At minimum the Blowers screen shall display equipment running status, fault status, current (A), air flow (cfm), and any other relevant data that could be utilized by operations in running the plant. Blowers Alarms: All alarms shall have red/green indication for each alarm activity. Each alarm shall display a timestamp and date of most recent activation.
Interlocks:	Interlocks below are hardwired: Existing MSB-09-101 Phase Failure MSB-09-201 Phase Failure MSB-09-301 Phase Failure MSB-09-401 Phase Failure MSB-09-501 Phase Failure MSB-09-101 E-Stop MSB-09-201 E-Stop MSB-09-301 E-Stop MSB-09-401 E-Stop MSB-09-501 E-Stop MSB-09-101 SSRV Fail MSB-09-201 SSRV Fail MSB-09-301 SSRV Fail MSB-09-401 SSRV Fail MSB-09-501 SSRV Fail MSB-09-101 Surge MSB-09-201 Surge MSB-09-301 Surge MSB-09-401 Surge MSB-09-501 Surge MSB-09-101 Overload MSB-09-201 Overload MSB-09-301 Overload MSB-09-401 Overload MSB-09-501 Overload MSB-09-101 Lock Stop Switch

	MSB-09-201 Lock Stop Switch MSB-09-301 Lock Stop Switch MSB-09-401 Lock Stop Switch MSB-09-501 Lock Stop Switch MSB-09-101 Standby Power Lockout MSB-09-201 Standby Power Lockout MSB-09-301 Standby Power Lockout MSB-09-401 Standby Power Lockout MSB-09-501 Standby Power Lockout <u>Proposed</u> MSB-09-601 Phase Failure MSB-09-601 E-Stop MSB-09-601 SSRV Fail MSB-09-601 Surge MSB-09-601 Overload MSB-09-601 Lock Stop Switch MSB-09-601 Standby Power Lockout
Alarms and Indications:	<u>Alarms Indicated on SCADA</u> MSB-09-101 Phase Failure MSB-09-201 Phase Failure MSB-09-301 Phase Failure MSB-09-401 Phase Failure MSB-09-501 Phase Failure MSB-09-601 Phase Failure MSB-09-101 E-Stop MSB-09-201 E-Stop MSB-09-301 E-Stop MSB-09-401 E-Stop MSB-09-501 E-Stop MSB-09-601 E-Stop MSB-09-101 SSRV Fail MSB-09-201 SSRV Fail MSB-09-301 SSRV Fail MSB-09-401 SSRV Fail MSB-09-501 SSRV Fail MSB-09-601 SSRV Fail MSB-09-101 Surge MSB-09-201 Surge MSB-09-301 Surge MSB-09-401 Surge MSB-09-501 Surge MSB-09-601 Surge MSB-09-101 Overload MSB-09-201 Overload MSB-09-301 Overload MSB-09-401 Overload MSB-09-501 Overload MSB-09-601 Overload

	PSL-09-001 Low Header Pressure No. 1 Alarm PSL-09-002 Low Header Pressure No. 2 Alarm PSL-09-003 Low Header Pressure No. 3 Alarm See IO list for a complete list of alarms and status indications

2.10 ALUM FEED SYSTEM

Process Description:	Two (2) existing and one (1) proposed peristaltic pumps shall discharge alum from three storage tanks to the existing and proposed rapid mix basins. All three alum tanks, including two (2) existing and one (1) proposed, shall be used to provide alum discharge for said rapid mix basins. Proposed manual valves shall be used to direct flow between the two basins and the three (3) total tanks based on need as determined by operators. Two pumps shall be operated continuously and the other shall be standby, if the INTERLOCKS below are not active. The pumps speed shall be based on the flow paced 4-20mA signal from the PLC based on the combined Non-Potable Water System flow and the Plant Final Effluent Flow. The dosage of the pumps shall be controlled based on the calculated dosage utilizing the formula listed in the PLC Functions section below. A pressure switch on the discharge of each pump shall shut off and alarm the respective pump in the event the pressure in the discharge line increases to high pressure setpoint. In the event of a pump interlock due to high pressure, flow verification, or tube failure alarms the standby pump shall become duty. A level instrument on each tank shall provide local indication, as well as display level and alarms on SCADA. A Leak Senor provides leak detection for the system. A flow switch shall be installed on the potable water supply line to the eyewash stations in the containment area which shall alarm if an emergency shower or eyewash has been engaged. Leak sensors shall be installed in the sumps within the containment wall to alarm operations of a chemical leak. Two (2) proposed supply fans shall be installed in the chemical building to provide required ventilation. A small supply fan control panel shall be provided to operate the fans and shall contain all of the necessary breakers and starters to run these fans continuously. Hand-Off-Auto switches shall allow operators to designate which fans will be controlled by the chemical area PLC (PLC-11-001). A switch mounted to the wall shall allow the operator to call all supply fans that are in Auto to run continuously until they are shut off by the operator. When not in continuous function, the PLC shall call the supply fans to run for five min. every hour.
P&ID:	11C-I-1 Alum Feed System P&ID
Controlled Devices:	<u>Existing</u> PSP-11C-101 Alum Peristaltic Pump No. 1 PSP-11C-201 Alum Peristaltic Pump No. 2 <u>Proposed</u> PSP-11C-301 Alum Peristaltic Pump No. 3 SFAN-11-001 Supply Fan No. 1

	SFAN-11-002 Supply Fan No. 2
Instrumentation Devices:	Existing LIT-11C-101 Existing Alum Bulk Tank No. 1 Level LIT-11C-201 Existing Alum Bulk Tank No. 2 Level Proposed LIT-11C-301 Alum Bulk Tank No. 3 Level PSH-11C-101 Alum Peristaltic Pump No. 1 High Pressure PSH-11C-201 Alum Peristaltic Pump No. 2 High Pressure PSH-11C-301 Alum Peristaltic Pump No. 3 High Pressure LS-11C-001 Chemical Containment Leak Sensor LS-11C-002 Chemical Containment Leak Sensor FS-11C-001 Eyewash #1 Flow Switch TIT-11D-001 Heat Tracing Panel Temperature
Local Functions:	Peristaltic Pumps: The pump shall be controlled by its integrated pump control system. See Specification 11160 – Peristaltic Pumps Heat Trace Panel: Heat tracing local control and monitoring shall be provided via dedicated panel. Supply Fans: Two (2) supply fans shall be controlled by the Supply Fan Control Panel. When place in Hand, the supply fan shall run continuously unless the interlocks listed in the Interlock section below are active. See Specification 15831 – Fans.
MCC Functions:	None
HMI Functions:	None
PLC Functions:	Alum Feed: In Remote mode, the PLC shall receive pump run confirmation and alarms from the pumps. The pumps speed shall be based on the combined NPW flow and effluent flow. The PLC shall automatically calculate the desired usage rate using the following algorithm and adjust the metering pump speed to reach the desired chemical feed rate (mg/L). • Usage Rate (lbs/day) = (Flow (MGD) x (Influent – Effluent Phosphorus Concentration (mg/L)) x Dosage ((lbs Alum/lbs Phosphrus) / Day) / (Alum Solution Concentration (% as decimal) x 1.33 (Specific Gravity of Alum)) x 9.59 (correction factor) • Usage Rate (gal/hour) = Usage Rate (lbs/day) / 24 (hours/day) o Note: Dosage and Alum Solution Concentration are user adjustable values. Alum Feed System: • Standby Pump Selector: Pump No. 1 / Pump No. 2 / Pump No. 3. In the event of a pump interlock due to high pressure, flow verification, or tube failure alarms the standby pump shall become duty • Chemical tank levels • Chemical pump Run status • Chemical pump speeds (%) • Chemical pump Flowrates (gph) • Combined Final Effluent Flow (Total flow of FIT-08-001 WWTP Chlorinated Effluent

	and FIT-10-001 NPW System Flow) • Chemical pump Alarms, see below • Emergency Shower & Eyewash Flow Detected • Chemical Leak Detected Supply Fans: Two (2) supply fans shall be controlled by the PLC when the Supply Fan Control Panel controls are placed in Auto. When placed in Auto, the supply fan shall run continuously when called by the operator using the wall mounted switch, unless the interlocks listed in the Interlock section below are active. When not in continuous use, the PLC shall call any fans placed in Auto to run for five min. every hour as long as the interlocks listed in the Interlock section below are not active.
SCADA Functions:	Alum Overview: SCADA screen shall show the Alum Feed System in a graphical layout similar to the P&IDs. This screen shall show at a minimum, the status of the pumps, pump speed (%), dosing request, and flowrate (gph). This screen shall have a user-adjustable input for concentration that is incorporated in the equation mentioned in the PLC functions section. This screen shall display the Alum tank levels both in inches and in gallons. The PCSS shall coordinate with the vendor for I/O tags and IP addresses. Alum Feed System Alarms: This screen shall list all available alarms with red/green indication for each alarm activity. Each alarm shall display a timestamp and date of the most recent activation.
Interlocks:	Interlocks below are hardwired: SWT-11C-101 Alum Tank No. 1 Low Level SWT-11C-201 Alum Tank No. 2 Low Level SWT-11C-301 Alum Tank No. 3 Low Level PSP-11C-101 Alum Peristaltic Pump No. 1 Tube Failure PSP-11C-101 Alum Peristaltic Pump No. 1 High Discharge Pressure PSP-11C-101 Alum Peristaltic Pump No. 1 Failure PSP-11C-201 Alum Peristaltic Pump No. 2 Tube Failure PSP-11C-201 Alum Peristaltic Pump No. 2 Discharge High Pressure PSP-11C-201 Alum Peristaltic Pump No. 2 Failure PSP-11C-301 Alum Peristaltic Pump No. 3 Tube Failure PSP-11C-301 Alum Peristaltic Pump No. 3 High Discharge Pressure PSP-11C-301 Alum Peristaltic Pump No. 3 Failure SFAN-11-001 Supply Fan No. 1 Overload SFAN-11-002 Supply Fan No. 2 Overload
Alarms and Indications:	Alarms Indicated on SCADA LIT-11C-101 Alum Tank No. 1 Low Level LIT-11C-201 Alum Tank No. 2 Low Level LIT-11C-301 Alum Tank No. 3 Low Level PSP-11C-101 Alum Peristaltic Pump No. 1 Failure PSP-11C-201 Alum Peristaltic Pump No. 2 Failure PSP-11C-301 Alum Peristaltic Pump No. 3 Failure PSP-11C-101 Alum Peristaltic Pump No. 1 High Discharge Pressure PSP-11C-201 Alum Peristaltic Pump No. 2 High Discharge Pressure PSP-11C-301 Alum Peristaltic Pump No. 3 High Discharge Pressure PSP-11C-101 Alum Peristaltic Pump No. 1 Tube Failure

	PSP-11C-201 Alum Peristaltic Pump No. 2 Tube Failure PSP-11C-301 Alum Peristaltic Pump No. 3 Tube Failure PSP-11C-101 Alum Peristaltic Pump No. 1 Flow Verification Failure PSP-11C-201 Alum Peristaltic Pump No. 2 Flow Verification Failure PSP-11C-301 Alum Peristaltic Pump No. 3 Flow Verification Failure LS-11C-001 Chemical Containment Leak Detected LS-11C-002 Chemical Containment Leak Detected FS-11C-001 Eyewash #1 In-Use SFAN-11-001 Failure SFAN-11-002 Failure See IO list for a complete list of alarms and status indications

2.11 SODIUM HYPOCHLORITE FEED SYSTEM

Process Description:	Two (2) proposed peristaltic pumps shall be provided under the chemical feed system canopy. The pumps shall be utilized to pump sodium hypochlorite from two (2) existing bulk tanks to the existing tertiary filter basins and disinfection basin. One pump shall be operated continuously, and the other shall be standby, if the INTERLOCKS below are not active. The pumps speed shall be based on the flow paced 4-20mA signal from the PLC based on the combined Non-Potable Water System flow and the Plant Final Effluent Flow. The dosage of the pumps shall be either manually adjusted at the pump in local mode or controlled based on the calculated dosage utilizing the formula below. A pressure switch on the discharge of each pump shall shut off and alarm the respective pump in the event the pressure in the discharge line increases to high pressure setpoint. In the event of a pump interlock due to high pressure, flow verification, or tube failure alarms the standby pump shall become duty. A level instrument on each tank shall provide local indication, as well as display level and alarms on SCADA. A Leak Senor provides leak detection for the system. A flow switch shall be installed on the potable water supply line to the eyewash in the containment area which shall alarm if the emergency shower or eyewash have been engaged. Leak sensors shall be installed in the sumps within the containment wall to alarm operations of a chemical leak.
P&ID:	11A-I-1 Sodium Hypochlorite Feed System P&ID
Controlled Devices:	PSP-11A-101 Sodium Hypochlorite Peristaltic Pump No. 1 PSP-11A-201 Sodium Hypochlorite Peristaltic Pump No. 2
Instrumentation Devices:	LIT-11A-101 Sodium Hypochlorite Bulk Tank No. 1 Level LIT-11A-201 Sodium Hypochlorite Bulk Tank No. 2 Level PSH-11A-101 Sodium Hypochlorite Peristaltic Pump No. 1 High Pressure PSH-11A-201 Sodium Hypochlorite Peristaltic Pump No. 2 High Pressure LSL-11A-001 Chemical Containment Leak Sensor FS-11A-001 Eyewash #1 Flow Switch

Local Functions:	Peristaltic Pumps: The pump shall be controlled by its integrated pump control system. See Specification 11160 – Peristaltic Pumps.
MCC Functions:	None
HMI Functions:	None

PLC Functions:	Sodium Hypochlorite Feed: In Remote mode, the PLC shall receive pump run confirmation and alarms from the pumps. The pumps speed shall be based on the combined NPW flow and effluent flow. The PLC shall automatically calculate the desired usage rate using the following algorithm and adjust the metering pump speed to reach the desired chemical feed rate (mg/L).
	
	• Chlorine Available per Gallon of Fresh Commercial Solution (lbs/gal) = Available Chlorine (gram/L) x (3.785/453.6 (unit conversion grams to lbs and L to gal))
	• Usage Rate (gal/day) = (Flow (MGD) x Dosage (ppm) x 8.34 (lbs/gal)) / Chlorine Available per Gallon of Fresh Commercial Solution (lbs/gal)
	• Usage Rate (gal/hr) = Usage Rate (gal/day) / 24 (hours/day)
	  o Note: Available Chlorine will be a value provided by the supplier. As the bleach degrades over time, adjust the Dosage to correct the Usage Rate.
	  o Note: Available Chlorine and Dosage are user adjustable values.
	
	Sodium Hypochlorite System:
	• Duty Pump Selector: Pump No. 1 / Pump No. 2. In the event of a pump interlock due to high pressure, flow verification, or tube failure alarms the standby pump shall become duty
	• Chemical tank levels
	• Chemical pump Run status
	• Chemical pump speeds (%)
	• Chemical pump Flowrates (gph)
	• Combined Final Effluent Flow (Total flow of FIT-08-001 WWTP Chlorinated Effluent
	• and FIT-10-001 NPW System Flow)
	• Chemical pump Alarms, see below
	• Emergency Shower & Eyewash Flow Detected
	• Chemical Leak Detected

SCADA Functions:	Sodium Hypochlorite Disinfection Overview: SCADA screen shall show the Sodium Hypochlorite Feed System in a graphical layout similar to the P&IDs. This screen shall show at a minimum, the status of the pumps, pump speed (%), dosing request, and flowrate (gph). This screen shall have a user-adjustable input for concentration that is incorporated in the equation mentioned in the PLC functions section. This screen shall display the Sodium Hypochlorite tank levels both in inches and in gallons. The PCSS shall coordinate with the vendor for I/O tags and IP addresses. Sodium Hypochlorite Feed System Alarms: This screen shall list all available alarms with red/green indication for each alarm activity. Each alarm shall display a timestamp and date of the most recent activation.
Interlocks:	Interlocks below are hardwired: SWT-11A-101 Sodium Hypochlorite Tank No. 1 Low Level

	SWT-11A-201 Sodium Hypochlorite Tank No. 2 Low Level PSP-11A-101 Sodium Hypochlorite Peristaltic Pump No. 1 Tube Failure PSP-11A-101 Sodium Hypochlorite Pump No. 1 High Discharge Pressure PSP-11A-101 Sodium Hypochlorite Peristaltic Pump No. 1 Failure PSP-11A-201 Sodium Hypochlorite Peristaltic Pump No. 2 Tube Failure PSP-11A-201 Sodium Hypochlorite Pump No. 2 High Discharge Pressure PSP-11A-201 Sodium Hypochlorite Peristaltic Pump No. 2 Failure
Alarms and Indications:	<u>Alarms Indicated on SCADA</u> PSP-11A-101 Sodium Hypochlorite Peristaltic Pump No. 1 Failure PSP-11A-201 Sodium Hypochlorite Peristaltic Pump No. 2 Failure PSH-11A-101 Sodium Hypochlorite Peristaltic Pump No. 1 High Discharge Pressure PSH-11A-201 Sodium Hypochlorite Peristaltic Pump No. 2 High Discharge Pressure PSP-11A-101 Sodium Hypochlorite Peristaltic Pump No. 1 Tube Failure PSP-11A-201 Sodium Hypochlorite Peristaltic Pump No. 2 Tube Failure PSP-11A-101 Sodium Hypochlorite Peristaltic Pump No. 1 Flow Verification Failure PSP-11A-201 Sodium Hypochlorite Peristaltic Pump No. 2 Flow Verification Failure LSL-11A-001 Chemical Leak Detected FS-11A-001 Eyewash #1 In-Use See IO list for a complete list of alarms and status indications

2.12 SODIUM BISULFITE SYSTEM

Process Description:	Two (2) proposed peristaltic pumps shall be provided under the chemical feed system canopy. The pumps shall be utilized to pump sodium Bisulfite from two (2) existing bulk tanks to the existing dechlorination chamber. One pump shall be operated continuously, and the other shall be standby, if the INTERLOCKS below are not active. The pumps speed shall be based on the flow paced 4-20mA signal from the PLC based on the combined Non-Potable Water System flow and the Plant Final Effluent Flow. The dosage of the pumps shall be either manually adjusted at the pump in local mode or controlled based on the calculated dosage utilizing the formula below. A pressure switch on the discharge of each pump shall shut off and alarm the respective pump in the event the pressure in the discharge line increases to high pressure setpoint. In the event of a pump interlock due to high pressure, flow verification, or tube failure alarms the standby pump shall become duty.

	A level instrument on each tank shall provide local indication, as well as display level and alarms on SCADA. A Leak Senor provides leak detection for the system. A flow switch shall be installed on the potable water supply line to the eyewash in the containment area which shall alarm if the emergency shower or eyewash have been engaged. Leak sensors shall be installed in the sumps within the containment wall to alarm operations of a chemical leak.
P&ID:	11B-I-1 Sodium Bisulfite Feed System P&ID
Controlled Devices:	PSP-11B-201 Sodium Bisulfite Peristaltic Pump No. 1 PSP-11B-202 Sodium Bisulfite Peristaltic Pump No. 2
Instrumentation Devices:	LIT-11B-101 Sodium Bisulfite Bulk Tank No. 1 Level LIT-11B-201 Sodium Bisulfite Bulk Tank No. 2 Level PSH-11B-101 Sodium Bisulfite Peristaltic Pump No. 1 High Pressure PSH-11B-201 Sodium Bisulfite Peristaltic Pump No. 2 High Pressure LSL-11B-001 Chemical Containment Leak Sensor FS-11B-001 Eyewash #1 Flow Switch
Local Functions:	Peristaltic Pumps: The pump shall be controlled by its integrated pump control system. See Specification 11160 – Peristaltic Pumps.
MCC Functions:	None
HMI Functions:	None
PLC Functions:	Sodium Bisulfite Feed: In Remote mode, the PLC shall receive pump run confirmation and alarms from the pumps. The pumps speed shall be based on the combined NPW flow and effluent flow. The PLC shall automatically calculate the desired usage rate using the following algorithm and adjust the metering pump speed to reach the desired chemical feed rate (mg/L). • Usage Rate (lbs/day) = Flow (MGD) x Dosage (ppm) x 8.34 (lbs/gal) x 1.465 (parts SBS Dose/ 1 part Chlorine Dose) • Usage Rate (gal/day) = (Usage Rate (lbs/day) / 10.90 (lbs of SBS/gal of SBS)) * (1 / SBS Solution Concentration (% as decimal)) • Usage Rate (gal/hour) = Usage Rate (gal/day) / 24 (hours/day) o Note: Dosage and SBS Solution Concentration are user adjustable values. Sodium Bisulfite System: • Duty Pump Selector: Pump No. 1 / Pump No. 2. In the event of a pump interlock due to high pressure, flow verification, or tube failure alarms the standby pump shall become duty

	• Chemical tank levels • Chemical pump run status • Chemical pump speeds (%) • Chemical pump flowrates (gph) • Combined Final Effluent Flow (Total flow of FIT-08-001 WWTP Chlorinated Effluent and FIT-10-001 NPW System Flow) • Chemical pump Alarms, see below • Emergency Shower & Eyewash Flow Detected • Chemical Leak Detected
SCADA Functions:	Sodium Bisulfite Feed System Overview: SCADA screen shall show the Sodium Bisulfite Feed System in a graphical layout similar to the P&IDs. This screen shall show at a minimum, the status of the pumps, pump speed (%), dosing request, and flowrate (gph). This screen shall have a user-adjustable input for concentration that is incorporated in the equation mentioned in the PLC functions section. This screen shall display the Sodium Bisulfite tank levels both in inches and in gallons. The PCSS shall coordinate with the vendor for I/O tags and IP addresses. Sodium Bisulfite Feed System Alarms: This screen shall list all available alarms with red/green indication for each alarm activity. Each alarm shall display a timestamp and date of the most recent activation.
Interlocks:	Interlocks below are hardwired: SWT-11B-101 Sodium Bisulfite Tank No. 1 Low Level SWT-11B-201 Sodium Bisulfite Tank No. 2 Low Level PSP-11B-101 Sodium Bisulfite Peristaltic Pump No. 1 Tube Failure PSP-11B-101 Sodium Bisulfite Pump No. 1 High Discharge Pressure PSP-11B-101 Sodium Bisulfite Peristaltic Pump No. 1 Failure PSP-11B-201 Sodium Bisulfite Peristaltic Pump No. 2 Tube Failure PSP-11B-201 Sodium Bisulfite Pump No. 2 High Discharge Pressure PSP-11B-201 Sodium Bisulfite Peristaltic Pump No. 2 Failure
Alarms and Indications:	Alarms Indicated on SCADA SWT-11B-101 Sodium Bisulfite Tank No. 1 Low Level SWT-11B-201 Sodium Bisulfite Tank No. 2 Low Level PSP-11B-101 Sodium Bisulfite Peristaltic Pump No. 1 Failure PSP-11B-201 Sodium Bisulfite Peristaltic Pump No. 2 Failure PSP-11B-101 Sodium Bisulfite Peristaltic Pump No. 1 High Discharge Pressure PSP-11B-201 Sodium Bisulfite Peristaltic Pump No. 2 High Discharge Pressure PSP-11B-101 Sodium Bisulfite Peristaltic Pump No. 1 Tube Failure PSP-11B-201 Sodium Bisulfite Peristaltic Pump No. 2 Tube Failure PSP-11B-101 Sodium Bisulfite Peristaltic Pump No. 1 Flow Verification Failure PSP-11B-201 Sodium Bisulfite Peristaltic Pump No. 2 Flow Verification Failure LSL-11B-001 Chemical Leak Detected FS-11B-001 Eyewash #1 In-Use See IO list for a complete list of alarms and status indications

2.13 TERTIARY FILTERS

Process Description:	Two (2) cloth-media disk filters shall be provided alongside the four (4) existing cloth-media disk filters in each of two (2) existing tertiary filtration basins to filter the clarified effluent from the clarifiers before discharging to the disinfection basin. Two (2) existing backwash pumps per basin shall clean the filter disks and pump the backwash waste back to the head of the plant. Two existing control panels (one per basin) shall control their corresponding backwash valves and backwash pumps. The backwash sequence shall be initiated once the water level reaches the manufacturer defined backwash level set-point. The solids removal process shall remain as currently programmed. An existing submersible transducer in each filter basin shall measure the liquid level in the filter basin. An existing float provides a backup to the transducers. See Specification Section - 11340 - Cloth Media Disk Filter
P&ID:	7-I-1 Tertiary Filters P&ID
Alarms and Indications:	Alarms Indicated on SCADA: Basin No. 1 Fail Basin No. 1 Backwash Pump No. 1 Fail Basin No. 1 Backwash Pump No. 2 Fail Basin No. 1 High Level Alarm Basin No. 1 Turbidimeter High Pressure Alarm Basin No. 2 Fail Basin No. 2 Backwash Pump Fail Basin No. 2 Backwash Pump No. 1 Fail Basin No. 2 Backwash Pump No. 2 Fail Basin No. 2 High Level Alarm Basin No. 2 Turbidimeter High Pressure Alarm

2.14 NON-POTABLE WATER PUMP STATION

Process Description:	Two (2) proposed self-priming non-potable water (NPW) pumps (one duty, one spare) rated for variable frequency drive (VFD) service shall be controlled by the central PLC. The NPW pumps shall operate to maintain the system at the normal operating pressure setpoint. A flow meter shall measure and transmit the NPW flow to the chemical system PLC, where it shall be summed with the Parshall Flume flow measurement to dictate the speed of the chemical pumps.
P&ID:	10-I-1 Non-Potable Water System P&ID
Controlled Devices:	Proposed: SPP-10-101 NPW Pump No. 1 SPP-10-201 NPW Pump No. 2 (Spare)
Instrumentation Devices:	Existing: FIT-10-001 NPW System Flow PS-10-001 NPW Pressure Switch Low/High PS-10-002 NPW Pressure Switch Low/High

	Proposed: PIT-10-001 NPW System Pressure
Local Functions:	The existing local control panel contains the following for each pump: • H-O-A Switch • A green light to indicate the pumps running status • Elapsed Time Meter • Reset Push Button • Pump Speed Control In the HAND position, each pump shall operate continuously, with the speed adjustable via panel mounted speed control, if the interlocks for the pump listed in the INTERLOCKS section below are not active.
MCC Functions:	None.
Remote Functions:	None.
HMI Functions:	None.
PLC Functions:	In the AUTO position, the NPW pumps shall operate upon receiving a call signal from the PLC. The Central PLC Control Panel shall be utilized for the primary control of the non-potable water station. The signal from the proposed pressure indicating transmitter shall be sent to the PLC as the Primary Variable for the PID control loop that sets the speed of the pump VFDs. Pump operation: Call the pumps based on pressure setpoints and alternate pump after each pump off cycle or after an operator adjustable time period. All pump call setpoints shall be operator adjustable. The PLC shall maintain the pressure setpoint, setting the VFD speed based on a PID control loop. The PLC shall receive pump statuses (Pump in Auto, Running, Overload) from the local control panel. If an alarm is active, the PLC shall exclude the corresponding pump from the call sequence until the alarm is reset. NPW Flow: PLC shall use the NPW flow in its calculations to determine the chemical feed rates for Sodium Hypochlorite, Sodium Bisulfite, and Alum. Dewatering Building Exhaust Fan Flow Verification In addition to the NPW system controls, the NPW PLC shall will provide all monitoring of the dewatering building exhaust fans. Each exhaust fan will be equipped with a 4-20mA differential pressure monitor capable of verifying exhaust fan flow. At a minimum, logic for the exhaust fans should be developed to include:

	1. Should all four exhaust fans not be running during normal operation, the PLC should generate an alarm to be notified at SCADA 2. PCSS and/or System integrator shall coordinate with the exhaust fan vendor to determine the alarm and reset values for the exhaust fan differential pressure flow verification. Should the differential pressure be satisfied, the flow verification alarm will automatically be reset by the PLC. 3. Should all four exhaust fans be running but the required flow pressure differential not be satisfied, the PLC should generate an alarm to be notified at SCADA and via a strobe light on the dewatering building.
SCADA Functions:	NPW System Overview: This screen shall show the NPW System graphical layout similar to the P&IDs. A graphical representation of the selector switches, lights, and ETMs shall be shown. The non-potable water system pressure and operational set points for the lead and lag pumps shall be indicated on the screen. NPW system flow shall also be displayed, in addition to the combined effluent. NPW System Alarms: All alarms shall have red/green indication for each alarm activity. Each alarm shall display a timestamp and date of most recent activation.
Interlocks:	All interlocks below are hardwired: LSL-08-001 Chlorine Contact Basin Low Level CP-10-001 Phase Failure SPP-10-101 Fail SPP-10-201 Fail PSH-10-101 NPW Pump No. 1 High Pressure PSH-10-201 NPW Pump No. 2 High Pressure
Alarms and Indications:	Alarms Indicated on SCADA: CPP-10-001 Control Power CPP-10-001 Phase Fail SPP-10-101 in Auto SPP-10-101 Run SPP-10 -101 Fail SPP-10-201 in Auto SPP-10-201 Run SPP-10 -201 Fail PSL-10-101 NPW Pump No. 1 Low Pressure PSH-10-101 NPW Pump No. 1 High Pressure PSL-10-201 NPW Pump. No. 2 Low Pressure PSH-10-201 NPW Pump No. 2 High Pressure SFAN-14-01 Run Status SFAN-14-02 Run Status SFAN-14-03 Run Status SFAN-14-04 Run Status SFAN-14-01 Overload SFAN-14-02 Overload SFAN-14-03 Overload SFAN-14-04 Overload Loss of Exhaust Fan Flow

	See IO list for a complete list of alarms and status indications

2.15 DEWATERING PRESS FEED PUMPS

Process Description:	Two (2) Double Disk Diaphragm pumps (one duty, one spare) shall be provided to pump Waste Activated Sludge (WAS) from the existing Sludge Holding Tank to feed the Volute Press at the Dewatering Facility. Each pump shall be operated by a VFD to regulate the flow. WAS flow shall be monitored via proposed flow meter FM-14A-101, outside the press feed pumps at the Dewatering building. The operator shall be able to set the desired flow rate, and the feed pumps shall operate to maintain that flow via a PID control loop. Any variations from the preset flow shall cause the dewatering system to shut down and alarm. The Double Disc Diaphragm Pumps form part of the dewatering PCS system. See Specification Section - 11152 – Double Disc Diaphragm Pump and Section 11445 – Volute Press for process control narrative.
P&ID:	14A-I-1 Dewatering Press Feed Pumps P&ID 14D-I-1 Volute Dewatering Press P&ID
Controlled Devices:	DDP-14A-101 Dewatering Press Feed Pump No. 1 DDP-14A-201 Dewatering Press Feed Pump No. 2
Instrumentation Devices:	PS-14A-101 Dewatering Press Feed Pump No. 1 Low/High Pressure Alarm PS-14A-201 Dewatering Press Feed Pump No. 2 Low/High Pressure Alarm VSH-14A-101 Dewatering Press Feed Pump No.1 High Vacuum Alarm VSH-14A-201 Dewatering Press Feed Pump No.2 High Vacuum Alarm FIT-14A-101 Sludge Flow
Local Functions:	None
MCC Functions:	None
HMI Functions:	None

PLC Functions:	Double Disc Diaphragm Pumps shall be controlled from panel CP-14D-001. HOA, speed control, and pump status shall be accessed using the Volute Dewatering System OIT. In HAND, the pump shall run continuously, if the interlocks in the INTERLOCKS section below are not active. Pump speed shall be set from the Volute Dewatering System OIT. In AUTO, Dewatering Press Feed Pumps shall be called at the start of the dewatering sequence from panel CP-14D-101 if the Interlocks in the INTERLOCKS section below are not active. WAS flow shall be monitored via a proposed flow meter outside the press feed pumps at the Dewatering building. The operator shall be able to set the desired flow, and the Dewatering Press Feed Pumps shall operate to maintain that flow via a PID control loop. Any variations from the preset flow shall cause the dewatering system to shut down and alarm. Each pump shall alternate which pump is the LEAD pump and LAG pump upon each successive pump call from the Volute Dewatering System. Dewatering Press Feed Pumps shall shut off either based on an operator adjustable internal flow totalizer setpoint or using the timers set by the PLC during the dewatering shutdown sequence from CP-14D-101, any clock settings that are set, by manual pushbutton selection from the OIT screen, remote SCADA stop signal, or any shutdown alarm per the manufacturer's Alarm Shutdown Table. Any E-Stop being pressed shall immediately stop ALL equipment. The Double Disc Diaphragm Pumps form part of the dewatering PCS system. For startup sequence see Specification 13441 Section 2.18 – Volute Dewatering.
SCADA Functions:	Dewatering Press Feed Pumps Overview: This screen shall show the Dewatering Press Feed Pump system with a graphical layout similar to the P&IDs. A graphical representation of the selector switches, lights, and ETMs shall be shown. Sludge Flow, target speeds and operational set points for the lead and lag pumps shall be indicated on the screen. The screen shall show at a minimum, the PID flow control setpoint, pumps running, and any faults or alarms. Dewatering Press Feed Pumps Alarms: All alarms shall have red/green indication for each alarm activity. Each alarm shall display a timestamp and date of most recent activation.
Interlocks:	Interlocks below are hardwired: LSH-14D-101 Volute Press High Level Lockout PSH-14A-101 Dewatering Press Feed Pump No. 1 Pressure Switch High PSH-14A-201 Dewatering Press Feed Pump No. 2 Pressure Switch High VSH-14A-101 Dewatering Press Feed Pump No.1 High Vacuum Alarm VSH-14A-201 Dewatering Press Feed Pump No.2 High Vacuum Alarm LSL-13-001 Sludge Holding Tank Low Level Alarm LSL-13-002 Sludge Holding Tank Low Level Alarm ES-14D-100 E-Stop Activated ES-14D-101 E-Stop Activated ES-14D-102 E-Stop Activated FIT-14A-101 Low Sludge Flow Cutoff

Alarms and Indications:	Alarms Indicated on SCADA: DDP-14A-101 Dewatering Press Feed Pump No. 1 VFD Fail DDP-14A-201 Dewatering Press Feed Pump No. 2 VFD Fail PSL-14A-101 Dewatering Press Feed Pump No. 1 Pressure Switch Low PSH-14A-101 Dewatering Press Feed Pump No. 1 Pressure Switch High PSL-14A-201 Dewatering Press Feed Pump No. 2 Pressure Switch Low PSH-14A-201 Dewatering Press Feed Pump No. 2 Pressure Switch High LSL-13-001 Sludge Holding Tank Low Level Alarm LSL-13-002 Sludge Holding Tank Low Level Alarm FIT-14A-101 Low Sludge Flow Cutoff See IO list for a complete list of alarms and status indications

2.16 DEWATERING NPW BOOSTER PUMPS

Process Description:	Two (2) Dewatering NPW booster pumps (one duty, one spare) shall be provided to meet water pressure requirements of the dewatering system. The Dewatering NPW Booster Pumps shall begin startup following the initiation of start operations on the Dewatering Press Feed Pumps. The Dewatering NPW Booster Pumps shall be stopped following the Dewatering Press Feed Pumps being stopped. The Dewatering NPW Booster Pumps form part of the dewatering PCS system. See Specification Section - 11144 – Multi-Stage Vertical Turbine Pump and Section 11445 – Volute Press for process control narrative.
P&ID:	14B-I-1 Dewatering NPW Booster Pumps P&ID
Controlled Devices:	VMP-14B-101 – Dewatering NPW Booster Pump No. 1 VMP-14B-201 – Dewatering NPW Booster Pump No. 2
Instrumentation Devices:	PS-14B-101 – Dewatering NPW Pump No. 1 Low/High Pressure Switch PS-14B-201 – Dewatering NPW Pump No. 2 Low/High Pressure Switch
Local Functions:	Local Control Panel: The proposed local control panel shall contain the following for each pump. • H-O-A Switch. • A green light shall indicate the pumps running status. • Red lights to indicate the pump fault status, and low and high discharge pressure alarms. • Elapsed Time Meter. • Reset Push Button. In the HAND position, each pump shall operate if the interlocks for the pump listed in the INTERLOCKS section below are not active.
MCC Functions:	None
HMI Functions:	None

PLC Functions:	In the AUTO position, each pump shall alternate which pump is the LEAD pump and LAG pump upon each successive pump call from the Volute Dewatering System. Dewatering NPW Booster Pumps are called as part of the Dewatering sequence.
SCADA Functions:	Dewatering NPW Booster Pumps Overview: This screen shall show the Dewatering NPW Booster Pump system with a graphical layout similar to the P&IDs. A graphical representation of the selector switches, lights, and ETMs shall be shown. The screen shall show at a minimum, pumps running and any faults or alarms. Dewatering NPW Booster Pumps Alarms: All alarms shall have red/green indication for each alarm activity. Each alarm shall display a timestamp and date of most recent activation.
Interlocks:	Interlocks below are hardwired: LSL-08-001 Chlorine Contact Basin Low Level PSH-14B-101 – Dewatering NPW Booster Pump No. 1 Pressure Switch High PSH-14B-201 – Dewatering NPW Booster Pump No. 2 Pressure Switch High ES-14D-100 E-Stop Activated ES-14D-101 E-Stop Activated ES-14D-102 E-Stop Activated
Alarms and Indications:	Alarms Indicated on SCADA: VMP-14B-101 - Dewatering NPW Booster Pump No. 1 Fail VMP-14B-201 - Dewatering NPW Booster Pump No. 2 Fail PSL-14B-101 – Dewatering NPW Booster Pump No. 1 Pressure Switch Low PSH-14B-101 – Dewatering NPW Booster Pump No. 1 Pressure Switch High PSL-14B-201 – Dewatering NPW Booster Pump No. 2 Pressure Switch Low PSH-14B-201 – Dewatering NPW Booster Pump No. 2 Pressure Switch High See IO list for a complete list of alarms and status indications

2.17 POLYMER SYSTEM

Process Description:	Two (2) Polymer Blending Units (one duty, one spare) shall be provided for the proposed Volute Press. The polymer blending units shall startup following the initiation of start operations on the Dewatering Press Feed Pumps. The Polymer Blending Unit shall be stopped following the Dewatering Press Feed Pumps being stopped. The Dewatering Press Feed Pumps shall pump WAS from the existing sludge holding tank to proposed Volute Press, based on control signals from the Dewatering Control Panel (CP-14D-101). The Polymer Blending Unit shall receive the feed start signal and flow pacing speed signals from the Dewatering Control Panel. Dewatering Control panel OIT allows operator input of desired sludge feed rate and polymer dose. The Polymer Blending Units form part of the dewatering PCS system. See Specification Section 11540 – Liquid Polymer Blending Unit and Section 11445 – Volute Press for process control narrative.
P&ID:	14C-I-1 Polymer System P&ID

Controlled Devices:	PBU-14C-101 Polymer Blending Unit No. 1 PBU-14C-201 Polymer Blending Unit No. 2
Instrumentation Devices:	Control system is part of vendor supplied package. See specification 11540 – Liquid Polymer Blending Unit
Local Functions:	See specification 11540 – Liquid Polymer Blending Unit
MCC Functions:	None
HMI Functions:	Polymer Blending Unit system shall be vendor supplied and controlled by the vendor supplied control panel.
PLC Functions:	See specification 11540 – Liquid Polymer Blending Unit
SCADA Functions:	Polymer Blending Unit Overview: This screen shall show the Polymer Blending Unit skids with a graphical layout similar to the P&IDs. The screen shall show at a minimum, pumps running and any faults or alarms. Polymer pumps are vendor provided. The PCSS shall coordinate with the vendor for I/O tags and IP addresses. Polymer Blending Unit Alarms: All alarms shall have red/green indication for each alarm activity. Each alarm shall display a timestamp and date of most recent activation
Interlocks:	ES-14D-100 E-Stop Activated ES-14D-101 E-Stop Activated ES-14D-102 E-Stop Activated
Alarms and Indications:	Alarms Indicated on SCADA: PBU-14C-101 Fail PBU-14C-201 Fail PBU-14C-101 Loss of Dilution Water Flow Alarm PBU-14C-201 Loss of Dilution Water Flow Alarm PSL-14C-101 Low Water Pressure PSL-14C-201 Low Water Pressure

2.18 VOLUTE DEWATERING

Process Description:	One (1) Volute Press shall be installed in the proposed Dewatering facility. The volute press shall be utilized to dewater sludge from the existing Sludge Holding Tank. Dewatering Press Feed Pumps shall pump waste activated sludge (WAS) from the Sludge Holding Tank to the Volute Press flocculation tank. The Dewatering Control Panel shall send and receive signals from Press Feed Pumps. Polymer solution shall be injected into the Volute press flocculation tank from two (2) polymer blend units (one duty, one spare) at a rate based on the WAS flow rate. Variable speed mixers in the flocculation tanks can be adjusted at the Dewatering Control Panel. Flocculated WAS shall discharge directly into the Volute Press for dewatering. Dewatered sludge (cake) from Volute Press shall discharge into the screw conveyors, which discharge for off-site disposal. The Volute Press forms part of the dewatering PCS system. See Specification Section 11152 – Double Disc Diaphragm Pump, Section 11144 – Multi-Stage Vertical Turbine Pump, Section 11733 – Screw Conveyors, and Section 11540 – Liquid Polymer Blending Unit for process control narrative. The Volute Press system shall be vendor supplied and controlled by the vendor supplied control panel. See Specification Section - 11445 - Volute Press.
P&ID:	14D-I-1 Volute Press P&ID
Controlled Devices:	VP-14D-101 Volute Press No. 1 FCT-14D-101 Flocculation Tank Mixer No. 1 FCT-14D-102 Flocculation Tank Mixer No. 2 FCT-14D-103 Flocculation Tank Mixer No. 3 SCC-14D-101 Screw Conveyor No. 1 SCC-14D-102 Screw Conveyor No. 2 DDP-14A-101 Dewatering Press Feed Pump No. 1 DDP-14A-201 Dewatering Press Feed Pump No. 2 VMP-14B-101 Dewatering NPW Booster Pump No. 1 VMP-14B-201 Dewatering NPW Booster Pump No. 2 PBU-14C-101 Polymer Blending Unit No. 1 PBU-14C-201 Polymer Blending Unit No. 2
Instrumentation Devices:	LSH-14D-101 Flocculation Tank No. 1 Level Switch High LT-14D-101 Flocculation Tank No. 2 Level Transmitter LT-14D-102 Flocculation Tank No. 3 Level Transmitter MS-14D-101A Volute Press No. 1 Motion Sensor No. 1 MS-14D-101B Volute Press No. 1 Motion Sensor No. 2 MS-14D-101C Volute Press No. 1 Motion Sensor No. 3 MS-14D-101D Volute Press No. 1 Motion Sensor No. 4 MS-14D-101E Volute Press No. 1 Motion Sensor No. 5 MS-14D-101F Volute Press No. 1 Motion Sensor No. 6 ES-14D-100 Volute Press No. 1 E-Stop ES-14D-101 Screw Conveyor No. 1 E-Stop ES-14D-201 Screw Conveyor No. 2 E-Stop SV-14D-101 Solenoid Valve SV-14D-102 Solenoid Valve SV-14D-103 Solenoid Valve SV-14D-104 Solenoid Valve

	SV-14D-105 Solenoid Valve SV-14D-106 Solenoid Valve
Local Functions:	The Volute Press system shall be vendor supplied and controlled by the vendor supplied control panel. See Specification Section - 11445 - Volute Press.
MCC Functions:	None
HMI Functions:	The Volute Press system shall be vendor supplied and controlled by the vendor supplied control panel. See Specification Section - 11445 - Volute Press.
PLC Functions:	In AUTO mode, PLC shall provide for the operational control of all components of the Volute Thickener- system including the ability to set times and operating speeds for any feed pump installed, solids conveyor, dewatering drums, mixers, polymer dosing system and wash-down sprays. PLC shall allow suitably qualified operators to adjust operating parameters such as delay timers for fault alarms and system calibration constants. PLC shall allow the operator to inspect the operation of all the components including indicators such as output frequency, current draw, thermal condition, elapsed operating times, and any faults present. Operator shall be able to view approximated readouts of all operational speeds and flowrates relevant to the operation of the system. Operator shall be able to manually operate each item of equipment from the OIT for inspection and maintenance reasons. Operator shall be able to set the unit to operate at a specific time or on specific days with no operators present. When set to AUTO, all items of equipment shall work as per the following descriptions. • Clock Operation o The clock function shall be controlled by the PLC in the control panel. Two clock functions shall be allowed for in the program. The clock may be set to either “On” or “Auto/timer” via the OIT. ▪ If the clock is set to “On” the plant shall run for as long as the main switch is set to “Auto”. ▪ When the clock is set to “Auto/Timer” the plant shall operate in accordance with the clock settings. o Clock function settings shall allow the operator to set the dewatering press and all associated equipment to switch on and off, at pre-designated times on pre-designated days with no operators being present. o A minimum of two (2) different “clock programs” shall be allowed for in the PLC program. Control Sequence: 1. In AUTO, Operation of the volute press shall be initiated by engaging the following sequence: a. Run Permissives enable automatic control b. Prompt input of desired sludge feed rate and polymer dose. c. Sequence Start 1. System shall begin sequence start by OIT pushbutton 2. System Time Clock scheduled sequence start 3. SCADA run signal d. System shall begin Auto Start Delay Timer

	e. Volute press shall initiate system start operations (Optional start delay timers for all equipment): 1. Dewatering Press Feed Pumps shall be started 2. Polymer Blending Unit shall be started 3. Dewatering NPW Booster Pumps shall be started 4. Flocculation Mixers shall be started 5. Dewatering Drums shall be started 6. Screw Conveyors shall be started a. Conveyor No. 2 shall be started and rotation confirmed. b. Conveyors No. 1 shall be started and rotation confirmed. f. System Stop shall be initiated by 1. Run Flow Total Stop On a. System shall begin stop operation when Totalizer setpoint is achieved 2. Run Flow Total Stop Off a. Runs Continuously until the system receives a system stop signal initiated by any of the following: i. Local operator pushbutton from the control panel OIT ii. Local Time Clock stop setpoint iii. Remote stop signal from the operator over SCADA iv. Alarm shutdown shall occur for any enabled fault status, refer to manufacturer documentation for Alarm Shutdown Table 2. Stopping the dewatering operation shall initiate the following sequence (Optional stop timers for all equipment): a. Normal or Extended stop timers shall be started b. Dewatering Press Feed Pump(s) shall be turned off. c. Polymer blending unit shall be stopped. d. Drum equipment shall initiate system stop. 1. All drum sprays shall operate on a separate cycle timer e. Conveyor No. 1 shall run for 60 seconds and then stop. Zero rotation shall be confirmed. f. Conveyor No. 2 shall run for 60 seconds and the stop. Zero rotation shall be confirmed. g. Dewatering NPW Booster Pumps shall be stopped. h. Some Optional Timers shall be bypassed by certain alarm groups, refer to manufacturer documentation for Alarm Shutdown Table. i. E-Stops are hard-wired and shall shut off ALL equipment immediately and alarm SCADA.
SCADA Functions	Volute Press Overview: SCADA screen shall show the dewatering system in a graphical layout similar to the P&IDs. The screen shall show at a minimum, the PID sludge flow control setpoint, polymer

	dosing setpoint, equipment running, and any faults or alarms. Volute Press is a vendor provided package. The PCSS shall coordinate with the vendor for I/O tags and IP addresses. Volute Press Alarms: All alarms shall have red/green indication for each alarm activity. Each alarm shall display a timestamp and date of most recent activation.
Interlocks:	All interlocks below are hardwired: FIT-14A-101 Low Sludge Flow LSL-13-001 Sludge Holding Tank Low Level Alarm LSL-13-002 Sludge Holding Tank Low Level Alarm ES-14D-100 E-Stop Activated ES-14D-101 E-Stop Activated ES-14D-102 E-Stop Activated All interlocks below are programmed: FIT-14A-101 Low Sludge Flow PBU-14C-101 Polymer Blend Unit No. 1 Fail PBU-14C-201 Polymer Blend Unit No. 2 Fail PBU-14D-101 Polymer Blend Unit No. 1 Low Flow PBU-14D-201 Polymer Blend Unit No. 2 Low Flow PBU-14D-101 Polymer Blend Unit No. 1 Low Pressure PBU-14D-201 Polymer Blend Unit No. 2 Low Pressure VP-14D-101 Volute Press No. 1 System Fail MS-14D-101A Volute Press No. 1 Motion Sensor No. 1 Alarm MS-14D-101B Volute Press No. 1 Motion Sensor No. 2 Alarm MS-14D-101C Volute Press No. 1 Motion Sensor No. 3 Alarm MS-14D-101D Volute Press No. 1 Motion Sensor No. 4 Alarm MS-14D-101E Volute Press No. 1 Motion Sensor No. 5 Alarm MS-14D-101F Volute Press No. 1 Motion Sensor No. 6 Alarm DDP-14A-101 Dewatering Press Feed Pump No. 1 Fail DDP-14A-201 Dewatering Press Feed Pump No. 2 Fail DDP-14A-101 Dewatering Press Feed Pump No. 1 Low Pressure DDP-14A-201 Dewatering Press Feed Pump No. 2 Low Pressure VMP-14B-101 Dewatering NPW Booster Pump No. 1 Fail VMP-14B-201 Dewatering NPW Booster Pump No. 2 Fail VMP-14B-101 Dewatering NPW Booster Pump No. 1 Low Pressure VMP-14B-201 Dewatering NPW Booster Pump No. 2 Low Pressure FCT-14D-101 Flocculation Tank Mixer No. 1 Fail FCT-14D-102 Flocculation Tank Mixer No. 2 Fail FCT-14D-103 Flocculation Tank Mixer No. 3 Fail LSH-14D-102 High Flocculation Tank No. 1 Level LT-14D-101 High Flocculation Tank No. 2 Level LT-14D-102 High Flocculation Tank No. 3 Level SCC-14D-101 Screw Conveyor No. 1 Fail SCC-14D-102 Screw Conveyor No. 2 Fail SCC-14D-101 Screw Conveyor No. 1 Zero Speed Sensor SCC-14D-102 Screw Conveyor No. 2 Zero Speed Sensor LSL-13-001 Sludge Holding Tank Low Level Alarm LSL-13-002 Sludge Holding Tank Low Level Alarm ES-14D-100 E-Stop Activated

	ES-14D-101 E-Stop Activated ES-14D-102 E-Stop Activated
Alarms and Indications:	Alarms Indicated on SCADA: CP-14D-001 Dewatering Control Power Fail PLC-14D-101 Dewatering PLC Fail VP-14D-101 Volute Press No. 1 System Fail DDP-14A-101 Dewatering Press Feed Pump No. 1 Fail DDP-14A-201 Dewatering Press Feed Pump No. 2 Fail FIT-14A-101 Low Sludge Flow PS-14B-101 Dewatering NPW Booster Pump No. 1 Low Discharge Pressure PS-14B-201 Dewatering NPW Booster Pump No. 1 Low Discharge Pressure FCT-14D-101 Flocculation Tank Mixer No. 1 Fail FCT-14D-102 Flocculation Tank Mixer No. 2 Fail FCT-14D-103 Flocculation Tank Mixer No. 3 Fail LSH-14D-102 High Flocculation Tank No. 1 Level LT-14D-101 High Flocculation Tank No. 2 Level LT-14D-102 High Flocculation Tank No. 3 Level SCC-14D-101 Screw Conveyor No. 1 Fail SCC-14D-102 Screw Conveyor No. 2 Fail PBU-14C-101 Polymer Blend Unit No. 1 Fail PBU-14C-201 Polymer Blend Unit No. 2 Fail PBU-14D-101 Polymer Blend Unit No. 1 Low Flow PBU-14D-201 Polymer Blend Unit No. 2 Low Flow PBU-14D-101 Polymer Blend Unit No. 1 Low Pressure PBU-14D-201 Polymer Blend Unit No. 2 Low Pressure MS-14D-101A Volute Press No. 1 Motion Sensor No. 1 Alarm MS-14D-101B Volute Press No. 1 Motion Sensor No. 2 Alarm MS-14D-101C Volute Press No. 1 Motion Sensor No. 3 Alarm MS-14D-101D Volute Press No. 1 Motion Sensor No. 4 Alarm MS-14D-101E Volute Press No. 1 Motion Sensor No. 5 Alarm MS-14D-101F Volute Press No. 1 Motion Sensor No. 6 Alarm ES-14D-100 E-Stop Activated ES-14D-101 E-Stop Activated ES-14D-102 E-Stop Activated See IO list for a complete list of alarms and status indications.

END OF SECTION

0 1 2 3 4 5 ORIGINAL SCALE IN INCHES FOR REDUCED PLANS

NETWORK ACHITECTURE LEGEND:

ESW	ETHERNET SWITCH	FIT	ANALYZER INDICATING TRANSMITTER
FPP	FIBER-OPTIC PATCH PANEL	PSP	PERISTALTIC PUMP
HMI	HUMAN/MACHINE INTERFACE	UPS	UNINTERRUPTIBLE POWER SUPPLY
VFD	VARIABLE FREQUENCY DRIVE	PIT	PRESSURE INDICATING TRANSMITTER
LIT	LEVEL INDICATING TRANSMITTER		

FIELD I/O (DISCRETE/ANALOG)

ETHERNET (CAT 6)

FIBER OPTIC CABLE

Lift Station

Lift Station Local Control Panel
CP-02-101

LIT-02-101

Lift Station PLC Control Panel
CP-02-002
PLC-02-001 — ESW-02-001 — FFP-02-001

Chemical Building

FIT-08-001
FIT-10-001

Chemical System Control Panel
CP-11-101
PLC-11-101 — ESW-11-101 — FPP-11-101

LIT-11A-101
LIT-11A-201
LIT-11B-101
LIT-11B-201
LIT-11C-101
LIT-11C-201
LIT-11C-301

PSP-11A-101
PSP-11A-201
PSP-11B-101
PSP-11B-201
PSP-11C-101
PSP-11C-201
PSP-11C-301

Headworks

Headworks Control Panel No. 1
CP-03-101
PLC-03-101 — ESW-03-101
LIT-03-101

Headworks Control Panel No. 2
CP-03-301
PLC-03-301 — EWS-03-301
LIT-03-301

Blower No. 1
CP-09-101
PLC-09-101
OIT-09-101

Blower No. 2
CP-09-201
PLC-09-201
OIT-09-201

Blower No. 3
CP-09-301
PLC-09-301
OIT-09-301

Blower No. 4
CP-09-401
PLC-09-401
OIT-09-401

Blower No. 5
CP-09-501
PLC-09-501
OIT-09-501

Blower No. 6
CP-09-601
PLC-09-601
OIT-09-601

Sludge Holding Tank

FIT-13-101
FIT-13-102
FIT-13-201
FIT-13-202
FIT-13-301
FIT-13-302
LSL-13-001
LSL-13-002

SH Mixer Control Panel
CP-08-301

SBS Mixer Control Panel
CP-08-301

PSL-09-001
PSL-09-002
PSL-09-003

Peak Shaving Basin Control Panel
CP-04-201
PLC-04-201 — ESW-04-201

Dewatering Building

NPW Control Panel
CP-10-001
PLC-10-001
ESW-10-001
FPP-10-001

LSL-08-001
PIT-10-001
PSL-10-001
PSH-10-002

Dewatering Press Control Panel
CP-14D-101
PLC-14D-101 — EWS-14D-101

Polymer Blending Unit No. 1
PBU-14C-101

Polymer Blending Unit No. 2
PBU-14C-201

FIT-14D-201
LIT-14D-101
LSH-14D-101

Dewatering NPW Booster Pumps Control Panel
CP-14B-001

PSL-14A-001
PSH-14B-001

Tertiary Filter Control Panel No.1
CP-07-101
PLC-07-101 — ESW-07-101
OIT-07-101

AIT-07-101
FIT-07-101
LE-07-101
PSH-07-101

SPP-07-101 VFD
SPP-07-101 VFD

PIT-07-101
PIT-07-102
PIT-07-103
PIT-07-104

Tertiary Filter Control Panel No.2
CP-07-201
PLC-07-201 — ESW-07-201
OIT-07-201

AIT-07-201
FIT-07-201
LE-07-201
PSH-07-201

SPP-07-201 VFD
SPP-07-201 VFD

PIT-07-201
PIT-07-202
PIT-07-203
PIT-07-204

Clarifier No. 1 Control Panel
CP-06-101

Clarifier No. 2 Control Panel
CP-06-201

Clarifier No. 3 Control Panel
CP-06-301

Aeration Basin

AIT-05-101
AIT-05-201
AIT-05-301

FIT-05-101
FIT-05-102
FIT-05-201
FIT-05-202
FIT-05-301
FIT-05-302

Electrical Building

Control Room
CP-12-101

ESW-12-101
PLC-12-101
PPC-12-101 (Ignition Data Collector)
Firewall

FPP-12-101
FPP-12-201
FPP-12-301

Ignition Virtual SCADA Server

Electrical Room

Communication Panel
ESW-12-102

MCC
Power Quality Meter
ATS

NO.	DATE	REVISIONS	APP.
3	11/12/26	REVISIONS FOR ADDENDUM NO. 3	JJJ

WILBARGER CREEK M.U.D. No. 2
TRAVIS COUNTY, TEXAS

WASTEWATER TREATMENT PLANT EXPANSION TO 1.5 MGD

NETWORK ARCHITECTURE

QUIDDITY
Texas Board of Professional Engineers and Land Surveyors Reg. No. F-23290
912 South Capital of Texas Hwy, Suite 300 • Austin, TX 78746 • 512.441.9493

SCALE: NONE
DATE: FEBRUARY 2026
JOB NO. 0A651-0021-02
SUBMITTED:
DGN. BY: DO'DAY
DWN. BY: SSOMERS
DWG. NO.
SURV. BY:
F.B. NO.

STATE OF TEXAS
JOEL J. JOHN
115778
LICENSED PROFESSIONAL ENGINEER
11/12/2026

0-E-17
SHEET NO. 158 OF 223

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0 1 2 3 4 5 ORIGINAL SCALE IN INCHES FOR REDUCED PLANS

SCADA

Lift Station Singles (See I/O List in Specifications)

ML 04001 Photocell

Peak Shaving Basin Control Panel (CP-04-001)

Y YL 04001A CP-04-001 Control Power On	R YL 04001B CP-04-001 PLC Fail Alarm	R YL 04001D LSL-04-001 Low Level	R YL 04001E LSH-04-001 High Level	KI 04101 SPP-04-101 Runtime	KI 04201 SPP-04-201 Runtime	KI 04301 SPP-04-301 Runtime
OO HS 04001A CP-04-001 Phase Failure Bypass	BK PB 04001A CP-04-001 Backup System Test	R YL 04001C CP-04-001 Pumps On Photo Backup	OO HS 04001D CP-04-001 Alarm Beacon On-Off	HOA HS 04101 SPP-04-101 Hand-Off-Auto	HOA HS 04201 SPP-04-201 Hand-Off-Auto	HOA HS 04301 SPP-04-301 Hand-Off-Auto
OO HS 04001B CP-04-001 Controls Primary-Backup	BK PB 04001C CP-04-001 Alarm Silence	R PB 04001B CP-04-001 Backup System Reset	OO HS 04001C CP-04-001 Alarm Horn On-Off	G YL 04101 SPP-04-101 Running	G YL 04201 SPP-04-201 Running	G YL 04301 SPP-04-301 Running
	BK PB 04001C CP-04-001 Alarm Silence	BK PB 04001D CP-04-001 Alarm Test	R PB 04001E CP-04-001 Alarm Reset	R YL 04101 SPP-04-101 Overload	R YL 04201 SPP-04-201 Overload	R YL 04301 SPP-04-301 Overload

R YL 04001F CP-04-001 Rotating Beacon

LSH-04-001 HIGH LEVEL

To Lift Station (See Sheet 2-1-1)

4" GS - AIR

6"x4"

6" GS - AIR

12" DI - RS From Onsite Lift Station (See Sheet 2-1-1)

8" DI - RS From Onsite Lift Station (See Sheet 2-1-1)

6" BFV-04-002

10"x6"

10" GS - AIR

PI 04002 1/2" BV-04-003

PI 04001 1/2" BV-04-002

DI GS

10" DI - AIR From Blowers (See Sheet 9-1-1)

10" BFV-04-001

10" GS - AIR

5/8" HB-04-001

LSH 04001

LSL 04001

120 SHTR

M P

6" PV-04-301

6" SCV-04-301

6" PV-04-302

SPP-04-301 15 HP

120 SHTR

6" PV-04-101

6" SCV-04-101

6" PV-04-102

SPP-04-101 15 HP

120 SHTR

6" PV-04-201

6" SCV-04-201

6" PV-04-202

SPP-04-201 15 HP

PI 04001

2" ARV-04-001

1/2" BV-04-001

2" PVC - DR

2" BV-04-002

6" DPS-04-001

6" DI - RS To Headworks (See Sheet 3-1-1)

4" PV-04-003

4" DI - RS

8" DI - RS

5/8" HB-04-002

6" PV-04-001

6" PVC - DR To Onsite Drain Manhole No. 1

2"x1"

2" PVC - NPW From Headworks (See Sheet 3-1-1)

2" PVC - NPW

2"x1"

6" PV-04-002

6" PVC - DR To Onsite Drain Manhole No. 1

NOTES:

1. Aeration equipment is shown for illustrative purposes only. See specifications for performance requirements. Number of diffusers and pipe size shall be per approved equipment submittals.

For Electrical and Instrumentation Only:

STATE OF TEXAS JOEL J. JOHN 115776 LICENSED PROFESSIONAL ENGINEER 11/12/26

NO.	DATE	REVISIONS	APP.
1	11/12/26	Rev. Per Add. No. 3: Motor HP	JZ

WILBARGER CREEK M.U.D. No. 2
TRAVIS COUNTY, TEXAS

WASTEWATER TREATMENT PLANT EXPANSION TO 1.5 MGD

PEAK SHAVING BASIN P&ID

QUIDDITY
Texas Board of Professional Engineers and Land Surveyors Reg. No. F-23290
912 South Capital of Texas Hwy, Suite 300 • Austin, TX 78746 • 512.441.9493

SCALE: NONE DGN. BY: JZ
DATE: FEBRUARY 2026 DWN. BY: SSOMERS
JOB NO. 0A651-0021-02 DWG. NO.
SUBMITTED: SURV. BY:
F.B. NO.

STATE OF TEXAS JORDAN ZYLBERBERG 142350 LICENSED PROFESSIONAL ENGINEER 11/12/26

4-1-1
SHEET NO. 214 OF 230

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