City of Medical Lake
124 S Lefevre Street
PO Box 369
Medical Lake, WA 99022-0369
509-565-5000

Request for Proposal (RFP)

WWTP HEADWORKS PLC AND SCADA UPDATE

City of Medical Lake

Purpose:

The City of Medical Lake ("City") is seeking a qualified Control Systems Integrator ("Consultant") to upgrade selected Programmable Logic Controllers (PLCs) and Supervisory Control and Data Acquisition (SCADA) systems at the City's existing Wastewater Treatment Plant (WWTP).

Background:

The City commissioned its Waste-Water Treatment Plant in November of 2001 as an extended aeration oxidation ditch activated sludge treatment facility treating its effluent to Class A reclaimed water standards. The Headworks Building is where wastewater is screened, de-gritted, sampled, and metered prior to flowing to the Aeration Structure.

Project Overview:

This project is an upgrade of selected existing automation equipment at the City's WWTP. The work and materials for the upgrade effort are summarized into three task areas including:

1. Influent Pump States. A new Variable Frequency Drive for each of the three existing pumps in the Station. Note that these new Drives and associated wiring are already existing. The Consultant will be responsible for signal and communications connections to the Drives and for their commissioning and integration with the PLC and SCADA systems explained below.
2. Headworks. Removal of existing PLC in the existing Headworks control panel and the installation of a new, fully programmed and commissioned PLC. Note that the PLC components will be supplied by the City. Existing PLC is Allen-Bradley brand and the new PLC is a Schneider Electric brand.
3. Operations. Design, engineering, partial supply, programming, installation, and testing of a new SCADA platform to monitor and control the above two areas.

Scope of Work:

See Attachment 1, General Specification Guidelines for Upgrading the Automation Technology at the Influent Portion of Water Reclamation Facility.

Each of these tasks in Attachment 1 generally outline the work, but it shall be the responsibility of each consultant responding to the RFP to specifically identify the tasks, including a timetable to perform the completed work. Consultants should feel free to suggest amendments to the scope which they feel would be of benefit to the City, though the cost may not be based on such. The proposal shall clearly address all of the information requested herein. To achieve a uniform review process and obtain the maximum degree of comparability, proposals must be organized and contain all information as specified below:

Proposal Requirements:

Cover Letter: Maximum of two (2) pages serving as an executive summary which shall include an understanding of the scope of services.

Brief Company Profile: General company information including number of employees, location of company headquarters and branch offices, number of years in business and organization, disciplines, and staffing. Describe the general qualification(s) of the firm as they relate to the work proposed with this RFP.

Organization and Staffing: Provide a list of the Consultant's employees and agents which the consultant anticipates assigning to this project. This list shall include a summary of the qualifications, licenses, and experience of each individual; and the professional level of work to be performed by each individual. The City will retain under its agreement with the successful Consultant the right of approval of all individuals performing under the agreement.

Description and Approach: The proposal should demonstrate the Consultant's knowledge of the needs and objectives of the work proposed under this RFP.

Cost Proposal: The cost proposal shall include the hourly rate for all provided services. Include any sub-consultant's fee schedule, if applicable. This should include hourly billable costs of each team member.

Résumé: Relevant Projects/Services with References. Provide résumés of the individual(s) from the Consultant's firm or entity that will be directly responsible for carrying out the contract, three (3) references to include name, address, contact person and phone number of the municipality/company, length of time services were provided, and a description of the services provided.

General Conditions:

The City shall not be liable for any pre-contractual expenses incurred.

The City reserves the right to withdraw this RFP at any time without prior notice and to reject any and all proposals submitted without indicating any reasons. Any award of contract for services will be made to the firm best qualified and responsive in the opinion of the City.

The selected firm must agree to indemnify, hold harmless and defend the City, its officers, employees, and agents; and assigns from any and all liability or loss resulting from any suites,

claims or actions brought against the City which result directly or indirectly from the wrongful or negligent actions of the Consultant in the performance of the contract.

The selected firm will be required to comply with all existing State and Federal labor laws including those applicable to equal opportunity employment provisions.

The City reserves the right to negotiate special requirements and service levels using the selected qualification(s) as a basis. Compensation for additional services will be negotiable.

All responses to this RFP become the property of the City.

No amendments, additions or alternates shall be accepted after the submittal deadline.

All documents, records, designs and specifications developed by the selected firm with regard to this project shall be the property of the City.

Submittals

Three (3) color copies and one (1) digital pdf copy of the proposal must be submitted (hand-delivered, mailed, or delivered by courier) no later than **4:00 PM, Tuesday, November 26, 2024** (No submittals will be accepted after that date and time) to the following location:

City of Medical Lake Planning Department
"RFP WWTP Headworks PLC and SCADA Update"
Attn: Sonny Weathers
124 S Lefevre Street
Medical Lake, WA 99022

All questions regarding this RFP shall be directed in writing to Sonny Weathers, City Administrator, at sweathers@medical-lake.org or 509-565-5000. No postmarks will be accepted.

Proposal Evaluation and Selection:

The City intends to engage the most qualified consultant available that demonstrates a thorough understanding of the City's needs. City staff will use the following criteria to evaluate proposals:

- Understanding of Work to be Performed (the Scope of Services): **15 points**
- Demonstrated Quality Firm and Professional Staff Technical Skill, Experience, Performance and Approach: **20 points**
- Familiarity with City, County, and State Procedures: **15 points**
- Firm and Professional Staff References/Satisfaction of Clients: **15 points**
- Completeness and Quality of Proposal: **25 points**
- Cost Approach to performing this type of service: **10 points**
- Total: **100 points**

The City may request a qualification interview with the highest ranked consultant(s) prior to determining the final ranking. This selection will be conducted according to the City's adopted procedures. The City reserves the right to reject any and all proposals.

Schedule:

The solicitation, submittal receipt, evaluation and final decision selection will substantially conform to the following schedule:

Advertisement	November 7, 2024
Submittal Deadline 4:00 PM	November 26, 2024
Notice to Proceed	December 4, 2024
Project Completion	March 15, 2025

Other Information:

Submittals received by the City in response to this solicitation become public records and are subject to Chapter 42.56 RCW, the Public Records Act. The Consultant should clearly identify in its proposal any specific information that it claims to be confidential or proprietary. If the City receives a Public Records Act request to view the information so marked in the Consultant's proposal and the City determines that it must produce that information in response to the Public Records Act request, its sole obligations shall be to notify the Consultant (1) of the request and (2) of the date that such information will be released to the requester unless the Consultant obtains a court order to enjoin that disclosure pursuant to RCW 42.56.450. If the Consultant fails to timely obtain a court order enjoining disclosure, the City will release the requested information on the date specified.

GENERAL SPECIFICATION GUIDELINES FOR UPGRADING THE AUTOMATION TECHNOLOGY AT THE INFLUENT PORTION OF WATER RECLAMATION FACILITY, v1.1

PART 1- GENERAL

1.1 SUMMARY

A. This project is an upgrade of selected existing automation equipment at the City of Medical Lake's existing Wastewater Treatment and Reuse Facility. Work and materials for the upgrade effort and specified in this section include automation technology supporting the Influent portion of the wastewater treatment facility only. The three task areas that make up the Influent portion, as well as a simple description of required work, include:

1. Influent Pump Station: A new Variable Frequency Drive for each of the three existing pumps in the Station. Note that these new Drives and associated wiring are already existing. Control System Integrator (CSI) will be responsible for signal and communications connections to the Drives, and for their commissioning and integration with the PLC and SCADA systems, below.
2. Headworks: Removal of existing PLC in the existing Headworks control panel and the installation of a new, fully programmed and commissioned PLC. Note that the PLC components will be supplied by the Owner. Existing PLC is an Allen-Bradley brand and the new PLC is a Schneider Electric brand.
3. Operations: Design, engineering, partial supply, programming, installation, and testing of a new SCADA platform to monitor and control the above two areas.
    a. Note: Installer has the right to accept for a fee or decline additional, unspecified requests to install miscellaneous ancillary wiring, usually close-by and 120 volts or less, to support proper installation and operation of the system.

1.2 DEFINITIONS

A. Contract, Terms Regarding:

1. WWTP: City of Medical Lake Wastewater Treatment Plant, (Same facility as WRF.)
2. WRF: Water Reclamation Facility (Same facility as WWTP.)
3. CSI: Control System Integrator is the party that furnishes services and designated materials and components to:
    a. Complete wiring and commission of three new Variable Frequency Drives.
    b. Remove existing PLC and replace with a new model.
    c. Program, install and commission a suitably sized new SCADA system.
    d. Supply documentation and limited training for the Owner.

B. Technology, Terms Regarding:

1. Influent Control Sub-System: A sub-set of the WRF's larger control system, it includes the instruments, control devices, computers, software programmable controllers, input and output devices, sensors, interfacing devices, cabinets, enclosures and other components associated with the process of monitoring and operating the Influent & Headworks portion of the WRF.
2. Identical-to-Existing: Behavior that is identical to the existing control system with the exception that it replaces the existing system and respective aspects and

components. Thus, all of the CSI's engagement, operation and performance is applied to and is with respect to the new, replacement components and system. In general, and only with specified and/or agreed-to exception, performance and operation of the new components and system will be made to duplicate the existing Influent, Headworks, and respective SCADA system.

3. PLC: Programmable Logic Controller
4. SCADA: Supervisory Control And Data Acquisition
5. VFD: Variable Frequency Drive

C. Manufacturer's Ethical Framework, Terms Regarding:

1. Environmental Sustainability, Terms Regarding:

a. Carbon Neutral: A state in which the greenhouse gas emissions that an entity releases into the atmosphere have been reduced, avoided or temporarily captured and the remaining ones are compensated with Carbon Credits that have been certified through certain methods and/or projects recognized by the United Nations.

b. Net-Zero Ready: Emissions that the manufacturer controls directly (aka "Scope 1 emissions') as well as those controlled indirectly and come from sources upstream of the organization, including but not limited to the energy they purchase and use (aka "Scope 2 emissions"), will have de-creased by 90% in 2030, as compared to 2017 emission levels. In addition, residual emissions will be balanced (offset) only through the use of Carbon REMOVAL credits.

c. Net-Zero: Emissions are completely eliminated or are reduced to the extent such that they're in line with the latest climate science, as per the Science Based Targets initiative. Any balancing (offsetting) of remaining residual emissions is accomplished only through the use of Carbon REMOVAL credits.

1.3 SYSTEM DESCRIPTION

A. The existing Influent & Headworks Control Sub-System includes the instruments, control devices, programmable controllers, computers, software, input and output devices, sensors, interfacing devices, cabinets, enclosures and other components existing (some to be replaced) on site and/or indicated and implied by the existing engineering documents, drawings, specifications and being a part of the Influent portion of the WRF's site and operations.

B. The Influent & Headworks Control Sub-System includes the following major components:

1. Components to be upgraded:

a. Influent Building: Three Variable Frequency Drives (VFD's), one each for each of the three existing influent pumps. (VFD's not supplied or installed by CSI.)

b. Headworks Building: One Programmable Logic Controller (Rockwell Automation model SLC-500).

c. Operations Building: New SCADA System and Station, including all associated computer, network, and ancillary hardware and software. Also in the Operations Building is the existing SCADA system, to which CSI will make minor modifications to limit its previous existing interaction with the Headworks and Influent systems.

2. Those components already existing and not presently intended to be upgraded:

a. Motor Control Centers and power infrastructure. (Headworks Building)

b. Level, flow, pressure instruments, switches, etc. (Influent Building)

1.4 RESPONSIBILITY OF CSI

A. General

1. The updates to the existing Influent, Headworks and SCADA system shall be reviewed, engineered, fabricated and installed by the CSI. In general, goods and services to include:

d. Limited supply and complete replacement PLC hardware, software and programming services are to provide for duplication of the existing PLC's operation. Functionality shall include monitoring and control of pump motor VFD's and ancillary equipment, network and functional connection to new SCADA system, and capabilities indicated and implied by the existing system and by these specifications.

e. Limited supply and complete installation of computer hardware, software and programming services to provide for a limited duplication of the existing SCADA System's operation, specifically those features and components of the existing system that are associated with the control and monitoring of the Influent & Headworks portion of the facility. This includes SCADA software and programming of same for the Influent portion database, monitoring and control aspects only on at least these HMI screens:

1) Site Overview Screen

2) Influent Pump Station

3) Headworks

4) All Trending

5) All Alarms

f. All of the automation technology defined in this document and associated with the Influent & Headworks Control System shall be updated by the CSI to be an integrated system composed completely of components which are designed and used for and in conjunction with control and operation of motor-driven pumps and equipment. All components shall be standard, catalog-listed products, new and free of defects.

B. Supply of Materials, Components

1. Note that Section PART 2 - PRODUCTS provides complete details of individual materials and components.

2. Supply of materials and equipment shall be as follows:

a. General

1) (None.)

b. At Influent Building:

1) Supplied by Owner:

a) Three (3) Variable Frequency Drives (VFD's). Units are 40 horsepower Schneider Electric Altivar 340 Process Drives.

2) Supplied by CSI:

a) Miscellaneous items needing replacement or provisioning, such as connectors, minor wires fully terminated within close proximity of one piece

of equipment or item, such as a VFD, a level sensor, or manual pump operator panel.

c. At Headworks Building:

1) Supplied by Owner:

a) PLC Components. This includes rack (chassis), power supply, PLC processor module, IO modules, and Profibus DP communication module. All owner-supplied PLC components will be Schneider Electric Modicon brand and are as listed in Appendix 1 – PAC / PLC Components.

2) Supplied by CSI:

a) Any ancillary PLC or PLC-related modules or components, mounting brackets, connectors, terminations, and similar items typically installed in a control surface and deemed necessary to duplicate the installation, operation and possibly improve the performance of the existing automation system, as agreed by owner.

d. At Operations Building:

1) Supplied by Owner:

a) Computer and Network Components. This includes a Schneider Electric Harmony P6 industrial computer (configured per available design and features from Schneider Electric, with optional IO Module), an eight-plus-two port Schneider Electric Modicon network managed switch, a Schneider Electric 24VDC power supply and a UPS unit, two computer displays, display mounting apparatus, a computer keyboard, and a computer mouse.

2) Supplied by CSI:

a) SCADA Computer Technology Mounting Panel. See section D. Engineering and Fabrication Services, below, for description. See also section G. Installation-Only Services for installation specifications. Panel shall a flat "back panel-only" fitted with the following primary hardware and software components:

i. Two identical industrial computers, network switch, 24VDC power supply and UPS components.

ii. Wiring, terminal blocks and any necessary relays or ancillary components to support diagnostic signal interface from UPS system to IO Module installed in industrial computer.

iii. Fully installed, tested, and functional programming software for the PLC logic and for all the SCADA screens.

Note that computer displays, display mounts, keyboard, and mouse are not installed on the SCADA Computer Technology Mounting Panel.

b) Services to fully complete the configuration, assembly, and commissioning of the above-mentioned industrial computer. Such services to include but not be limited to the installation and configuration of:

i. Schneider Electric P6 computer IO Module

ii. Third-party video graphics card for second HMI display.
Note: High quality video graphics card to be selected by CSI. Card to have maximum available video memory. Option of CSI to

also supply said card also exists, as agreed to by CSI and Owner.

c) Supply and installation of local wires, terminal blocks, connectors, mounting devices, and ancillary components necessary to complete the fully functional SCADA Technology Mounting Panel and SCADA Station.

d) Any ancillary communications modules, power supplies, mounting brackets, connectors, terminations, and similar items typically installed in a control station and deemed necessary to duplicate the installation, operation and possibly improve the performance of the existing automation system, as agreed by owner.

C. Engineering-Only Services

1. Selection of high-quality video graphics card for Industrial Computer.
2. UPS Sizing

D. Engineering and Fabrication Services

1. SCADA Computer Technology Mounting Panel.

a. CSI shall design, engineer, layout, fabricate, deliver and commission a flat panel on which will be mounted computer and network technology associated with the new SCADA Station. Mounting Panel shall be a standard-sized "back panel" from one of Schneider Electric's line of Green Premium certified enclosures, as agreed by Owner.

1) CSI will install slotted channel strut (approx. 1" x 1") around the backside perimeter of the panel using right-angle brackets and mounting hardware manufactured by strut manufacturer and/or enclosure manufacturer. Panel will be mounted (screwed) to strut in a strong and robust way, using ample screws to ensure a strong and lasting attachment.

2) Panel engineering will include services to design, fabricate test and implement circuitry to deliver diagnostic status signals from the UPS system to the IO Module installed in the industrial computer. System shall convey up to sixteen (16) 5V DC inputs to the IO Module, indicating status states such as Battery Disconnected, On-Battery Mode, Low Battery, and Replace Battery.

b. Panel design and implementation shall be subject to the Owner's approval. (See Section J. Drafting Services.) Procurement and fabrication of Mounting Panel shall not commence without Owner's written approval of panel design.

c. Hardware mounted on panel shall conform to specification section PART 2 – PRODUCTS, and is expected to include at least:

1) Two (2) identical MS Windows-based surface mounted Industrial Computers. (Software and hardware to be implemented in a "mirror" configuration.)

2) One (1) network managed switch (eight ports for copper, two Gbit SFP ports).

3) One (1) 24V DC power supply. Input voltage: 120VAC.

4) An arrangement of UPS equipment, sized to keep the SCADA Technology energized for 30 minutes. BVS240XDPDR and up to four XB005XPDR. (Suitable number of batteries determined by CSI, approved by owner.)

5) Full complement of high quality, industrial-grade finger-safe ancillary equipment needed to ensure proper and safe functionality of SCADA

technology hardware. See PART 2 – PRODUCTS, section 2.5 PANEL POWER DISTRIBUTION. Typical ancillary equipment on Panel includes:

a) Connection and switching components for data and signal, including but not limited to diagnostic circuitry between UPS system and IO Module in industrial computer.

b) Control power distribution and circuit protection components. Power-present pilot indication.

c) Terminal blocks, wireway and components to support interconnections and/or network interface with devices on the Panel and with VFD and PLC components.

d. Mounting Panel shall meet all local and state requirements to be a human-safe system when energized and also allow all installed hardware to comply with manufacturer's environmental specifications without being mounted inside an enclosure.

E. Programming Services

1. General

a. Fully installed, tested, and functional programming software for the PLC logic and for all the SCADA screens. All PLC logic and SCADA system to be identical in form and function to the respective WRF facility's existing system(s).

2. PLC Programming

a. Programming of the programmable controller (PLC) shall be completed, tested and commissioned by the CSI. Logic and functionality shall be identical-to-existing PLC system.

b. Reproduce all existing programming and logic functionality presently in place that provides communication between the PLC and:

1) The SCADA computer and software

2) All automation equipment in the Influent Pump Station, including at least:

a) Level Sensors

b) Variable Frequency Drives

c) The Manual Control Station

3) All automation equipment in the Headworks building, including at least:

a) Motor Control Centers (Siemens)

4) Any other existing systems and infrastructure associated with the Influent Pump Station and/or Headworks building and presently fitted with network connectivity to the existing PLC and SCADA system.

a) Note that the existing SLC-500 system uses a third-party module for Profibus comms to the Siemens MCC's. The new Schneider Electric PLC architecture will use a Schneider Electric Profibus module for the same purpose.

c. Full on-screen and print-out documentation of programming, as suitable and agreed to by owner. Documentation per:

1) Subroutine

2) Logical Task

3) Rung

4) Instruction

d. Additional reference materials include:

1) "Headworks" excerpt from existing system Operation and Maintenance Manual. See Appendix Five.

2) Electronic copy of existing PLC ladder logic. (PDF print-out and executable logic file.)

3. SCADA Programming

a. SCADA system programming shall include functions and screens that manage, control, and report on the Influent Pump Station and Headworks facility, which shall be identical as possible to existing SCADA system for the respective treatment processes. This includes programming of same for at least:

1) Site Overview Screen- Influent & Headworks system only.

2) Influent Pump Station Screen

3) Headworks Screen

4) Trending Screen(s) - Influent & Headworks system only.

5) Alarm Screen(s) - Influent & Headworks system only.

b. Installation of all engineered programmed software files, and all other files associated with the software and its ownership and original license keys for all software to be included.

c. Services provided by the CSI will also include modification of the existing SCADA system such that its ability to control the Headworks Process can be disabled without causing triggering of any alerts or alarms. Modification to also enable the cessation of status signals from Influent and Headworks without causing alarms in same system. Disabling will be performed using well-reasoned and professionally implemented modifications, to be well documented in Help files (or similar) within the system and in printed form. Backup copies of all files to be modified will be store in separate directory prior to any modifications being made.

1) Note: Installer has the right to accept for a fee or decline additional, unspecified requests to program and/or install necessary functionality and/or equipment to the existing SCADA system to support terminating its interface with the Influent and Headworks processes. Similarly, owner has the right to have such miscellaneous services supplied by others.

d. Fully completed and installed software programming for the PLC logic and for all the SCADA screens, all of which to be identical in form and function to the existing system(s). All programmed software files, and all other files associated with the software and its ownership and original license keys for all software to be included.

F. Factory Acceptance Testing Services

1. The CSI shall perform operational witness testing of the control system in their shop and do so in part for the purpose of inviting and supporting eyewitness validation by the owner of performance described herein. The CSI shall notify the owner via phone call and again via email at least 15 days prior to proposed testing date, with acceptance of arrangement plans subject to the owner's approval.

2. With the exception of the equipment identified herein as being supplied by Owner, all resources to facilitate and conduct the test, including but not limited to test cables, simulators, volt-ohm meters, the project-scope specified equipment, connections (copper, fiber optic, rf, or other media) required to provide communication between system components, shall be provided by the CSI.

3. Owner will supply selected automation equipment (automation technology noted herein as supplied by owner) to the CSI for testing purposes. CSI will be responsible for transport the equipment from the owner's location to the CSI's testing location. Equipment will be returned to owner by CSI after completion of testing. CSI is responsible for the proper care of the equipment while they're in the CSI's possession. Timing and logistical arrangements for transport of the equipment will be the responsibility of the CSI, but acceptance of arrangement plans subject to the owner's approval. Selected automation equipment to be supplied by owner is identified in previous Section B, Supply of Material, Components.

   If additional equipment normally existing at WWTP and deemed critical to the test but cannot be a part of the testing process (due to logistics, etc.), CSI will discuss with the owner for the purpose of identifying an acceptable interim test solution.

4. The testing of the control system shall include validation of the entire system, including PLC, VFD's, complete SCADA station, and all available communications and ancillary equipment.

   If additional equipment normally existing at WWTP and deemed critical to the test but cannot be a part of the testing process (due to logistics, etc.), CSI will discuss with the owner for the purpose of identifying an acceptable interim test solution.

   Testing will include energizing each digital input and output and simulating each analog input and output using a loop simulator and calibrator. Circuits not energized shall be tested for continuity. Energized circuits shall be tested through the input point on the input module, through the hardware I/O memory locations in the PLC, through all communications equipment, to-and-throughout the scada system, and to the VFD's. Similarly, signals, circuits and equipment shall also be tested in reverse directions and all pathways, from VFD's to SCADA and/or PLC's, to/from SCADA to PLC and VFD's, and PLC to/from VFD's.

5. The CSI shall provide an I/O checklist for all points wired to the PLC. The list shall include for each point, the tag name of the points, a description of the point, comments, date and time of the test, and a signature line for the person performing the test. Show that each digital point was set and reset. Show verification of all analog points at 0 percent, 25 percent, 50 percent, and 100 percent of range.

6. As a part of the test and with the owner's witness, the CSI shall record and provide to owner an I/O checklist for all points in the control panel. The list shall include for each point, the tag name of the points, a description of the point, comments, date and time of the test, and a signature line for the person performing the test. Show that each digital point was set and reset. Show verification of all analog points at 0 percent, 25 percent, 50 percent, and 100 percent of range. Show that all applicable data was communicated and engaged by the PLC, scada, and VFD's. Upon satisfactory test performance, owner shall initial CSI's copy of same report.

7. The presence of the owner during testing does not relieve the CSI from conforming to the requirements of the contract documents and shall in no way imply acceptance of the equipment.

G. Retrofit Services

   1. General

a. Inspection and testing of Headworks PLC installation, Influent VFD installation and Manual Control panel, and SCADA workstation whenever possible.

b. Coordinate with Owner for component and system implementation, including any specific requirements not discussed herein.

c. Termination or landing of all control equipment wiring (not data network wiring) existing inside the existing PLC control cabinet, in close proximity of and intended for the VFD's, or at the SCADA workstation area, as necessary for proper Influent operation.

1) Note: Installer has the right to accept for a fee or decline additional, unspecified requests to install miscellaneous ancillary wiring, usually close-by and 120 volts or less, to support proper installation and operation of the system.

2. At Influent Pump Station

a. Proper connection of all control, status, and network communications wiring for the three new VFD's in the Influent Pump Station facility.

b. Startup and commissioning of the three new VFD's.

c. Program each VFD for required operational sequences, including but not limited to status indications, alarms, event recording, and display features. Clear event or fault from memory after all testing and prior to general system completion.

d. Program for utilization of Embedded Special Functions inherent in the Schneider Electric Altivar 630 Process Drive. List of Embedded Special Functions included in Appendix Two. Selection of Embedded Special Functions to be utilized is to be reviewed with and agreed to by owner. Selected Functions will be implemented at a schedule that may require additional visits to the facility and will be agreed-to by owner.

1) Note: Installer has the right to accept for a fee or decline additional, unspecified requests to program and implement Embedded Special Functions, to support proper installation and operation of the system.

e. Test and inspect VFD's according to existing functional norms.

1) Test each VFD while connected to its specified motor.

2) Verification of Performance: Report each VFD's status according to operation of functions and features specified.

3. At Headworks Building

a. PLC Replacement

1) Demolition of one (1) Programmable Logic Controller (Rockwell Automation model SLC-500), consisting of a PLC processor, chassis, power supply, and I/O modules and located inside the existing control cabinet at the Headworks facility.

2) Configuration and complete installation and wiring of all replacement PLC components. Includes at least PLC chassis, power supply, PLC processor, all IO modules and all communications modules. See previous Section B- Supply of Materials and also Part 2 – PRODUCTS, Section 2.2 for further information about PLC components.

3) Wiring- Removal from the old PLC and reconnection to the new PLC all of the wiring (power, communications, signal, control, and ground bonding).

4. At Operations Building
    a. Modification of existing SCADA software.
        a. See section E. Programming Services, 3. SCADA Programming.

H. Installation-Only Services
    1. General
        a. (None.)
    2. At Influent Pump Station
        a. (None, except possibly ancillary components.)
    3. At Headworks Building
        a. (None, except possibly ancillary components.)
    4. At Operations Building
        a. Install SCADA Computer Technology Mounting Panel
            1) Labor to assist in the installation of the SCADA Computer Technology Mounting Panel. Nuance of scope to be discussed and agreed to by owner and CSI. Wired connection of the Industrial Computer equipment to the computer display, keyboard, and mouse may include passing wires through the wall via agreed-to junction box and connectors.
                a) See section 3.8 OPERATING DEVICE LOCATION for additional information.
                b) Note: Installer has the right to accept for a fee or decline additional, unspecified requests to install Panel and/or miscellaneous ancillary wiring, usually close-by and 120 volts or less, or is communications type, to support proper installation and operation of the SCADA Station. Similarly, owner has the right to have such miscellaneous services supplied by others.
                    i. Fully installed and tested software. Software to include SCADA HMI and database, as well as PLC logic programming software. Software to be supplied by owner. See section E. Programming Services for description of same.

I. On-Site Testing, Start-Up and Commissioning Services
    1. General
        a. (None, except possibly minor ancillary tasking.)
    2. At Influent Pump Building
        a. Connection of instrumentation and data wiring, configuration, commissioning and start-up of three new VFD's, one each for each of the three existing influent pumps in the Influent Building. Similar to the existing units, their operation includes their remote monitoring and control via the PLC and SCADA system.
    3. At Headworks Building
        a. Testing of all wire connections to and from the new PLC.
        b. See also Part 3, Execution, Testing
    4. At Operations Building
        a. Testing of all network connections to and from the new PLC and VFD's.
        b. See also Part 3, Execution, Testing

J. Drafting Services

1. General

   a. The CSI shall provide high quality, professional drawing(s) described herein of the:

      1) VFD Installation at Influent Pump Station

      2) Headworks Control Panel

      3) SCADA Workstation

   b. All drawings shall:

      1) Be in format consistent with the Owner's existing drawing set.

      2) Have a minimum of one sheet per each subsystem (PLC, VFD Station, SCADA equipment).

      3) Have numbering and nomenclature to be consistent with and/or appending the Owner's existing drawings.

      4) Drawings provided by CSI shall be in both electronic and hard-copy form. Electronic copies of drawings shall be rendered in CAD software and delivered in the following file types: dwg, dxf, jpg, and png.

      5) Be provided on NON-FOLDED sheets no larger than 11 by 17 inches. Shop drawings shall include specific product detail such as rating, size, and number of contacts, etc. Wiring diagrams shall be included for all components in the system including control equipment supplied with mechanical devices.

   c. Where As-Built drawings are specified, the CSI is allowed to modify existing drawing images, as they may exist and be in owner-acceptable condition, to clearly indicate system modifications being implemented. (A copy of existing drawing images shall be provided to the CSI.) The CSI can render the updated product-replacement content in the foreground of the new CAD file, layered on top of the suitably masked background image and surround by red-lined cloud lines. Alternately, if the CSI prefers, or as may be necessary by the Owner, the CSI shall provide the specified drawings as rendered completely from scratch, ensuring that they're similar to the existing drawing set style and structure, and that they conform to content to the description and specification herein. Whether modifying existing drawings or rendering new ones, the delivery of high quality, professional drawings is required.

2. At Influent Pump Station

   a. Supplied As-Built drawing shall show the completed arrangement of the VFD's as mounted on the wall in the Pump Station building.

   b. Supply a wiring diagram illustrating the line-side, load-side, control, and network interface connections of each of the three drives. Use of Typical Connection illustration is permitted, as long as a legend or reference table clarifies connections of individual drives.

3. At Headworks Building

   a. Supply an As-Built drawing showing placement of the new PLC in the existing control panel. Include identification and slot placement of all individual modules, power supply, and chassis. All items to be labeled and documented in a fashion coordinated with Bill of Material, below, and existing drawings.

   b. Supply a Wiring Diagram showing:

1) Bill of Material, showing for each item in the PLC chassis as well as any new ancillary equipment the name of manufacture, the catalog number, the quantity, a detailed description, and name and phone number of the supplying vendor for each item.

2) Include details of individual PLC input and output cards with card wiring, base, slot, input, output, terminal, and device identification

3) Control wiring, showing associated I/O to or from field devices, VFD's, other control panels or devices, and any associated network connections, such as Modbus or similar. Include functional descriptions as well as wire and connection terminal numbers and identifiers.

4) Power wiring, showing line-side connections, conductor sizes, and notations indicating electrical voltages. Include functional descriptions as well as wire and connection terminal numbers and identifiers.

5) A reference table or diagrammatical illustration of all individual connections to all PLC modules and all other new equipment in panel.

4. At Operations Building

a. Supply a new network diagram drawing showing Bill of Material, relational layout and all connections for the SCADA, PLC, and VFD's within the scope of this project.

b. Supply a new Shop Drawing showing general placement of equipment as mounted on SCADA Computer Technology Mounting Panel. Include identification and placement of all individual components (computer, network switch, UPS), as well as all connections for Industrial Computer, Ethernet switch, electrical power, uninterruptable electrical power (UPS), and ancillary components. All items to be identified in a manner coordinated with Bill of Material, to be included.

c. Connections for Industrial Computer, Ethernet switch, electrical power, uninterruptable electrical power (UPS), and ancillary components.

1.5 COMPONENTS AND SERVICES TO BE PROVIDED BY OTHERS (NOT THE CSI)

A. Components to be provided by the Owner include:

1. PLC Components. See PART 2 – PRODUCTS, 2.2, A., and Appendix One

2. Industrial Computer(s), computer displays, display mounts, keyboard, or mouse. See PART 2 – PRODUCTS, 2.3, B.

3. Network Switch. See PART 2 – PRODUCTS, 2.3, C.

4. Uninterruptable Power Supply Equipment. See PART 2 – PRODUCTS, 2.3, D.

B. Services to be provided by others, include:

1. Installation of the interconnecting wiring between the Influent Station, Headworks, and SCADA is by others. Any data network wiring shall be terminated, tested and labeled. As might be a part of the retrofit process, said wiring shall be designed and implemented to duplicate the design and functionality of the existing wiring.

2. The existing three VFD's will be demo'd and replaced by Owner. Installation and power wiring of new VFD's also by Owner.

1.6 WARRANTY

A. As part of the guarantee required by these Specifications, the CSI shall make any and all repairs, replacements, modifications and adjustments required to eliminate any and all defects in design, materials and workmanship for his work, which are disclosed within the one-year guarantee period beginning at the date of substantial completion. The CSI shall begin all repairs, replacements, modifications and adjustments within twenty-four (24) hours of notification by telephone by the Owner and shall complete such repairs, replacements, modifications and adjustments within forty-eight (48) hours of notification. Should the CSI fail to begin the work within 24 hours or complete the work within 48 hours, the Owner may proceed to undertake or complete the work. In such event, the CSI and his surety shall be liable for all costs incurred by the Owner.

1.7 COORDINATION WITH OTHER EQUIPMENT

A. As pertaining to the scope of this project, and with the specification of matching the designed performance of the existing system,

1. The CSI shall be solely and completely responsible for coordination and integration of new system components with other related equipment. The CSI shall communicate directly with the manufacturer(s) and supplier(s) of all related control equipment to determine all intended details of the equipment which may influence or affect the control system.

2. The CSI shall determine all requirements for and shall cause integration of the control system and all other control equipment into a unified operating system. The CSI shall define all requirements for all interfacing equipment and shall supply all appurtenances, accessories and all such devices which may be required for proper interfacing as part of the control system.

1.8 QUALITY ASSURANCE

A. Qualifications for Manufacturer of Automation Technology

1. Regarding Industry Experience

a. Manufacturer shall be a reputable, experienced manufacturer with at least twenty (20) years' experience in the manufacture of similar equipment.

2. Regarding Social Responsibility

a. Regarding Environmental Sustainability, manufacturer shall:

1) Have the Environment Certification ISO 14001 for EcoDesign.

2) Provide in a conveniently available venue of accurate and easily comprehended evidence as to how and to what extent their company incorporates into their policies and processes actions that align with internationally recognized objectives in reducing greenhouse gases and improving environmental sustainability. (Footnote: Bib ES Ref1)

3) Provide comprehensive evidence of policies and actions pursuant to this objective shall be publicly posted (on their company website, in annual or quarterly stockholder's reports, or other official document or venue) and clearly state their strategy, goals, performance on goals, and/or physical evidence thereof to: (Footnote: Bib ES Ref1)

a) A convenient and publicly available venue for viewing, reading and collecting or downloading data on the company's performance on this and other related topics. (Footnote: Bib ES Ref3)

b) A detailed summary document of the company's usage and performance information, including specific details in standard local market unit metrics, regarding at least the use and management of greenhouse-causing materials (Scopes 1 through 3) must also be available for convenient reading and/or convenient download. This summary might be considered to be, or available as, a "dashboard" of respective information. (Footnote: Bib ES Ref3)

c) Convenient availability via computer, smart phone or device 24 hours a day seven days a week environmental performance information that's relevant to individual products that the company manufactures and markets. (Footnote: Bib ES Ref4)

4) Be committed to Environmental, Social, & Governance as set out by the United Nations. (Footnote: Bib ES Ref5)

5) Setting goals and taking significant and meaningful steps to become Net-Zero across the company's entire value chain. (Footnote: Bib ES Ref6)

6) Deploy Net-Zero targets that are validated by the Science Based Targets initiative. (Footnote: Bib ES Ref6)

7) Proclaim a policy and goals calling for the reduction of greenhouse gas emissions at a pace at least as quick and influential as the following schedule:

a) 2025: Be Carbon Neutral in their operations, including use of CO_2 credit offsets.

b) 2030: Achieve 25% absolute reduction across their entire value chain, as well as "Net-Zero ready" in their operations. (Includes but is not limited to 90% reduction of their CO_2 emissions and removals of their residual emissions.)

c) 2040: Be Carbon Neutral across their entire value chain, including activities that are upstream and downstream of their own operations, including the use of CO_2 credit offsets.

d) 2050: Achieve Net-Zero CO_2 emissions across their entire value chain. (Footnote: Bib ES Ref7)

8) Have in place and operating significant internal processes to help the manufacturer's top 1,000 component and service suppliers meet their climate-positive goal to reduce CO_2 emissions as per the manufacturer's stated goals. (Footnote: Bib ES Ref8)

9) Make conveniently and constantly available to the consumer exact data accurately describing the complete environmental footprint, including but not limited to any specific product's regulatory compliance, material content, environmental impact and circularity attributes. A highly comprehensive review of the product's environmental impact shall also be available as a downloadable document from this source. Such information will be available a webpage or by the user simply utilizing a smart phone or device to scan a QR code, barcode, part number, catalog number, or other alphanumeric or symbol pattern, as viewed and accurately processed via common optical camera routinely available on standard modern phone or smart device on the product(s) and access said data within two "clicks" after following the link associated with the above code find a modern, intuitive and easy to use venue displayed on the device. (Footnote: Bib ES Ref4)

10) Maintain and apply in a conspicuous way an easily recognizable product certification method that enables the consumer to easily identify products that have been manufactured per policies and procedures that minimize CO_2 emissions. Such policies shall include:

a) "Information Transparency" whereas environmental information and performance in achieving said goal regarding the submitted (certified) products is conveniently and readily available digitally 24/7.

b) Minimal use of hazardous substances in, and beyond, compliance with regulations (RoHS, REACh).

c) Provide environmental disclosures in summary form, to provide robust environmental information.

d) Provide circularity disclosures in summary form, to provide guidance on responsible product end of life treatments along with circular value information.

e) Have an established goal of using at least 50% green materials in the manufacture of submitted (certified) products by 2025.

f) Have an established goal of 100% of primary and secondary packaging being free from single-use plastic and utilizes recycled cardboard products by 2025.

(Footnote: Bib ES Ref9)

B. Control Systems Integrator Qualifications:

1. CSI to be a Schneider Electric Alliance Partner.
2. Address of CSI's primary operations shall be within a one-hour drive from the Owner's address.
3. CSI shall provide with as a part of their proposal documentation that describes or includes the following:
   a. Description of ownership and organization of company.
   b. Resumes of principals and/or key employees, including those employees that will be performing the majority or all of the work associated with the CSI's bid.
   c. Description of expertise in design, assembly, testing and installation of control systems for municipal waterworks and sewerage facilities.
   d. Description of municipal control systems designed, assembled and installed in the last five years; similar size and nature, if possible. Description shall include:
      1) Names of employees involved in each system.
      2) Detailed description and drawings of each system.
      3) Names and telephone numbers of Owners involved in operation and maintenance of each system.
      4) Description of the service capabilities normally provided by the company including resumes of employees assigned to field service and listing of service equipment.
      5) Additional information that may assist the Owner in ascertaining the CSI's general ability to perform the work.
   e. Acceptability of the CSI will be determined solely by the Owner. Owner's evaluation will include consideration of depth and character of CSI's technical

abilities, financial standing, general ongoing responsiveness, ability to perform in a timely manner, and familiarity with the Owner's site and operations.

f. The CSI and the selected manufacturer shall anticipate that the Owner may withhold approval of the selected manufacturer if, in the opinion of the Owner, the manufacturer does not have the experience, capability or for performance and execution of similar projects in the past.

g. The CSI and any manufacturer not approved by the Owner shall not be entitled to an extension of time or to any claim for damages because of extra and unanticipated costs, hindrances, delays or complications caused by or resulting from failure by the Owner to approve any manufacturer for whatever reason.

1.9 APPROVED CONTROL SYSTEM INTEGRATORS

A. The CSI shall be considered for acceptability by the Owner based on the qualifications noted in 1.8, B. above. Qualification shall be submitted with bids to be considered.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment to the job site at the appropriate time for installation. Equipment items shall be in original packaging, and/or crated, and/or affixed to pallets boxed and packed with protective wrappings. Exercise care to prevent damage from handling. Store mechanical and electrical components off the ground in weathertight enclosures. Keep equipment dry at all times.

PART 2 - PRODUCTS

2.1 GENERAL

A. Design And Assembly

1. Approved Equipment and Materials Manufacturers

a. All equipment and materials utilized in the system shall:

1) Be the products of reputable, experienced manufacturers with at least twenty (20) years' experience in the manufacture of similar equipment.

2) Conform to standards of social responsibility, as outlined above in Part 1 – GENERAL, 1.8 QUALITY ASSURANCE

b. Use of other alternate equipment and materials manufacturers shall be subject to approval by the Owner.

2. Similar items in the system shall be the products of the same manufacturer. All equipment shall be of industrial grade and of standard construction, shall be capable of long, reliable, trouble-free service, and shall be specifically intended for control and monitoring of operation of motor-driven pumps and equipment. All equipment shall be of modular design to facilitate interchangeability of parts and to assure ease of servicing. All equipment, where practical, shall be of solid state, integrated circuit design.

3. All components and equipment shall be prewired to the maximum extent possible.

B. Interconnecting Wiring/Terminals

1. In general, all control wiring shall be as the previously existing on or for the older, to-be-removed equipment.

2. The CSI shall confirm suitability of all existing field interconnecting wiring between the control system components they service and/or install as a part of this project scope and existing sensors, pumps and equipment. The CSI shall confirm the correct number, size, and type of wires and the number, size, type, and location of conduits and wireways already in place. CSI shall advise owner if modifications are recommended.
3. CSI is to ensure that all wires connecting to the newly installed equipment is numbered and labeled in a fashion identical to the wiring already existing and previously connected to the older, to-be-removed equipment. Labeling technique may require thermoplastic insulation and cabling of groups and supported so as to prevent breaking and to present an orderly arrangement and neat appearance.
4. Ensure that fusing and circuit protection performance for all energized circuits (power and control) powered from the panel and extend outside of the panel remains as designed and previously existing on or for the older, to-be-removed equipment.
5. Ensure that fusing and circuit protection performance for all signal circuits powered from the panel and extend outside of the panel remains as designed and previously existing on or for the older, to-be-removed equipment.
6. Utilize all wire-ways as designed and previously existing on or for the older, to-be-removed equipment.
7. Low voltage DC control and signal conductors shall be bundled separately from alternating current circuits. Separate raceways and wire gutters shall be dedicated for AC and DC wiring and labeled as such on the shop drawings. Wiring may cross at right angles if necessary. Special caution shall be used for PLC I/O card wiring and field terminations to accommodate the separation of AC and DC circuits. Intrinsically safe wiring shall be physically separated from non-intrinsically safe wiring.
8. All wiring shall be neatly tied in position with nylon cable ties. Instruments with portable cord connections shall be fed through the instrument panel plug strip which shall be located near the top of the panel directly above the instruments. Instrument supply cords shall be the only panel wiring which is not continuously supported and tied.
9. All wiring and tubing crossing hinges shall be installed in a manner to prevent chafing. Bundles of similar conductors shall be clamped securely to the door and to the panel, and the bundles shall run parallel to the hinge for at least 12 inches. Spiral nylon cable wrap shall be provided in the hinge section of the bundle to fully protect the conductors or tubing against chafing.

2.2 PROGRAMMABLE CONTROLLER EQUIPMENT

A. Programmable Logic Controller (PLC)

1. Cybersecurity - The control system's Main Control Processor (PLC, PAC, ePac) shall retain the following cybersecurity features:
    a. Be Achilles Level 2 Certified (Footnote: Bib CS Ref1)
    b. Include advanced built-in cyber security features as defined by standard IEC 62443
    c. Have passed successfully the "Certification de Sécurité de Premier Niveau," also known as the "First-Level Security Certification" (CSPN) test. (Footnote: Bib CS Ref2)
    d. Digitally sign and encrypt its internal firmware. (Footnote: Bib CS Ref3)

e. Firmware shall be encrypted using AES256 encryption algorithm and SHA 256-bit algorithm. Further, the integrity of the firmware shall be automatically checked after any new firmware upload and at startup of the system. Integrity shall be checked via an automatic checksum analysis, where the value of the installed firmware is compared to the checksum value previously known by the system. Checksum discrepancies will be automatically flagged as a security fault.
(Footnote: Bib CS Ref4)

f. Be capable of logging any security events into a System Logging Protocol (SysLog) database in a structure that's in accordance with Request For Comments (RFC) Syslog Protocol 5424, published by the Internet Engineering Task Force. Security Events to be logged shall include and be defined as any of the events listed here:

   1) TCP failure connection due to Access Control List
   2) Enable/Disable of communication services [invoked] via logic commands from within the main logic processor's (PLC, PAC, ePAC) user programming.
   3) Occurrence of an Ethernet port Link Up or Link Down event.
   4) A change in the network's Rapid Spanning Tree Protocol (RSTP).
   5) Configuration download of COM services
   6) Program operating Mode change of COMs (Run, stop)
   7) Failed and successful FTP login (for Firmware update and Fast Device Replacement)
      (Footnote: Bib CS Ref5)

g. Allow the user to easily disable any of the following Ethernet services, the selected set of which can be protected from alteration via use of an applicable password:
(Footnote: Bib CS Ref6)

   1) File Transfer Protocol (FTP)
   2) Trivial File Transfer Protocol (TFTP)
   3) Hypertext Transfer Protocol, Secure (HTTPS)
   4) Ethernet/IP (EIP)
   5) Dynamic Host Configuration Protocol (DHCP)
   6) Bootstrap Protocol (BOOTP)
   7) Simple Network Management Protocol (SNMP)

h. Must have easily accessible an Access Control List (Whitelist) for each protocol and each valid connected IP address. The List shall utilize IPSec methodology to allow/disallow incoming traffic on specific Ethernet services based on Ethernet packet IP address or subnet. These Ethernet services shall include:

   1) Modbus server (port 502)
   2) EIP adapter
   3) FTP server
   4) TFTP server
   5) HTTP server

6) SNMP agent

Access to List shall be protected via use of an applicable password. (Footnote: Bib CS Re7)

i. IPSec (Internet Protocol Security) shall be used in a way that at a minimum utilizes methods of anti-replay, message integrity check, and message origin authentication to provide secure communications with authentication and integrity of data between the control system's Main Control Processor and one or more Windows-based PC's being used as a workstation and on which is installed:

1) Main Control Processor logic programming software

and/or

2) Supervisory Control and Data Acquisition (SCADA) software

In general, and additionally, when IPSec is enabled on the system, the following traffic/services shall be able to be IP secured:

1) SNMP Agent and SNMP Traps
2) NTP Client
3) EtherNet/IP TCP Traffic as Adapter/Server
4) Modbus Server (Port502)
5) HTTPS
6) ICMP (Ping, etc.)
7) FTP Server, TFTP Server (Footnote: Bib CS Ref8)

j. Must require the user operator to enter a password when enabling or making any modification to the logic program or any of the unit's configuration. Thus, the user and processor must authenticate before making any changes. (Footnote: Bib CS Ref9)

k. Must utilize an Ethernet/IP network for link to Remote I/O Adapter Modules* communication modules and the chassis in which they reside. (*Remote I/O Adapter Module(s) shall be the module, usually residing in the left-most slot, that serves to manage communications between the network and the I/O modules in that chassis. It has no logical program storage or operation capability.) (Footnote: Bib CS Ref10)

l. The Main Control Processor constantly, including while executing user logic programs, checks the integrity of its memory, of its system tasks, of its microprocessor and instructions to be processed. At the instant it detects something unexpected on those checks, it then automatically switches into a system stop mode, recording the last states of the memory, processors, and tasks in a readable location available for analysis. (Footnote: Bib CS Ref11)

m. Must utilize a Trusted Platform Module (TPM) secure crypto processor, providing secured storage for cryptographic keys.

n. Must support End-to-End Cybersecurity, specifically, IEC 62443-4-2 Security Level 2 Certification.

o. Must support Open Platform Communications Unified Architecture (OPC UA) Client

p. The manufacturer's brand of engineering software (logic programming software) must include means for the operator to check its integrity on demand. This must include a checksum of all executable files used by the logic programming software, including Dynamic Link Library (.dll) type of files. Any differences must be automatically flagged. The user must be able to correct the issue through a simple process made available in the software, such as running a setup and/or repair. (Footnote: Bib CS Ref12)

2. The PLC 's and I/O shall be a Schneider Electric Modicon M580 platform. Portion of same shall be supplied by Owner and as indicated in Appendix 1.

3. Spare I/O: Match the Schneider Electric Modicon M580 replacement PLC technology supplied by the Owner or specified in this document. Spare I/O shall be supplied by Owner.

4. The I/O rack assemblies in the Modicon M580 platform will provide mounting slots for the processor, power supply and I/O modules. All I/O shall be bundled together up to the terminal blocks. The I/O rack must, along with the manufacturer's proprietary data bus, also include in the rack's backplane a built-in Ethernet bus, allowing suitably designed and manufactured I/O modules transparent access to and interchange with data that may be accessible on said Ethernet backplane bus, as well as on the/a extended Ethernet network that might also be connected to the chassis backplane.

2.3 SCADA COMPUTER AND NETWORK HARDWARE TECHNOLOGY

A. SCADA Computer Technology Mounting Panel

1. In general, equipment listed in this section (2.3, B through E) shall be installed on the Mounting Panel.

   a. Note: Among other accommodations, the panel should include and reserve mounting space for two (2) Industrial Computers in a side-by-side configuration; units described below.

2. For more specific information about the dimensions and design of the Panel itself, see also PART 1 – GENERAL section 1.4, D, 1. Engineering and Fabrication Services.

B. Industrial Computer:

1. Two (2) identical MS Windows-based surface mounted Industrial Computer. Computer shall be Schneider Electric Harmony P6 Industrial Computer, based on model HMIP67BCTO, configured with:

   a. Intel Core i7 Processor

   b. HDMI Display Port

   c. Configured for 24VDC Input Power

   d. Two (2) Spare PCIe-type Slots

   e. One (1) 512GB Solid-State Primary Drive (High Endurance)

   f. One (1) 512GB Solid-State Secondary Drive (High Endurance)

   g. 32GB RAM Memory

   h. One (1) Optional Input/Output Card

   i. Cooling Fan

   j. DP-DVI Cable

k. Windows 10 Operating System, for Core i7 Processor

l. Schneider Electric EcoStruxure Machine SCADA Expert software licenses, Run-Time, 4,000 Tags, Factory Preinstalled.

2. Two (2) Computer Display Monitors. Schneider Electric Harmony P6 Industrial Display, based on model HMIFP6900WCD.

a. Diagonally 546.1 mm (21.5inches). Aka 532.6mm (width) x 330.6mm (height) for 16:9 aspect ratio. Also, 32mm (depth)

b. 1920 x 1080-pixel resolution. Full HD, 16M colors,

c. PCAP Multi Touch (two points) surface with optimized noise filter, Glove mode, and Water Detection mode

d. IP66F, IP67F, Type 1, Type 4X (NEMA indoor use only), and Type 13 degree of protection

3. One (1) Keyboard, Mechanical Full-sized Mechanical Keyboard, Akko brand, model 3098B.

4. One (1) Mouse, Razor brand, Pro Click Mini model.

C. Managed Network Switch:

1. One (1) network managed switch. Schneider Electric Modicon, based on model MCSESM103F2CU0

a. Eight (8) Ports for CAT 5E Copper, 10/100BASE-TX, Shielded RJ45 Connections

b. Two (2) Gbit SFP Ports, 100/1000, Fiber Optic Connections, MultiMode

c. Extensive cybersecurity features, including at least:

1) Port hardening

2) IP-based port security

3) MAC-based port security

4) Port-based access control

5) Role-based access control

6) RADIUS assignment

7) DoS prevention

d. Certifications: CE, UL, RCM, DNV, ATEX

D. UPS Equipment:

1. One (1) arrangement of UPS equipment sized to keep the SCADA Technology energized for at least 30 minutes. Schneider Electric Easy UPS, based on model BVS240XDPDR Control Module and based on model XB005XPDR Battery Module. Chain up to four (4) Battery Modules per Control Module. Implement multiple Controller / Battery configurations as required.

a. Controller includes:

1) DC Input – DC Output

2) LED's and Relay Diagnostic Contacts

3) Emergency Power-Off

4) DIN Rail Mounting

b. Battery Units include:

1) 4.5Ah each, 24VDC – DC

2) Valve Regulated Lead-Acid Technology

3) DIN Rail Mounting

E. Panel Power, Distribution

1. Control Panel Circuit Breakers

a. Control panel circuit breakers shall be DIN rail mounted sized for actual circuit load. Provide 1 spare circuit breaker of each size used.

b. Control panel circuit breakers shall be of Schneider Electric's Multi 9 or other suitable product line, or approved equal.

2. Power Supplies for 24 VDC and other Low Voltage DC Power

a. Power supplies shall be linear type, sized to be able to supply the demand. Power supplies for current loops shall be separate from other DC loads.

b. Unit shall include features:

1) Automatic reset ability.

2) Power reserve (boost) function for absorbing transient current peaks demanded by load.

3) Diagnostic LED's and output

c. Unit shall be as manufactured Schneider Electric, of the ABL8RP line, or approved equal.

2.4 Software

A. Along with MS Windows v10 or later operating system, the SCADA station Industrial Computer shall include and have fully installed, tested and running the following software from schneider electric:

1. EcoStruxure Control Expert PLC logic programming software, for use in programming and monitoring logic in the Modicon M580 PLC, and suitable to support three users, with floating digital licenses.

a. Include also Topology Manager and M580 Safety Modules.

b. "Xl" implementation, three (3) users, floating digital license.

c. Catalog number: CEXSPMCZXGPBZZ

2. EcoStruxure Machine SCADA Expert database and HMI software suitable for monitoring all aspects of the SCADA operator screens and user experience. SCADA software shall support up to 4,000 tags.

3. Any necessary software drivers, accessories, and ancillary installations to ensure full functionality. This might include software that was not available already installed by schneider electric, such as:

a. All programmed software files, and all other files associated with the software and its ownership and original license keys for all software shall be included and installed by the manufacturer or per the manufacturer's directions.

PART 3 – EXECUTION

3.1 OPERATIONAL TESTING

A. General Case:

1. The general objective of operational testing is to confirm that the components and completed system operate in a manner that's identical-to-existing system operateration.

B. Factory Acceptance Testing of Control System

1. See PART 1- GENERAL, Section 1.4 Responsibility Of CSI

C. Field Testing of the Control System

1. The CSI shall perform operational testing of the control system in the field. The initial testing shall be similar in nature to the Factory Acceptance Testing but will also include infrastructure and aspects of the Influent, Headworks, and SCADA functionalities as they exist and operate at the WTTP.

2. The initial testing of the control system shall include configuration of the PLC and its communications equipment, energizing each digital input and output and simulating each analog input and output using a loop simulator and calibrator. Circuits not energized shall be tested for continuity. Energized circuits shall be tested through all components from the field instrument to the input point on the input module, through the hardware I/O memory locations in the PLC, through all communications equipment, to-and-throughout the SCADA system, and to the VFD's. VFD's shall be tested for proper engagement of control signals and proper operation. Similarly, signals, circuits and equipment shall also be tested in reverse directions and all pathways, from VFD's to SCADA and/or PLC's, to/from SCADA to PLC and VFD's, and PLC to/from VFD's.

   If testing of a point cannot be verified within fifteen minutes of starting the check that point shall be noted as a punch list item to be corrected and re-tested at a later time.

3. As a part of the test and with the Owner's witness, the CSI shall record and provide to Owner an I/O checklist for all points wired to the PLC in the control panel. The list shall include for each point, the tag name of the points, a description of the point, comments, date and time of the test, and a signature line for the person performing the test. Show that each Digital point was set and reset. Show verification of all Analog points at 0 percent, 25 percent, 50 percent, and 100 percent of range. Show that all applicable data was communicated and engaged by the PLC, SCADA, and VFD's. Upon satisfactory test performance, Owner shall initial CSI's copy of same report.

4. Field testing of the control system shall be considered completed only after the control system has operated continuously, 24 hours per day, for at least one week.

3.2 INSTALLATION

A. The in-scope system equipment shall not be shipped to the site until a suitable environment is available for installation of the equipment. A suitable environment for the purposes of this contract for the control panels and motor control center shall be dry, covered and heated to maintain a minimum ambient temperature of 60 degrees Fahrenheit. Prior to shipment of equipment, the CSI shall contact the Owner for field verification of a suitable environment.

B. The control system shall be installed such that they directly replace the existing equipment and/or are indicated as agreeable by the Owner. Installation shall be

performed by workers who are skilled and experienced in the installation of electrical instrumentation and control systems.

3.3 CALIBRATION AND START-UP

A. All components of the control system installed by the CSI shall be calibrated by the CSI after completion of installation. Each component shall be adjusted to be within the manufacturer's required range and for the specific application.

B. The control system shall be placed into operation by the CSI.

C. All components installed by the CSI shall be recorded on loop check-off forms and shall be witnessed tested by the Owner or representative.

3.4 SYSTEM VALIDATION

A. When the installation is ready for validation testing, the CSI shall determine that all system components connect up correctly to each other so that the system works as designed.

B. After the integration testing is complete, validation testing shall be by the CSI, with the Owner present. Validation testing shall include operation and verification of all control components and features of the entire control system. The CSI shall inform the Owner of the testing schedule at least one week prior to the commencement of testing. Validation testing shall be considered complete when the Owner has determined that all of the original system requirements have been met.

C. The CSI shall revise, modify, adjust and reprogram the system as required during and following start-up to provide the operation required by the Engineer.

D. Note: The Owner shall not be called out by the CSI for validation testing on equipment until all components are installed, all wiring points have been checked, and operation has been tested and verified by the CSI.

3.5 SYSTEM MAINTENANCE

A. The CSI shall be solely and completely responsible for all maintenance of the hardware system installed by the CSI from time of start-up to the date of acceptance, by formal action of the Owner, of all work under the contract. The CSI shall correct all deficiencies and defects and make any and all repairs, replacements, modifications, and adjustments as malfunctions or failures occur. The CSI shall perform all such work required or considered to be required by the Owner to cause and maintain proper operation of the system and to properly maintain the system.

B. The CSI shall anticipate that the Owner may delay acceptance of all work under the contract if, in the judgment of the Owner, malfunctions or failures in operation of the control system repeatedly occur after start-up. The CSI shall not be entitled to an extension of time or to any claim for damages because of hindrances, delays or complications caused by or resulting from delay of the work because of malfunctions or failures in operation of the control system.

3.6 OPERATION AND MAINTENANCE TRAINING

A. The CSI shall conduct specifically organized training sessions in operation and maintenance of the control system for personnel employed by the Owner. The training sessions shall be conducted to educate and train the personnel in maintenance and operation of all components of the control system. Training shall be limited in nature and application to the in-scope equipment, but will include at least the following:

1. Preventative Maintenance Procedures

2. Troubleshooting

3. Calibration
4. Testing
5. Replacement of Components
6. Automatic Mode Operation
7. Manual Mode Operation

B. Up to two separate training sessions, each of a duration agreed-to by the Owner, shall be conducted at the facility after start-up of the system. The CSI shall prepare and assemble specific instruction materials for each training session and shall supply such materials to the Owner at least one week prior to the time of the training.

3.7 OPERATION AND MAINTENANCE DATA

A. The CSI shall prepare and assemble an Operation and Maintenance Guidelines document as applicable to equipment and software implemented by the CSI and as needed and agreed to by Owner. (May include but not be limited in-scope to product manuals.) The Guidelines document shall include as agreed to by the Owner the following:

1. Complete parts list for all equipment and control devices.
2. Listing of recommended spare parts.
3. Preventative Maintenance Procedures
4. Troubleshooting
5. Calibration
6. Testing
7. Replacement of components
8. Automatic mode operation
9. Programming
10. Manual mode operation
11. System schematics / shop drawings
12. Electronic copy on disk of all drawings in version of AUTOCAD acceptable to Owner.
13. As-built wiring diagrams of in-scope equipment and of overall implementation.

B. CSI will also provide:

1. Program documentation printout with tag numbers and descriptive comments.
2. Backup of all software programs on a USB thumb drive.

3.8 OPERATING DEVICE LOCATION:

A. SCADA Station Panel shall be installed on designated wall space in the Operations Building and as designated by the owner and agreed to as reasonable by the CSI.

Note: Installer has the right to accept for a fee or decline additional, unspecified requests to install miscellaneous ancillary wiring and wiring accessories, usually close-by and 120 volts or less, to support proper installation and operation of the system.

END OF SECTION

APPENDICES

Appendix One – PAC / PLC Components Supplied by Owner

A. Process Automation Components to be supplied by Owner are Schneider Electric Modicon brand and include:

1. One (1) BMEXBP1200 Twelve Slot Backplane (Chassis), Ethernet and Bus-X design, Single Rack Configuration.
2. One (1) BMXCPS2000 Power Supply Module, 120-240VAC, 20W
3. One (1) BMEP582040 Modicon M580 Processor
4. One (1) PMEPXM0100 Profibus DP Communications Module
5. Three (3) BMXDAI1604 Sixteen-Point Discrete Input Modules, 120VAC
6. Two (2) BMXDRC0805 Eight-Point Relay Output Modules, 24-240VAC, 24-125VDC
7. One (1) BMXAMO0410 Four Channel, 0-20mA Analog Current Output Module
8. Two (2) BMXAMI0810 Eight Channel Isolated Analog Input Module, Configurable ±10V DC or ±20 mA, 16 Bit Resolution.

Appendix Two - Embedded Special Functions of the Schneider Electric Altivar 630 Process Drive

A. The following three categories separate the types of embedded Special Functions that might be of interest for the Owner to have activated in the M340 Processes Variable Frequency Drives.

1. Embedded Controls:

a. PID Regulator- An external regulator loop that allows the user to regulate an external process based on its speed, pressure, flow temperature, etc. Useful for maintaining a constant pressure whatever the water flow in the pipes.

b. Flow Limitation- Utilization of an external flow sensor to limit pump speed, flow. May be used with PID.

c. Skip Frequency- Prevents running at a speed that might be harmful to the system. For example, running at a natural harmonic frequency.

d. Pipe Fill Function- Prevents water hammering by filling the pipes at a low rate.

e. Anti-Jam Function- Allows manual or automatic execution of forward and reverse pump rotations in effort to shake debris off of pump rotor. "Shakes" debris off rotor.

f. Jockey Pump Control- Reduces ware and energy consumption during very low demand periods.

g. Priming Pump Control- Maintains fluid supply to inlet of main pump by running the priming pump before main pump starts.

h. Sleep / Wakeup Function- Avoids operating a pump without water flow. Stops motor if process is at standstill.

i. Advanced Sleep / Wakeup- Useful for centrifugal pumps. Helps prevent false, continuous run at speed higher than sleep speed.

j. Booster Control- Maintains desired outlet pressure of multiple variable-speed and fixed-speed supply pumps connected in parallel to common manifold or consumer.

k. Level Control- Avoids overflow during fill process or emptying tank/pond during emptying process when either is managed by multiple variable-speed and fixed-speed pumps.

l. Friction Loss Compensation- Estimates pressure drop over pipeline system. Display mode or Compensation mode.

2. Embedded Monitoring:

a. Pump Monitoring- Wide range of data as applicable to Process Level, Installation Level, and Pump Level. Includes embedded pump curve.

b. Monitoring PID Feedback- Supervises system to detect issues such as breaks, leaks, blockages. Responds to avoid (further) damage.

c. Sensor-less Flow Estimation- Provides estimation of flow based on predefined pump curves.

d. Monitoring of Energy Consumed- Provides data on input power & energy, output power. Offers energy bill calculation and conformance to Common Industry Protocols.

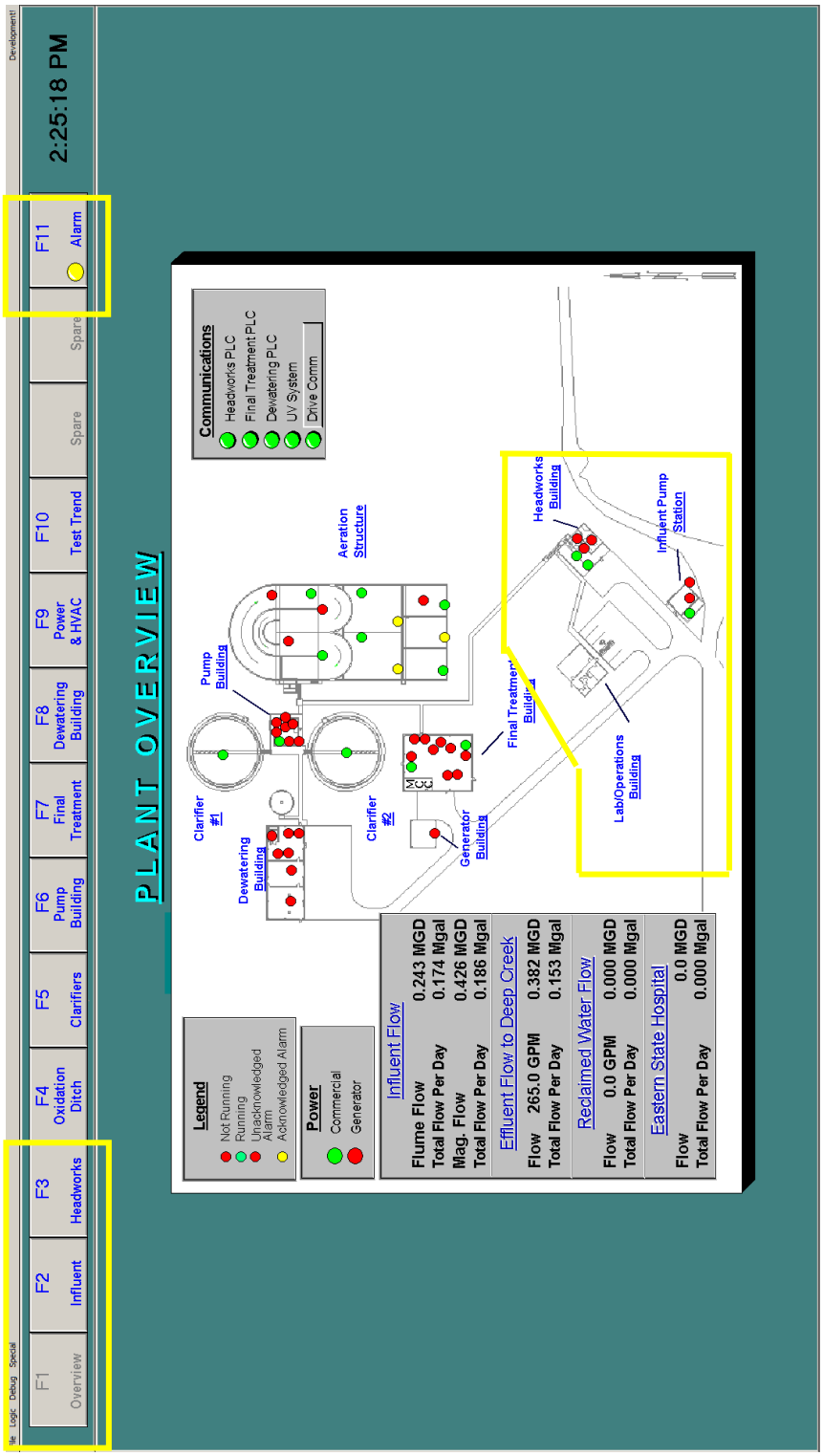
3. Embedded Protections:
    a. High Flow Protection- Helps to detect abnormal high flow situations, such as a pipe burst.
    b. No or Low Flow Protection- Helps protect against damaging or destroying pumps due to low flow status. Offers variety of configured fault managements.
    c. Cavitation Pump Protection- Two functions help protect against damaging or destroying pumps due to cavitation.
    d. Pump Cyclic Start Protection- Protects pump against too many restarts in given time period.
    e. Dry Running Pump Protection- Helps protect against damaging or destroying pumps due to dry running.
    f. Low Pressure Pump Protection- Helps protect against damaging pumps due to running at unusually low pressure.
    g. Inlet/Outlet Pressure Protection- Prevents operation outside of abnormal application operating conditions, such as too high or low pipe pressure.

Appendix Three – Existing SCADA Screens

A. The following images illustrate the existing SCADA screens that monitor and control the Headworks portion of the Medical Lake Wastewater Treatment and Reuse facility.

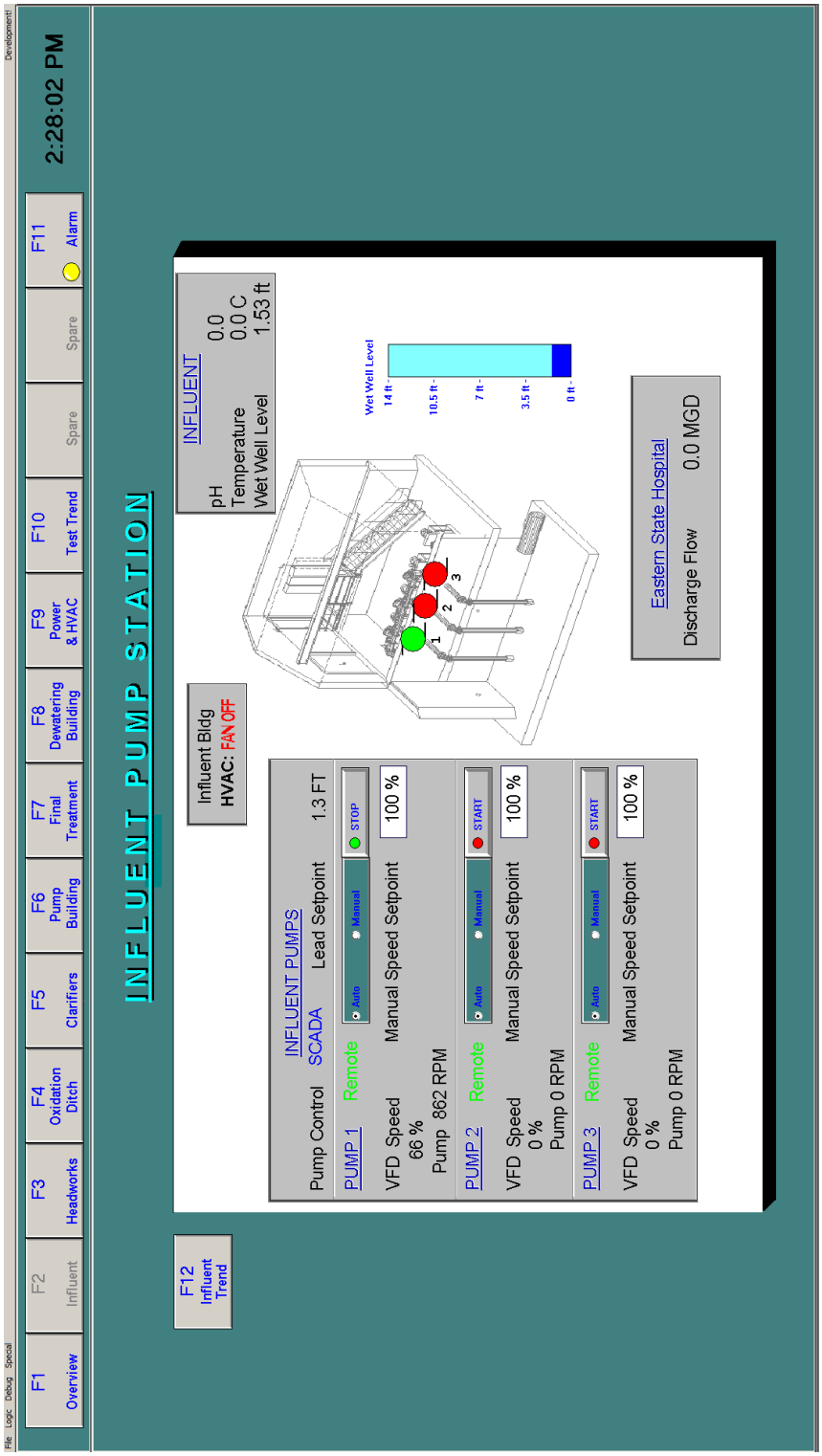
1. WWTP Overview Graphic

a. Note that only the portion outlined in yellow, the Headworks portion of the facility and function buttons, and related displayed information are to be active and functional.



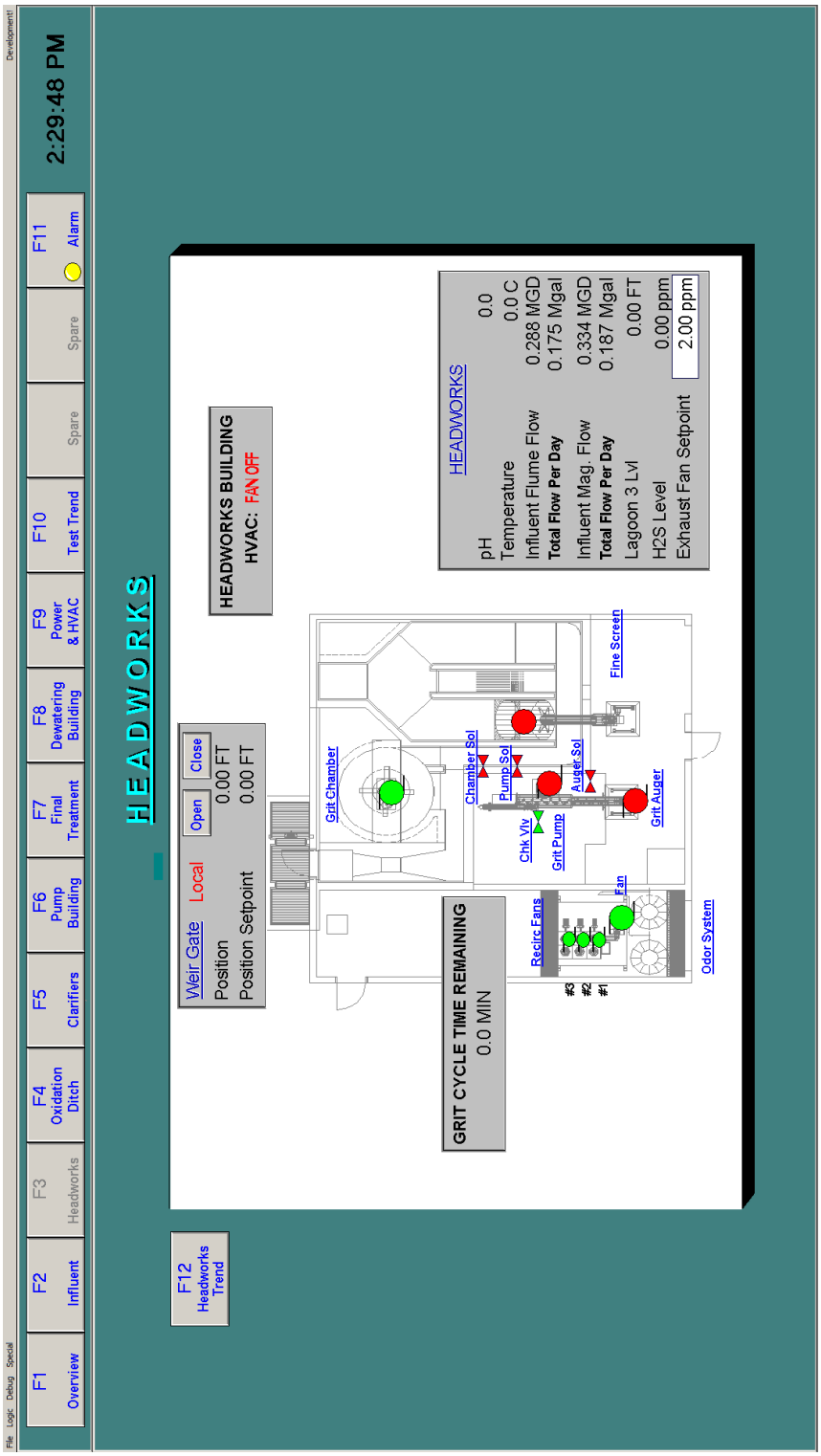
Appendix Three – Existing SCADA Screens *(Continued)*

B. Influent Pump Station Graphic



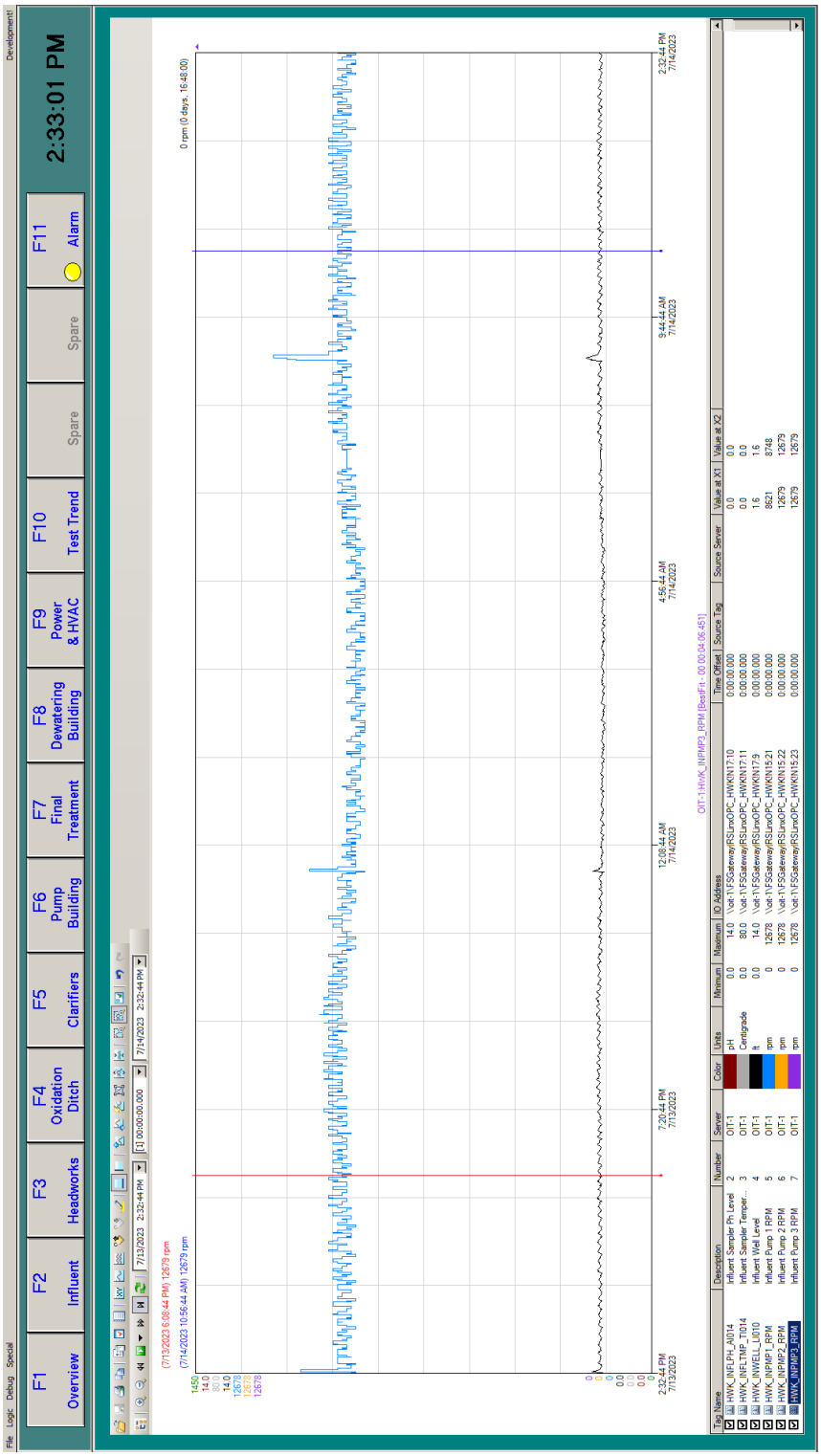
Appendix Three – Existing SCADA Screens *(Continued)*

A. Headworks Graphic



Appendix Three – Existing SCADA Screens *(Continued)*

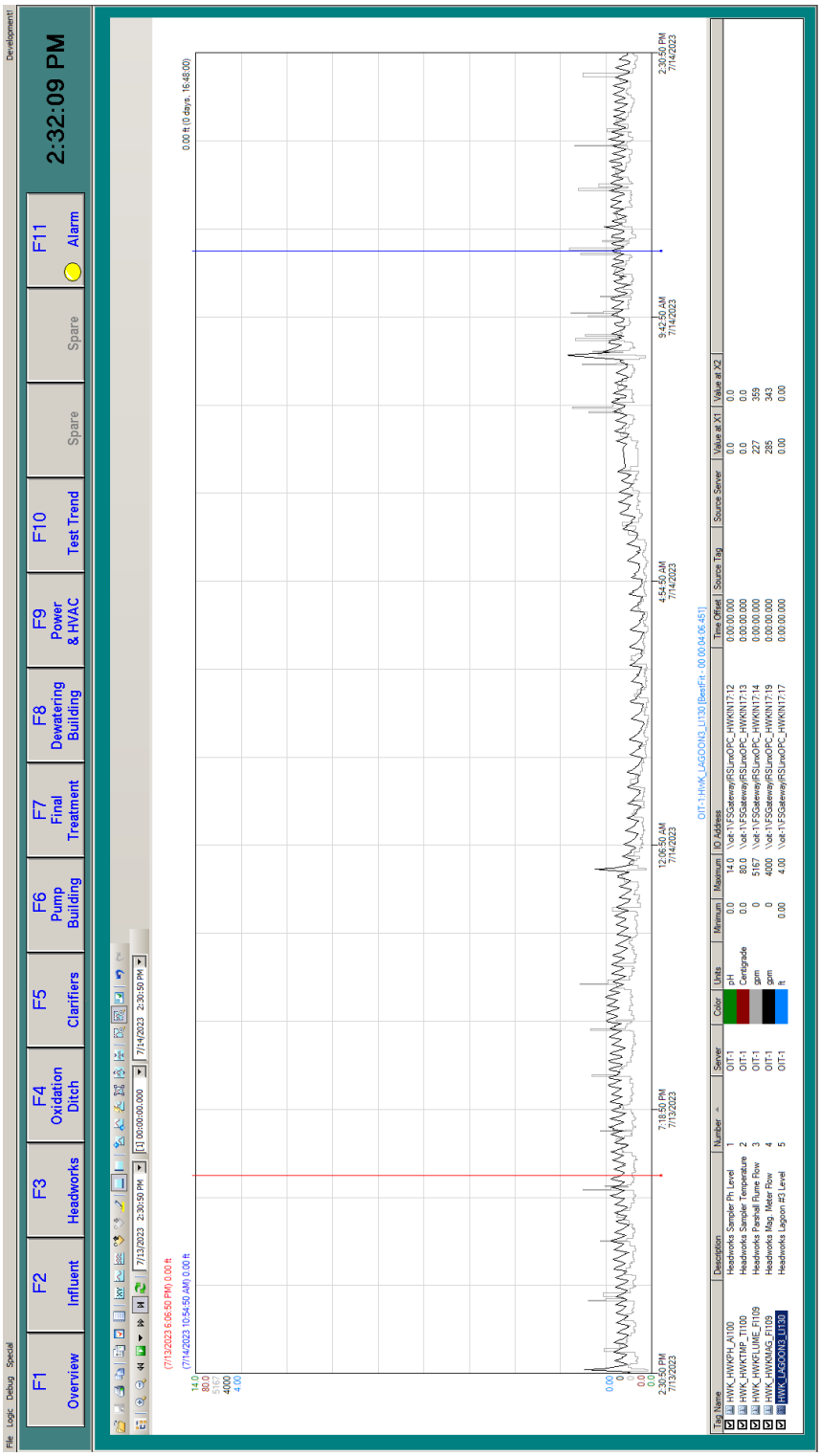
A. Influent Trend



Appendix Three – Existing SCADA Screens *(Continued)*

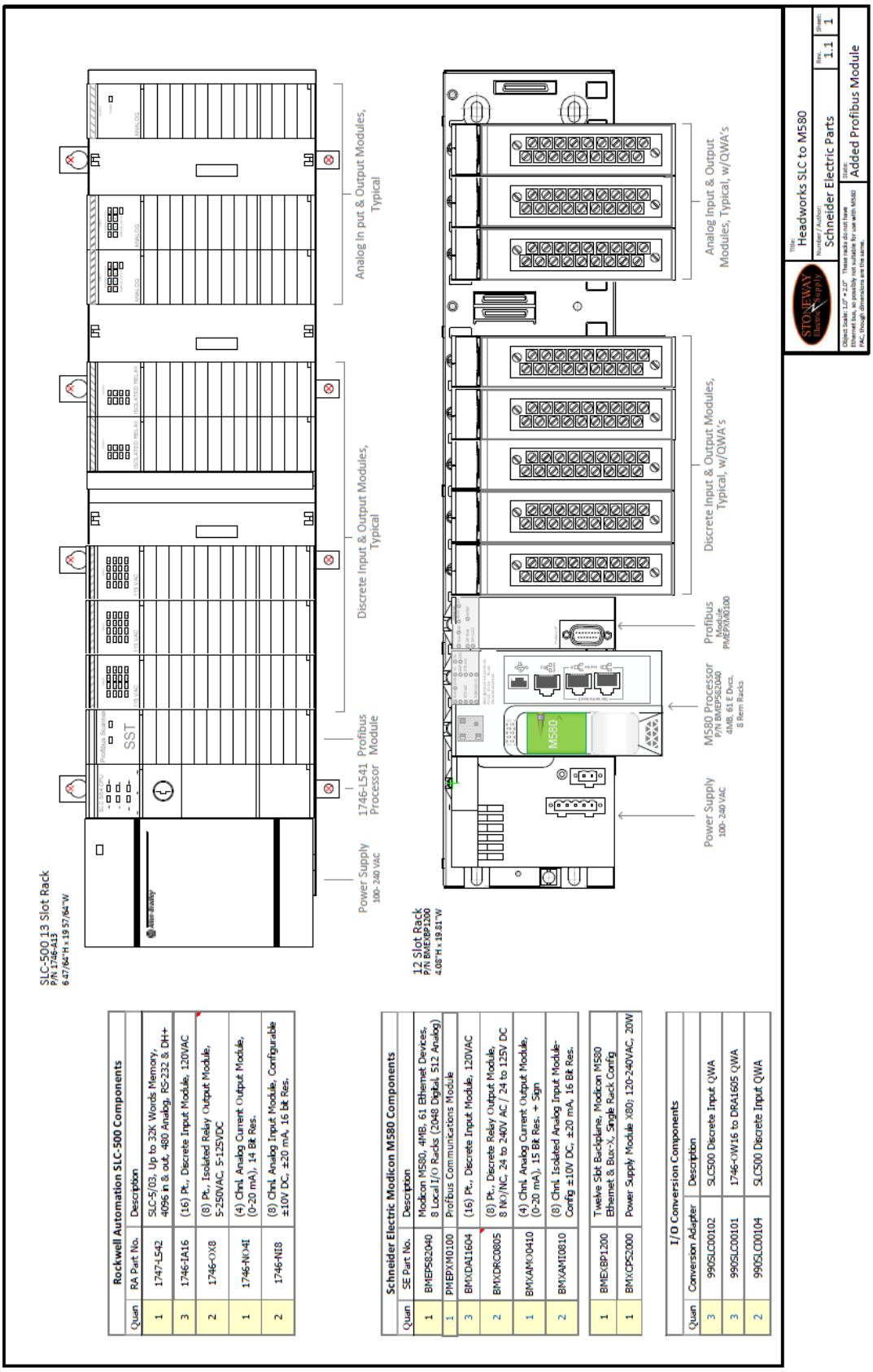
A. Headworks Trend

B. Also, not seen here, is Alarm Screen. (List of colorized alarm banners.)



Appendix Four – PLC Components Diagram

A. Diagram illustrating existing SLC-500 installation, and replacement M580 installation.



Rockwell Automation SLC-500 Components		
Quan	RA Part No.	Description
1	1747-L542	SLC-5/03, Up to 32K Words Memory, 4096 in & out, 480 Analog, RS-232 & DH+
3	1746-IA16	(16) Pt., Discrete Input Module, 120VAC
2	1746-OX8	(8) Pt., Isolated Relay Output Module, 5-250VAC, 5-125VDC
1	1746-NO4I	(4) Chnl Analog Current Output Module, (0-20 mA), 14 Bit Res.
2	1746-NI8	(8) Chnl Analog Input Module, Configurable ±10V DC, ±20 mA, 16 Bit Res.

Schneider Electric Modicon M580 Components		
Quan	SE Part No.	Description
1	BMEP582040	Modicon M580, 4MB, 61 Ethernet Devices, 8 Local I/O Racks (2048 Digital, 512 Analog)
1	PMEPXM0100	Profibus Communications Module
3	BMXDAI1604	(16) Pt., Discrete Input Module, 120VAC
2	BMXDRC0805	(8) Pt., Discrete Relay Output Module, 8 NO/NC, 24 to 240V AC / 24 to 125V DC
1	BMXAMO0410	(4) Chnl Analog Current Output Module, (0-20 mA), 15 Bit Res. + Sgn
2	BMXAMI0810	(8) Chnl Isolated Analog Input Module-Config ±10V DC, ±20 mA, 16 Bit Res.
1	BMEXBP1200	Twelve Slot Backplane, Modicon M580 Ethernet & Bus-X, Single Rack Config
1	BMXCPS2000	Power Supply Module X80; 120-240VAC, 20W

I/O Conversion Components		
Quan	Conversion Adapter	Description
3	990SLC00102	SLC500 Discrete Input QWA
3	990SLC00101	1746-OW16 to DRA160S QWA
2	990SLC00104	SLC500 Discrete Input QWA

Appendix Five – Operation and Maintenance Manual, Extracted

A. The following pages to serve as reference for the operation of the Headworks portion of the Medical Lake Wastewater Treatment and Reuse facility.

3.3 HEADWORKS

The equipment items listed below are located in the Headworks as shown on Figure 3-7, Headworks Building Floor Plan. Refer to the O&M manuals and specification sections listed in parentheses next to each equipment item for additional information. These O&M Manuals may be referenced in this section.

1. In-Channel Fine Screen (Tab A-2, In-Channel Fine Screen, Bid Package A-11071):
2. Grit Removal System (Tab A-6, Grit Chamber, Washer, and Pump, Bid Package A-11075);
3. Odor Control System (Tab A-19, Odor Control System, Bid Package B-11960):
4. Parshall Flume Influent Flowmeter (Tab B-6, Instrumentation. Bid Package B. B-13420);
5. Automatic Sampler (Tab B-6, Instrumentation, Bid Package B-13422);
6. Hydrogen Sulfide Gas Detection System (Tab B-6, Instrumentation, Bid Package B-13426);
7. Portable Gantry Crane (Tab B-2, Cranes, Bid Package B-14310);
8. Electric Unit Heaters (Tab B-8, Mechanical, Bid Package B-15625);
9. Make-Up Air Unit (Tab B-8. Mechanical, Bid Package B-15856); and
10. Exhaust Fans (Tab B-8, Mechanical, Bid Package B-15870);
11. Motor Control Center (MCC-HWK) (Tab A-21C, Bid Package A-16481A).

Refer to the following As-Built Drawings for addition information:

1. Process Drawings: OP3, HP1-HP6
2. Structural and Architectural Drawings: H1, HA1 HA2, HS1-HS4
3. Electrical Drawings: HE1-HE5
4. Mechanical Drawings: HM1, HM2
5. Instrumentation Drawings: O12, O13, O14, O15, O120, O121

3.3.1 In-Channel Fine Screen and Manually Cleaned Bar Rack

3.3.1.1 Description

The purpose of the fine screen is to remove debris from the wastewater. including plastics and other aesthetically undesirable materials which might cause problems in the other treatment unit processes, unsightly conditions in the effluent, or aesthetically displeasing materials within the processed sludge (biosolids). Wastewater enters into the Headworks Building Pretreatment Room through an influent box located in the northeast corner and uppermost level of the building. From this influent box, wastewater flows into the fine screen channel where it is directed by a deflector plate into a wedgewire, rotary, in-channel fine screen drum with 3 mm (0.12") openings. The deflector plate conforms to the shape of the channel and prevents the wastewater from bypassing the screen. Screenings are captured on the interior of the rotating wedgewire drum and dropped onto a screw conveyor for removal. The screw conveyor transports the screenings to a compaction zone within a conveyance tube, where the screenings are dewatered before discharge to a dumpster on the building's lowest level. Water released from the screenings in the compaction zone drains back into the channel. The City's solid waste contractor should be scheduled to remove the screenings on a periodic basis.

Notes (for this Plan)

(N1) In—Channel finescreen.
(N2) Finescreen local control panel.
(N3) Finescreen main control panel.
(N4) Manually cleaned bar rack.
(N5) Grit chamber.
(N6) Grit mechanism.
(N7) Grit washer/conveyor.
(N8) Grit pump (below mezzanine).
(N9) Screening and grit bins.
(N10) Odor control system.
(N11) Distribution Box A.
(N12) Automatic weir gate.
(N13) Parshall flume.
(N14) Automatic sampler.
(N15) Sampler pH/temperature probe.
(N16) H2S sensor (below mezzanine).
(N17) Local disconnect switch.
(N18) Make—up air unit.
(N19) Electric unit heaters.
(N20) Exhaust fans.
(N21) Motor control center (MCC—HWK).
(N22) PLC—HWK.

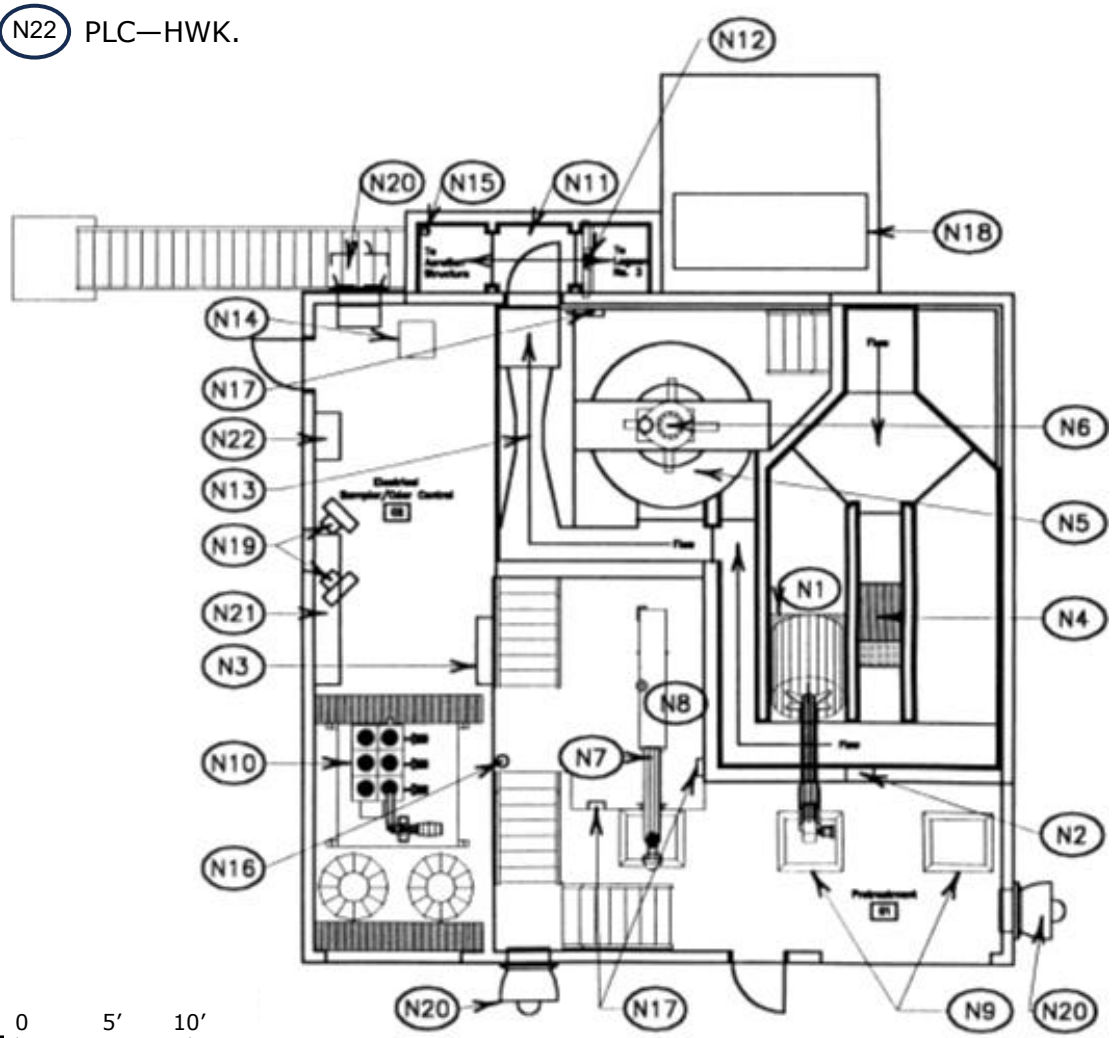


Figure 3-7 **HEADWORKS FLOOR PLAN**
Hwk—PL (120)

0 5′ 10′
Scale

A manually cleaned bar-rack with 3/4" openings is located in an adjacent bypass channel. The purpose of the bar-rack is to remove larger debris from any wastewater bypassing the screen. A third parallel channel is located on the other side of the bar-rack channel and has been provided to accommodate a future second fine screen. The fine screen has a hydraulic capacity of 6.2 MGD, and therefore, can screen wastewater up to this capacity for short periods of time without causing unscreened wastewater to back-up behind the screen and overflow into the adjacent bypass channel.

3.3.1.2 Operation

Screen operation is controlled by both the Local Control Panel, located adjacent to the screen in the Pretreatment Room, and the Main Control Panel, in the Electrical Room. The Local Control Panel is explosion proof and includes HOA selector switches for the wash water solenoid valves and for the screen drive as well as a Forward-Off-Reverse switch for the screen basket. The Main Control Panel includes: a PLC with a handheld programmer; an ultrasonic level controller; "Power On", "Screen Running", "Screen Standby", and "Overload" indicators, and a "Reset" pushbutton. The "Screen Standby" indication signifies that the screen is not currently in a cleaning cycle but will initiate cleaning when called to do so. The "Overload" indication signifies that either the screen drive power monitor or VFD was tripped due to a power overload.

Manual Operation: To manually operate the screen, place the screen HOA selector switch in the "Hand" position. Placing the Forward-Off-Reverse switch in either "Forward" or "Reverse" will allow the screen to run forward or reverse continuously until the selector is placed back into the "Off position. To manually open the wash water solenoid valves, place the valve HOA selector switches in the "Hand" position.

Automatic Operation: During automatic operation, the fine screen continuously operates by allowing wastewater to pass through the wedgewire screen while preventing the screenings from passing. The screen is cleared periodically by rotation of the wedgewire screenings basket to move screenings into the screw conveyor for removal. The screenings removal cycle is triggered by either a high-water signal from the ultrasonic transducer on the upstream side of the screen, or by a timer. Once the cycle is triggered, three solenoid valves open, allowing plant utility water to be sprayed onto the screen, preventing materials from clogging the basket and removing fecal and other biodegradable matter from the screenings. The solenoids direct wash water to the spray nozzle manifold along the basket, a header in the conveyance tube along the screw conveyor, and a header in compaction zone. During cleaning cycles, the utility water is required at a minimum pressure of 60 PSIG, and a maximum flow of 50 GPM.

Automatic operation is achieved by placing the HOA selector switches on the Local Control Panel in the "Auto" position. The cleaning cycle timer (cleaning frequency) and cycle duration are adjustable through the Main Control Panel PLC. The cycle timer can be adjusted from 0.5 to 60 minutes; and the cycle duration can be adjusted from 0 to 10 minutes. The high water setpoint (to initiate the cleaning cycle) is adjustable through the ultrasonic level transducer in the Main Control Panel. The high water setpoint is typically set at 24 inches above the floor of the channel (2427-6"). The high water setpoint and the cycle timer should be set to clean the screen *(continued next page…)*

frequently enough to ensure that the upstream water level does not significantly rise at low or moderate flows and does not rise above the elevation of the overflow gate during high flows.

If the high water setpoint is reached during a cleaning cycle, the cycle will continue to run until the upstream wastewater level drops below the high water setpoint. If the upstream wastewater level continues to rise beyond above the high-water level setpoint, a high-water level alarm will be triggered. The high-water level alarm should be set at 36 inches above the floor of the channel (2428-6").

If the screen is unintentionally shut-off for a long period of time, or its cleaning mechanism fails, screenings will build up in its drum, eventually clogging it. Excess screenings build-up or wastewater flow beyond the design capacity of the screen will increase the head loss across the screen causing the unscreened wastewater to overflow over the top of the gate (G-H-2-HI) in the adjacent bypass channel. The top of the overflow gate is set at 2428'-9" allowing fifteen inches of freeboard for overflow.

To bypass the screen (for maintenance or repair), the isolation gate upstream of the fine screen should be inserted and the gate upstream of the bypass channel should be removed to direct flow to the grit removal system. The channel bottom elevation drops one foot after the screen allowing water to drain from the channel at low flows facilitating wash down of the channel. The screen has also been provided with a pivoting support stand so that the screen basket can be removed from the channel for maintenance purposes.

3.3.1.3 Start-Up and Shut-Down Procedures

When removing the fine screen from service for maintenance purposes, it is recommended that the following procedures be performed:

1. Insert the isolation gate upstream of the fine screen and remove the gate upstream of the bypass channel.
2. At the local control panel, place screen and solenoid HOA switches in the "Off position.
3. Lock-out the disconnect switch at the Main Control Panel in the "Off position.
4. Review the O&M Manual for fine screen prior to performing maintenance.

To place the unit back in service, the following procedures are recommended:

1. Place the disconnect switch at the Main Control Panel in the "On" position.
2. At the local control panel, place screen and solenoid HOA switches in "Auto" position.
3. Manually operate the screen drive to ensure that the unit is operating satisfactorily, and no obstruction exists. Place the screen HOA selector switch in the "Hand" position. Place the Forward-Off-Reverse switch in "Forward", then "Reverse" for a full rotation. Place the switch back to the "Off position.
4. Simulate an auto clean cycle by placing target under the ultrasonic level sensor or push the "Reset" button on the control panel and hold for three seconds. Observe the operation of the screen to assure that the cleaning cycle is automatically initiated and that all the wash water valves actuate.

5. Remove the isolation gate upstream of the fine screen and insert the gate upstream of the bypass channel.

3.3.1.4 Recommended Maintenance Procedures

The following maintenance procedures are recommended on a daily basis:

1. Observe the operation of the screen basket and screw conveyor. Check for obstructions.
2. Hose-down the channel walls, screen basket, and screw conveyor. (Preventing the accumulation of screenings debris on surfaces in the screening channel and equipment will help to prevent odors and blinding of the screen due grease collection.)
3. Observe the wash water sprays along the basket and screw conveyor. Check for plugging.
4. Hose down the areas surrounding the screen and the screenings dumpster to prevent slipping problems and odors.
5. Check unit for increased noise, surface temperature, vibration, and shaft movement. Check motor amperage draw as necessary.
6. Check to see that screenings dumpster is not full.
7. Clean bar rack and spray bypass channel walls as required.

The following maintenance procedures are recommended on a periodic basis:

1. Check speed reducer (Nord gearbox) for oil seepage and gear noise (weekly).
2. Inspect and clean wash water Y-strainer and solenoid valves (monthly).
3. Check alignment of bearing shoes (monthly).
4. Check alignment and wear of basket seal (monthly).
5. Check top and lower basket bearings for excessive wear (semi-annually, or every 500 hours).
6. Clean dust from motor fan (yearly).
7. Change oil in speed reducer (Nord gearbox) (for first two years) (yearly, or every 10,000 hours).

See also Table 6-1, which incorporates the recommended maintenance procedures for the entire WWT&RF sorted by building, frequency, and equipment type. Refer to In-Channel Fine Screen O&M manual for specific instructions on the manufacturer recommended maintenance procedures.

3.3.1.5 Safety

The following safety procedures are recommended when maintaining the in-channel fine screen:

1. During maintenance operations of the in-channel fine screen, such as when someone may put objects in or near the screen basket or conveyor (i.e. to remove debris hung up on the screw conveyor spray), or when the screen is tilted from the channel for service, it is imperative that the SCREEN be LOCKED OUT.
2. Maintenance activities that involve any entry into the screen channel should be conducted only when two or more persons are present.

5.3.2 Grit Removal System

5.3.2.1 Description

Grit Chamber: The grit chamber is a "Pista Grit™" grit removal chamber consisting of a 10'-0" diameter grit chamber with a deep grit storage hopper, baffles and a mechanism. The mechanism consists of a constant speed drive with a centrifugal, up-flow impeller. The impeller imposes a circumferential velocity to keep organic solids in suspension while allowing inorganic leavier grit to settle into the grit storage hopper. Depending on the amount of organic material o be excluded, the grit chamber mechanism blade can be raised (to increase the amount of grit Ind organics to be recovered) or lowered (to reduce the amount of grit and organics to be -recovered). It is recommended that the bottom of the blade be located 3 inches from the floor with the pitch at 45 degrees. The grit chamber inlet channel includes an aluminum baffle to farrow the effective channel width. The baffle is designed to help maintain influent velocity and -educe solids accumulation in the channel.

Grit Pump: The grit pump conveys water and grit from the bottom of the grit storage hopper in the grit chamber to the grit washer/classifier. The grit pump is an end suction, vertical, non-clog centrifugal type, with a curved vane, flow-inducing impeller, capable of passing a 4" spherical, solid. An uninstalled standby pump has been provided for redundancy complete with base, rotor, and suction and discharge connections. Utility water can be injected into the bottom of the grit storage hopper and into the pump suction pipe to assist in suspending the grit prior to pumping. Each injection line has a solenoid valve for automatic operation and a manual solation valve.

Grit Washer/Conveyor: The grit washer/conveyor receives wastewater containing grit from the grit chamber, delivered by the grit pump. The pump is designed to impart a velocity on the pumped fluid to concentrate the grit in the concentrator (located above the washer/conveyor) as it is discharged into the grit washer/conveyor. Utility water can be injected into the grit washer/conveyor to rinse excess organics from the grit. The injection line has a solenoid valve for automatic operation and a manual isolation valve. Excess water overflows the grit washer/conveyor into the building drain back to the Influent Pump Station wet well. Washed (classified) grit can be disposed with the screenings by the City's solid waste contractor.

3.3.2.2 Operation

Manual Operation: The grit mechanism should normally operate on a continuous basis. An On-Off switch is located at the MCC-HWK to manually turn on or off the mechanism. The mechanism can also be energized or turned off at its local disconnect switch.

The grit pump can be controlled manually from the SCADA Headworks - Grit Pump/Washer Screen by selecting the "Manual" radio button for the pump, and selecting "Start/Stop" toggle button to initiate or shut-off the pump. Pump operation can also be controlled from the MCC-HWK located in the Headworks Building Electrical Room. Placing the HOA Switch in "Hand" position allows the pump to be initiated manually; placing the HOA switch in the "Auto" position allows the pump to be controlled by the PLC-HWK and SCADA remotely; and placing the HOA Switch in the "Off position turns the pump off. The pump can also be energized or turned off at its local disconnect switch.

When the grit pump is started manually from the SCADA Headworks - Grit Pump/Washer Screen, operation of the injection water solenoid valves (the valves that control injection of the utility water into the grit storage hopper and grit pump suction piping, also called the "grit pump and chamber solenoids" on the SCADA Headworks - Grit Pump/Washer Screen) are still controlled automatically by the PLC-HWK based on the SCADA time settings. To manually control the injection water solenoid valves, the operator must open and close the valves locally. The injection water solenoid valves should be manually opened before the pump is initiated, so that the grit is adequately flushed into the grit washer/classifier and to prevent clogging, and then manually closed after the pump is shut off.

The grit washer/conveyor can be controlled manually at the MCC-HWK located in the Headworks Building Electrical Room. Placing the HOA Switch in "Hand" position allows the grit washer/conveyor to be initiated manually; placing the HOA switch in the "Auto" position allows the pump to be controlled by the PLC-HWK and SCADA automatically; and placing the HOA Switch in the "Off position turns the grit washer/conveyor off. The grit washer/conveyor can also be energized or turned off at its local disconnect switch. Prior to manually starting the grit pump (at the MCC-HWK), turn on the grit washer/conveyor and washer/conveyor wash water solenoid valve. Allow the washer/conveyor and wash water solenoid valve to operate well after the grit pump is turned off in order to wash and discharge the collected grit into the grit bin.

Automatic Operation: The grit pump is automatically controlled by the PLC-HWK by selecting the "Duty Cycle" radio button at the SCADA Headworks - Grit Pump/Washer Screen. The PLC-HWK operates the pump based on the operator adjustable "Duty Cycle" and "Percent On" settings entered into the SCADA Headworks - Grit Pump/Washer Screen. The "Duty Cycle" is the duration of the pump's on-off cycle, and the "Percent On" is the percentage of the duty cycle the pump is operated. For example, a grit pump may operate for ten minutes with a frequency of three times per day. The duty cycle would be 24 hours/3 times per day, or 8 hours; and the percent on would be 10 minutes/8 hours/60 minutes per hour, or approximately 2 percent.

The PLC-HWK automatically operates the injection water solenoid valves based on the operator adjustable "Pre On" and "Delay Off settings entered into the SCADA Headworks - Gri Pump/Washer Screen. The "Pre On" setting is the time in seconds that the solenoid valves will open prior to the grit pump starting. The "Delay Off setting is the time in seconds that the solenoid valves will remain open after the grit pump has started.

The PLC-HWK automatically operates the grit washer/conveyor based on the operator adjustable "Delay On" and "Delay Off settings entered into the SCADA Headworks - Grit Pump/Washer Screen. The "Delay On" setting is the time in seconds that the washer/conveyor will start after the grit pump has started. The "Delay Off setting is the time in minutes that the washer/conveyor will continue to operate after the grit pump has stopped.

The PLC-HWK automatically operates the grit washer/conveyor wash water solenoid valve based on the operator adjustable "Pre On" and "Delay Off settings entered into the SCADA Headworks - Grit Pump/Washer Screen. The "Pre On" setting is the time in seconds that the solenoid valve will open before the washer/conveyor has started. The "Delay Off setting is the time in seconds that the solenoid will remain open after the washer/conveyor has started.

Whether operated manually or automatically, the grit pump and injection water solenoid valve: should be operated frequently enough to prevent excess grit accumulation in the grit storage hopper and to ensure that the grit does not compact in the grit storage hopper or clog the grit pumping lines (i.e., twice per day). The grit chamber storage hopper is sized to hold a minimum of 24 hours of storage, although it is recommended to operate the grit pumping system at least two to three times per day to prevent grit compacting in the hopper. Further care should be taker to limit the duration of grit pump operation to prevent pumping down the grit chamber to fa (which will disrupt the downstream parshall flume readings). If the grit system is operated two to three times per day, it is recommended that the grit pump be operated approximately 10 to 15. minutes each cycle to adequately discharge the grit.

The grit washer/conveyor should be operated for an adequate length of time to prevent excess grit from accumulating in the conveyor trough; and the grit washer/conveyor solenoid valve should remain open long enough to adequately flush organic materials out of the separated grit.

To bypass the grit removal system (for maintenance or repair), insert the stop gates upstream am downstream of the grit chamber.

3.3.2.3 Start-Up and Shut-Down Procedures

When removing the grit chamber or grit mechanism from service for maintenance purposes. it is recommended that the following procedures be performed:

1. Insert the stop gates upstream and downstream of the grit chamber.
2. At the MCC-HWK, place the mechanism On-Off switch in the "Off position.
3. Lock-out the local disconnect switch for the mechanism in the "Off position.
4. If required, manually pump down the grit chamber by opening the injection water valves and placing the pump HOA switch at the MCC-HWK in the "Hand". Depending on the injection water flow rate, these valves may need to be throttled to sufficiently pump down the chamber.
5. Once the chamber is pumped down, close the injection water isolation valves and place the grit pump and washer/conveyor HOA switches in the "Off position.
6. Lock-out the local disconnect switches for the pump and the washer/conveyor in the "Off position.
7. Review the O&M Manual for the grit mechanism prior to performing maintenance.

To place the grit chamber or grit mechanism back in service, the following procedures are recommended:

1. Place the local disconnect switch for the mechanism in the "On" position.
2. Place the mechanism On-Off switch at the MCC-HWK in the "On" position.
3. Observe the rotation of the mechanism to ensure that it is operating satisfactorily.
4. Remove the stop gates upstream and downstream of the grit chamber.
5. Open the injection water isolation valves.
6. Place the grit pump and washer/conveyor HOA switches at the MCC-HWK in the "Auto" position.
7. Once the grit chamber is filled to the same level as the liquid level in the chamber entrance channel, place the local disconnect switches for the pump and the washer/conveyor in the "On" position.
8. At the SCADA Headworks - Grit Pump/Washer Screen, select the "Manual" radio button for the pump, and select the "Start" toggle button to initiate the pump. Observe the operation of the pump, injection water solenoids, and washer/conveyor to assure that the pumping cycle is remotely initiated, and that all the wash water valves and the washer/conveyor automatically actuate at the appropriate times.
9. If the system appears to be operating satisfactorily, place the unit back into automatic operation by selecting the "Duty Cycle" radio button at the SCADA Headworks - Grit Pump/Washer Screen.

When removing the grit pump or grit washer/conveyor from service for maintenance purposes. it is recommended that the following procedures be performed:

1. If removing the pump and washer/classifier for relatively short periods of time (i.e., less than the amount of time required to fill up the grit storage hopper). there is no need to remove the grit chamber and mechanism from service. Otherwise follow steps no. 1-3 for removing the chamber and mechanism from service above.
2. Close the pump injection water isolation valves and place the grit pump HOA switch in the "Off' position.
3. Place the washer/conveyor HOA switch in the "Hand" position and operate the conveyor until most of the grit is removed from the unit; then place the washer/conveyor HOA switch in the "Off position.
4. Close the injection water isolation valve for the grit washer/conveyor.
5. Lock-out the local disconnect switches for the pump and the washer/conveyor in the "Off' position.
6. Close the grit pump suction and discharge isolation valves.
7. Drain the washer/conveyor unit as required.
8. Review the O&M Manual for the grit pump and washer/conveyor prior to performing maintenance.

To place the grit pump or washer/classifier back in service, the following procedures are recommended:

1. If the grit chamber or mechanism is removed from service, see steps no.1-4 for placing the grit chamber and mechanism back in service above.
2. Open the grit pump suction and discharge isolation valves.
3. Open the three injection water isolation valves.
4. If the grit chamber was pumped down, wait until its level reaches the liquid level in the chamber entrance channel, place the local disconnect switches for the pump and the washer/conveyor in the "On" position.
5. Place the grit pump and washer/conveyor HOA switches at the MCC-HWK in the "Auto" position.
6. At the SCADA Headworks - Grit Pump/Washer Screen, select the "Manual" radio button for the pump, and select the "Start" toggle button to initiate the pump. Observe the operation of the pump, injection water solenoids, and washer/conveyor to assure that the pumping cycle is remotely initiated, and that all the wash water valves and the washer/conveyor automatically actuate at the appropriate times. Observe the rotation of the conveyor to ensure that it is operating satisfactorily.
7. If the system appears to be operating satisfactorily, place the unit back into automatic operation by selecting the "Duty Cycle" radio button at the SCADA Headworks - Grit Pump/Washer Screen.

3.3.2.4 Recommended Maintenance Procedures

The following maintenance procedures are recommended on a daily basis:

1. Observe the operation of the grit mechanism. Check the mechanism for correct rotation and the grit chamber liquid surface for turbulence.
2. Check around the grit mechanism shaft, the inlet channel baffle, and the inlet and outlet channels to assure that floating debris does not accumulate and does not impair operation of the mechanism in any way.
3. Observe the operation of (at least) one grit-pumping cycle per day to determine that the grit pump, injection water solenoid valves, and washer/conveyor are operating properly and in the correct sequence.
4. Check the conveyor for increased noise, vibration, and shaft movement. Check to see if screw conveyor lower end bearing needs lubricant.
5. Hose down the inlet channel to the grit chamber and flush the solids into the grit chamber.
6. Hose down the area surrounding grit dumpster.
7. Check to see that grit dumpster is not full.

The following maintenance procedures are recommended on a periodic basis:

1. Observe a full operating cycle of the grit pump, injection water solenoid valves, and washer/conveyor to assess if the system time settings for automatic operation are appropriate. Enter observations into the plant log (weekly). Adjust as necessary.
2. Check to see that the grit pump discharge check valve is opening as required. Clean/unclog if necessary (Weekly).
3. Exercise grit pump isolation (plug) valves (Monthly).
4. Inspect injection water solenoid valves and operators. Clean strainers (monthly).
5. Check lubricant level of paddle drive turntable bearing (monthly).
6. Change oil in paddle drive turntable bearing (semi-annually).
7. Lubricate grit pump motor (semi-annually).
8. Lubricate screw conveyor gearbox (semi-annually).
9. Check, and replace, if necessary, grit pump mechanical seal (yearly).
10. Lubricate screw conveyor motor (yearly).
11. Check screw conveyor v-belt for slippage (yearly).

See also Table 6-1, which incorporates the recommended maintenance procedures for the entire WWT&RF sorted by building, frequency, and equipment type. Refer to Grit Removal System O&M manual for specific instructions on the manufacturer recommended maintenance procedures.

3.3.2.5 Safety

The following safety procedures are recommended when maintaining the grit removal system:

1. Do not operate pump against a closed valve for long periods of time. If operated against a closed discharge valve, pump may overheat or rupture.
2. During maintenance, it is imperative that the equipment be LOCKED OUT.
3. Maintenance inside the wet well should be only by authorized and qualified personnel. No one should enter the wet well without proper safety precautions including checking the wet well atmosphere for toxic or explosive gases and for low dissolved oxygen, proper harnessing and proper standby personnel operating the safety lines and lifts necessary for entrance into this hazardous enclosed space.
4. Maintenance activities that involve any entry into the grit chamber should be conducted only when two or more persons are present.

3.3.3 Odor Control System

3.3.3.1 Description

The approach taken to controlling odors in the Headworks Building is to cover all the open :channels in the building and blow the air from the channel headspace through the Odor Control system for treatment. The Odor Control System is a wet absorption type scrubber that works by transferring odorous compounds from the air stream into liquid solutions of caustic soda (sodium hydroxide) and sodium (or calcium) hypochlorite across a gas-liquid interface. The caustic soda s used to absorb odorous hydrogen sulfide by raising the pH of the scrubbing liquid thereby increasing the solubility of sulfide in the scrubbing solution. Sodium or calcium hypochlorite is used to oxidize any remaining hydrogen sulfide as well as other odorous compounds in addition to absorbing them.

The scrubber is a vertical, three-stage, counter-current (e.g., the air and liquid flow in opposite directions), packed-bed scrubber. Each of the three stages, or modules, includes a bed of plastic 'packing material, used to provide intimate contact between the air stream and scrubbing solution, and a sump where the scrubbing solution is collected and then re-circulated through nozzles at the top of the packed bed. Three vertical, centrifugal pumps are used to re-circulate the scrubbing solutions. The caustic soda and sodium hypochlorite are metered into the sumps by diaphragm metering pumps, one primary and one standby pump for each chemical. Calcium hypochlorite can also be used in lieu of sodium hypochlorite and can be metered into the sump from the calcium hypochlorite tablet chlorination system. The chemicals and utility water are ,added to the scrubbing solution on a continuous basis to maintain the required solution concentration. A portion of the solution continually overflows to the building drain to maintain he level in the sump. Caustic soda is added to the first two stages under the control of a pH controller; and sodium hypochlorite is added to the final module under control of an Oxygen Reduction Potential (ORP) controller. If calcium hypochlorite is used, it is metered into the final nodule continuously and is not controlled by the ORP controller.

3.3.3.2 Operation

The Local Control Panel for the Odor Control System is mounted on the scrubber skid in the Headworks Building Electrical Room. The face of the Local Control Panel includes: HOA and pump selector switches and run lights for the caustic soda and sodium hypochlorite metering pumps; On-Off selector switches and run lights for the blower, recirculation pumps, and panel fan; and "pH Out of Range", "ORP Out of Range", and "Control Power On" indicator lights. The Local Control Panel also includes the pH and ORP controllers, the chemical feed pumps. and make-up water equipment.

The pH Out of Range alarm is triggered when the pH falls below the low pH alarm setpoint; and the ORP Out of Range alarm is triggered when the ORP falls below the low ORP alarm setpoint. The low pH and ORP setpoints, programmed during performance testing at the plant start-up, are 7.0 standard units and 60 mV respectively. The Odor Control System O&M Manual provides recommendations on how to determine and program these alarm setpoints.

The make-up water equipment includes a manual isolation valve, rotameter, pressure gauge, pressure regulator, filter, and backflow preventer. Water flow rate to the scrubber is controlled by throttling the isolation valve until the rotameter and pressure gauge display readings in the desired ranges. The make-up water flow rate is typically set between 0.5 and 2.0 GPM. The minimum recommended water pressure is 40 PSIG. Flow splitter valves are provided in the injection line to each sump. These valves can be throttled to proportion the flow between scrubber stages. Typically, 60 to 75 percent of the flow is directed to stage 2 and 25 to 40 percent of the flow is directed to stage 3.

The fan and the recirculation pumps are designed to operate at a constant speed on a continuous basis. Placing the fan and pump "On-Off switches in the "On" position initiates the fan and pumps, and placing the switches in the "Off position will shut off the fan and pumps.

The fan continuously blows air from the fine screen and grit removal channels, through the three stages of the odor control system, and out the exhaust ducting. The odorous air is extracted from the channels near the parshall flume entrance. The treated air can either be discharged from the building or re-circulated back into the building (to conserve heat) by manually adjusting a damper in the exhaust duct (located in the northwest corner of the Pretreatment Room).

The recirculation pumps continuously pump the chemical solutions from the sump at the base of the modules to spray nozzles at the top of the packed beds. The sump circulation valves, located in the discharge piping of the recirculation pumps. divert a fraction of the pumped solution to sump recirculation jets. The purpose of the recirculation jet is to keep the sump contents well mixed and prevent the recirculation pumps from "dead-heading" in the event the spray nozzles clog.

Manual Operation: To manually operate the chemical metering pumps, place the chemical metering pump HOA selector switches in the "Hand" position to initiate the pumps or in the "Off' position to shut the metering pumps off. Since the metering pumps operate continuously when placed in "Hand", it may be necessary to turn down the metering pump feed rates (from the rates required during automatic operation) to maintain the solution concentrations in the desired ranges. The speed of the metering pumps can be adjusted on the face of the metering pump by changing the stroke length (from 10 to 100%) or speed (from 1 to 100 strokes per minute).

If calcium hypochlorite is used in lieu of sodium hypochlorite, it is necessary to shut-off the sodium hypochlorite metering pumps and close the discharge valves. The calcium hypochlorite is then metered through a tablet chlorination system into the third module sump. Utility water is supplied to the tablet chlorination system through a manual isolation valve. rotameter, and filter. The solution flow rate is controlled by throttling the isolation valve until the rotameter displays the desired flow rate.

Automatic Operation: To automatically operate the chemical metering pumps, place the chemical metering pump HOA selector switches in the "Auto" position. The caustic soda metering pumps are initiated when the pH decreases below the pH setpoint and are shut off when the pH rises above the pH setpoint. The sodium hypochlorite metering pumps are initiated when the ORP decreases below the ORP setpoint and are shut off when the ORP rises above the ORP setpoint. The manufacturer recommended pH and ORP setpoints, determined during performance testing at the plant start-up, are 10.5 standard units and 430 mV, respectively.

3.3.3.3 Start-Up and Shut-Down Procedures

When removing the Odor Control System from service for maintenance purposes. it is recommended that the following procedures be performed (refer to Odor Control System O&M Manual for more detailed information):

1. Remove chemical feed pump suction lines from chemical drums and place pump HOA switches in "Hand" until air is drawn through the chemical feed piping. For maintenance procedures that do not involve the chemical feed pumps, closing the discharge valves and shutting off the pumps may be adequate to isolate the chemicals from the system. If using the calcium hypochlorite tablet chlorination system, close the system isolation valve.
2. Place all equipment switches in the "Off' position.
3. Lock-out the disconnect switch at the Main Control Panel in the "Off" position.
4. Close make-up water isolation valve.
5. Drain scrubbing solution out of sump using the three-way valves on discharge side of pumps and rinse with water.
6. If performing maintenance on recirculation pumps, drain liquid from pumps and associated piping.
7. Remove and cap pH/ORP sensors if draining piping to ensure tips remain wet.
8. Review the O&M Manual for Odor Control System prior to performing maintenance.…

To place the unit back in service, the following procedures are recommended (refer to Odor Control System O&M Manual for more detailed information):

1. Fill the module sumps by opening the make-up water isolation valve until the sumps overflow; then adjust the flow rate to appropriate level. Check flow splitter valves for proper division of flow.
2. Place the disconnect switch at the Local Control Panel in the "On" position.
3. Install the pH/ORP sensors. Calibrate the pH/ORP controllers as necessary.
4. Place the recirculation pumps On-Off switches in the "On" position. Check nozzles and rotameter for flow. Adjust sump circulation valves as required.
5. Place the chemical feed pump HOA switches in the "Auto" position. Open the utility water supply valve to the tablet chlorination system and do not turn on sodium hypochlorite metering pump, if using calcium hypochlorite in lieu of sodium hypochlorite.
6. Once the pH/OPR levels are in the appropriate ranges, place the blower On-Off switch in the "On" position.
7. Inspect operation of system.

3.3.3.4 Recommended Maintenance Procedures

The following maintenance procedures are recommended on a daily basis:

1. Observe for any hydrogen sulfide or organic odors in the air, particularly down wind of the scrubber (on the northwest side of the Headworks Building, if exhausted outside, or in the northwest corner of the Headworks Building Pretreatment Room, if exhausted inside). Troubleshoot system if required.
2. Observe the operation of the recirculation pumps and fan. Check for excess vibration and noise. Repair as necessary.
3. Observe the operation of the chemical feed pumps to ensure they are remaining primed.
4. Hose down any areas where chemicals may have spilled or leaked into containment sump.
5. Check supply of chemicals.
6. Check to see that the room temperature is above 53 °F at all times to prevent crystallization of caustic soda.

The following maintenance procedures are recommended on a periodic basis:

1. Check the pH and chlorine residual of the scrubber solutions with calibrated pH meter and chlorine test kit. Calibrate the pH and ORP meters as required (weekly).
2. Verify that make-up water flow rate and pressure are in the correct ranges; adjust isolation valve as required (weekly).
3. Check spray nozzles for an even flow pattern. Remove and clean nozzles if necessary (weekly).
4. Visually inspect the system skid, floor, and containment sump for leaks or standing water or chemicals (monthly). Identify source of any leaks and repair if necessary.
5. Check make-up water filter and clean if necessary (monthly).

6. Acid wash scrubber (monthly, or as required).
7. Measure the hydrogen sulfide gas concentration in the sample ports and record (semiannually, or as required).
8. Check system modules and duct work for air leaks. Repair as necessary (Annually).

See also Table 6-1, which incorporates the recommended maintenance procedures for the entire WWT&RF sorted by building, frequency, and equipment type. Refer to Odor Control System D&M manual for specific instructions on the manufacturer recommended maintenance procedures. Records of all maintenance and monitoring of the odor control system must be kept and made available to SCAPCA personnel upon request during their periodic inspections.

3.3.3.5 Safety

The following safety procedures are recommended when operating or maintaining the Odor Control System:

1. During maintenance, it is imperative that the disconnect switch at the Local Control Panel be LOCKED OUT.
2. All chemical spills from the storage containers should be contained within the secondary containment berms. Whenever possible and appropriate, the bulk chemical should be pumped by a sump pump back into the storage container. Otherwise, the solution can be slowly metered with large quantities of water to the building drain system.
3. When acid washing the scrubbers, use extreme caution not to mix the acid with sodium hypochlorite that may cause chlorine gas to be released.
4. Use extreme care when handling caustic soda or sodium hypochlorite. These chemicals will burn on contact with skin and eyes. Upon contact, immediately flush with large quantities of water for a minimum of 15 minutes. Remove contaminated clothing. Do not attempt to neutralize with chemical agents. If ingested, drink large quantities of water. Do not induce vomiting. Obtain medical attention as soon as possible.
5. Workers handling these chemicals should wear long-sleeved cotton clothing (caustic soda attacks wool); rubber, heavy canvas, moleskin or rubber gloves; hard hats or caps; laced rubber safety shoes or leather safety shoes protected by work rubbers; and proper eye protection such as safety goggles. Do not wear contact lenses without safety goggles when working with these chemicals.
6. Storage tanks should be placarded with hazard identification signs. Smoking should be prohibited near the stored chemicals and scrubber.
7. Do not operate pumps against a closed valve for long periods of time. If operated against a closed discharge valve, pump may overheat or rupture.

3.3.4 Automatic Weir Gate

3.3.4.1 Description

An automatic weir gate (W-H-2) is located between the center and southern chamber of Distribution Box A (on the northeast side of the Headworks Building). The weir gate controls the amount of flow directed to Lagoon No. 3 for equalization of the influent flow above 6.2

MGD, the peak design flow of the treatment facility. A solid-state proximity sensor, mounted on the front of the gate, measures the location of the gate and transmits this information to the PLC-HWK and SCADA. The elevation, or "position", of the top of the gate is displayed on the SCADA Headworks Screen. Refer to Drawing HP3, Module 3.4 for a section through Distribution Box A.

3.3.4.2 Operation

Local Control: To raise or lower the weir gate locally, place the "Local-Off-Remote" switch on the motorized actuator in the "Local" position. The gate can then be lowered by pressing the "Open" button or raised by pressing the "Closed" button. If the motorized actuator fails, the gate can be manually raised or lower using the hand-wheel.

Remote Control: To raise or lower the weir gate remotely, place the "Local-Off-Remote" switch on the motorized actuator in the "Remote" position. When the gate is in remote control, the operator can manually set the elevation of the top of the weir by selecting the "Open" or Close" buttons on the SCADA Headworks Screen. The PLC-HWK will then transmit a signal to the gate's motorized actuator, which will raise or lower the gate.

Note: The position reading increases as the gate is lowered (or opened) and decreased as the gate is raised (or closed). In the closed position, the elevation of the top of the weir crest is 2424.75 feet. This corresponds to a "position" of 0.00 feet. The lowest elevation the top of the weir can be set is 2422.25 feet. This corresponds to a position of 2.5 feet.

The following control strategy is intended to direct up to approximately 6.2 MGD to the treatment facility and any excess flow to Lagoon No. 3. The recommended control strategy is as follows:

1. For influent flows less than 6.2 MGD, set the weir crest at 0 feet (elevation = 2424.75 feet). This should prevent wastewater from overflowing into Lagoon No. 3.
2. For influent flows between 6.2 and 6.5 MGD, set the weir crest position between 0.28 and 0.4 feet (elevation = (Flow in MGD x -0.43) + 2427.14 feet) (between 2424.47 and 2424.35 feet). This will direct between 0 and 0.3 MGD to Lagoon No. 3.
3. For influent flows between 6.5 and 8.0 MGD, set the weir crest position between 0.4 and 0.72 feet (elevation = (Flow in MGD x -0.21) + 2425.71 feet) (between 2424.35 feet and 2424.03 feet). This will direct between 0.3 and 1.8 MGD to Lagoon No. 3.
4. For influent flows between 8.0 and 12.4 MGD, set the weir crest position between 0.72 and 1.25 feet (elevation = (Flow in MGD x -0.12) + 2424.99 feet) (between 2424.03 feet and 2423.50 feet). This will direct between 1.8 and 6.2 MGD to Lagoon No. 3.
5. For flows equal to 12.4 MGD or above, lower the weir crest to 1.2 feet (elevation = 2423.5 feet). This will split the flow equally between the lagoon and treatment facility.

To route all of the flow to Lagoon No. 3, lower the position of the weir gate to 2423.5 feet and insert the stop gate ((G-H-1-HE) in the opposite channel (on the north side of the center chamber). This will stop flow to the aeration structure.

3.3.4.3 Recommended Maintenance Procedures

If the actuator on the gate needs to be removed from service for maintenance purposes, flow to the weir gate can be stopped by inserting stop gate (G-H-2-HE).

The following maintenance procedures are recommended on an annual basis:

1. Disconnect power to actuator. Inspect interior of actuator electrical enclosure. Tighten all electrical connections. Inspect for damage.
2. Check lubricant level. Fill or replace if required.

See also Table 6-1, which incorporates the recommended maintenance procedures for the entire WWT&RF sorted by building, frequency, and equipment type. Refer to Gate O&M manual for specific instructions on the manufacturer recommended maintenance procedures.

3.3.5 Monitoring

3.3.5.1 Parshall Flume (Influent Flowmeter)

Influent flowmeter is an 18" parshall flume with an ultrasonic level sensor and open channel monitor/transmitter. The open channel monitor receives signals from the level sensor and converts this measurement to head and flow rate. The flow rate signal is then transmitted to PLC-HWK and SCADA where it is totalized, recorded, and displayed on the SCADA Plant Overview Screen.

observation of the influent flowmeter should be made daily. The instantaneous flow shown on he open channel monitor display and a visual measurement of parshall flume water depth should)e recorded daily. At the end of each week, the water depth measurement should be translated to low and compared with the recorded open channel monitor display reading. If these values differ by more than 2%, the reason for the difference should be investigated. Appendix H includes the parshall flume calibration table and curve.

3.3.5.2 Automatic Sampler

An automatic sampler is located in the electrical room in the Headworks Building. This sampler s used for collecting composite samples of the raw sewage following screening and de-gritting. The sample intake tube is located inside a PVC conduit that extends into the 18-inch Aeration Structure influent line. The sampler measures the temperature and pH of the Headworks effluent and transmits this data for display on the Headworks SCADA screen. The pH/temperature probe s mounted in the northern chamber of Distribution Box A.

Samples can be collected manually or automatically, on a volumetric (flow proportional) or periodic (time proportional) basis. To manually collect a (grab) sample, press the "manual node" button on the sampler. This will allow manual control of the sample pump and sample distributor.

To collect samples volumetrically, the sampler must be programmed to collect samples on a flow proportional basis and to receive an external pulse. (Refer to the Sampler O&M Manual f programming the sample collection mode.) The parshall flume level controller transmits a pulse directly to the sampler after a preset volume of flow through the parshall flume. The volume flow between pulses is set at 4,000 gallons but is adjustable at the level controller. Refer to the Parshall Flume Level Controller O&M Manual for instructions on changing this parameter. The sampler automatically withdraws a sample (aliquot) after it receives a preset amount of pulses from the level controller. The sampler is programmed to take one-100 ml sample after each pulse. The volume per sample and the number of pulses between samples are adjustable and must be regulated to collect an adequate sample for all analyses required and avoid collection excessive samples causing the 3-gallon container in the sampler to overflow. Refer to the Automatic Sampler O&M Manual for instructions on changing these parameters.

To collect samples on a periodic basis, the sampler must be programmed to collect samples on timed proportional basis. The sampler is currently programmed to collect one-100 ml sample every 20 minutes. Refer to the Sampler O&M Manual for programming the sample collection mode, the volume of sample, and sample frequency.

Routine maintenance of the sampler includes checking the sampler tubing and flushing a required, checking the humidity indicator and replacing the desiccant as required, cleaning the sampler, and cleaning/calibration of the pH/temperature probe. Refer to the Instrumentation O&M Manual for instructions on performing these maintenance procedures.

3.3.5.3 Hydrogen Sulfide Gas Detection System

A hydrogen sulfide gas sensor is located below the stairs in the Pretreatment Room of the Headworks Building. The sensor measures the hydrogen sulfide gas concentration and transmit the measurement to the "receiver module" located in the Electrical Room of the Headwork Building. The receiver module displays the gas concentration and transmits the concentration signal to the PLC-HWK and SCADA. The system is capable of measuring between 0 and 5' PPM of hydrogen sulfide.

The gas concentration is displayed on the SCADA Headworks screen as "H2S Level". Th exhaust fans, motorized louvers, and make-up air unit can be automatically turned on when the hydrogen sulfide gas level reaches a preset concentration, the "Exhaust Fan Setpoint" entered of the SCADA Headworks Screen. It is recommended that the exhaust fan setpoint be set relatively: low (-2 PPM) to ensure nuisance odors do not accumulate. If the gas concentration reaches PPM, the High Hydrogen Sulfide alarm is triggered.

Routine maintenance includes calibration of the sensor on an annual basis and replacement of the sensor every few years. Refer to the Instrumentation O&M Manual for instructions o performing these maintenance procedures.

3.3.5.4 Information Displayed at SCADA

Table 3-6 lists the monitoring information displayed at the SCADA Headworks Screens. All MI monitoring information included in Table 3-6 is transmitted from the monitoring source to the SCADA System via the PLC-HWK, except where the information source is listed as SCADA. I the monitoring source is listed as SCADA, the information is selected by the operator (i.e., duty cycle/manual control of the grit pump). If a "Yes" is indicated in the "Trending" column. the information is stored in a database and can be displayed in graphical form versus time on the SCADA trending screens. Refer to the Instrumentation O&M Manual for more information or reviewing trending data.

Table 3-6. Monitoring Information Displayed on SCADA Headworks Screens

Information Displayed	Monitoring Source	Trending
Screen Status - Running/Not Running/Alarm	Screen Main Control Panel	No
Grit Chamber — Running/Not Running/Alarm	MCC-HWK	No
Grit Pump Status - Running/Not Running/Alarm	MCC-HWK	No
Grit Pump Status - Duty Cycle/Manual Control	SCADA - Selected	No
Grit Pump Check Valve Status — Open/Closed	Valve Proximity Switch	No
Grit Washer/Conveyor - Running/Not Running/Alarm	MCC-HWK	No
OCS' Recirc. Pumps Status — Running/Not Running	Local Control Panel	No
OCS Fan Status — Running/Not Running	Local Control Panel	No
Weir Gate Control — Local/Remote	Local Actuator Switch	No
Weir Gate Position	Proximity Sensor	No
Influent Flow	Open Channel Monitor	Yes
Influent Flow Totalizer	SCADA	No
Influent pH and Temperature	Automatic Sampler	Yes
Hydrogen Sulfide Measurement	H2S Gas Detection System	Yes
Heating and Ventilation System — On/Off	PLC -HWK	No

1 OCS — Odor Control System

3.3.5.5 Alarms

In-Channel Fine Screen: If the fine screen fails, a yellow alarm light will appear on the SCADA Headworks Screen. The operator should acknowledge the alarm on the SCADA alarm screen. A fine screen fault indication at SCADA is caused by any number of alarms generated by the fine screen Main Control Panel PLC; two common alarms include a screen drive power monitor or VFD power overload and a screen drive motor overload. These overload alarms may be caused by an obstruction in the screen, so it is important to check the screen prior to resetting these alarms. To reset the motor overload alarm, open the control panel and push the overload -reset button. Pressing the "Reset" button on the front of the fine screen Main Control Panel will reset the power monitor or VFD power overload. The ultrasonic level controller in the Main 2ontrol Panel generates the high-water level alarm and transmits this indication to SCADA. This alarm is automatically reset once the water level decreases to below the high-water alarm level.

Gritt Mechanism, Pump, Washer/Conveyor: If the grit mechanism, pump, or grit washer/conveyor fail, a yellow alarm light will appear on the SCADA Headworks Screen for the appropriate unit. The operator should acknowledge the alarm on the SCADA alarm screen. The fault indication at SCADA for the grit pump is caused by a motor thermal overload signal sent to the MCC-HWK. The fault indication for the grit mechanism and washer/conveyor is caused by a motor overload. In either case, to reset these faults, press the "Reset" button on the front of the MCC-HWK for the appropriate motor.

Grit Pump Check Valve: The grit pump check valve has a valve proximity switch that transmits a valve open indication to the PLC-HWK when the check valve counterweight passes the switch. The valve is shown as open or closed on the SCADA Headworks Screen. An alarm is indicated at the SCADA alarm screen if the valve is not opened within a present amount of time (-5 seconds) after the pump motor is initiated. The operator should acknowledge the alarm on the SCADA alarm screen, and then visually check the valve counterweight to see if it is in the open position when the pump is operating. If the valve counterweight does not respond when the pump is initiated, check to see that there is flow to the pump (i.e., that the pump isolation valves are open and that the grit chamber is full), and then if the valve is clogged or there is some other obstruction in the grit piping. This alarm is generated within the SCADA system; therefore. no local reset of this alarm is required.

Odor Control System: If the odor control system fails, a common alarm indication will be listed on the SCADA alarm screen. The operator should acknowledge the alarm on the SCADA alarm screen. An odor control system fault indication at SCADA is generated by the odor control system Local Control Panel and is caused by the following alarms: recirculation pump motor thermal overload, fan motor overload, pH out of range alarm, or ORP out of range alarm. All these alarms are automatically reset once the monitored parameters are within the appropriate ranges.

Weir Gate Alarm: If the weir gate fails, an alarm indication will be listed on the SCADA alarm screen. The operator should acknowledge the alarm on the SCADA alarm screen. The fault indication at SCADA is caused by two alarms generated by the motorized actuator including: motor thermal overload and high torque alarm. These alarms are automatically reset.

High Hydrogen Sulfide Gas Alarm: If the hydrogen sulfide gas concentration reaches 3 PPM in the Headworks Building, the hydrogen sulfide gas detection system will transmit an alarm indication to PLC-HWK. The high hydrogen sulfide alarm will be displayed on the SCADA alarm screen. The operator should acknowledge the alarm on the SCADA alarm screen. Prior to entering the Headworks Building to check the hydrogen sulfide detection system, the operator should follow any safety procedures required for enclosed areas with dangerous gases. Refer to Section 6 for a description of these procedures. The high hydrogen sulfide level alarm is generated within the SCADA system; therefore, no local reset of this alarm is required.

[END Extracted Pages]