Washington County
MARYLAND

PURCHASING DEPARTMENT
DIVISION OF BUDGET & FINANCE

PUR-1623
ADDENDUM NO. 5
INVITATION TO BID

SMITHSBURG WwTP ENR UPGRADE AND EXPANSION

DATE: Wednesday, September 20, 2023

BIDS DUE: Wednesday, September 13, 2023
2:00 P.M.(EDT/EST)
(Revised Due Date – Addendum No. 3)

To Bidders:

This Addendum is hereby made a part of the Contract Documents on which all bids will be based and is issued to correct and clarify the original documents.

Please acknowledge receipt of this Addendum at the appropriate space on the Proposal Form. This Addendum consists of five (5) pages and four (4) attachments.

NOTE: All Bidders must enter the Washington County Administration Complex through either the front door at the 100 West Washington Street entrance or through the rear entrance (w/blue canopy roof) which is handicap accessible and must use the elevator to access the Purchasing Department to submit their bid and/or to attend the Pre-Bid Conference. Alternate routes are controlled by a door access system. The general public will be subject to wand search and will be required to remove any unauthorized items from the building prior to entry. Prohibited items include but are not limited to: Weapons of any type; Firearms, ammunition, and explosive devices; Cutting instruments of any type - including knives, scissors, box cutters, work tools, knitting needles, or anything with a cutting edge, etc.; Pepper spray, mace, or any other chemical defense sprays; and Illegal substances.

ITEM NO. 1: *Inquiry:* Specification section 25 50 45 references section 25 50 50 for the Description of Operation. I cannot seem to locate this section. Can it be provided?

Response: Spec Section 25 50 50 is attached with this Addendum.

ITEM NO. 2: *Inquiry:* We would like to request that WEDECO, a Xylem brand, get added as a named manufacturer to Section 46 66 56 – Ultraviolet Disinfection System, paragraph 1.2.F.

Response: WEDECO is an acceptable "approved equal"

ITEM NO. 3: *Inquiry:* In section 07 54 23-4 (2.3 A-3) the color is specified as tan, then in (2.3 C-5) The color says white. Which color TPO do you want?

Response: The preferred TPO color is white.

ITEM NO. 4: *Inquiry:* Section 07 54 23-4 calls for 2" maximum insulation with enough layers to equal R-30. Is this required or can we use 2 layers of 2.6" to equal exactly R-30?

Response: 2 layers of 2.6" is acceptable for R-30 minimum at low point of roof (perimeter roof edge) with 1/4" per foot tapered insulation on top of that to provide roof slope as shown on roof plan.

ITEM NO. 5: *Inquiry:* Section 07 54 23-2+3 says warranty is to include damages up to 90 MPH wind. Section 07 54 23-4 says bottom layer of insulation is to be cold adhesive attached to the steel deck. Section 20 00 00-3 says "work shall meet requirements of the FM Global." FM does not recognize adhesive securement of insulation direct to a steel deck. In order to achieve FM standards, you would have to mechanically attach the bottom layer of insulation to steel deck and adhere any additional layers. Can we propose to fasten the bottom layer of insulation instead of adhere.

Response: Mechanically attaching the bottom layer of insulation to steel deck in order to comply with FM standards is acceptable.

ITEM NO. 6: *Inquiry:* As far as I can tell there is only one VTR on the roof and no curbs or other penetrations. Could you verify this information.

Response: Yes, that is correct.

ITEM NO. 7: *Inquiry:* Sheet PM-6 Note 2. Interior of existing disc filters to be cleaned and recoated by contractor – see project manual for cleaning requirements and acceptable coatings. Where in the manual is this information located?

Response: See updated specification section 09 96 00 issued with Addendum No. 2.

ITEM NO. 8: *Inquiry:* The temporary UV trailer is shown to be piped on PM-17. The installation instructions in Appendix A shows contradictory information. Please review and confirm the inlet and outlet connections.

Response: Contractor to connect 8" temporary influent pipe to temporary UV System as shown on PM-17. Contractor to assume temporary UV system shall include 16" influent flowmeter and 16" flanged inlet connection to temporary UV system trailer. Contractor to provide 8"x 16" reducer, and 16" pipe to connect to temporary UV system trailer per installation instructions as required.

ITEM NO. 9: *Inquiry:* PM-17 shows 8" influent piping, while the Trojan instructions notes 10" flow meter and 10" flange influent connections, but also notes 16" flow meter and 16" flange influent connection further in the instructions.

Response: Contractor to connect 8" temporary influent pipe to temporary UV System as shown on PM-17. Contractor to assume temporary UV system shall include 16" influent flowmeter and 16" flanged inlet connection to temporary UV sytem trailer. Contractor to provide 8"x 16" reducer, and 16" pipe to connect to temporary UV sytem trailer per installation instructions as required.

ITEM NO. 10: *Inquiry:* PM-17 shows 12" effluent piping, while Trojan installation notes (4) 10" effluent flanges, but also notes (2) 12" outlet flanges further in the instructions.

Response: Contractor to assume temporary UV System trailer shall include 12" flanged effluent connection.

ITEM NO. 11: *Inquiry:* PM-17 does not show bypass piping. The Trojan instructions notes a bypass line should be installed. Please clarify if the bypass is to be installed and provide details if required.

Response: Contractor to provide temporary minimum 12" bypass piping and valves as required to allow bypass of temporary UV system trailer as recommended by temporary UV system installation instructions.

ITEM NO. 12: *Inquiry:* The installation instructions note to install a pump. There is not pump shown on PM-17. Is the UV influent being pumped by the existing Post EQ pumps? Or does the Contractor need to supply a temporary pump for the UV influent into the trailer? Please clarify if anything other than the temporary piping needs to be furnished.

Response: Influent to the temporary UV system will be pumped utilizing existing plant pumps. The contractor does not need to supply temporary pumping for the temporary UV system.

ITEM NO. 13: *Inquiry:* Specification Section: 44 53 49 Shear Mill Please clarify where this is located and what drawing this is shown on.

Response: Shear mill to be provided by the contractor as a shelf spare and turned over to the County for storage.

ITEM NO. 14: *Inquiry:* Drawing A-4: Detail 3/A-4 shows a 8"x6"x5/16" Bent plate at the TOM, This detail conflicts what is shown on Detail A on Drawings S-12 Please clarify what is required.

Response: Section 3/A-4 is correct except include approximately 2-1/2" thick of 8" CMU above CMU bond beam to underside of steel angle/roof deck as shown on A/S-12. Anchor lower steel angle to CMU Bond Beam with 3/4" anchors @ 2'-0" O.C. similar to as shown in G/S-12.

SPECIFICATION REVISIONS:

REPLACE Specification Section 01 14 00 Special Requirements in its entirety with revised Specification Section 01 14 00 Special Requirements attached.

REPLACE Specification Section 01 54 00 Bypass Pumping in its entirety with revised Specification Section 01 54 00 Bypass Pumping attached.

Section 25 50 30, Instrumentation, ADD the following radar level transmitter to the Schedule of Radar Level Transmitters in Paragraph 2.1.C:

Influent EQ Box Influent EQ Box Level

REPLACE Specification Section 05 50 00 Miscellaneous Metals in its entirety with revised Specification Section 05 50 00 Miscellaneous Metals attached.

ADD new Specification Section 25 50 50 Description of Operation in its entirety.

DRAWING REVISIONS:

Drawing PM-6 – ADD the following note with leader arrow to the NEW CONTROL PANEL:

DISC FILTER CONTROL PANEL TO BE PROVIDED AS DESCRIBED IN SPECIFICATION SECTION 44 42 62. OIT SHALL BE 12".

Drawing E-14, Pre-Anoxic Tank Electrical Plan, ADD a radar level transmitter to the Influent Equalization Box. Run 1 Pr. #18 Shld.- 3/4"C from the radar level transmitter to the Influent Pump Control Panel.

REPLACE Drawing E-22, Chemical Building Power Plan, in its entirety with revised Drawing E-22 attached.

REPLACE Drawing E-23, Chemical Building Panelboard Schedules, in its entirety with revised Drawing E-23 attached.

REPLACE Drawing E-26, Operations Building Electrical Plan, in its entirety with revised Drawing E-26 attached.

REPLACE Drawings PCS-13 thru PCS-17, Influent Pump Control Panel Wiring Diagram, in their entirety with revised Drawings PCS-13, PCS-14, PCS-15, PCS-16, and PCS-17 attached.

By Authority of:

Rick F. Curry, CPPO
Director of Purchasing

SECTION 25 50 50

DESCRIPTION OF OPERATION

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SECTION 25 50 50

DESCRIPTION OF OPERATION

A. PROCESS CONTROL SYSTEM CONFIGURATION

1. General Description

   a. The Process Control System for the Smithsburg Wastewater Treatment Plant consists of motor control centers, variable frequency drives, control panels, instrumentation, a programmable controller system, and HMI software, which will all be integrated to form a complete Process Control System for the upgraded wastewater treatment plant.

2. Motor Control Center

   a. A new motor control center will be provided in the Chemical Building Electrical Room to house circuit breakers, motor starters, and variable frequency drives for the plant equipment in the area of the Chemical Building. The motor control center is designated as MCC-CH.

3. Variable Frequency Drives

   a. Variable frequency drives (VFDs) will be provided for the following process equipment:

      1) Influent EQ Pumps
      2) Influent Pumps
      3) SBR Blowers No. 1B, No. 2B, and No. 3B
      4) Post EQ Pumps

4. Vendor Provided Control Panels

   a. The following control panels will be provided by equipment manufacturers/suppliers:

      1) SBR Control Panel
      2) Disk Filter Control Panel
      3) UV System Control Center

   b. Each vendor provided control panel will be interfaced with the Process Control System.

5. Programmable Controller System

   a. Five (5) Allen-Bradley CompactLogix PLCs will be provided for the treatment plant to provide for automatic control and monitoring of the facility. The programmable controllers will be designated and located as follows:

Designation	Location
PLC-IP	Influent Pump Control Panel
PLC-SBR	SBR Control Panel
PLC-OP	Operations Building PLC Panel
PLC-D	Disk Filter Control Panel
PLC-UV	UV System Control Center

   b. The PLCs will be networked via Ethernet. Data will be transferred between the PLCs via the Ethernet network.

6. Operator Interface Terminals

    a. A programmable operator interface terminal will be provided on each Control Panel and PLC Panel. The operator interface terminals will be color touch screens that will be networked to the PLC System via Ethernet.

    b. The operator interface terminals will be programmed to perform the following functions:

        1) Display Graphic Screens of the Process
        2) Display Process Variables
        3) Display Setpoint Screens
        4) Display Alarm Messages

    c. Rockwell Software Factory Talk View ME HMI software will be installed on each operator interface.

7. Operator Workstation

    a. A personal computer will be provided in the Control Building to serve as an operator workstation for the Process Control System.

    b. The computer will be networked to the PLC System via Ethernet.

8. Programmable Controller Software

    a. Rockwell Software Studio5000 programmable controller programming and documentation software will be provided to program the PLCs. The software will be loaded on the operator workstation so that the workstation can be utilized to view, edit, program, document, and print the logic program contained in the memory of the programmable controllers.

9. HMI Software

    a. Rockwell Software Factory Talk View SE HMI software will be provided for the treatment plant. The HMI software shall be programmed to provide for control and monitoring of the treatment plant equipment.

    b. The HMI software will run under the Windows-platform and will be utilized as the operator interface to the PLC System. The software will be installed on the operator workstation located in the Control Building. A Historian software package will also be provided for logging and archiving historical data. The HMI software shall perform the following functions:

        1) Graphic Displays of the Process
        2) Event Logging and Printing
        3) Alarm Logging and Printing
        4) Real-Time and Historical Trends of Process Variables
        5) Generate Process Reports

    c. Graphic displays shall be developed in the HMI software for each unit process.

    d. All graphic displays programmed on the operator interface terminals shall be duplicated in the HMI software.

10. Alarm Notification Software

    a. TopView alarm notification software will be provided for the Process Control System to provide for remote notification of treatment plant alarms. The alarm notification software will be installed on the operator workstation.

B. PLANT INFLUENT FLOW METERING

1. General Description

   a. A plant influent flow metering manhole will be constructed under the ENR Upgrade and Expansion project. The metering manhole will be installed on the existing plant influent line downstream of the bar screens.

   b. A palmer-bowless flume will be installed in the manhole to meter the plant influent flow. The flume will produce a head proportional to the flow rate. An ultrasonic open channel flow meter will be provided for the flume to measure the head over the flume and compute the flow.

   c. The flow meter will consist of an ultrasonic transducer mounted upstream of the flume, which will be wired to a flow meter transmitter wall mounted in the Operations Building. The head over the flume will be measured by the ultrasonic transducer. The flow meter transmitter will compute the plant influent flow rate based on the measured head over the flume, and the transmitter will output a 4-20mA signal proportional to the flow rate to PLC-OP.

   d. The plant influent flow shall be displayed on the operator interface located on the Operations Building PLC Panel, and the operator interface located on the Influent Pump Control Panel. The HMI software shall display, trend, and totalize the plant influent flow.

2. Programmable Controller PLC-OP Inputs

   a. The plant influent flow signal will be wired to PLC-OP located in the Operations Building PLC Panel.

   b. Analog Inputs (4-20mA):

	Description	Origination Point
1)	Plant Influent Flow	Open Channel Flow Meter Flow Transmitter

3. Description of Operation

   a. The plant influent flow signal shall be utilized in the control algorithm for the influent EQ pumps.

C. INFLUENT EQ PUMPS

1. General Description

   a. Two rail-mounted submersible influent EQ pumps will be installed in the Influent EQ Box of the Pre-Anoxic Tank to pump influent wastewater to the influent EQ tank when the plant influent flow exceeds 0.6 MGD. The pumps will operate in the on-line/standby mode and will be designated as Influent EQ Pumps No. 1 and No. 2.

   b. A variable frequency drive (VFD) will be provided for each influent EQ pump to vary the pump discharge rate. The VFDs will be located in MCC-CH.

   c. A radar level transmitter which will be mounted on the top of the influent EQ box to monitor the wastewater level in the box. The radar level transmitter will output a 4-20mA level signal to PLC-IP proportional to the wastewater level. The influent EQ box level shall be displayed on the operator interface located on the Influent Pump Control Panel, and the level shall be displayed and trended by the HMI software.

2. Influent EQ Pump Motor Controls

   a. Motor Control Center-CH, located in the Chemical Building Electrical Room, will house the following for each influent EQ pump:

      1) Motor Circuit Breaker
      2) Line Reactors
      3) Variable Frequency Drive
      4) Control Transformer
      5) H/O/A Selector Switch
      6) VFD Run Relay
      7) VFD Run Indication Light
      8) VFD Fault Relay
      9) VFD Fault Alarm Light
      10) VFD Fault Reset Push Button
      11) Motor Overtemp Alarm Relay
      12) Motor Overtemp Alarm Light
      13) Seal Failure Relay
      14) Seal Failure Alarm Relay
      15) Seal Failure Alarm Light
      16) Elapsed Time Meter
      17) Ventilation Fan
      18) VFD Keypad

   b. Each pump H/O/A selector switch will have an auxiliary normally open contact that will close when the switch is placed in the "auto" position. This contact will be wired to PLC-IP for switch position monitoring by the PLC.

   c. The “auto” position of each H/O/A switch will be wired to the VFD for selecting automatic speed control.

d. Each variable frequency drive will have a run contact that will close when the drive is energized and outputting a frequency to the pump motor. This contact will be wired to a VFD run relay located in MCC-CH, and to a run indication light located on the MCC. The run relay will have three normally open contacts that will close when the relay is energized. One contact will be wired to the ventilation fan in the MCC, one contact will be wired to the elapsed time meter on the MCC, and the third contact will be wired to PLC-IP for run status monitoring by the PLC.

e. Each variable frequency drive will have a VFD fault contact that will close when a drive fault occurs. This contact will be wired to a VFD fault relay in the MCC and to a VFD fault alarm light on the MCC. The VFD fault relay will have a normally open contact that will close when the relay is energized. This contact will be wired to PLC-IP for VFD fault alarm monitoring by the PLC.

f. Each variable frequency drive will output a 4-20mA speed signal proportional to the drive speed to PLC-IP. The drive speed shall be displayed on the operator interface located on the Influent Pump Control Panel and the speed shall be displayed and trended by the HMI software.

g. A disconnect switch will be backboard mounted adjacent to each influent EQ pump to disconnect power to the pump motor.

3. Programmable Controller PLC-IP Inputs and Outputs

a. The PLC inputs and outputs for the Influent EQ Pumps will be wired to and from PLC-IP located in the Influent Pump Control Panel.

b. Digital Inputs (24vdc):

	Description	Origination Point
1)	Influent EQ Pump No. 1 H/O/A Switch "Auto" Position	H/O/A Switch on MCC-CH
2)	Influent EQ Pump No. 1 Running	VFD Run Relay in MCC-CH
3)	Influent EQ Pump No. 1 VFD Fault	VFD Fault Relay in MCC-CH
4)	Influent EQ Pump No. 1 Motor Overtemp	Motor Overtemp Alarm Relay in MCC-CH
5)	Influent EQ Pump No. 1 Seal Failure	Seal Failure Alarm Relay in MCC-CH
6)	Influent EQ Pump No. 2 H/O/A Switch "Auto" Position	H/O/A Switch on MCC-CH
7)	Influent EQ Pump No. 2 Running	VFD Run Relay in MCC-CH
8)	Influent EQ Pump No. 2 VFD Fault	VFD Fault Relay in MCC-CH

9)	Influent EQ Pump No. 2 Motor Overtemp	Motor Overtemp Alarm Relay in MCC-CH
10)	Influent EQ Pump No. 2 Seal Failure	Seal Failure Alarm Relay in MCC-CH

c. Digital Outputs (24vdc, Relay Output):

	Description	Destination Point
1)	Influent EQ Pump No. 1 Start/Stop	Pump Start Relay in Influent Pump Control Panel
2)	Influent EQ Pump No. 2 Start/Stop	Pump Start Relay in Influent Pump Control Panel

d. Analog Inputs (4-20mA):

	Description	Origination Point
1)	Influent EQ Box Level	Radar Level Transmitter
2)	Influent EQ Pump No. 1 Speed	Pump VFD in MCC-CH
3)	Influent EQ Pump No. 2 Speed	Pump VFD in MCC-CH

e. Analog Outputs (4-20mA):

	Description	Destination Point
1)	Influent EQ Pump No. 1 Speed Reference Signal	Pump VFD in MCC-CH
2)	Influent EQ Pump No. 2 Speed Reference Signal	Pump VFD in MCC-CH

4. Description of Operation

a. The influent EQ pumps will be controlled by the individual H/O/A selector switches located on MCC-CH. The "hand" and "off" positions of the H/O/A selector switches provide for manual start/stop control of the pumps. When a pump H/O/A switch is in the "hand" position, the pump speed will be manually controlled from the VFD keypad. When the pump H/O/A switches are in the "auto" position, the influent EQ pumps will be automatically controlled by PLC-IP as follows:

1) A graphic display shall be programmed in the operator interface located on the Influent Pump Control Panel, and in the HMI software, for the influent EQ pumps. An auto/manual selector switch shall be configured in the display for each pump to select either manual or automatic control of the pump. In the “manual” mode, the plant operator may manually start and stop the pump and control the pump speed from the operator interface or the HMI software. The desired pump speed (0-60 Hz) will be entered on the graphic display, and PLC-IP will output a 4-20mA analog speed reference signal, equivalent to the value entered, to the pump VFD. When the auto/manual switch is in the “auto” position, the pump will be automatically

controlled by PLC-IP as follows:

a) The plant influent flow signal will be transmitted from PLC-OP to PLC-IP. Plant influent flow setpoints will be programmed in PLC-IP for the following plant influent flows:

1) Influent EQ Pump Start Flow
2) Influent EQ Pump Stop Flow

b) The flow setpoints shall be adjustable via the operator interface located on the Influent Pump Control Panel, or via the HMI software.

c) The operator interface and HMI software shall be programmed to allow the operator to select the on-line influent EQ pump, or to select automatic alternation of the pumps. When automatic alternation is selected, PLC-IP will alternate the on-line/standby status of the influent EQ pumps after each pumping cycle.

d) If the plant influent flow exceeds the “lead influent EQ pump start” flow setpoint, a timer in PLC-OP shall be started. If this timer times out, and the influent flow still exceeds the flow setpoint, the PLC shall start the on-line influent EQ pump.

e) The plant operator will enter the desired pump speed for the influent EQ pump on the operator interface, or the HMI software. PLC-OP will output a 4-20mA speed reference signal to the pump VFD corresponding to the speed entered.

f) When the plant influent flow drops to the “influent EQ pump stop” flow setpoint, a timer in PLC-OP will be started. If this timer times out and the flow is below the flow setpoint, PLC-OP will shut down the influent EQ pump.

b. PLC-IP will provide failure monitoring for each influent EQ pump as follows:

1) When a pump H/O/A switch is in the "auto" position and the pump gets a signal to start, a failure timer in the PLC will be started. If this timer times out and the pump VFD is not running, an "Influent EQ Pump Failure" alarm message shall be displayed on the operator interface located on the Influent Pump Control Panel, and a pump failure alarm shall be displayed by the HMI software.

c. PLC-IP will provide VFD fault monitoring for each influent EQ pump as follows:

1) If a drive fault occurs, the drive will shut down and the pump VFD fault relay will be energized. When this occurs, an "Influent EQ Pump VFD Fault" alarm message shall be displayed on the operator interface, and a pump VFD fault alarm shall be displayed by the HMI software.

2) The VFD fault alarm will be reset by pushing the reset push button on the MCC.

d. Each influent EQ pump motor will be furnished with a normally closed thermal switch in the motor windings to detect a high motor temperature, and a seal leak sensor in the pump casing to detect a leakage of water into the oil chamber. The thermal switch and the seal leak sensor will be wired in series to a pump supervision relay located in the pump relay panel. This relay will sense the current in the loop. A low current will indicate a high temperature condition in the motor, and a high current will indicate a seal failure. PLC-IP will provide alarm monitoring for each pump as follows:

1) The high temperature circuit has a normally open contact that is wired to a motor overtemp relay located in the pump relay panel. This contact changes state when the relay is powered

and the temperature is normal.

2) The motor overtemp relay has a normally open contact that is wired in series with the pump start/stop control circuit, and a normally closed contact that will be wired to PLC-IP. When a high motor temperature occurs, the motor overtemp relay will be de-energized and the pump will shut down. When this occurs, an "Influent EQ Pump Motor Overtemp" alarm message shall be displayed on the operator interface, and a pump motor overtemp alarm shall be displayed by the HMI software.

3) If a high current is sensed by the relay, a seal leak contact in the relay will close. This contact will be wired to a seal failure relay in the relay panel. The seal failure relay has a normally closed contact wired in series with the pump start/stop circuit, and a normally open contact that will be wired to PLC-IP. When a seal leak occurs, the seal failure relay will be energized and the pump will shut down. When this occurs, an "Influent EQ Pump Seal Failure" alarm message shall be displayed on the operator interface, and a pump seal failure alarm shall be displayed by the HMI software.

e. If an influent EQ pump experiences a failure, VFD fault, motor overtemp, or seal failure alarm, PLC-IP will index the on-line/standby assignments of the pumps so that the standby pump becomes the on-line pump.

5. Influent EQ Pump Alarms

a. The following alarms for the Influent EQ Pumps shall be displayed on the operator interface located on the Influent Pump Control Panel, and shall be displayed and logged by the HMI software:

1) Influent EQ Pump No. 1 Failure
2) Influent EQ Pump No. 1 VFD Fault
3) Influent EQ Pump No. 1 Motor Overtemp
4) Influent EQ Pump No. 1 Seal Failure
5) Influent EQ Pump No. 2 Failure
6) Influent EQ Pump No. 2 VFD Fault
7) Influent EQ Pump No. 2 Motor Overtemp
8) Influent EQ Pump No. 2 Seal Failure

D. INFLUENT EQUALIZATION TANK

1. General Description

   a. An Influent Equalization (EQ) Tank will be constructed under the ENR Upgrade and Expansion project to provide for flow equalization of the influent wastewater. Two submersible mixers will be installed in the tank to mix the wastewater in the tank to keep the solids in suspension and prevent settling from occurring. The mixers will be designated as Influent EQ Tank Mixers No. 1 and No. 2.

   b. A radar level transmitter will be installed in the influent EQ tank to monitor the wastewater level in the tank. The level transmitter will be a 2-wire instrument, which will output a 4-20mA signal proportional to the tank level to PLC-IP.

   c. The influent EQ tank level shall be displayed on the operator interface located on the Influent Pump Control Panel, and the tank level shall be displayed and trended by the HMI software.

2. Influent EQ Tank Mixer Motor Controls

   a. Motor Control Center-CH, located in the Chemical Building Electrical Room, will house the following for each influent EQ tank mixer:

      1) Motor Circuit Breaker
      2) Motor Starter
      3) Control Transformer
      4) H/O/A Selector Switch
      5) Run Indication Light
      6) Elapsed Time Meter
      7) Mixer Supervision Relay
      8) Motor Overtemp Relay
      9) Motor Overtemp Alarm Light
      10) Seal Failure Relay
      11) Seal Failure Alarm Light
      12) Motor Overtemp Reset Push Button

   b. Each mixer H/O/A selector switch will have an auxiliary normally open contact that will close when the switch is placed in the "auto" position. This contact will be wired to PLC-IP for switch position monitoring by the PLC.

   c. Each mixer motor starter will have two auxiliary normally open contacts that will close when the motor starter is energized. One contact will be wired to the run indication light and elapsed time meter on MCC-CH, and the other contact will be wired to PLC-IP for run status monitoring by the PLC.

   d. A disconnect switch will be backboard mounted adjacent to each mixer to disconnect power to the mixer motor.

3. Programmable Controller PLC-IP Inputs and Outputs

   a. The PLC inputs and outputs for the Influent Equalization Tank will be wired to and from PLC-IP located in the Influent Pump Control Panel.

b. Digital Inputs (24vdc):

	Description	Origination Point
1)	Influent EQ Tank Mixer No. 1 H/O/A Switch "Auto" Position	H/O/A Switch on MCC-CH
2)	Influent EQ Tank Mixer No. 1 Running	Mixer Motor Starter in MCC-CH
3)	Influent EQ Tank Mixer No. 1 Motor Overtemp	Motor Overtemp Relay in MCC-CH
4)	Influent EQ Tank Mixer No. 1 Seal Failure	Seal Failure Relay in MCC-CH
5)	Influent EQ Tank Mixer No. 2 H/O/A Switch "Auto" Position	H/O/A Switch on MCC-CH
6)	Influent EQ Tank Mixer No. 2 Running	Mixer Motor Starter in MCC-CH
7)	Influent EQ Tank Mixer No. 2 Motor Overtemp	Motor Overtemp Relay in MCC-CH
8)	Influent EQ Tank Mixer No. 2 Seal Failure	Seal Failure Relay in MCC-CH

c. Digital Outputs (24vdc, Relay Output):

	Description	Destination Point
1)	Influent EQ Tank Mixer No. 1 Start/Stop	Mixer Start Relay in Influent Pump Control Panel
2)	Influent EQ Tank Mixer No. 2 Start/Stop	Mixer Start Relay in Influent Pump Control Panel

d. Analog Inputs (4-20mA):

	Description	Origination Point
1)	Influent EQ Tank Level	Influent EQ Tank Radar Level Transmitter

4. Description of Operation

a. The influent EQ tank mixers will be controlled by the individual H/O/A selector switches located on MCC-CH. The “hand” and “off” positions of the H/O/A switch provide for manual start/stop control of the mixer. When the H/O/A switch is in the “auto” position the mixer will be automatically controlled by PLC-IP as follows:

1) A graphic display shall be programmed in the operator interface located on the Influent Pump

Control Panel, and in the HMI software, for the influent EQ tank. A manual/auto selector switch shall be configured for each EQ tank mixer in the graphic display to select either manual or automatic control of the mixer. If manual control is selected, the plant operator will be able to manually start and stop the mixer from the graphic display. If automatic control is selected, the mixer will be automatically controlled by the EQ tank level and PLC-IP as follows:

a) The influent EQ tank level will be continuously monitored by PLC-IP. Level setpoints will be programmed in the PLC for the following tank levels:

1) Influent EQ Tank Mixer Stop Level
2) Influent EQ Tank Mixer Start Level
3) Influent EQ Tank High Level

b) The tank level setpoints shall be adjustable via the operator interface located on the Influent Pump Control Panel, or via the HMI software.

c) When the wastewater level in the influent EQ tank rises to the “mixer start” level setpoint, a timer in the PLC will be started. If this timer times out and the tank level is still at or above the mixer start level setpoint, PLC-IP shall start the EQ tank mixer. When the mixer is started, it will continue to run until the wastewater level in the tank drops to the “mixer stop” level setpoint. When this occurs, a timer in the PLC will be started. If this timer times out and the tank level is still at or below the mixer stop level setpoint, PLC-IP shall shut down the mixer.

b. If the influent EQ tank level rises to the "high level" level setpoint, a timer in PLC-IP will be started. If this timer times out and the tank level is still at or above the "high level" setpoint, an “Influent EQ Tank High Level” alarm message shall be displayed on the operator interface, and an EQ tank high level alarm shall be displayed by the HMI software.

c. PLC-IP will provide failure monitoring for each influent EQ tank mixer as follows:

1) When a mixer H/OA switch is in the “auto” position, and the mixer gets a signal to start, a failure timer in the PLC will be started. If this timer times out and the mixer motor starter is not energized, an “Influent EQ Tank Mixer Failure” alarm message shall be displayed on the operator interface located on the Influent Pump Control Panel, and a mixer failure alarm shall be displayed by the HMI software.

d. Each influent EQ tank mixer motor will be furnished with a normally closed thermal switch in the motor windings to detect a high motor temperature, and a seal leak sensor in the mixer casing to detect a leakage of water into the oil chamber. The thermal switch and the seal leak sensor will be wired in series to a mixer supervision relay located in MCC-CH. This relay will sense the current in the loop. A low current will indicate a high temperature condition in the motor, and a high current will indicate a seal failure. PLC-IP will provide alarm monitoring for each mixer as follows:

1) The high temperature circuit has a normally open contact that is wired to a motor overtemp relay located in MCC-CH. This contact changes state when the relay is powered, and the temperature is normal.

2) The motor overtemp relay has a normally open contact that is wired in series with the mixer control circuit, and a normally closed contact that will be wired to PLC-IP. When a high motor temperature occurs, the motor overtemp relay will be de-energized and the mixer will shut down. When this occurs, an “Influent EQ Tank Mixer Motor Overtemp” alarm message shall be displayed on the operator interface, and a mixer motor overtemp alarm shall be displayed

by the HMI software.

3) If a high current is sensed by the relay, a seal leak contact in the relay will close. This contact will be wired to a seal failure relay in MCC-CH. The seal failure relay has a normally closed contact wired in series with the mixer control circuit, and a normally open contact that will be wired to PLC-IP. When a seal leak occurs, the seal failure relay will be energized, and the mixer will shut down. When this occurs, an "Influent EQ Tank Mixer Seal Failure" alarm message shall be displayed on the operator interface, and a mixer seal failure alarm shall be displayed by the HMI software.

e. PLC-IP will continuously monitor the analog signal received from the influent EQ tank radar level transmitter. The PLC will provide failure monitoring for the level transmitter as follows:

1) If an error is detected with the level transmitter signal (below 4 mA or above 20 mA), a timer in the PLC shall be started. If this timer times out and the transmitter error still exists, an "Influent EQ Tank Level Transmitter Out of Range" alarm message shall be displayed on the operator interface, and an EQ tank level transmitter out of range alarm shall be displayed by the HMI software.

5. Influent Equalization Tank Alarms

a. The following alarms for the Influent Equalization Tank shall be displayed on the operator interface located on the Influent Pump Control Panel, and shall be displayed and logged by the HMI software:

1) Influent EQ Tank Mixer No. 1 Failure
2) Influent EQ Tank Mixer No. 1 Motor Overtemp
3) Influent EQ Tank Mixer No. 1 Seal Failure
4) Influent EQ Tank Mixer No. 2 Failure
5) Influent EQ Tank Mixer No. 2 Motor Overtemp
6) Influent EQ Tank Mixer No. 2 Seal Failure
7) Influent EQ Tank High Level
8) Influent EQ Tank Level Transmitter Out of Range

E. INFLUENT EQ TANK RETURN FLOW CONTROL

1. General Description

   a. A flow control valve and flow meter will be provided for the treatment plant to control the influent flow returned from the Influent EQ Tank to the Pre-Anoxic Tank. The flow control valve and flow meter will be installed in a new EQ Return Flow Control Valve Vault.

   b. The flow control valve will be an electrically actuated modulating pinch valve. This valve will be designated as the EQ Return Flow Control Valve.

   c. The flow meter will be a magnetic flow meter, located upstream of the flow control valve. This flow meter will be designated as the EQ Return Flow Meter. The magnetic flow meter will output a voltage signal proportional to the flow rate to a flow transmitter wall mounted in the Chemical Building Electrical Room. The flow transmitter will convert the voltage signal to a 4-20mA analog signal proportional to the flow rate and will output this flow signal to PLC-IP.

   d. The EQ return flow shall be displayed on the operator interface located on the Influent Pump Control Panel, and the flow shall be displayed, trended, and totalized by the HMI software.

2. EQ Return Flow Control Valve Actuator Controls

   a. The EQ return flow control valve will incorporate the following electrical controls:

      1) Integral Disconnect Switch
      2) Reversing Contactor
      3) Local/Off/Remote Selector Switch
      4) Open/Stop/Close Push Buttons
      5) Open and Closed Position Indication Lights
      6) Valve Position Indication Limit Switches
      7) Valve Positioner
      8) Valve Position Transmitter

   b. The local/off/remote selector switch will have an auxiliary normally open contact that will close when the switch is placed in the "remote" position. This contact will be wired to the PLC-IP for switch position monitoring by the PLC.

   c. The valve actuator will have a valve "open" limit switch that will close when the valve is open, and a valve "closed" limit switch that will close when the valve is fully closed. The valve open and closed limit switches will be wired to the open and closed position indication lights on the valve actuator.

   d. The valve position transmitter will output a 4-20mA analog signal proportional to the valve position to PLC-IP for valve position monitoring by the PLC. The valve position shall be displayed on the operator interface located on the Influent Pump Control Panel, and the position shall be displayed and trended by the HMI software.

   e. The valve actuator will have a normally open actuator fault contact that will close if an actuator fault occurs. This contact will be wired to PLC-IP for actuator fault monitoring by the PLC.

3. Programmable Controller PLC-IP Inputs and Outputs

   a. The programmable controller inputs and outputs for the EQ Return Flow Control Valve and Flow Meter will be wired to and from PLC-IP located in the Influent Pump Control Panel.

b. Digital Inputs (24vdc):

	Description	Origination Point
1)	EQ Return Flow Control Valve L/O/R Switch "Remote" Position	L/O/R Switch on Valve Actuator
2)	EQ Return Flow Control Valve Actuator Fault	Fault Contact in Valve Actuator

c. Analog Inputs (4-20mA):

	Description	Origination Point
1)	EQ Return Flow Control Valve Position	Position Transmitter in Valve Actuator
2)	EQ Return Flow	Magnetic Flow Meter Transmitter

d. Analog Outputs (4-20mA):

	Description	Destination Point
1)	EQ Return Flow Control Valve Positioning Signal	Valve Positioner in Valve Actuator

4. Description of Operation

a. The EQ return flow control valve will be controlled by the local/off/remote selector switch located on the valve actuator. When the local/off/remote switch is in the "local" position, the valve may be locally controlled by the open/stop/close push buttons located on the valve actuator. When the local/off/remote switch is in the "remote" position, the flow control valve will be automatically controlled by PLC-IP as follows:

1) A graphic display shall be developed on the operator interface located on the Influent Pump Control Panel, and in the HMI software, for the EQ return flow control valve. An auto/manual selector switch shall be configured in the display for the control valve to select either manual or automatic control of the valve. In the "manual" mode, the plant operator may manually position the valve from the operator interface or the HMI software. When the auto/manual switch is in the "auto" position, the valve will be automatically controlled by PLC-IP as follows:

a) An EQ return flow controller shall be programmed in PLC-IP to control the flow returned from the influent EQ tank.

b) The plant operator will enter the desired flow to be returned from the EQ tank in the operator interface, or in the HMI software. The value entered will be the flow setpoint for the EQ return flow controller.

c) The flow controller will compare the actual return flow, as measured by the EQ return flow meter, to the flow setpoint, and will output a 4-20mA positioning signal to position the valve as required to maintain the flow setpoint.

b. PLC-IP will provide actuator fault monitoring for the EQ return flow control valve as follows:

1) If a valve actuator fault occurs, a fault timer in the PLC will be started. If this timer times out and the fault alarm is still present, an “EQ Return Flow Control Valve Actuator Fault" alarm message shall be displayed on the operator interface located on the Influent Pump Control Panel, and a valve actuator fault alarm shall be displayed by the HMI software.

5. EQ Return Flow Control Valve Alarms

a. The following alarms for the EQ Return Flow Control Valve shall be displayed on the operator interface located on the Influent Pump Control Panel, and shall be displayed and logged by the HMI software:

1) EQ Return Flow Control Valve Actuator Fault

F. PRE-ANOXIC TANK MIXER

1. General Description

   a. A Pre-Anoxic Tank will be constructed under the ENR Upgrade and Expansion project to provide a pre-anoxic zone for treatment of the influent wastewater. A submersible mixer will be installed in the Pre-Anoxic Tank to mix the wastewater in the tank to keep the solids in suspension and prevent settling from occurring.

2. Pre-Anoxic Tank Mixer Motor Controls

   a. Motor Control Center-CH, located in the Chemical Building Electrical Room, will house the following for the pre-anoxic tank mixer:

      1) Motor Circuit Breaker
      2) Motor Starter
      3) Control Transformer
      4) Off/On Selector Switch
      5) Run Indication Light
      6) Elapsed Time Meter
      7) Mixer Supervision Relay
      8) Motor Overtemp Relay
      9) Motor Overtemp Alarm Light
      10) Seal Failure Relay
      11) Seal Failure Alarm Light
      12) Motor Overtemp Reset Push Button

   b. The mixer off/on selector switch will have an auxiliary normally open contact that will close when the switch is placed in the "on" position. This contact will be wired to PLC-IP for switch position monitoring by the PLC.

   c. The mixer motor starter will have two auxiliary normally open contacts that will close when the motor starter is energized. One contact will be wired to the run indication light and elapsed time meter on MCC-CH, and the other contact will be wired to PLC-IP for run status monitoring by the PLC.

   d. A disconnect switch will be backboard mounted adjacent to the mixer to disconnect power to the mixer motor.

3. Programmable Controller PLC-IP Inputs

   a. The PLC inputs for the Pre-Anoxic Mixer will be wired to PLC-IP located in the Influent Pump Control Panel.

   b. Digital Inputs (24vdc):

	Description	Origination Point
1)	Pre-Anoxic Tank Mixer Off/On Switch "On" Position	Off/On Switch on MCC-CH
2)	Pre-Anoxic Tank Mixer Running	Mixer Motor Starter in MCC-CH

3)	Pre-Anoxic Tank Mixer Motor Overtemp	Motor Overtemp Relay in MCC-CH
4)	Pre-Anoxic Tank Mixer Seal Failure	Seal Failure Relay in MCC-CH

4. Description of Operation

   a. The pre-anoxic tank mixer will be manually controlled by the off/on selector switch located on MCC-CH. The mixer will normally run continuously.

   b. PLC-IP will provide failure monitoring for the pre-anoxic tank mixer as follows:

      1) When the mixer off/on switch is placed in the "on" position, a failure timer in the PLC will be started. If this timer times out and the mixer motor starter is not energized, a “Pre-Anoxic Tank Mixer Failure” alarm message shall be displayed on the operator interface located on the Influent Pump Control Panel, and a mixer failure alarm shall be displayed by the HMI software.

   c. The pre-anoxic tank mixer motor will be furnished with a normally closed thermal switch in the motor windings to detect a high motor temperature, and a seal leak sensor in the mixer casing to detect a leakage of water into the oil chamber. The thermal switch and the seal leak sensor will be wired in series to a mixer supervision relay located in MCC-CH. This relay will sense the current in the loop. A low current will indicate a high temperature condition in the motor, and a high current will indicate a seal failure. PLC-IP will provide alarm monitoring for the mixer as follows:

      1) The high temperature circuit has a normally open contact that is wired to a motor overtemp relay located in MCC-CH. This contact changes state when the relay is powered, and the temperature is normal.

      2) The motor overtemp relay has a normally open contact that is wired in series with the mixer control circuit, and a normally closed contact that will be wired to PLC-IP. When a high motor temperature occurs, the motor overtemp relay will be de-energized and the mixer will shut down. When this occurs, a “Pre-Anoxic Tank Mixer Motor Overtemp” alarm message shall be displayed on the operator interface, and a pre-anoxic tank mixer motor overtemp alarm shall be displayed by the HMI software.

      3) If a high current is sensed by the relay, a seal leak contact in the relay will close. This contact will be wired to a seal failure relay in MCC-CH. The seal failure relay has a normally closed contact wired in series with the mixer control circuit, and a normally open contact that will be wired to PLC-IP. When a seal leak occurs, the seal failure relay will be energized, and the mixer will shut down. When this occurs, a “Pre-Anoxic Tank Mixer Seal Failure” alarm message shall be displayed on the operator interface, and a pre-anoxic tank mixer seal failure alarm shall be displayed by the HMI software.

5. Pre-Anoxic Tank Mixer Alarms

   a. The following alarms for the Pre-Anoxic Tank Mixer shall be displayed on the operator interface located on the Influent Pump Control Panel, and shall be displayed and logged by the HMI software:

      1) Pre-Anoxic Tank Mixer Failure
      2) Pre-Anoxic Tank Mixer Motor Overtemp
      3) Pre-Anoxic Tank Mixer Seal Failure

G. INFLUENT PUMPS

1. General Description

   a. The influent wastewater will be piped from the Pre-Anoxic Tank to the existing Influent Pump Station.

   b. The two existing influent pumps in the pump station will be replaced with two new rail-mounted submersible influent pumps. The influent pumps will pump the influent wastewater from the pump station to the SBRs. The two pumps will operate in the lead/lag mode.

   c. A submersible level transducer will be installed in the pump station to monitor the wastewater level in the station. The level transducer will output a 4-20mA level signal proportional to the station level to PLC-IP for level monitoring by the PLC. The pump station level shall be displayed on the operator interface terminal located on the Influent Pump Control Panel, and the level shall be displayed and trended by the HMI software.

   d. Five float switches will be suspended in the pump station for back-up control of the influent pumps should the transducer or PLC fail, and for alarm indication. Each float switch will be wired to an intrinsically safe relay located in the Influent Pump Control Panel. The float switches will be designated as follows:

      1) Pump Station Low Level
      2) Pump Off
      3) Lead Pump Start
      4) Lag Pump Start
      5) Pump Station High Level

2. Influent Pump Motor Controls

   a. Motor Control Center-CH, located in the Chemical Building Electrical Room, will house the following for each influent pump:

      1) Motor Circuit Breaker
      2) Line Reactors
      3) Variable Frequency Drive
      4) Control Transformer
      5) H/O/L/A Selector Switch
      6) VFD Run Relay
      7) VFD Run Indication Light
      8) VFD Fault Relay
      9) VFD Fault Alarm Light
      10) VFD Fault Reset Push Button
      11) Pump Shutdown Relay and Alarm Light
      12) Elapsed Time Meter
      13) Ventilation Fan
      14) VFD Keypad

   b. Each pump H/O/L/A selector switch will have an auxiliary normally open contact that will close when the switch is placed in the “local” position. This contact will be wired to the Influent Pump Station Local Control Panel.

   c. Each pump H/O/L/A selector switch will have an auxiliary normally open contact that will close when the switch is placed in the “auto” position. This contact will be wired to PLC-IP for switch

position monitoring by the PLC.

d. The “auto” position of the H/O/L/A switch will be wired to the pump VFD for selecting automatic speed control.

e. Each variable frequency drive will have a run contact that will close when the drive is energized and outputting a frequency to the pump motor. This contact will be wired to a "run" relay located in MCC-IP, and to a run indication light located on the MCC. The "run" relay will have four normally open contacts that will close when the relay is energized. One contact will be wired to an elapsed time meter located on MCC-CH, one contact will be wired to a ventilation fan in the VFD, one contact will be wired to the Influent Pump Station Local Control Panel, and the other contact will be wired to PLC-IP for run status monitoring by the PLC.

f. Each variable frequency drive will have a VFD fault contact that will close when a drive fault occurs. This contact will be wired to a VFD fault relay in the MCC, and to a VFD fault alarm light on the MCC. The VFD fault relay will have a normally open contact that will close when the relay is energized. This contact will be wired to PLC-IP for VFD fault alarm monitoring by the PLC.

g. Each variable frequency drive will output a 4-20mA speed signal proportional to the drive speed to PLC-IP. The drive speed shall be displayed on the operator interface located on the Influent Pump Control Panel and on the HMI graphic display for the influent pumps.

h. A disconnect switch will be backboard mounted on top of the SBR Valve Vault for each influent pump to disconnect power to the pump motor.

3. Influent Pump Station Local Control Panel

a. An Influent Pump Station Local Control Panel will be backboard mounted on the top of the SBR Valve Vault to provide for local start/stop control of the influent pumps. The control panel will house the following for the influent pumps:

1) Pump Station Level Digital Meter
2) Pump Local Control Indication Light for each Pump
3) Pump Start and Stop Push Buttons for each Pump
4) Pump Local Start Relay for each Pump
5) Pump Run Indication Light for each Pump
6) Pump Motor Overtemp Relay and Alarm Light for each Pump
7) Pump Seal Failure Relay and Alarm Light for each Pump
8) Pump Low Oil Level Relay and Alarm Light for each Pump
9) Pump Shutdown Relay for each Pump
10) Terminals for Low Oil Level Switches
11) Terminals for SBR Valve Vault Flooding Float Switch

4. Influent Pump Controls in the Influent Pump Control Panel

a. The Influent Pump Control Panel will house the following controls for the influent pumps:

1) Intrinsically Safe Relay for each Pump Station Float Switch
2) Back-up Relay Logic for Influent Pump Control
3) Control Relays

5. Programmable Controller PLC-IP Inputs and Outputs

a. The programmable controller inputs and outputs for the Influent Pumps will be wired to and from

PLC-IP located in the Influent Pump Control Panel.

b. Digital Inputs (24vdc):

	Description	Origination Point
1)	Influent Pump No. 1 H/O/L/A Switch "Auto" Position	H/O/L/A Switch on MCC-CH
2)	Influent Pump No. 1 Running	VFD Run Relay in MCC-CH
3)	Influent Pump No. 1 VFD Fault	VFD Fault Relay in MCC-CH
4)	Influent Pump No. 1 Motor Overtemp	Motor Overtemp Relay in Influent Pump Station Local Control Panel
5)	Influent Pump No. 1 Seal Failure	Seal Failure Relay in Influent Pump Station Local Control Panel
6)	Influent Pump No. 1 Low Oil Level	Low Oil Level Relay in Influent Pump Station Local Control Panel
7)	Influent Pump No. 2 H/O/L/A Switch "Auto" Position	H/O/L/A Switch on MCC-CH
8)	Influent Pump No. 2 Running	VFD Run Relay in MCC-CH
9)	Influent Pump No. 2 VFD Fault	VFD Fault Relay in MCC-CH
10)	Influent Pump No. 2 Motor Overtemp	Motor Overtemp Relay in Influent Pump Station Local Control Panel
11)	Influent Pump No. 2 Seal Failure	Seal Failure Relay in Influent Pump Station Local Control Panel
12)	Influent Pump No. 2 Low Oil Level	Low Oil Level Relay in Influent Pump Station Local Control Panel
13)	Influent Pump Station Low Level	Intrinsically Safe Relay in Influent Pump Control Panel

14)	Influent Pump Station Pump Off Level	Intrinsically Safe Relay in Influent Pump Control Panel
15)	Influent Pump Station Lead Pump Start	Intrinsically Safe Relay in Influent Pump Control Panel
16)	Influent Pump Station Lag Pump Start	Intrinsically Safe Relay in Influent Pump Control Panel
17)	Influent Pump Station High Level	Intrinsically Safe Relay in Influent Pump Control Panel

c. Digital Outputs (Relay, 24vdc):

	Description	Destination Point
1)	Influent Pump No. 1 Start/Stop	Pump Start Relay in Influent Pump Control Panel
2)	Influent Pump No. 2 Start/Stop	Pump Start Relay in Influent Pump Control Panel

d. Analog Inputs (4-20mA):

	Description	Origination Point
1)	Influent Pump Station Level	Submersible Level Transducer in Pump Station
2)	Influent Pump No. 1 Speed	Pump VFD in MCC-CH
3)	Influent Pump No. 2 Speed	Pump VFD in MCC-CH

e. Analog Outputs (4-20mA):

	Description	Origination Point
1)	Influent Pump No. 1 Speed Reference Signal	Pump VFD in MCC-CH
2)	Influent Pump No. 2 Speed Reference Signal	Pump VFD in MCC-CH

6. Description of Operation

a. The two influent pumps will be controlled by the individual H/O/L/A selector switches located on MCC-CH. The "hand" and "off" positions of the H/O/L/A selector switches provide for manual start/stop control of the pumps. When a pump H/O/L/A switch is in the “local” position, the pump may be locally controlled by the start and stop push buttons located on the Influent Pump Station

Local Control Panel. When a pump H/O/L/A switch is in the “local” position, a pump local control indication light on the panel will be lit. When the pump H/O/L/A switches are in the "auto" position, the influent pumps will be automatically controlled by PLC-IP in response to the pump station level as follows:

1) A graphic display shall be programmed in the operator interface located on the Influent Pump Control Panel, and in the HMI software, for the influent pumps. An auto/manual selector switch shall be configured in the display for each pump to select either manual or automatic control of the pump. In the “manual” mode, the plant operator may manually start and stop the pump and control the pump speed from the operator interface or the HMI software. The desired pump speed (0-60 Hz) will be entered on the graphic display, and PLC-IP will output a 4-20mA analog speed reference signal, equivalent to the value entered, to the pump VFD. When the auto/manual switch is in the “auto” position, the pump will be automatically controlled by PLC-IP as follows:

    a) Level setpoints shall be programmed in PLC-IP for the following pump station levels:

        1) Pump Station Low Level
        2) Pump Stop
        3) Lead Pump Start
        4) Lag Pump Start
        5) Pump Station High Level
        6) Pump Station Level Controller Setpoint

    b) The level setpoints shall be adjustable via the operator interface located on the Influent Pump Control Panel, or via the HMI software.

    c) The operator interface and HMI software shall be programmed to allow the operator to select the lead and lag influent pumps, or to select automatic alternation of the pumps. When automatic alternation is selected, PLC-IP will alternate the lead/lag status of the influent pumps after a preset time period. This time period shall be adjustable via the operator interface or the HMI software.

    d) A PID level controller will be configured in the PLC to control the sewage level in the pump station. The level controller will vary the speed of the influent pumps as required to match the pump discharge flow rate to the pump station influent flow rate. The desired level to be maintained in the pump station will be programmed in PLC-IP as the setpoint for the level controller. The level controller will compare the actual pump station level measured by the pump station submersible level transducer to the setpoint level, and will output a speed reference signal to the pump VFDs to increase or decrease the speed of the pumps as required to maintain the setpoint level.

    e) When the sewage level in the pump station rises to the elevation of the "lead pump start" level setpoint, PLC-IP will start the lead influent pump. When the lead pump is started, it will run with its speed being varied by the PLC to maintain the setpoint level in the pump station. As long as the influent flow rate into the pump station is sufficient to maintain the sewage level in the pump station above the lead pump stop level, the lead pump will run continuously with its speed varied to match the pump discharge rate to the pump station influent flow rate as the influent flow rate varies from the minimum pumping rate to the maximum capacity of the lead pump. When the level in the pump station is drawn down to the "lead pump stop" level setpoint, PLC-IP will shut down the lead pump.

f) If the lead influent pump cannot keep up with the influent flow, the sewage level in the pump station will rise to the "lag pump start" level setpoint. When this level is reached, a start delay timer in the programmable controller will be started. When this timer times out, the PLC will start the lag pump and will output equivalent speed reference signals to both the lead and lag pumps so that both pumps match speeds. As long as the sewage level is above the lag pump stop level, both pumps will run continuously with the speed of the lead and lag pumps being varied by the PLC as required to match the combined pump discharge rates to the pump station influent flow rate. When the sewage level in the pump station is pumped down to the "lag pump stop" level setpoint, the PLC will shut down the lag pump.

b. If the sewage level in the pump station is drawn down to the "pump station low level" setpoint, a timer in the programmable controller will be started. If this timer times out and the low level condition still exists, PLC-IP will shut down the influent pumps. When this occurs, an "Influent Pump Station Low Level" alarm message shall be displayed on the operator interface located on the Influent Pump Control Panel, and a pump station low level alarm shall be displayed by the HMI software.

c. If the sewage level in the pump station rises to the elevation of the "pump station high level" setpoint, a timer in the programmable controller will be started. If this timer times out and the high level condition still exists, an “Influent Pump Station High Level" alarm message shall be displayed on the operator interface, and a pump station high level alarm shall be displayed by the HMI software.

d. PLC-IP will continuously monitor the analog signal received from the pump station level transducer. If an error is detected with the level transducer signal, a "Pump Station Level Transducer Failure, Pumps on Float Switch Control" alarm message shall be displayed on the operator interface, and a level transducer failure alarm shall be displayed by the HMI software. When this occurs, the PLC will automatically switch the pump station level control to the float switches. The float switches will remain in control until the alarm condition for the level transducer is corrected. The float switches and PLC-IP will provide automatic start/stop control of the pumps as follows:

1) The "pump off", "lead pump start", and "lag pump start" float switches will be wired to individual intrinsically safe relays located in the Influent Pump Control Panel. These relays will each have a normally open contact that will be wired to the back-up relay logic in the control panel and a normally open contact that will be wired to PLC-IP for pump control.

2) When the sewage level in the pump station rises to the level of the "lead pump start" float switch, PLC-IP will start the lead pump. When the lead pump is started, it will continue to run until the sewage level in the pump station is drawn down to the level of the "pump off" float switch. When this occurs, PLC-IP will shut down the lead pump.

3) If the sewage level in the pump station rises to the level of the "lag pump start" float switch, PLC-IP will start the lag pump. When the lag pump is started, it will continue to run until the sewage level in the pumping station is drawn down to the level of the "pump off" float switch. When this occurs, PLC-IP will shut down the lag pump.

e. The "pump station low level" float switch will be wired to an intrinsically safe relay located in the Influent Pump Control Panel. This relay will have a normally open contact that will be wired to the back-up relay logic in the control panel, and a normally open contact that will be wired to PLC-IP for pump station low level monitoring. If the sewage level in the pump station is drawn down to the

elevation of the low level float switch, the low level relay will be energized and PLC-IP will shut down the influent pumps. When this occurs, an “Influent Pump Station Low Level, Detected by Low Level Float" alarm message shall be displayed on the operator interface, and a pump station low level alarm shall be displayed by the HMI software.

f. The "pump station high level" float switch will be wired to an intrinsically safe relay located in the Influent Pump Control Panel. This relay will have a normally open contact that will be wired to PLC-IP for pump station high level monitoring. If the water level in the pump station rises to the elevation of the high level float switch, the high level relay will be energized, and an “Influent Pump Station High Level, Detected by High Level Float" alarm message shall be displayed on the operator interface, and a pump station high level alarm shall be displayed by the HMI software.

g. Relays and timers will be provided in the Influent Pump Control Panel to enable the influent pumps to be controlled by the float switches if the PLC fails. This relay logic will serve as a back-up to the control logic programmed in the PLC and will be initiated as follows:

    1) A control relay will be wired to an output from the PLC so that it is always energized whenever the PLC is operating. A normally closed contact on this relay will be wired in series with the pump station float switch relay logic control of the influent pumps. If the PLC system fails, the relay will be de-energized and the relay contact will close. When this occurs, the pump station float switches will provide automatic start/stop control of the pumps.

h. PLC-IP will provide failure monitoring for each influent pump as follows:

    1) When a pump H/O/L/A switch is in the "auto" position and the pump gets a signal to start, a failure timer in the programmable controller will be started. If this timer times out and the pump motor starter is not energized, an “Influent Pump Failure" alarm message shall be displayed on the operator interface, and a pump failure alarm shall be displayed by the HMI software.

i. PLC-IP will provide VFD fault monitoring for each influent pump as follows:

    1) If a drive fault occurs, the pump will shut down and the pump VFD fault relay will be energized. When this occurs, an “Influent Pump VFD Fault" alarm message shall be displayed on the operator interface, and a pump VFD fault alarm shall be displayed by the HMI software.

j. PLC-IP will provide motor high temperature monitoring for each influent pump as follows:

    1) Each influent pump motor will be furnished with normally closed thermal switches in the motor windings to detect a high motor temperature.

    2) The thermal switches will be wired to a motor overtemp relay in the Influent Pump Station Local Control Panel. The relay will have a two normally closed contacts. One contact will be wired to a motor overtemp alarm light on the Local Control Panel, and the other contact will be wired to PLC-IP.

    3) When the relay is powered and the temperature is normal, the motor overtemp relay will be energized. If the pump is running and a high motor temperature occurs, one or more thermal switches will open, the motor overtemp relay will be de-energized, and the pump will shut down. When this occurs, an "Influent Pump Motor Overtemp" alarm message shall be displayed on the operator interface, and a pump motor overtemp alarm shall be displayed by the HMI software.

k. Each influent pump will be furnished with a water-in-oil seal leak sensor to monitor a leakage of water into the pump oil chamber. The seal leak sensor will be wired to a seal leak relay located in the Influent Pump Station Local Control Panel. A normally open contact on this relay will be wired to a seal failure relay and seal failure alarm light on the local control panel. A normally open contact on the seal failure relay will be wired to PLC-IP for seal failure monitoring by the PLC. If a seal leak occurs, the seal failure relay will be energized, an "Influent Pump Seal Failure" alarm message shall be displayed on the operator interface, and an influent pump seal failure alarm shall be displayed by the HMI software.

l. Each influent pump will be furnished with a normally open low oil level switch to monitor the oil level in the pump's oil reservoir. The level switch will close when the reservoir is full of oil. The oil level switch will be wired to a low oil level relay in the Influent Pump Station Local Control Panel. This relay will have two normally closed contacts. One contact that will be wired to a low oil level alarm light on the local control panel, and one contact that will be wired to PLC-IP. If a loss of oil occurs, the oil level in the reservoir will drop and the oil level switch will open. When this occurs, the influent pump will shut down, an "Influent Pump Low Oil Level" alarm message shall be displayed on the operator interface, and an influent pump low oil level alarm shall be displayed by the HMI software.

m. The pump motor overtemp and low oil level relays will each have a normally closed contact, and the pump seal failure relay will have a normally open contact that will be wired to a pump shutdown relay in the Influent Pump Station Local Control Panel. The pump shutdown relay will have a normally open contact that will be wired to the pump VFD control circuit in MCC-CH for shutdown of the pump.

n. If an influent pump is taken out of "auto", or experiences a failure, VFD fault, motor overtemp, seal failure, or low oil level, PLC-IP will index the lead/lag assignments of the pumps so that this pump now becomes the lag pump. The remaining pump will become the lead pump. The pump that has become lag pump will be locked out of the pump sequence until it is placed back in "auto" or its alarm has been cleared.

7. Influent Pump Alarms

a. The following alarms for the Influent Pumps shall be displayed on the operator interface located on the Influent Pump Control Panel, and shall be displayed and logged by the HMI software:

1) Influent Pump No. 1 Failure
2) Influent Pump No. 1 Starter Fault
3) Influent Pump No. 1 Motor Overtemp
4) Influent Pump No. 1 Seal Failure
5) Influent Pump No. 1 Low Oil Level
6) Influent Pump Station Low Level
7) Influent Pump Station High Level
8) Influent Pump Station Low Level Detected by Float Switch
9) Influent Pump Station High Level Detected by Float Switch
10) Influent Pump Station Level Transducer Failure, Pumps on Float Control

H. SBR INFLUENT FLOW METERING

1. General Description

   a. The existing magnetic flow meter on the influent pump discharge line will be replaced with a new magnetic flow meter to meter the flow to the SBRs. The flow meter will be located in the SBR valve vault.

   b. The magnetic flow meter will output a voltage signal proportional to the flow rate to a flow transmitter backboard mounted above the valve vault. The flow transmitter will convert the voltage signal to a 4-20mA analog signal proportional to the flow rate and will output this signal to PLC-SBR.

   c. The SBR influent flow shall be displayed on the operator interface located on the SBR Control Panel, and the HMI software shall display, trend, and totalize the SBR influent flow.

2. Programmable Controller PLC-SBR Inputs

   a. The PLC input for the SBR Influent Flow signal will be wired to PLC-SBR located in the SBR Control Panel.

   b. Analog Inputs (4-20mA):

	Description	Origination Point
1)	SBR Influent Flow	Magnetic Flow Meter Transmitter

I. SEQUENCING BATCH REACTORS

1. General Description

   a. The treatment plant has two (2) sequencing batch reactors (SBRs) that treat the influent wastewater. The SBRs are designated as SBR No. 1 and SBR No. 2. Each SBR consists of a single basin that provides aeration, sedimentation, clarification, and biological nutrient removal.

   b. Each SBR will have an intermittent operating cycle consisting of six time-controlled phases. These phases are as follows:

      1) Mixed Fill Phase - SBR is being filled with raw sewage and contents of basin are mixed by the SBR mixer only.

      2) React Fill Phase - SBR is being filled with raw sewage and contents of basin are mixed and aerated by the SBR mixer and one of the SBR blowers.

      3) React Phase - Contents of SBR are aerated and mixed, but there is no influent flow.

      4) Settle Phase - The mixer and the blower are shut off and the contents of the SBR are settled.

      5) Decant Phase - The decanter and decant valve are opened and clarified effluent is removed from the basin and piped to the Post EQ Tank.

      6) Waste Sludge Phase - Sludge is wasted from the SBR to the sludge screen in the BioMag Building.

   c. The plant influent flow will be pumped from the Influent Pumps to the SBRs.

   d. Individual raw sewage influent lines are run to each SBR. The existing electrically actuated plug valve on each influent line will be replaced with a new valve to enable the raw sewage flow to be alternated between the two basins. The influent valves will be located in the SBR Valve Vault.

   e. A floating mixer is installed in each SBR to mix the contents of the basin. Refer to the Description of Operation section for the SBR MIXERS for a description of the mixer controls.

   f. Three existing positive displacement blowers currently supply air to the diffusers in the each SBR to aerate the contents of the basin. Under the ENR Upgrade, three additional positive blowers will be provided to supply additional air to the SBRs. Refer to the Description of Operation sections for the SBR BLOWERS for a description of the blower controls.

   g. The existing decanter in each SBR will be replaced with a new decanter to decant the clarified liquid in the basin during the decant phase. The decanter consists of a circular floating weir that will be opened and closed against the float by a linear actuator. The decanter will be piped to an effluent pipe which will convey the SBR effluent to the post EQ tank. An electrically actuated plug valve is installed on the decanter effluent pipe in to keep the effluent pipe full at all times. This valve is designated as the SBR decant valve.

   h. A submersible waste activated sludge (WAS) pump is installed in each SBR to pump sludge from the basin during the waste sludge phase. This pump is controlled by the BioMag Control Panel.

   i. The existing submersible level transducer in each SBR will be replaced with a new level transducer to monitor the wastewater level in the basin. Each level transducer will output a 4-20mA analog signal proportional to the level in the basin to PLC-SBR for tank level monitoring by the PLC. The

level in each SBR shall be displayed on the operator interface located on the SBR Control Panel, and the level shall be displayed and trended by the HMI software.

j. The existing high level float switch in each SBR will be replaced with a new high level float switch to detect a high wastewater level in the basin. Each float switch will be wired to PLC-SBR. When the wastewater level rises to the elevation of the high level float switch, the SBR sequence will go into Storm Flow Mode.

k. The existing D.O. probe each SBR will be replaced with a new D.O. probe to monitor the D.O. of the wastewater in the basin. Each D.O. probe will be wired to a D.O. transmitter which will be backboard mounted at the SBR. The D.O. transmitter will display the D.O. reading and it will output a 4-20mA signal proportional to the D.O. to PLC-SBR. The D.O. concentration in each SBR shall be displayed on the operator interface, and the D.O. shall be displayed and trended by the HMI software.

l. A pH probe will be installed in each SBR to monitor the pH of the wastewater in the basin. Each pH probe will be wired to a pH transmitter which will be backboard mounted at the SBR. The pH transmitter will display the pH reading and it will output a 4-20mA signal proportional to the pH to PLC-SBR. The pH of the wastewater in each SBR shall be displayed on the operator interface, and the pH shall be displayed and trended by the HMI software.

m. All instrumentation and controls for the SBR equipment will be provided by the SBR equipment manufacturer.

2. SBR Control Panel

a. The existing SBR Control Panel will be replaced with a new SBR Control Panel, which will be provided by the SBR equipment manufacturer. The control panel will be installed in the Control Building. The control panel will house an Allen-Bradley CompactLogix PLC, an operator interface terminal with color touch screen, selector switches, push buttons, pilot lights, relays, and other associated controls to provide for complete control and monitoring of the equipment for the SBRs.

b. The PLC in the SBR Control Panel will be programmed by the SBR system manufacturer to provide for automatic control of the following equipment:

1) SBR Influent Valves
2) SBR Mixers
3) SBR Blowers
4) SBR Decanters and Decant Valves
5) SBR Alum Feed Pumps
6) SBR Micro-C Pumps

3. SBR Influent Valve and Decant Valve Actuator Controls

a. The valve actuator for each SBR influent valve and decant valve will house the following electrical controls:

1) Reversing Contactor
2) Control Transformer
3) Valve Position Indication Limit Switches

b. Each valve actuator will have two sets of valve open and closed position indication limit switches. One set will be wired to the open and closed position indication lights on the valve actuator, and the second set will be wired to valve position indication lights on the SBR Control Panel, and to

PLC-SBR for valve position monitoring by the PLC.

c. Each valve actuator will be furnished with a manual handwheel override to enable the valve to be manually operated if the actuator should fail.

4. Programmable Controller PLC-SBR Inputs and Outputs

a. The PLC inputs and outputs for the SBR Valves, Decanters, and Instrumentation will be wired to and from PLC-SBR located in the SBR Control Panel.

b. Digital Inputs (120 VAC):

	Description	Origination Point
1)	SBR No. 1 On-Line/Off-Line Switch "On-Line" Position	On-Line/Off-Line Switch on SBR Control Panel
2)	SBR No. 1 Lead Basin Select	Basin Select Push Button on SBR Control Panel
3)	SBR No. 2 On-Line/Off-Line Switch "On-Line" Position	On-Line/Off-Line Switch on SBR Control Panel
4)	SBR No. 2 Lead Basin Select	Basin Select Push Button on SBR Control Panel
5)	SBR Cycle Reset	Cycle Reset Push Button on SBR Control Panel
6)	SBR No. 1 Influent Valve O/C/A Switch "Auto" Position	O/C/A Switch on SBR Control Panel
7)	SBR No. 1 Influent Valve Open	Open Limit Switch in Valve Actuator
8)	SBR No. 1 Influent Valve Closed	Closed Limit Switch in Valve Actuator
9)	SBR No. 1 Decanter O/C/A Switch "Auto" Position	O/C/A Switch on SBR Control Panel
10)	SBR No. 1 Decanter Open	Open Limit Switch in Decanter
11)	SBR No. 1 Decanter Closed	Closed Limit Switch in Decanter
12)	SBR No. 1 Decant Valve O/C/A Switch "Auto" Position	O/C/A Switch on SBR Control Panel

13)	SBR No. 1 Decant Valve Open	Open Limit Switch in Valve Actuator
14)	SBR No. 1 Decant Valve Closed	Closed Limit Switch in Valve Actuator
15)	SBR No. 1 High Level	High Level Float Switch in SBR
16)	SBR No. 2 Influent Valve O/C/A Switch "Auto" Position	O/C/A Switch on SBR Control Panel
17)	SBR No. 2 Influent Valve Open	Open Limit Switch in Valve Actuator
18)	SBR No. 2 Influent Valve Closed	Closed Limit Switch in Valve Actuator
19)	SBR No. 2 Decanter O/C/A Switch "Auto" Position	O/C/A Switch on SBR Control Panel
20)	SBR No. 2 Decanter Open	Open Limit Switch in Decanter
21)	SBR No. 2 Decanter Closed	Closed Limit Switch in Decanter
22)	SBR No. 2 Decant Valve O/C/A Switch "Auto" Position	O/C/A Switch on SBR Control Panel
23)	SBR No. 2 Decant Valve Open	Open Limit Switch in Valve Actuator
24)	SBR No. 2 Decant Valve Closed	Closed Limit Switch in Valve Actuator
25)	SBR No. 2 High Level	High Level Float Switch in SBR
26)	SBR Alarm Reset	Reset Push Button on SBR Control Panel

c. Digital Outputs (Relay, 120 VAC):

	Description	Destination Point
1)	SBR No. 1 Influent Valve Open	Valve Open Relay in SBR Control Panel
2)	SBR No. 1 Influent Valve Close	Valve Close Relay in SBR Control Panel

3)	SBR No. 1 Decanter Open	Decanter Open Relay in SBR Control Panel
4)	SBR No. 1 Decanter Close	Decanter Close Relay in SBR Control Panel
5)	SBR No. 1 Decant Valve Open	Valve Open Relay in SBR Control Panel
6)	SBR No. 1 Decant Valve Close	Valve Close Relay in SBR Control Panel
7)	SBR No. 2 Influent Valve Open	Valve Open Relay in SBR Control Panel
8)	SBR No. 2 Influent Valve Close	Valve Close Relay in SBR Control Panel
9)	SBR No. 2 Decanter Open	Decanter Open Relay in SBR Control Panel
10)	SBR No. 2 Decanter Close	Decanter Close Relay in SBR Control Panel
11)	SBR No. 2 Decant Valve Open	Valve Open Relay in SBR Control Panel
12)	SBR No. 2 Decant Valve Close	Valve Close Relay in SBR Control Panel

d. Analog Inputs (4-20mA):

	Description	Origination Point
1)	SBR No. 1 Level	Submersible Level Transducer in SBR
2)	SBR No. 1 D.O.	SBR D.O. Transmitter
3)	SBR No. 1 pH	SBR pH Transmitter
4)	SBR No. 2 Level	Submersible Level Transducer in SBR
5)	SBR No. 2 D.O.	SBR D.O. Transmitter
6)	SBR No. 2 pH	SBR pH Transmitter

5. Description of Operation

a. An on-line/off-line selector switch will be provided on the SBR Control Panel for each SBR. When the selector switch is in the "on-line" position, that SBR will be included in the SBR sequence.

Normally both basins will be on-line and the SBR will operate in a two basin sequence. If one of the basins is out of service, that basin will be placed "off-line" and the remaining SBR will operate in the sequence.

b. A time-controlled sequence shall be programmed in PLC-SBR to automatically control the SBR influent valves, mixers, blowers, decanters, decant valves, alum feed pumps, and Micro-C feed pumps. The control description for the mixers, blowers, alum feed pumps, and Micro-C feed pumps is provided in subsequent Description of Operation sections.

c. Each SBR influent valve will be controlled by its corresponding O/C/A selector switch located on the SBR Control Panel. The "open" and "close" positions of each O/C/A switch provide for manual open/close control of the valves. When the O/C/A switches are in the "auto" position, the valves will be automatically controlled by PLC-SBR as follows:

1) When an SBR mix fill phase begins, PLC-SBR shall energize the valve open relay for the influent valve for that basin, which will open the influent valve. The influent valve shall remain open during the mix fill and react fill phases of the SBR sequence. When the SBR enters the react phase, PLC-SBR will energize the influent valve close relay and the influent valve will close.

2) The SBR influent valve shall be inhibited from closing until another influent valve is open, so that there is always one influent valve open at all times.

d. Each SBR decanter and decant valve will be controlled by its corresponding O/C/A selector switch located on the SBR Control Panel. The "open" and "close" positions of the O/C/A switches provide for manual open/close control of the decanter and decant valve. When the O/C/A switches are in the "auto" position, the decanters and decant valves will be automatically controlled by PLC-SBR as follows:

1) When an SBR decant phase begins, PLC-SBR shall energize the decanter open relay for the decanter in that basin, which will open the decanter. At the same time, PLC-SBR will energize the decant valve open relay, which will open the decant valve, and allow the SBR effluent to be decanted to the Post EQ Tank.

2) When the decanter is opened, a decant phase duration timer in the programmable controller will be started. When this timer times out, PLC-SBR will energize the decant valve close relay, and the decant valve will close. When the decant valve is closed, PLC-SBR will energize the decanter close relay, which will close the decanter.

e. <u>SBR Sequence</u>

1) A time controlled sequence for each SBR shall be programmed so that the duration of the Mix Fill and React Fill Phases is equal to the total duration of the React, Settle and Decant Phases. The plant operator will enter the desired duration of each phase on the operator interface, or via the HMI software. The operator interface and HMI software shall be programmed to show the time remaining in each phase.

2) <u>Mix Fill Phase</u>

a) The Mix Fill Phase for an SBR will start when the other SBR enters the React Phase. When the Mix Fill Phase starts, a mix fill phase duration timer in PLC-SBR will be started, and PLC-SBR will perform the following:

1) Open the SBR influent valve

2) Start the SBR mixer

b) When the mix fill phase duration timer times out, the React Fill Phase will be started.

3) React Fill Phase

a) When the React Fill Phase starts, a react fill phase duration timer in PLC-SBR will be started, and PLC-SBR will perform the following:

1) Start the SBR blower

b) When the react fill phase duration timer times out, PLC-SBR will open the influent valve for the other SBR. When the influent valve for the other SBR is fully open, PLC-SBR will close the influent valve for the SBR that was in the React Fill Phase, and the React Phase will be started.

4) React Phase

a) When the React Phase starts, a react phase duration timer in PLC-SBR will be started. During the react phase, the wastewater in the basin will be mixed and aerated, without the addition of raw sewage influent. When the react phase duration timer times out, the SBR will enter the settle phase.

5) Settle Phase

a) When the Settle Phase starts, a settle phase duration timer in PLC-SBR will be started, and PLC-SBR will perform the following:

1) Stop the SBR mixer
2) Stop the SBR blower

b) During the Settle Phase, the wastewater in the basin will become quiescent, which will allow the solids to settle. When the settle phase duration timer times out, the Decant Phase will be started.

6) Decant Phase

a) When the Decant Phase starts, a decant phase duration timer in PLC-SBR will be started, and PLC-SBR will open the decanter and the decant valve to decant clarified effluent from the SBR to the Post EQ Tank.

b) At the end of the Decant Phase, PLC-SBR will start the SBR WAS Pump. When the WAS pump starts, a pump run duration timer in the programmable controller will be started. When this timer times out, PLC-SBR will shut down the WAS pump.

c) When the decant phase duration timer times out, PLC-SBR will close the decant valve and the decanter, and the SBR will enter the Mix Fill Phase and the sequence will be repeated.

f. A SBR cycle reset push button will be provided on the SBR Control Panel to reset the SBR sequence. When the reset push button is pushed, PLC-SBR will place the basin selected in the Mix Fill Phase, and the other SBR will be placed in the React Phase.

g. PLC-SBR will provide failure monitoring for each SBR influent valve and decant valve as follows:

1) When a valve O/C/A switch is in the "auto" position and the valve gets a signal to open, a failure timer in the programmable controller will be started. If this timer times out and the valve has not reached the open position, a "SBR Valve Failed to Open" alarm message shall be displayed on the operator interface located on the SBR Control Panel, and a valve failed to open alarm shall be displayed by the HMI software.

2) When a valve O/C/A switch is in the "auto" position and the valve gets a signal to close, a failure timer in the programmable controller will be started. If this timer times out and the valve has not reached the closed position, a "SBR Valve Failed to Close" alarm message shall be displayed on the operator interface, and a valve failed to close alarm shall be displayed by the HMI software.

h. PLC-SBR will provide failure monitoring for each SBR decanter as follows:

1) When a decanter O/C/A switch is in the "auto" position and the decanter gets a signal to open, a failure timer in the programmable controller will be started. If this timer times out and the decanter has not reached the open position, a "SBR Decanter Failed to Open" alarm message shall be displayed on the operator interface, and a decanter failed to open alarm shall be displayed by the HMI software.

2) When a decanter O/C/A switch is in the "auto" position and the decanter gets a signal to close, a failure timer in the programmable controller will be started. If this timer times out and the decanter has not reached the closed position, a "SBR Decanter Failed to Close" alarm message shall be displayed on the operator interface, and a decanter failed to close alarm shall be displayed by the HMI software.

i. If the sewage level in an SBR rises to the elevation of the high level float switch, a "SBR High Level" alarm message shall be displayed on the operator interface, and a high level alarm shall be displayed by the HMI software.

6. SBR Alarms

a. The following alarms for the SBR valves, decanters, and float switches shall be displayed on the operator interface located on the SBR Control Panel, and shall be displayed and logged by the HMI software:

1) SBR No. 1 Influent Valve Failed to Open
2) SBR No. 1 Influent Valve Failed to Close
3) SBR No. 1 Decanter Failed to Open
4) SBR No. 1 Decanter Failed to Close
5) SBR No. 1 Decant Valve Failed to Open
6) SBR No. 1 Decant Valve Failed to Close
7) SBR No. 1 High Level
8) SBR No. 2 Influent Valve Failed to Open
9) SBR No. 2 Influent Valve Failed to Close
10) SBR No. 2 Decanter Failed to Open
11) SBR No. 2 Decanter Failed to Close
12) SBR No. 2 Decant Valve Failed to Open
13) SBR No. 2 Decant Valve Failed to Close
14) SBR No. 2 High Level

b. Refer to the Description of Operation sections for the SBR Mixers and SBR Blowers for additional SBR alarms associated with this equipment.

J. SBR MIXERS

1. General Description

   a. A floating mixer is installed in each SBR to mix the wastewater in the basin during the mix fill, react fill and react phases of the SBR sequence. The mixers are designated as SBR No. 1 Mixer and SBR No. 2 Mixer.

2. SBR Mixer Motor Controls

   a. Existing Motor Control Center-C, located in the Control Building, houses the following for each SBR mixer:

      1) Motor Circuit Breaker
      2) Motor Starter
      3) Control Transformer
      4) Run Indication Light
      5) Elapsed Time Meter

   b. Each mixer motor starter has two auxiliary normally open contacts that will close when the motor starter is energized. One contact is wired to the run indication light and elapsed time meter on MCC-C, and the other contact will be wired to the run indication light on the SBR Control Panel, and to PLC-SBR for run status monitoring by the PLC.

   c. A disconnect switch is handrail mounted near each SBR mixer to disconnect power to the mixer motor.

3. SBR Mixer Controls on SBR Control Panel

   a. The SBR Control Panel will house the following for each SBR mixer:

      1) H/O/A Selector Switch
      2) Run Indication Light
      3) Mixer Start Relay

   b. The H/O/A selector switch for each mixer will have an auxiliary normally open contact that will close when the switch is placed in the "auto" position. This contact will be wired to PLC-SBR for switch position monitoring by the PLC.

4. Programmable Controller PLC-SBR Inputs and Outputs

   a. The programmable controller inputs and outputs for the SBR Mixers will be wired to and from PLC-SBR located in the SBR Control Panel.

   b. Digital Inputs (120 VAC):

	Description	Origination Point
1)	SBR No. 1 Mixer H/O/A Switch "Auto" Position	H/O/A Switch on SBR Control Panel
2)	SBR No. 1 Mixer Running	Mixer Motor Starter in MCC-C

3)	SBR No. 2 Mixer H/O/A Switch "Auto" Position	H/O/A Switch on SBR Control Panel
4)	SBR No. 2 Mixer Running	Mixer Motor Starter in MCC-C

c. Digital Outputs (Relay):

	Description	Destination Point
1)	SBR No. 1 Mixer Start/Stop	Mixer Start Relay in SBR Control Panel
2)	SBR No. 2 Mixer Start/Stop	Mixer Start Relay in SBR Control Panel

5. Description of Operation

a. The SBR mixers will be controlled by the individual H/O/A selector switches located on the SBR Control Panel. The "hand" and "off" positions of the H/O/A switches provide for manual start/stop control of the mixers. When a mixer H/O/A switch is placed in the "hand" position, a mixer start relay in the control panel will be energized. A normally open contact on this relay will be wired to the mixer motor starter control circuit, so that when the relay is energized, this contact will close, and the mixer will start. When the H/O/A switches are in the "auto" position, the mixers will be automatically controlled by PLC-SBR as follows:

1) When a SBR mix fill phase begins, PLC-SBR shall energize the mixer start relay for the mixer in that basin, which will start the mixer. The mixer shall continue to run during the mix fill, react fill and react phases of the SBR sequence. When the SBR enters the settle phase, PLC-SBR will de-energize the mixer start relay and the mixer will shut down. The mixer shall remain off during the settle phase and decant phase.

b. PLC-SBR will provide failure monitoring for each SBR mixer as follows:

1) When a mixer H/O/A switch is in the "auto" position and the mixer gets a signal to start, a failure timer in the programmable controller will be started. If this timer times out and the mixer motor starter is not energized, a "SBR Mixer Failure" alarm message shall be displayed on the operator interface located on the SBR Control Panel, and a mixer failure alarm shall be displayed by the HMI software.

6. SBR Mixer Alarms

a. The following alarms for the SBR Mixers shall be displayed on the operator interface located on the SBR Control Panel, and shall be displayed and logged by the HMI software:

1) SBR No. 1 Mixer Failure
2) SBR No. 2 Mixer Failure

K. SBR BLOWERS NO. 1A, NO. 2A AND NO. 3A

1. General Description

   a. Three positive displacement blowers currently supply air to the diffusers in the SBRs. Each blower is located in a weatherproof enclosure that is pad mounted outside near the SBRs. The three blowers will be designated as SBR Blowers No. 1A, No. 2A, and No. 3A.

   b. Each blower has a variable frequency drive (VFD) to vary the blower output. The VFDs are located in an outdoor enclosure pad mounted near the blowers.

2. SBR Blowers No. 1A, No. 2A and No. 3A Motor Controls

   a. The blower VFD enclosure houses the following for each blower:

      1) Main Disconnect Switch
      2) Line Reactors
      3) Variable Frequency Drive
      4) Control Transformer
      5) VFD Run Relay
      6) VFD Run Indication Light
      7) VFD Fault Relay
      8) VFD Fault Alarm Light
      9) VFD Fault Reset Push Button
      10) Elapsed Time Meter
      11) Ventilation Fan
      12) VFD Keypad

   b. The H/O/A switch for each blower will be located on the SBR Control Panel. The “auto” position of each H/O/A switch will be wired to the VFD for selecting automatic speed control.

   c. Each variable frequency drive has a run contact that will close when the drive is energized and outputting a frequency to the blower motor. This contact is wired to a VFD run relay located in the VFD enclosure, and to a run indication light on the enclosure. The run relay has two normally open contacts that will close when the relay is energized. One contact will be wired to the elapsed time meter, and the other contact will be wired to PLC-SBR for run status monitoring by the PLC.

   d. Each variable frequency drive has a normally open VFD fault contact that will be wired to a VFD fault relay located in the VFD enclosure, and to a VFD fault alarm light on the enclosure. The fault relay has a normally open contact that will close when the relay is energized. This contact will be wired to PLC-SBR for VFD fault monitoring by the PLC.

   e. Each variable frequency drive will output a 4-20mA analog speed signal proportional to the drive speed to PLC-SBR. The drive speed shall be displayed on the operator interface located on the SBR Control Panel, and the speed shall be displayed and trended by the HMI software.

   f. A disconnect switch is mounted adjacent to each SBR blower to disconnect power to the blower motor.

3. SBR Blower Controls on SBR Control Panel

   a. The SBR Control Panel will house the following for each SBR blower:

      1) H/O/A Selector Switch
      2) Run Indication Light

3) VFD Fault Alarm Light
4) Blower Start Relay

b. The H/O/A selector switch for each blower has an auxiliary normally open contact that will close when the switch is placed in the "auto" position. This contact will be wired to PLC-SBR for switch position monitoring by the PLC.

4. Programmable Controller PLC-SBR Inputs and Outputs

a. The PLC inputs and outputs for SBR Blowers No. 1A, No. 2A and No.3A will be wired to and from PLC-SBR located in the SBR Control Panel.

b. Digital Inputs (120 VAC):

	Description	Origination Point
1)	SBR Blower No. 1A H/O/A Switch "Auto" Position	H/O/A Switch on SBR Control Panel
2)	SBR Blower No. 1A Running	VFD Run Relay in Blower VFD
3)	SBR Blower No. 1A VFD Fault	VFD Fault Relay in Blower VFD
4)	SBR Blower No. 2A H/O/A Switch "Auto" Position	H/O/A Switch on SBR Control Panel
5)	SBR Blower No. 2A Running	VFD Run Relay in Blower VFD
6)	SBR Blower No. 2A VFD Fault	VFD Fault Relay in Blower VFD
7)	SBR Blower No. 3A H/O/A Switch "Auto" Position	H/O/A Switch on SBR Control Panel
8)	SBR Blower No. 3A Running	VFD Run Relay in Blower VFD
9)	SBR Blower No. 3A VFD Fault	VFD Fault Relay in Blower VFD

c. Digital Outputs (Relay, 120 VAC):

	Description	Destination Point
1)	SBR Blower No. 1A Start/Stop	Blower Start Relay in SBR Control Panel

2)	SBR Blower No. 2A Start/Stop	Blower Start Relay in SBR Control Panel
3)	SBR Blower No. 3A Start/Stop	Blower Start Relay in SBR Control Panel

d. Analog Inputs (4-20mA):

	Description	Origination Point
1)	SBR Blower No. 1A Speed	Blower VFD
2)	SBR Blower No. 2A Speed	Blower VFD
3)	SBR Blower No. 3A Speed	Blower VFD

e. Analog Outputs (4-20mA):

	Description	Destination Point
1)	SBR Blower No. 1A Speed Reference Signal	Blower VFD
2)	SBR Blower No. 2A Speed Reference Signal	Blower VFD
3)	SBR Blower No. 3A Speed Reference Signal	Blower VFD

5. Description of Operation

a. The SBR blowers will be controlled by the individual H/O/A selector switches located on the SBR Control Panel. The "hand" and "off" positions of the H/O/A switches provide for manual start/stop control of the blowers. When a blower H/O/A switch is placed in the "hand" position, a blower start relay in the control panel will be energized. A normally open contact on this relay will be wired to the blower VFD control circuit, so that when the relay is energized, this contact will close, and the blower will start. When the H/O/A switch is in the "hand" position, the blower speed may be manually controlled from the VFD keypad.

b. When the blower H/O/A switch is in the "auto" position, the blower will be automatically controlled by PLC-SBR as follows:

1) When a SBR react fill phase begins, PLC-SBR will energize the blower start relay for the SBR blower, which will start the blower. The blower shall continue to run during the react fill and react phases of the SBR sequence. When the SBR enters the settle phase, PLC-SBR will de-energize the blower start relay and the blower will shut down. The blower shall remain off during the settle phase and decant phase.

2) When the SBR blower is started, it will be controlled based on an alternating timed sequence. When a SBR blower is started, it will run for a preset period of time, shut down, and then restart again.

3) The speed of the SBR blower will be controlled as follows:

a) A D.O. controller shall be programmed in PLC-SBR to control the D.O. of the mixed liquor in the basin.

b) The plant operator will enter the desired D.O. to be maintained in the basin on the operator interface located on the SBR Control Panel, or via the HMI software.

c) The D.O. controller will compare the actual D.O. in the basin, as measured by the D.O. probe, to the D.O. setpoint, and will output a 4-20mA speed reference signal to the blower VFD to increase or decrease the speed of the blower as required to maintain the D.O. setpoint.

4) The speed of each blower (0-60 Hz) shall be capable of being manually set by the plant operator via the operator interface, or via the HMI software. PLC-SBR shall output a 4-20mA speed reference signal to the blower VFD, equivalent to the value entered.

c. PLC-SBR will provide failure monitoring for each SBR blower as follows:

1) When a blower H/O/A switch is in the "auto" position and the blower gets a signal to start, a failure timer in the programmable controller will be started. If this timer times out, and the blower VFD is not running, an "SBR Blower Failure" alarm message shall be displayed on the operator interface located on the SBR Control Panel, and a blower failure alarm shall be displayed by the HMI software.

d. PLC-SBR will provide VFD fault monitoring for each SBR blower as follows:

1) If a drive fault occurs, the drive will shut down and the blower VFD fault relay will be energized. When this occurs, an "SBR Blower VFD Fault" alarm message shall be displayed on the operator interface, and a blower VFD fault alarm shall be displayed by the HMI software.

e. Each blower motor is furnished with normally closed thermal switches in the motor windings to detect a high motor temperature. The thermal switches are wired to the blower VFD. If the blower is running and a high motor temperature occurs, one or more thermal switches will open, and a blower VFD fault alarm will be initiated.

6. SBR Blowers No. 1A, No. 2A, and No. 3A Alarms

a. The following alarms for SBR Blowers No. 1A, No. 2A, and No. 3A shall be displayed on the operator interface located on the SBR Control Panel, and shall be displayed and logged by the HMI software:

1) SBR Blower No. 1A Failure
2) SBR Blower No. 1A VFD Fault
3) SBR Blower No. 2A Failure
4) SBR Blower No. 2A VFD Fault
5) SBR Blower No. 3A Failure
6) SBR Blower No. 3A VFD Fault

L. SBR BLOWERS NO. 1B, NO. 2B AND NO. 3B

1. General Description

   a. Three new positive displacement blowers will be provided under the ENR Upgrade and Expansion project to provide additional air for the SBRs. Each blower will be furnished in a weatherproof enclosure which will be pad mounted outside near the SBRs. The three blowers will be designated as SBR Blowers No. 1B, No. 2B, and No. 3B.

   b. A free-standing variable frequency drive (VFD) will be provided for each blower to vary the blower output. The VFDs will be located in the Control Building Electrical Room.

2. SBR Blowers No. 1B, No. 2B and No. 3B Motor Controls

   a. Each blower VFD enclosure will house the following:

      1) Main Disconnect Switch
      2) Line Reactors
      3) Variable Frequency Drive
      4) Control Transformer
      5) VFD Run Relay
      6) VFD Run Indication Light
      7) VFD Fault Relay
      8) VFD Fault Alarm Light
      9) VFD Fault Reset Push Button
      10) Elapsed Time Meter
      11) Ventilation Fan
      12) VFD Keypad

   b. The H/O/A switch for each blower will be located on the SBR Control Panel. The “auto” position of each H/O/A switch will be wired to the VFD for selecting automatic speed control.

   c. Each variable frequency drive will have a run contact that will close when the drive is energized and outputting a frequency to the blower motor. This contact will be wired to a VFD run relay located in the VFD enclosure, and to a run indication light on the enclosure. The run relay will have three normally open contacts that will close when the relay is energized. One contact will be wired to the ventilation fan, one contact will be wired to the elapsed time meter, and the third contact will be wired to PLC-SBR for run status monitoring by the PLC.

   d. Each variable frequency drive will have a normally open VFD fault contact that will be wired to a VFD fault relay located in the VFD enclosure, and to a VFD fault alarm light on the enclosure. The fault relay will have a normally open contact that will close when the relay is energized. This contact will be wired to PLC-SBR for VFD fault monitoring by the PLC.

   e. Each variable frequency drive will output a 4-20mA analog speed signal proportional to the drive speed to PLC-SBR. The drive speed shall be displayed on the operator interface located on the SBR Control Panel, and the speed shall be displayed and trended by the HMI software.

   f. A disconnect switch will be mounted adjacent to each SBR blower to disconnect power to the blower motor.

3. SBR Blower Controls on SBR Control Panel

   a. The SBR Control Panel will house the following for each SBR blower:

      1) H/O/A Selector Switch
      2) Run Indication Light
      3) VFD Fault Alarm Light
      4) Blower Start Relay

   b. The H/O/A selector switch for each blower will have an auxiliary normally open contact that will close when the switch is placed in the "auto" position. This contact will be wired to PLC-SBR for switch position monitoring by the PLC.

4. Programmable Controller PLC-SBR Inputs and Outputs

   a. The PLC inputs and outputs for SBR Blowers No. 1B, No. 2B and No. 3B will be wired to and from PLC-SBR located in the SBR Control Panel.

   b. Digital Inputs (120 VAC):

	Description	Origination Point
1)	SBR Blower No. 1B H/O/A Switch “Auto” Position	H/O/A Switch on SBR Control Panel
2)	SBR Blower No. 1B Running	VFD Run Relay in Blower VFD
3)	SBR Blower No. 1B VFD Fault	VFD Fault Relay in Blower VFD
4)	SBR Blower No. 2B H/O/A Switch “Auto” Position	H/O/A Switch on SBR Control Panel
5)	SBR Blower No. 2B Running	VFD Run Relay in Blower VFD
6)	SBR Blower No. 2B VFD Fault	VFD Fault Relay in Blower VFD
7)	SBR Blower No. 3B H/O/A Switch “Auto” Position	H/O/A Switch on SBR Control Panel
8)	SBR Blower No. 3B Running	VFD Run Relay in Blower VFD
9)	SBR Blower No. 3B VFD Fault	VFD Fault Relay in Blower VFD

c. Digital Outputs (Relay, 120 VAC):

	Description	Destination Point
1)	SBR Blower No. 1B Start/Stop	Blower Start Relay in SBR Control Panel
2)	SBR Blower No. 2B Start/Stop	Blower Start Relay in SBR Control Panel
3)	SBR Blower No. 3B Start/Stop	Blower Start Relay in SBR Control Panel

d. Analog Inputs (4-20mA):

	Description	Origination Point
1)	SBR Blower No. 1B Speed	Blower VFD
2)	SBR Blower No. 2B Speed	Blower VFD
3)	SBR Blower No. 3B Speed	Blower VFD

e. Analog Outputs (4-20mA):

	Description	Destination Point
1)	SBR Blower No. 1B Speed Reference Signal	Blower VFD
2)	SBR Blower No. 2B Speed Reference Signal	Blower VFD
3)	SBR Blower No. 3B Speed Reference Signal	Blower VFD

5. Description of Operation

a. The SBR blowers will be controlled by the individual H/O/A selector switches located on the SBR Control Panel. The "hand" and "off" positions of the H/O/A switches provide for manual start/stop control of the blowers. When a blower H/O/A switch is placed in the "hand" position, a blower start relay in the control panel will be energized. A normally open contact on this relay will be wired to the blower VFD control circuit, so that when the relay is energized, this contact will close, and the blower will start. When the H/O/A switch is in the "hand" position, the blower speed may be manually controlled from the VFD keypad.

b. When the blower H/O/A switch is in the "auto" position, the blower will be automatically controlled by PLC-SBR as follows:

1) When a SBR react fill phase begins, PLC-SBR will energize the blower start relay for the SBR blower, which will start the blower. The blower shall continue to run during the react fill and react phases of the SBR sequence. When the SBR enters the settle phase, PLC-SBR will de-

energize the blower start relay and the blower will shut down. The blower shall remain off during the settle phase and decant phase.

2) When the SBR blower is started, it will be controlled based on an alternating timed sequence. When a SBR blower is started, it will run for a preset period of time, shut down, and then restart again.

3) The speed of the SBR blower will be controlled as follows:

a) A D.O. controller shall be programmed in PLC-SBR to control the D.O. of the mixed liquor in the basin.

b) The plant operator will enter the desired D.O. to be maintained in the basin on the operator interface located on the SBR Control Panel, or via the HMI software.

c) The D.O. controller will compare the actual D.O. in the basin, as measured by the D.O. transmitter, to the D.O. setpoint, and will output a 4-20mA speed reference signal to the blower VFD to increase or decrease the speed of the blower as required to maintain the D.O. setpoint.

4) The speed of each blower (0-60 Hz) shall be capable of being manually set by the plant operator via the operator interface, or via the HMI software. PLC-SBR shall output a 4-20mA speed reference signal to the blower VFD, equivalent to the value entered.

c. PLC-SBR will provide failure monitoring for each SBR blower as follows:

1) When a blower H/O/A switch is in the "auto" position and the blower gets a signal to start, a failure timer in the programmable controller will be started. If this timer times out, and the blower VFD is not running, an "SBR Blower Failure" alarm message shall be displayed on the operator interface located on the SBR Control Panel, and a blower failure alarm shall be displayed by the HMI software.

d. PLC-SBR will provide VFD fault monitoring for each SBR blower as follows:

1) If a drive fault occurs, the drive will shut down and the blower VFD fault relay will be energized. When this occurs, an "SBR Blower VFD Fault" alarm message shall be displayed on the operator interface, and a blower VFD fault alarm shall be displayed by the HMI software.

e. Each blower motor will be furnished with normally closed thermal switches in the motor windings to detect a high motor temperature. The thermal switches will be wired to the blower VFD. If the blower is running and a high motor temperature occurs, one or more thermal switches will open, and a blower VFD fault alarm will be initiated.

6. SBR Blowers No. 1B, No. 2B, and No. 3B Alarms

a. The following alarms for SBR Blowers No. 1B, No. 2B, and No. 3B shall be displayed on the operator interface located on the SBR Control Panel, and shall be displayed and logged by the HMI software:

1) SBR Blower No. 1B Failure
2) SBR Blower No. 1B VFD Fault
3) SBR Blower No. 2B Failure
4) SBR Blower No. 2B VFD Fault
5) SBR Blower No. 3B Failure

6) SBR Blower No. 3B VFD Fault

M. POST EQ PUMPS

1. General Description

   a. The SBR effluent flow that is decanted from each SBR will be piped to the Post EQ Tank, which is located below the Operations Building.

   b. The two existing post EQ pumps, located in the Post EQ Tank, will be replaced with two new rail-mounted submersible post EQ pumps. The post EQ pumps will pump the SBR effluent through the disk filters to the UV disinfection system. The pumps will operate in the lead/lag mode and will be designated as Post EQ Pumps No. 1 and No. 2.

   c. The variable frequency drives for the existing post EQ pumps, located in MCC-OP, will be replaced with new VFDs, which will be provided for the new post EQ pumps. A variable frequency drive (VFD) will be provided for each new post EQ pump to vary the pump discharge rate.

   d. The existing level transmitter for the post EQ tank will be replaced with a radar level transmitter, which will be mounted on the top of the tank. The radar level transmitter will output a 4-20mA level signal to PLC-OP. The post EQ tank level shall be displayed on the operator interface located on the Operations Building PLC Panel, and the level shall be displayed and trended by the HMI software.

   e. The existing magnetic flow meter on the post EQ pump discharge line will be replaced with a new magnetic flow meter to meter the post EQ pump discharge flow. The magnetic flow meter will output a voltage signal proportional to the flow rate to a flow transmitter backboard mounted above the valve vault. The flow transmitter will convert the voltage signal to a 4-20mA analog signal proportional to the flow rate and will output this signal to PLC-OP. The post EQ pump discharge flow shall be displayed on the operator interface located on the operations Building PLC Panel, and the HMI software shall display, trend, and totalize the pump discharge flow.

2. Post EQ Pump Motor Controls

   a. A new VFD will be installed in existing Motor Control Center-OP, located in the Operations Building Electrical Room, for each post EQ Pump. Each VFD bucket will house the following:

      1) Motor Circuit Breaker
      2) Line Reactors (mounted above MCC)
      3) Variable Frequency Drive
      4) Control Transformer
      5) H/O/A Selector Switch
      6) VFD Run Relay
      7) VFD Run Indication Light
      8) VFD Fault Relay
      9) VFD Fault Alarm Light
      10) VFD Fault Reset Push Button
      11) Motor Overtemp Alarm Relay
      12) Motor Overtemp Alarm Light
      13) Seal Failure Relay
      14) Seal Failure Alarm Relay
      15) Seal Failure Alarm Light
      16) Elapsed Time Meter
      17) Ventilation Fan
      18) VFD Keypad

b. Each pump H/O/A selector switch will have an auxiliary normally open contact that will close when the switch is placed in the "auto" position. This contact will be wired to PLC-OP for switch position monitoring by the PLC.

c. The “auto” position of each H/O/A switch will be wired to the VFD for selecting automatic speed control.

d. Each variable frequency drive will have a run contact that will close when the drive is energized and outputting a frequency to the pump motor. This contact will be wired to a VFD run relay located in MCC-OP, and to a run indication light located on the MCC. The run relay will have three normally open contacts that will close when the relay is energized. One contact will be wired to the ventilation fan in the MCC, one contact will be wired to the elapsed time meter on the MCC, and the third contact will be wired to PLC-OP for run status monitoring by the PLC.

e. Each variable frequency drive will have a VFD fault contact that will close when a drive fault occurs. This contact will be wired to a VFD fault relay in the MCC and to a VFD fault alarm light on the MCC. The VFD fault relay will have a normally open contact that will close when the relay is energized. This contact will be wired to PLC-OP for VFD fault alarm monitoring by the PLC.

f. Each variable frequency drive will output a 4-20mA speed signal proportional to the drive speed to PLC-OP. The drive speed shall be displayed on the operator interface located on the Operations Building PLC Panel and the speed shall be displayed and trended by the HMI software.

g. A disconnect switch will be backboard mounted adjacent to each post EQ pump to disconnect power to the pump motor.

3. Programmable Controller PLC-OP Inputs and Outputs

a. The PLC inputs and outputs for the Post EQ Pumps will be wired to and from PLC-OP located in the Operations Building PLC Panel.

b. Digital Inputs (24vdc):

	Description	Origination Point
1)	Post EQ Pump No. 1 H/O/A Switch "Auto" Position	H/O/A Switch on MCC-OP
2)	Post EQ Pump No. 1 Running	VFD Run Relay in MCC-OP
3)	Post EQ Pump No. 1 VFD Fault	VFD Fault Relay in MCC-OP
4)	Post EQ Pump No. 1 Motor Overtemp	Motor Overtemp Alarm Relay in MCC-OP
5)	Influent EQ Pump No. 1 Seal Failure	Seal Failure Alarm Relay in MCC-OP
6)	Post EQ Pump No. 1 H/O/A Switch "Auto" Position	H/O/A Switch on MCC-OP

7)	Post EQ Pump No. 2 Running	VFD Run Relay in MCC-OP
8)	Post EQ Pump No. 2 VFD Fault	VFD Fault Relay in MCC-OP
9)	Post EQ Pump No. 2 Motor Overtemp	Motor Overtemp Alarm Relay in MCC-OP
10)	Post EQ Pump No. 2 Seal Failure	Seal Failure Alarm Relay in MCC-OP

c. Digital Outputs (24vdc, Relay Output):

	Description	Destination Point
1)	Post EQ Pump No. 1 Start/Stop	Pump Start Relay in Operations Building PLC Panel
2)	Post EQ Pump No. 2 Start/Stop	Pump Start Relay in Operations Building PLC Panel

d. Analog Inputs (4-20mA):

	Description	Origination Point
1)	Post EQ Tank Level	Post EQ Tank Radar Level Transmitter
2)	Post EQ Pump No. 1 Speed	Pump VFD in MCC-OP
3)	Post EQ Pump No. 2 Speed	Pump VFD in MCC-OP
4)	Post EQ Pump Discharge Flow	Post EQ Pump Flow Meter Transmitter

e. Analog Outputs (4-20mA):

	Description	Destination Point
1)	Post EQ Pump No. 1 Speed Reference Signal	Pump VFD in MCC-OP
2)	Post EQ Pump No. 2 Speed Reference Signal	Pump VFD in MCC-OP

4. Description of Operation

a. The post EQ pumps will be controlled by the individual H/O/A selector switches located on MCC-OP. The "hand" and "off" positions of the H/O/A selector switches provide for manual start/stop control of the pumps. When a pump H/O/A switch is in the "hand" position, the pump speed will be manually controlled from the VFD keypad. When the pump H/O/A switches are in the "auto" position, the post EQ pumps will be automatically controlled by PLC-OP as follows:

1) A graphic display shall be programmed in the operator interface located on the Influent Pump Control Panel, and in the HMI software, for the post EQ pumps. An auto/manual selector switch shall be configured in the display for each pump to select either manual or automatic control of the pump. In the “manual” mode, the plant operator may manually start and stop the pump and control the pump speed from the operator interface or the HMI software. The desired pump speed (0-60 Hz) will be entered on the graphic display, and PLC-OP will output a 4-20mA analog speed reference signal, equivalent to the value entered, to the pump VFD. When the auto/manual switch is in the “auto” position, the pump will be automatically controlled by PLC-OP as follows:

   a) Level setpoints will be programmed in PLC-OP for the following post EQ tank levels:

      1) Post EQ Tank Low Level
      2) Lead Pump Stop
      3) Lag Pump Stop
      4) Post EQ Tank Level Setpoint
      5) Lead Pump Start
      6) Lag Pump Start
      7) Post EQ Tank High Level

   b) The level setpoints shall be adjustable via the operator interface located on the Operations Building PLC Panel, or via the HMI software.

   c) The operator interface and the HMI software shall be programmed to allow the operator to select the lead and lag post EQ pumps, or to select automatic alternation of the pumps. When automatic alternation is selected, PLC-OP will alternate the lead/lag status of the post EQ pumps after each pumping cycle.

   d) A PID level controller will be configured in the PLC to control the effluent level in the post EQ tank. The level controller will vary the speed of the post EQ pumps as required to match the pump discharge flow rate to the EQ tank influent flow rate. The desired level to be maintained in the EQ tank will be programmed in PLC-OP as the setpoint for the level controller. The level controller will compare the actual EQ tank level measured by the EQ tank level transmitter to the setpoint level and will output a speed reference signal to the pump VFDs to increase or decrease the speed of the pumps as required to maintain the setpoint level.

   e) When the effluent level in the EQ tank rises to the elevation of the "lead pump start" level setpoint, PLC-OP will start the lead post EQ pump. When the lead pump is started, it will run with its speed being varied by the PLC to maintain the setpoint level in the EQ tank. As long as the flow rate into the EQ tank is sufficient to maintain the effluent level in the tank above the lead pump stop level, the lead pump will run continuously with its speed varied to match the pump discharge rate to the tank influent flow rate as the influent flow rate varies from the minimum pumping rate to the maximum capacity of the lead pump. When the level in the EQ tank is drawn down to the "lead pump stop" level setpoint, PLC-OP will shut down the lead pump.

   f) If the lead post EQ pump is not able keep up with the influent flow to the EQ tank, the effluent level in the tank will rise to the " lag pump start" level setpoint. When this level is reached, a start delay timer in the PLC will be started. When this timer times out, PLC-OP will start the lag pump and will output equivalent speed reference signals to both

the lead and lag pumps so that both pumps match speeds. As long as the effluent level is above the lag pump stop level setpoint, both pumps will run continuously with the speed of the lead and lag pumps being varied by PLC-OP as required to match the combined pump discharge rates to the tank influent flow rate. When the level in the EQ tank is pumped down to the "lag pump stop" level setpoint, PLC-OP will shut down the lag pump.

b. If the effluent level in the post EQ tank is drawn down to the "tank low level" setpoint, a timer in the PLC will be started. If this timer times out and the low level condition still exists, PLC-OP will shut down the post EQ pumps. When this occurs, a "Post EQ Tank Low Level" alarm message shall be displayed on the operator interface located on the Operations Building PLC Panel, and a tank low level alarm shall be displayed by the HMI software.

c. If the effluent level in the post EQ tank rises to the elevation of the "tank high level" setpoint, a timer in the PLC will be started. If this timer times out and the high level condition still exists, a "Post EQ Tank High Level" alarm message shall be displayed on the operator interface, and a high level alarm shall be displayed by the HMI software.

d. PLC-OP will provide failure monitoring for each post EQ pump as follows:

1) When a pump H/O/A switch is in the "auto" position and the pump gets a signal to start, a failure timer in the PLC will be started. If this timer times out and the pump VFD is not running, a “Post EQ Pump Failure" alarm message shall be displayed on the operator interface, and a pump failure alarm shall be displayed by the HMI software.

e. PLC-OP will provide VFD fault monitoring for each post EQ pump as follows:

1) If a drive fault occurs, the drive will shut down and the pump VFD fault relay will be energized. When this occurs, a “Post EQ Pump VFD Fault" alarm message shall be displayed on the operator interface, and a pump VFD fault alarm shall be displayed by the HMI software.

2) The VFD fault alarm will be reset by pushing the reset push button on the MCC.

f. Each post EQ pump motor will be furnished with a normally closed thermal switch in the motor windings to detect a high motor temperature, and a seal leak sensor in the pump casing to detect a leakage of water into the oil chamber. The thermal switch and the seal leak sensor will be wired in series to a pump supervision relay located in the pump relay panel. This relay will sense the current in the loop. A low current will indicate a high temperature condition in the motor, and a high current will indicate a seal failure. PLC-OP will provide alarm monitoring for each pump as follows:

1) The high temperature circuit has a normally open contact that is wired to a motor overtemp relay located in the pump relay panel. This contact changes state when the relay is powered and the temperature is normal.

2) The motor overtemp relay has a normally open contact that is wired in series with the pump start/stop control circuit, and a normally closed contact that will be wired to PLC-OX. When a high motor temperature occurs, the motor overtemp relay will be de-energized and the pump will shut down. When this occurs, a “Post EQ Pump Motor Overtemp” alarm message shall be displayed on the operator interface, and a pump motor overtemp alarm shall be displayed by the HMI software.

3) If a high current is sensed by the relay, a seal leak contact in the relay will close. This contact will be wired to a seal failure relay in the relay panel. The seal failure relay has a normally

closed contact wired in series with the pump start/stop circuit, and a normally open contact that will be wired to PLC-OP. When a seal leak occurs, the seal failure relay will be energized and the pump will shut down. When this occurs, a "Post EQ Pump Seal Failure" alarm message shall be displayed by the operator interface, and a pump seal failure alarm shall be displayed by the HMI software.

g. If a post EQ pump experiences a failure, VFD fault, motor overtemp, or seal failure alarm, PLC-OP will index the lead/lag assignments of the pumps.

h. PLC-OP will continuously monitor the analog signal received from the post EQ tank radar level transmitter. The PLC will provide failure monitoring for the level transmitter as follows:

1) If an error is detected with the level transmitter signal (below 4 mA or above 20 mA), a timer in the PLC shall be started. If this timer times out and the transmitter error still exists, an "Post EQ Tank Level Transmitter Out of Range" alarm message shall be displayed on the operator interface, and a tank level transmitter out of range alarm shall be displayed by the HMI software.

5. Post EQ Pump Alarms

a. The following alarms for the Post EQ Pumps shall be displayed on the operator interface located on the Operations Building PLC Panel, and shall be displayed and logged by the HMI software:

1) Post EQ Pump No. 1 Failure
2) Post EQ Pump No. 1 VFD Fault
3) Post EQ Pump No. 1 Motor Overtemp
4) Post EQ Pump No. 1 Seal Failure
5) Post EQ Pump No. 2 Failure
6) Post EQ Pump No. 2 VFD Fault
7) Post EQ Pump No. 2 Motor Overtemp
8) Post EQ Pump No. 2 Seal Failure
9) Post EQ Tank Low Level
10) Post EQ Tank High Level
11) Post EQ Tank Level Transmitter Out of Range

N. DISK FILTERS

1. General Description

   a. The two existing disk filters located in the Operations Building will filter the effluent flow pumped by the new post eq pumps prior to UV disinfection.

   b. The existing control panel for the disk filters will be replaced with a new control panel, which will be wall mounted in the Operations Building.

2. Disk Filter Control Panel

   a. The new Disk Filter Control Panel will house the following components:

      1) Main Circuit Breaker
      2) Allen-Bradley CompactLogix PLC (PLC-D)
      3) 12" Operator Interface Terminal
      4) Selector Switches, Push Buttons and Pilot Lights
      5) Relays

3. Programmable Controller PLC-OP Inputs

   a. The PLC inputs for the Disk Filters will be wired to PLC-OP located in the Operations Building PLC Panel.

   b. Digital Inputs (24vdc):

	Description	Origination Point
1)	Disk Filter No. 1 Backwash Pump Motor High Temp	High Temp Relay in Disk Filter Control Panel
2)	Disk Filter No. 1 Washwater Pump Motor High Temp	High Temp Relay in Disk Filter Control Panel
3)	Disk Filter No. 1 High Level	High Level Relay in Disk Filter Control Panel
4)	Disk Filter No. 2 Backwash Pump Motor High Temp	High Temp Relay in Disk Filter Control Panel
5)	Disk Filter No. 2 Washwater Pump Motor High Temp	High Temp Relay in Disk Filter Control Panel
6)	Disk Filter No. 2 High Level	High Level Relay in Disk Filter Control Panel

4. Disk Filter Alarms

   a. The following alarms for the Disk Filters shall be displayed on the operator interface located on the Operations Building PLC Panel, and shall be displayed and logged by the HMI software:

1) Disk Filter No. 1 Backwash Pump Motor High Temp
2) Disk Filter No. 1 Washwater Pump Motor High Temp
3) Disk Filter No. 1 High Level
4) Disk Filter No. 2 Backwash Pump Motor High Temp
5) Disk Filter No. 2 Washwater Pump Motor High Temp
6) Disk Filter No. 2 High Level

O. ULTRAVIOLET DISINFECTION SYSTEM

1. General Description

   a. Ultraviolet light will be utilized to disinfect the plant effluent prior to discharging it to the creek. A new ultraviolet (UV) light disinfection system will be furnished under the ENR Upgrade and Expansion to replace the existing UV System. The new UV System will be furnished as a complete system by the UV system manufacturer and will consist of UV modules, UV power distribution centers, a UV system control center, and a UV hydraulic system center. The UV System will be a UV3000 Plus system, manufactured by Trojan Technologies.

   b. The UV system will be installed in the existing UV channels. The system will contain two banks of UV lamps which are each powered from a UV power distribution center. Each UV bank will consist of four UV modules, with each module containing 8 UV lamps. The UV system will be capable of disinfecting a peak flow of 6.26 MGD.

   c. An automatic in place mechanical/chemical cleaning system with individual wiper mechanisms will be provided with the UV system to automatically clean the UV lamps.

   d. A submersible UV intensity sensor will be provided in each UV bank to monitor the UV intensity of the lamps.

2. UV System Control Center

   a. A UV system control center will be wall mounted in the Operations Building Electrical Room to monitor and control the operation of the UV disinfection system. The system control center will house the following:

      1) Main Circuit Breaker
      2) Allen-Bradley CompactLogix PLC (PLC-UV)
      3) Operator Interface Terminal
      4) Ethernet Switch
      5) UV System Controls
      6) Control Relays

3. Programmable Controller PLC-OP Inputs and Outputs

   a. The PLC inputs and outputs for the UV Disinfection System will be wired to PLC-OP located in the Operations Building PLC Panel.

   b. Digital Inputs (24vdc):

	Description	Origination Point
1)	UV Bank No. 1A On	UV System Control Center
2)	UV Bank No. 1A Low Intensity	UV System Control Center
3)	UV Bank No. 1B On	UV System Control Center
4)	UV Bank No. 1B Low Intensity	UV System Control Center

5)	UV System Minor Alarm	UV System Control Center
6)	UV System Major Alarm	UV System Control Center
7)	UV System PLC Failure	UV System Control Center

c. Analog Outputs (4-20mA):

	Description	Destination Point
1)	UV System Flow Pacing Signal	UV System Control Center

4. Description of Operation

a. PLC-OP will output a 4-20mA signal, proportional to the post Eq pump discharge flow, to the UV System Control Center for flow pacing of the UV Banks.

b. The UV System Control Center will monitor the on status of each UV bank. A "UV Bank On" relay will be provided in the UV System Control Center for each UV bank. A normally open contact on the relay will be wired to PLC-OP for UV Bank on status monitoring by the PLC.

c. The UV System Control Center will monitor the UV intensity for each UV bank. A "low UV intensity" alarm relay will be provided in the UV System Control Center for each UV bank. A normally open contact on the relay will be wired to PLC-OP. If a low UV intensity occurs, the relay will be energized, and a UV bank low UV intensity alarm shall be displayed by the HMI software.

d. The UV System Control Center will monitor the operation of the UV system. The UV system alarms will be grouped into common minor and major alarms for alarm indication as follows:

1) A minor alarm will indicate that maintenance is required to the UV system. A "minor alarm" relay will be provided in the UV System Control Center for each UV bank. A normally open contact on the relay will be wired to PLC-OP. If a minor alarm occurs, the relay will be energized and a “UV System Minor Alarm” message shall be displayed on the operator interface located on the UV System Control Center, and UV system minor alarm shall be displayed by the HMI software.

2) A major alarm will indicate a critical alarm condition that may jeopardize the performance of the UV disinfection system. A "major alarm" relay will be provided in the UV System Control Center for each UV bank. A normally open contact on the relay will be wired to PLC-OP. If a major alarm occurs, the relay will be energized and a “UV System Major Alarm” message shall be displayed on the operator interface, and UV system major alarm shall be displayed by the HMI software.

e. The PLC in the UV System Control Center will energize a PLC monitoring relay in the panel continuously. A normally open contact on this relay will be wired to PLC-OP for monitoring of the UV System PLC. If the UV System PLC fails, the monitoring relay will be de-energized, and a “UV System PLC Failure” alarm message shall be displayed on the operator interface on the Operations Building PLC Panel, and a UV System PLC failure alarm shall be displayed by the HMI software.

5. Ultraviolet Disinfection System Alarms

   a. The following alarms for the UV Disinfection System shall be displayed on the operator interface located on the UV System Control Center, and shall be displayed and logged by the HMI software:

      1) UV Bank No. 1A Low UV Intensity
      2) UV Bank No. 1B Low UV Intensity
      3) UV System Minor Alarm
      4) UV System Major Alarm

   b. The following alarms for the UV Disinfection System shall be displayed on the operator interface located on the UV System Control Center, and shall be displayed and logged by the HMI software:

      1) UV System PLC Failure

P. UTILTY WATER SYSTEM

1. General Description

   a. A utility water system will be provided for the treatment plant under the ENR Upgrade and Expansion project. The system will consist of a utility water pump station with two submersible pumps, and a valve vault housing a utility water pressure transmitter and flow meter. The utility water system will supply plant effluent for process water where needed throughout the plant.

   b. The utility water pumps will pump plant effluent from the utility water pump station to the plant's utility water pipe network. The two pumps will operate in the lead/lag mode of operation and will be designated as Utility Water Pumps No. 1 and No. 2.

   c. Two float switches will be installed in the pump station to enable the pumps to start when there is sufficient water level in the pump station, and to shut down the pumps if a low level occurs. The float switches will be designated as follows:

      1) Utility Water Pump Station Pump Start Level Float Switch
      2) Utility Water Pump Station Pump Low Level Float Switch

   d. A utility water pressure transmitter will be tapped into the utility water line in the valve vault to continuously monitor the system pressure and provide for automatic start/stop control of the utility water pumps. The pressure transmitter will be a 2-wire instrument which will output a 4-20mA analog signal proportional to the system pressure to PLC-IP located in the Influent Pump Control Panel.

   e. The utility water system pressure shall be displayed on the operator interface located on the Influent Pump Control Panel and the pressure shall be displayed and trended by the HMI software.

   f. A magnetic flow meter will be installed in the common utility water pump discharge line to measure the utility water flow. The flow meter will be located in the utility water valve vault. The magnetic flow meter will output a voltage signal proportional to the flow rate to a flow transmitter backboard mounted at the valve vault. The flow transmitter will convert the voltage signal to a 4-20mA analog signal proportional to the flow rate and will output this signal to PLC-IP.

   g. The utility water flow shall be displayed on the operator interface located on the Influent Panel Control Panel. The HMI software shall display, trend, and totalize the utility water flow.

2. Utility Water Pump Motor Controls

   a. Motor Control Center-CH, located in the Chemical Building Electrical Room, will house the following for each utility water pump:

      1) Motor Circuit Breaker
      2) Motor Starter
      3) Control Transformer
      4) H/O/A Selector Switch
      5) Run Indication Light
      6) Elapsed Time Meter
      7) Pump Monitoring Relay
      8) Motor Overtemp Relay
      9) Motor Overtemp Alarm Light
      10) Seal Failure Relay
      11) Seal Failure Alarm Light

12) Motor Overtemp Reset Push Button

b. Each pump H/O/A selector switch will have an auxiliary normally open contact that will close when the switch is placed in the "auto" position. This contact will be wired to PLC-IP for switch position monitoring by the PLC.

c. Each pump motor starter will have two auxiliary normally open contacts that will close when the motor starter is energized. One contact will be wired to the run indication light and elapsed time meter on MCC-CH, and the other contact will be wired to PLC-IP for run status monitoring by the PLC.

d. A disconnect switch will be provided for each utility water pump to disconnect power to the pump motor. The disconnect switches will be mounted on a backboard at the valve vault.

3. Programmable Controller PLC-IP Inputs and Outputs

a. The programmable controller inputs and outputs for the Utility Water System will be wired to and from PLC-IP located in the Influent Pump Control Panel.

b. Digital Inputs (24vdc):

	Description	Origination Point
1)	Utility Water Pump No. 1 H/O/A Switch "Auto" Position	H/O/A Switch on MCC-CH
2)	Utility Water Pump No. 1 Running	Pump Motor Starter in MCC-CH
3)	Utility Water Pump No. 1 Motor Overtemp	Motor Overtemp Relay in MCC-CH
4)	Utility Water Pump No. 1 Seal Failure	Seal Failure Relay in MCC-CH
5)	Utility Water Pump No. 2 H/O/A Switch "Auto" Position	H/O/A Switch on MCC-CH
6)	Utility Water Pump No. 2 Running	Pump Motor Starter in MCC-CH
7)	Utility Water Pump No. 2 Motor Overtemp	Motor Overtemp Relay in MCC-CH
8)	Utility Water Pump No. 2 Seal Failure	Seal Failure Relay in MCC-CH
9)	Utility Water Pump Station Pump Start Level	Pump Start Level Float Switch in Pump Station
10)	Utility Water Pump Station Low Level	Low Level Float Switch in Pump Station

c. Digital Outputs (24vdc, Relay Output):

	Description	Destination Point
1)	Utility Water Pump No. 1 Start/Stop	Pump Start Relay in Influent Pump Control Panel
2)	Utility Water Pump No. 2 Start/Stop	Pump Start Relay in Influent Pump Control Panel

d. Analog Inputs (4-20mA):

	Description	Origination Point
1)	Utility Water System Pressure	Pressure Transmitter in Utility Water Valve Vault
2)	Utility Water System Flow	Magnetic Flow Meter Transmitter at Utility Water Valve Vault

4. Description of Operation

a. The utility water pumps will be controlled by the individual H/O/A switches located on MCC-CH. The "hand" and "off" positions of each H/O/A switch provide for manual start/stop control of the pump. When the H/O/A switches are in the "auto" position, the utility water pumps will be automatically controlled by PLC-S as follows:

1) A graphic display shall be programmed in the operator interface located on the Influent Pump Control Panel, and in the HMI software, for the utility water pumps. A manual/auto selector switch shall be configured for each utility water pump in the graphic display to select either manual or automatic control of the pump. If manual control is selected, the plant operator will be able to manually start and stop the pump from the graphic display. If automatic control is selected, the utility water pumps will be automatically controlled by the utility water system pressure and PLC-IP as follows:

a) The graphic display shall allow the operator to select the lead and lag utility water pumps, or to select automatic alternation of the pumps. When automatic alternation is selected, PLC-IP will alternate the lead/lag status of the utility water pumps after each pumping cycle.

b) The utility water system pressure will be continuously monitored by PLC-IP. Pressure setpoints will be programmed in the PLC for the following pressures:

1) Utility Water System High Pressure
2) Lead Utility Water Pump Stop
3) Lag Utility Water Pump Stop
4) Lead Utility Water Pump Start
5) Lag Utility Water Pump Start
6) Utility Water System Low Pressure

c) The utility water system pressure setpoints shall be adjustable via the operator interface located on the Influent Pump Control Panel, or via the HMI software.

d) As the utility water in the system is utilized, the water pressure will drop. When the water pressure drops to the "lead pump start" pressure setpoint, a timer in PLC-IP will be started. If this timer times out and the water pressure is still at or below the "lead pump start" setpoint, and the water level in the pump station is above the pump start level float switch, the PLC will start the lead utility water pump. When the lead pump is started, it will run until the system pressure increases to the "lead pump stop" pressure setpoint. When this occurs, a stop delay timer in the PLC will be started. If this timer times out, and the system pressure is still at or above the "lead pump stop" setpoint, PLC-IP will shut down the lead pump.

e) If the system pressure drops to the "lag pump start" pressure setpoint, a timer in PLC-IP will be started. If this timer times out and the water pressure is still at or below the “lag pump start" setpoint, the PLC will start the lag utility water pump. The lag pump will continue to run until the system pressure increases to the "lag pump stop" pressure setpoint. When this setpoint is reached, a timer in the PLC will be started. If this timer times out and the system pressure is still at or above the " lag pump stop" setpoint, PLC-IP will shut down the lag pump.

f) If the water level in the pump station is pumped down to the level of the low level float switch, a timer in PLC-IP will be started. If this time times out and the water level is still at the elevation of the low level float, the PLC will shut down both utility water pumps.

b. If the utility water system pressure drops to the "low pressure" pressure setpoint, a timer in PLC-IP will be started. If this timer times out and the water pressure is still at or below the "low pressure" setpoint, a “Utility Water System Low Pressure” alarm message shall be displayed on the operator interface, and a utility water system low pressure alarm shall be displayed by the HMI software.

c. If the utility water system pressure increases to the "high pressure" pressure setpoint, a timer in PLC-IP will be started. If this timer times out and the water pressure is still at or above the "high pressure" setpoint, the PLC shall shut down the utility water pumps, and a “Utility Water System High Pressure” alarm message shall be displayed on the operator interface, and a utility water system high pressure alarm shall be displayed by the HMI software.

d. PLC-IP will provide failure monitoring for each utility water pump as follows:

1) When a pump H/O/A switch is in the "auto" position and the pump gets a signal to start, a failure timer in the PLC will be started. If this timer times out and the pump is not running, a “Utility Water Pump Failure” alarm shall be displayed on the operator interface, and a pump failure alarm shall be displayed by the HMI software.

e. Each utility water pump motor will be furnished with a normally closed thermal switch in the motor windings to detect a high motor temperature, and a seal leak sensor in the pump casing to detect a leakage of water into the oil chamber. The thermal switch and the seal leak sensor will be wired in series to a pump monitoring relay located in MCC-CH. This relay will sense the current in the loop. A low current will indicate a high temperature condition in the motor, and a high current will indicate a seal failure. PLC-OX will provide alarm monitoring for the pump as follows:

1) The high temperature circuit has a normally open contact that is wired to a motor overtemp relay located in MCC-CH. This contact changes state when the relay is powered, and the temperature is normal.

2) The motor overtemp relay has a normally open contact that is wired in series with the pump

start/stop control circuit, and a normally closed contact that will be wired to PLC-IP. When a high motor temperature occurs, the motor overtemp relay will be de-energized and the pump will shut down. When this occurs, a “Utility Water Pump Motor Overtemp” alarm message shall be displayed on the operator interface, and a utility water pump motor overtemp alarm shall be displayed by the HMI software.

3) If a high current is sensed by the relay, a seal leak contact in the relay will close. This contact will be wired to a seal failure relay in MCC-CH. The seal failure relay has a normally closed contact wired in series with the pump start/stop circuit, and a normally open contact that will be wired to PLC-IP. When a seal leak occurs, the seal failure relay will be energized, and the pump will shut down. When this occurs, a “Utility Water Pump Seal Failure” alarm message shall be displayed by the operator interface, and a utility water pump seal failure alarm shall be displayed by the HMI software.

f. If a utility water pump is taken out of "auto," or experiences a failure, motor overtemp, or seal failure, PLC-IP will lock out this pump and index the pump assignments so that the remaining pump becomes the lead pump.

g. PLC-IP will continuously monitor the analog signal received from the utility water system pressure transmitter. The PLC will provide failure monitoring for the pressure transmitter as follows:

1) If an error is detected with the pressure transmitter signal (below 4 mA or above 20 mA), a timer in the PLC shall be started. If this timer times out and the transmitter error still exists, a “Utility Water System Pressure Transmitter Out of Range” alarm message shall be displayed on the operator interface, and a pressure transmitter out of range alarm shall be displayed by the HMI software.

5. Utility Water System Alarms

a. The following alarms for the Utility Water System shall be displayed on the operator interface located on the Influent Pump Control Panel, and shall be displayed and logged by the HMI software:

1) Utility Water Pump No. 1 Failure
2) Utility Water Pump No. 2 Failure
3) Utility Water System Low Pressure
4) Utility Water System High Pressure
5) Utility Water System Pressure Transmitter Out of Range

Q. ALUM FEED SYSTEM

1. General Description

   a. An alum feed system will be provided for the treatment plant to feed alum to the SBRs for phosphorus removal. The feed system will consist of a fiberglass storage tank and four (4) alum feed pumps. The alum storage tank will be located outside adjacent to the new Chemical Building and the feed pumps will be located inside the building in the Chemical Pump Room.

   b. Each alum pump will be a variable speed peristaltic hose pump, and the pumps will feed to the following locations:

	Feed Pump Designation	Feed Point
1)	Alum Feed Pump No. 1	SBR No. 1
2)	Alum Feed Pump No. 2	SBR No. 2
3)	Alum Feed Pump No. 3	SBR No. 1 or No. 2 (Standby Pump)
4)	Alum Feed Pump No. 4	Post EQ Tank

   c. Each alum feed pump will have an integral local control panel as part of the pump. Each pump may be started and stopped locally at its local control panel, or remotely started from a remote start signal originating from the SBR Control Panel. The speed of the pump can be adjusted manually at the local control panel, or it can be remotely adjusted from the operator interface on the SBR Control Panel, or via the HMI software. Each feed pump will plug into a 120-volt receptacle.

   d. A radar level transmitter will be flange mounted on top of the alum storage tank to continuously monitor the alum level in the tank. The level transmitter will be a 2-wire instrument, which will output a 4-20mA analog signal proportional to the alum level to PLC-IP for tank level monitoring by the PLC.

   e. The chemical level in the alum storage tank shall be displayed on the operator interfaces located on the Influent Pump Control Panel and the SBR Control Panel, and the level shall be displayed and trended by the HMI software.

2. Alum Storage Tank Level Indicator Panel

   a. A level indicator panel will be provided for the alum storage tank to view the level of the tank when the tank is being filled. The control panel will be backboard mounted outside adjacent to the alum storage tank, and will house the following:

      1) Main Circuit Breaker
      2) Storage Tank Digital Meter
      3) High Level Alarm Horn
      4) High Level Alarm Silence Push Button
      5) High Level Alarm Silence Relay

3. Programmable Controller PLC-IP Inputs and Outputs

   a. The programmable controller inputs and outputs for the Alum Feed System will be wired to and from PLC-IP located in the Influent Pump Control Panel.

b. Digital Inputs (24vdc):

	Description	Origination Point
1)	Alum Feed Pump No. 1 in Auto	Feed Pump Control Panel
2)	Alum Feed Pump No. 1 Running	Feed Pump Control Panel
3)	Alum Feed Pump No. 1 Alarm	Feed Pump Control Panel
4)	Alum Feed Pump No. 1 Leak Detected	Feed Pump Control Panel
5)	Alum Feed Pump No. 2 in Auto	Feed Pump Control Panel
6)	Alum Feed Pump No. 2 Running	Feed Pump Control Panel
7)	Alum Feed Pump No. 2 Alarm	Feed Pump Control Panel
8)	Alum Feed Pump No. 2 Leak Detected	Feed Pump Control Panel
9)	Alum Feed Pump No. 3 in Auto	Feed Pump Control Panel
10)	Alum Feed Pump No. 3 Running	Feed Pump Control Panel
11)	Alum Feed Pump No. 3 Alarm	Feed Pump Control Panel
12)	Alum Feed Pump No. 3 Leak Detected	Feed Pump Control Panel

13)	Alum Feed Pump No. 4 in Auto	Feed Pump Control Panel
14)	Alum Feed Pump No. 4 Running	Feed Pump Control Panel
15)	Alum Feed Pump No. 4 Alarm	Feed Pump Control Panel
16)	Alum Feed Pump No. 4 Leak Detected	Feed Pump Control Panel

c. Digital Outputs (24vdc, Relay Output):

	Description	Destination Point
1)	Alum Feed Pump No. 1 Start/Stop	Pump Start Relay in Influent Pump Control Panel
2)	Alum Feed Pump No. 2 Start/Stop	Pump Start Relay in Influent Pump Control Panel
3)	Alum Feed Pump No. 3 Start/Stop	Pump Start Relay in Influent Pump Control Panel
4)	Alum Feed Pump No. 3 Start/Stop	Pump Start Relay in Influent Pump Control Panel

d. Analog Inputs (4-20mA):

	Description	Origination Point
1)	Alum Storage Tank Level	Alum Storage Tank Radar Level Transmitter
2)	Alum Feed Pump No. 1 Speed	Feed Pump Control Panel
3)	Alum Feed Pump No. 2 Speed	Feed Pump Control Panel
4)	Alum Feed Pump No. 3 Speed	Feed Pump Control Panel

5)	Alum Feed Pump No. 4 Speed	Feed Pump Control Panel

e. Analog Outputs (4-20mA):

	Description	Destination Point
1)	Alum Feed Pump No. 1 Pacing Signal	Feed Pump Control Panel
2)	Alum Feed Pump No. 2 Pacing Signal	Feed Pump Control Panel
3)	Alum Feed Pump No. 3 Pacing Signal	Feed Pump Control Panel
4)	Alum Feed Pump No. 3 Pacing Signal	Feed Pump Control Panel

4. Description of Operation

a. The alum feed pumps will be controlled by PLC-SBR in the SBR Control Panel. The inputs and outputs for the alum feed pumps will be wired to and from PLC-IP in the Influent Pump Control Panel. The pump start and stop signals, and speed pacing signals, will be transmitted from PLC-SBR to PLC-IP. The pump run signals, alarms, and speed signals will be transmitted from PLC-IP to PLC-SBR.

b. A graphic display shall be configured in the operator interface located on the Influent Pump Control Panel, and in the HMI software for the Alum Feed System. A graphic display will also be configured in the operator interface on the SBR Control Panel for the alum feed pumps. The graphic displays shall display the run status and speed for each alum feed pump.

c. Alum feed pumps No. 1 and No. 2 will be controlled by the auto/manual switch located on the pump control panel. When the switch is in the "manual" position, the pump may be manually started and stopped from the pump control panel, and the pump speed will be manually controlled from the control panel. When the switch is in the "auto" position, the pump will be automatically controlled by PLC-SBR and PLC-IP as follows:

1) When an SBR enters the React Phase, PLC-SBR shall transmit an alum feed pump start signal to PLC-IP. When PLC-IP receives the start signal, the PLC will energize the corresponding alum feed pump start relay in the Influent Pump Control Panel. A normally open contact on this relay will be wired to the alum feed pump control panel so that when the relay is energized, the pump will start. When the pump start relay is energized, a pump run duration timer in PLC-SBR will be started. When this timer times out, the PLC will de-energize the pump start relay and the pump will shut down.

2) The pump run duration shall be adjustable via the operator interface on the SBR Control Panel, or via the HMI software.

3) The speed of the alum feed pump will be automatically controlled by PLC-SBR as follows:

a) The graphic display shall allow the plant operator to manually set the pump speed via the operator interface on the SBR Control Panel, or via the HMI software. PLC-SBR will transmit a 0-100% speed signal to PLC-IP based on the speed entered. When PLC-IP receives the speed signal, the PLC will output a 4-20mA speed pacing signal to the alum feed pump equivalent to the speed entered.

d. Alum feed pump No. 4 will be controlled by the auto/manual switch located on the pump control panel. When the switch is in the "manual" position, the pump may be manually started and stopped from the pump control panel, and the pump speed will be manually controlled from the control panel. When the switch is in the "auto" position, the pump will be automatically controlled by PLC-SBR and PLC-IP as follows:

1) When an SBR enters the Decant Phase, PLC-SBR shall transmit an alum feed pump start signal to PLC-IP. When PLC-IP receives the start signal, the PLC will energize the alum feed pump No. 3 start relay in the Influent Pump Control Panel. A normally open contact on this relay will be wired to the alum feed pump control panel so that when the relay is energized, the pump will start. When the pump start relay is energized, a pump run duration timer in PLC-SBR will be started. When this timer times out, the PLC will de-energize the pump start relay and the pump will shut down.

2) The pump run duration shall be adjustable via the operator interface on the SBR Control Panel, or via the HMI software.

3) The speed of the alum feed pump will be automatically controlled by PLC-SBR as follows:

a) The graphic display shall allow the plant operator to manually set the pump speed via the operator interface on the SBR Control Panel, or via the HMI software. PLC-SBR will transmit a 0-100% speed signal to PLC-IP based on the speed entered. When PLC-IP receives the speed signal, the PLC will output a 4-20mA speed pacing signal to the alum feed pump equivalent to the speed entered.

e. PLC-IP will provide failure monitoring for each alum feed pump as follows:

1) When the pump auto/manual switch is in the "auto" position and the pump gets a signal to start, a failure timer in the programmable controller will be started. If this timer times out and the pump is not running, an "Alum Feed Pump Failure" alarm message shall be displayed on the operator interface located on the SBR Control Panel, and a pump failure alarm shall be displayed by the HMI software.

f. PLC-IP will provide alarm monitoring for each alum feed pump as follows:

1) Each pump control panel has pump alarm contact that will be wired to PLC-C. If a pump alarm occurs, this contact will close, and a timer in the programmable controller will be started. If this timer times out and the pump is still in alarm, an "Alum Feed Pump Alarm" message shall be displayed on the operator interface located on the SBR Control Panel, and a pump alarm shall be displayed by the HMI software.

g. PLC-IP will provide leak detection monitoring for each alum feed pump as follows:

1) Each pump control panel has a leak detected alarm contact that will be wired to PLC-C. If a pump leak is detected, this contact will close, and a timer in the programmable controller will

be started. If this timer times out and a pump leak is still detected, an "Alum Feed Pump Leak Detected" alarm message shall be displayed on the operator interface located on the SBR Control Panel, and a pump leak detected alarm shall be displayed by the HMI software.

h. PLC-IP will provide level monitoring for the alum storage tank as follows:

1) PLC-IP will continuously monitor the chemical level in the alum storage tank. Level set points shall be programmed in the programmable controller for the following tank levels:

a) Alum Storage Tank Reorder Level
b) Alum Storage Tank Low Level

2) The level setpoints shall be adjustable via the operator interface on the Influent Pump Control Panel, or via the HMI software.

3) If the alum level in the storage tank is drawn down to the "reorder level" setpoint, a timer in PLC-IP shall be started. If this timer times out and the alum level in the tank is still at the reorder level, an "Alum Storage Tank Reorder Level" alarm message shall be displayed on the operator interface located on the SBR Control Panel, and a storage tank reorder level alarm shall be displayed by the HMI software.

4) If the alum level in the storage tank is drawn down to the "low level" setpoint, a timer in PLC-IP shall be started. If this timer times out and the alum level in the tank is still low, an "Alum Storage Tank Low Level" alarm message shall be displayed on the operator interface located on the SBR Control Panel, and a storage tank low level alarm shall be displayed by the HMI software.

i. PLC-IP shall be programmed to compute the quantity of alum fed each day. This computation shall be based on the drop in the tank level over 24 hours, equated to gallons. The computed value shall be displayed on the operator interface and on the HMI software.

5. Alum Feed System Alarms

a. The following alarms for the Alum Feed System shall be displayed on the operator interface located on the SBR Control Panel, and shall be displayed and logged by the HMI software:

1) Alum Feed Pump No. 1 Failure
2) Alum Feed Pump No. 1 Alarm
3) Alum Feed Pump No. 1 Leak Detected
4) Alum Feed Pump No. 2 Failure
5) Alum Feed Pump No. 2 Alarm
6) Alum Feed Pump No. 2 Leak Detected
7) Alum Feed Pump No. 3 Failure
8) Alum Feed Pump No. 3 Alarm
9) Alum Feed Pump No. 3 Leak Detected
10) Alum Feed Pump No. 4 Failure
11) Alum Feed Pump No. 4 Alarm
12) Alum Feed Pump No. 4 Leak Detected
13) Alum Storage Tank Reorder Level
14) Alum Storage Tank Low Level

R. MICRO-C FEED SYSTEM

1. General Description

   a. A Micro-C feed system will be provided for the treatment plant to feed Micro-C to the SBRs to add carbon to the wastewater. The feed system will consist of a fiberglass storage tank and three Micro-C feed pumps. The Micro-C storage tank will be located outside adjacent to the new Chemical Building and the feed pumps will be located inside the building in the Chemical Pump Room.

   b. Each Micro-C pump will be a variable speed peristaltic hose pump, and the pumps will feed to the following locations:

	Feed Pump Designation	Feed Point
1)	Micro-C Feed Pump No. 1	SBR No. 1
2)	Micro-C Feed Pump No. 2	SBR No. 2
3)	Micro-C Feed Pump No. 3	SBR No. 1 or SBR No. 2

   c. Each Micro-C feed pump will have an integral local control panel as part of the pump. Each pump may be started and stopped locally at its local control panel, or remotely started from a remote start signal originating from the SBR Control Panel. The speed of the pump can be adjusted manually at the local control panel, or it can be remotely adjusted from the operator interface on the SBR Control Panel, or via the HMI software. Each feed pump will plug into a 120-volt receptacle.

   d. A radar level transmitter will be flange mounted on top of the Micro-C storage tank to continuously monitor the Micro-C level in the tank. The level transmitter will be a 2-wire instrument, which will output a 4-20mA analog signal proportional to the Micro-C level to PLC-IP for tank level monitoring by the PLC.

   e. The chemical level in the Micro-C storage tank shall be displayed on the operator interfaces located on the Influent Pump Control Panel and the SBR Control Panel, and the level shall be displayed and trended by the HMI software.

2. Micro-C Storage Tank Level Indicator Panel

   a. A level indicator panel will be provided for the Micro-C storage tank to view the level of the tank when the tank is being filled. The control panel will be backboard mounted outside adjacent to the Micro-C storage tank, and will house the following:

      1) Main Circuit Breaker
      2) Storage Tank Digital Meter
      3) High Level Alarm Horn
      4) High Level Alarm Silence Push Button
      5) High Level Alarm Silence Relay

3. Programmable Controller PLC-IP Inputs and Outputs

   a. The programmable controller inputs and outputs for the Micro-C Feed System will be wired to and from PLC-IP located in the Influent Pump Control Panel.

b. Digital Inputs (24vdc):

	Description	Origination Point
1)	Micro-C Feed Pump No. 1 in Auto	Feed Pump Control Panel
2)	Micro-C Feed Pump No. 1 Running	Feed Pump Control Panel
3)	Micro-C Feed Pump No. 1 Alarm	Feed Pump Control Panel
4)	Micro-C Feed Pump No. 1 Leak Detected	Feed Pump Control Panel
5)	Micro-C Feed Pump No. 2 in Auto	Feed Pump Control Panel
6)	Micro-C Feed Pump No. 2 Running	Feed Pump Control Panel
7)	Micro-C Feed Pump No. 2 Alarm	Feed Pump Control Panel
8)	Micro-C Feed Pump No. 2 Leak Detected	Feed Pump Control Panel
9)	Micro-C Feed Pump No. 3 in Auto	Feed Pump Control Panel
10)	Micro-C Feed Pump No. 3 Running	Feed Pump Control Panel
11)	Micro-C Feed Pump No. 3 Alarm	Feed Pump Control Panel
12)	Micro-C Feed Pump No. 3 Leak Detected	Feed Pump Control Panel

c. Digital Outputs (24vdc, Relay Output):

	Description	Destination Point
1)	Micro-C Feed Pump No. 1 Start/Stop	Pump Start Relay in Influent Pump Control Panel
2)	Micro-C Feed Pump No. 2 Start/Stop	Pump Start Relay in Influent Pump Control Panel
3)	Micro-C Feed Pump No. 3 Start/Stop	Pump Start Relay in Influent Pump Control Panel

d. Analog Inputs (4-20mA):

	Description	Origination Point
1)	Micro-C Storage Tank Level	Micro-C Storage Tank Radar Level Transmitter
2)	Micro-C Feed Pump No. 1 Speed	Feed Pump Control Panel
3)	Micro-C Feed Pump No. 2 Speed	Feed Pump Control Panel
4)	Micro-C Feed Pump No. 3 Speed	Feed Pump Control Panel

e. Analog Outputs (4-20mA):

	Description	Destination Point
1)	Micro-C Feed Pump No. 1 Pacing Signal	Feed Pump Control Panel
2)	Micro-C Feed Pump No. 2 Pacing Signal	Feed Pump Control Panel
3)	Micro-C Feed Pump No. 3 Pacing Signal	Feed Pump Control Panel

4. Description of Operation

a. The Micro-C feed pumps will be controlled by PLC-SBR in the SBR Control Panel. The inputs and outputs for the Micro-C feed pumps will be wired to and from PLC-IP in the Influent Pump Control

Panel. The pump start and stop signals, and speed pacing signals, will be transmitted from PLC-SBR to PLC-IP. The pump run signals, alarms, and speed signals will be transmitted from PLC-IP to PLC-SBR.

b. A graphic display shall be configured in the operator interface located on the Influent Pump Control Panel, and in the HMI software for the Micro-C Feed System. A graphic display will also be configured in the operator interface on the SBR Control Panel for the Micro-C feed pumps. The graphic displays shall display the run status and speed for each Micro-C feed pump.

c. The Micro-C feed pumps will be controlled by the auto/manual switch located on the pump control panel. When the switch is in the "manual" position, the pump may be manually started and stopped from the pump control panel, and the pump speed will be manually controlled from the control panel. When the switch is in the "auto" position, the pump will be automatically controlled by PLC-SBR and PLC-IP as follows:

    1) When an SBR enters the React Phase, PLC-SBR shall transmit an Micro-C feed pump start signal to PLC-IP. When PLC-IP receives the start signal, the PLC will energize the corresponding Micro-C feed pump start relay in the Influent Pump Control Panel. A normally open contact on this relay will be wired to the Micro-C feed pump control panel so that when the relay is energized, the pump will start. When the pump start relay is energized, a pump run duration timer in PLC-SBR will be started. When this timer times out, the PLC will de-energize the pump start relay and the pump will shut down.

    2) The pump run duration shall be adjustable via the operator interface on the SBR Control Panel, or via the HMI software.

    3) The speed of the Micro-C feed pump will be automatically controlled by PLC-SBR as follows:

        a) The graphic display shall allow the plant operator to manually set the pump speed via the operator interface on the SBR Control Panel, or via the HMI software. PLC-SBR will transmit a 0-100% speed signal to PLC-IP based on the speed entered. When PLC-IP receives the speed signal, the PLC will output a 4-20mA speed pacing signal to the Micro-C feed pump equivalent to the speed entered.

d. PLC-IP will provide failure monitoring for each Micro-C feed pump as follows:

    1) When the pump auto/manual switch is in the "auto" position and the pump gets a signal to start, a failure timer in the programmable controller will be started. If this timer times out and the pump is not running, a "Micro-C Feed Pump Failure" alarm message shall be displayed on the operator interface located on the SBR Control Panel, and a pump failure alarm shall be displayed by the HMI software.

e. PLC-IP will provide alarm monitoring for each Micro-C feed pump as follows:

    1) Each pump control panel has pump alarm contact that will be wired to PLC-IP. If a pump alarm occurs, this contact will close, and a timer in the programmable controller will be started. If this timer times out and the pump is still in alarm, a "Micro-C Feed Pump Alarm" message shall be displayed on the operator interface located on the SBR Control Panel, and a pump alarm shall be displayed by the HMI software.

f. PLC-IP will provide leak detection monitoring for each Micro-C feed pump as follows:

    1) Each pump control panel has a leak detected alarm contact that will be wired to PLC-IP. If a

pump leak is detected, this contact will close, and a timer in the programmable controller will be started. If this timer times out and a pump leak is still detected, a "Micro-C Feed Pump Leak Detected" alarm message shall be displayed on the operator interface located on the SBR Control Panel, and a pump leak detected alarm shall be displayed by the HMI software.

g. PLC-IP will provide level monitoring for the Micro-C storage tank as follows:

1) PLC-IP will continuously monitor the chemical level in the Micro-C storage tank. Level set points shall be programmed in the programmable controller for the following tank levels:

a) Micro-C Storage Tank Reorder Level
b) Micro-C Storage Tank Low Level

2) The level setpoints shall be adjustable via the operator interface on the Influent Pump Control Panel, or via the HMI software.

3) If the Micro-C level in the storage tank is drawn down to the "reorder level" setpoint, a timer in PLC-IP shall be started. If this timer times out and the level in the tank is still at the reorder level, a "Micro-C Storage Tank Reorder Level" alarm message shall be displayed on the operator interface located on the SBR Control Panel, and a storage tank reorder level alarm shall be displayed by the HMI software.

4) If the Micro-C level in the storage tank is drawn down to the "low level" setpoint, a timer in PLC-IP shall be started. If this timer times out and the level in the tank is still low, a "Micro-C Storage Tank Low Level" alarm message shall be displayed on the operator interface located on the SBR Control Panel, and a storage tank low level alarm shall be displayed by the HMI software.

h. PLC-IP shall be programmed to compute the quantity of Micro-C fed each day. This computation shall be based on the drop in the tank level over 24 hours, equated to gallons. The computed value shall be displayed on the operator interface and on the HMI software.

5. Micro-C Feed System Alarms

a. The following alarms for the Micro-C Feed System shall be displayed on the operator interface located on the SBR Control Panel, and shall be displayed and logged by the HMI software:

1) Micro-C Feed Pump No. 1 Failure
2) Micro-C Feed Pump No. 1 Alarm
3) Micro-C Feed Pump No. 1 Leak Detected
4) Micro-C Feed Pump No. 2 Failure
5) Micro-C Feed Pump No. 2 Alarm
6) Micro-C Feed Pump No. 2 Leak Detected
7) Micro-C Feed Pump No. 3 Failure
8) Micro-C Feed Pump No. 3 Alarm
9) Micro-C Feed Pump No. 3 Leak Detected
10) Micro-C Storage Tank Reorder Level
11) Micro-C Storage Tank Low Level

S. ROTARY DRUM THICKENER

1. General Description

   a. The existing rotary drum thickener located in the Operations Building will be utilized to thicken the waste activated sludge. The rotary thickener has a conditioning tank and a dewatering drum.

   b. Sludge will be pumped from the Waste Biosolids Holding Tank to the drum thickener by the existing thickener feed pump, which is a submersible pump rail-mounted in the tank. Polymer will be added to the sludge feed line to flocculate the sludge in the conditioning tank. The flocculated sludge will be discharged to the dewatering drum which will rotate to remove the free water in the sludge. The thickened sludge will be discharged to the Thickened Biosolids Tank.

   c. The rotary thickener has a spray wash system utilizing plant effluent to clean the drum. A submersible spray wash pump is installed in the post eq tank to pump spray wash water to the thickener.

   d. A pressure switch is installed on the thickener spray wash line to monitor a low spray wash pressure condition. The pressure switch will be wired to PLC-OP.

2. Rotary Thickener Conditioning Tank, Dewatering Drum, and Spray Wash Pump Motor Controls

   a. Existing MCC-OP, located in the Operations Building Electrical Room, houses the following for the rotary thickener conditioning tank, dewatering drum, and spray wash pump:

      1) Motor Circuit Breaker
      2) Motor Starter
      3) Control Transformer
      4) Elapsed Time Meter

   b. Each motor starter has two auxiliary normally open contacts that will close when the motor starter is energized. One contact is wired to the time meter on MCC-OP, and the other contact will be wired to PLC-OP for run status monitoring by the PLC.

   c. A disconnect switch is mounted adjacent to the spray wash pump to disconnect power to the pump motor.

3. Rotary Thickener Feed Pump Motor Controls

   a. Existing MCC-OP, located in the Operations Building Electrical Room, houses the following for the rotary thickener feed pump:

      1) Motor Circuit Breaker
      2) Variable Frequency Drive
      3) Control Transformer
      4) VFD Run Relay
      5) Elapsed Time Meter

   b. The variable frequency drive has a run contact that will close when the drive is energized and outputting a frequency to the pump motor. This contact is wired to a VFD run relay located in MCC-OP, and to a run indication light located on the MCC. The run relay has two normally open contacts that will close when the relay is energized. One contact is wired to the elapsed time meter on the MCC, and the other contact will be wired to PLC-OP for run status monitoring by the PLC.

   c. The variable frequency drive has a VFD fault contact that will close when a drive fault occurs. This

contact will be wired to PLC-OP for VFD fault alarm monitoring by the PLC.

d. A disconnect switch is mounted adjacent to the feed pump to disconnect power to the pump motor.

4. Rotary Thickener Control Panel

a. A new rotary thickener control panel will be provided for the rotary thickener. The control panel will be wall mounted in the Operations Building and will house the following:

1) Main Circuit Breaker
2) Conditioning Tank Start and Stop Push Buttons
3) Conditioning Tank Run Indication Light and Failure Alarm Light
4) Dewatering Drum Start and Stop Push Buttons
5) Dewatering Drum Run Indication Light and Failure Alarm Light
6) Spray Wash Pump Start and Stop Push Buttons
7) Spray Wash Pump Run Indication Light and Failure Alarm Light
8) Thickener Feed Pump Start and Stop Push Buttons
9) Thickener Feed Pump Run Indication Light and Failure Alarm Light
10) Thickener Feed Pump Man/Auto Speed Control Selector Switch
11) Thickener Feed Pump Manual Speed Potentiometer
12) Polymer System Off/On Selector Switch
13) Emergency Stop Push Button
14) Alarm Reset Push Button
15) Lamp Test Push Button
16) Emergency Stop Relays

b. The start and stop push buttons, run indication lights, and failure alarm lights will be wired to PLC-OP.

5. Programmable Controller PLC-OP Inputs and Outputs

a. The programmable controller inputs and outputs for the Rotary Thickener will be wired to and from PLC-OP located in the Operations Building PLC Panel.

b. Digital Inputs (24vdc):

	Description	Origination Point
1)	Rotary Thickener Emergency Stop	Emergency Stop Relay in Rotary Thickener Control Panel
2)	Rotary Thickener Conditioning Tank Start	Start Push Button on Rotary Thickener Control Panel
3)	Rotary Thickener Conditioning Tank Stop	Stop Push Button on Rotary Thickener Control Panel
4)	Rotary Thickener Conditioning Tank Running	Conditioning Tank Motor Starter in MCC-OP

5)	Rotary Thickener Dewatering Drum Start	Start Push Button on Rotary Thickener Control Panel
6)	Rotary Thickener Dewatering Drum Stop	Stop Push Button on Rotary Thickener Control Panel
7)	Rotary Thickener Dewatering Drum Running	Dewatering Drum Motor Starter in MCC-OP
8)	Rotary Thickener Spray Wash Pump Start	Start Push Button on Rotary Thickener Control Panel
9)	Rotary Thickener Spray Wash Pump Stop	Stop Push Button on Rotary Thickener Control Panel
10)	Rotary Thickener Spray Wash Pump Running	Spray Wash Pump Motor Starter in MCC-OP
11)	Rotary Thickener Spray Wash Pump Motor High Temp	Pump Supervision Relay in Monitoring Panel
12)	Rotary Thickener Spray Wash Pump Seal Leak	Pump Supervision Relay in Monitoring Panel
13)	Rotary Thickener Low Spray Wash Pressure	Pressure Switch on Thickener Spray Wash Line
14)	Rotary Thickener Feed Pump Start	Start Push Button on Rotary Thickener Control Panel
15)	Rotary Thickener Feed Pump Stop	Stop Push Button on Rotary Thickener Control Panel
16)	Rotary Thickener Feed Pump Running	VFD Run Relay in MCC-OP
17)	Rotary Thickener Feed Pump VFD Fault	Pump VFD in MCC-OP
18)	Rotary Thickener Feed Pump	Pump Supervision Relay in Monitoring Panel

	Motor High Temp	
19)	Rotary Thickener Feed Pump Seal Leak	Pump Supervision Relay in Monitoring Panel
20)	Rotary Thickener Control Panel Alarm Reset	Reset Push Button on Rotary Thickener Control Panel
21)	Rotary Thickener Control Panel Lamp Test	Test Push Button on Rotary Thickener Control Panel

c. Digital Outputs (24vdc, Relay Output):

	Description	Destination Point
1)	Rotary Thickener Conditioning Tank Start/Stop	Conditioning Tank Start Relay in Operations Building PLC Panel
2)	Rotary Thickener Conditioning Tank Running	Run Light on Rotary Thickener Control Panel
3)	Rotary Thickener Conditioning Tank Failure	Failure Alarm Light on Rotary Thickener Control Panel
4)	Rotary Thickener Dewatering Drum Start/Stop	Dewatering Drum Start Relay in Operations Building PLC Panel
5)	Rotary Thickener Dewatering Drum Running	Run Light on Rotary Thickener Control Panel
6)	Rotary Thickener Dewatering Drum Failure	Failure Alarm Light on Rotary Thickener Control Panel
7)	Rotary Thickener Spray Wash Pump Start/Stop	Spray Wash Pump Start Relay in Operations Building PLC Panel
8)	Rotary Thickener Spray Wash Pump Running	Run Light on Rotary Thickener Control Panel
9)	Rotary Thickener Spray Wash Pump Failure	Failure Alarm Light on Rotary Thickener Control Panel

10)	Rotary Thickener Feed Pump Start/Stop	Feed Pump Start Relay in Operations Building PLC Panel
11)	Rotary Thickener Feed Pump Running	Run Light on Rotary Thickener Control Panel
12)	Rotary Thickener Feed Pump Failure	Failure Alarm Light on Rotary Thickener Control Panel
13)	Rotary Thickener Polymer System Shutdown	Polymer System Shutdown Relay in Operations Building PLC Panel

d. Analog Inputs (4-20mA):

	Description	Origination Point
1)	Rotary Thickener Feed Flow	Sludge Feed Flow Meter Transmitter

e. Analog Outputs (4-20mA):

	Description	Destination Point
1)	Rotary Thickener Feed Pump Speed Reference Signal	Sludge Feed Pump VFD in MCC-OP

6. Description of Operation

a. The rotary thickener conditioning tank, dewatering drum, spray wash pump, and feed pump will be manually controlled by the start and stop push buttons located on the Rotary Thickener Control Panel. When a start button is pushed, PLC-OP will start the corresponding motor. When the motor is running, PLC-OP will energize the corresponding run indication light on the control panel. When a stop button is pushed, the PLC will stop the corresponding motor.

b. The speed of the rotary thickener feed pump will be controlled by the man/auto selector switch located on the rotary thickener control panel. When the switch is in the “man” position, the pump speed will be manually controlled by the speed control potentiometer located on the control panel. When the switch is in the “auto” position, the pump speed will be automatically controlled by PLC-OP as follows:

1) A thickener feed flow controller shall be programmed in PLC-OP to control the sludge feed flow to the thickener.

2) The operator will enter the desired thickener feed flow on the operator interface located on the Operations Building PLC Panel. The flow entered will be the feed flow setpoint for the controller.

3) The controller will compare the sludge feed flow as measure by the thickener feed flow meter, to the flow setpoint, and will output a 4-20mA speed reference signal to the feed pump VFD

to vary the pump speed as required to maintain the flow setpoint.

c. PLC-OP will provide low spray wash pressure monitoring for the rotary thickener as follows:

1) If a low spray water pressure occurs, a timer in the PLC will be started. If this timer times out and the spray wash pressure is still low, a “Rotary Thickener Low Spray Wash Pressure” alarm message shall be displayed on the operator interface located on the Operations Building PLC Panel, and a low spray wash pressure alarm shall be displayed by the HMI software.

d. PLC-OP will provide failure monitoring for the rotary thickener conditioning tank, dewatering drum, spray wash pump, and feed pump as follows:

1) When the equipment start button is pushed, a failure timer in the programmable controller will be started. If this timer times out and the corresponding motor not running, PLC-OP will energize a failure alarm light on the Rotary Thickener Control Panel, and a "Failure" alarm message shall be displayed on the operator interface located on the Operations Building PLC Panel, and a failure alarm shall be displayed by the HMI software.

e. PLC-OP will provide VFD fault monitoring for the rotary thickener feed pump as follows:

1) If a drive fault occurs, the drive will shut down and a pump VFD fault alarm will be initiated. When this occurs, an "Rotary Thickener Feed Pump VFD Fault" alarm message shall be displayed on the operator interface, and a pump VFD fault alarm shall be displayed by the HMI software.

f. PLC-OP will provide low spray wash pressure monitoring for the rotary thickener as follows:

1) If a low spray water pressure occurs, a timer in the PLC will be started. If this timer times out and the spray wash pressure is still low, a “Rotary Thickener Low Spray Wash Pressure” alarm message shall be displayed on the operator interface located on the Operations Building PLC Panel, and a low spray wash pressure alarm shall be displayed by the HMI software.

g. The spray wash pump motor and the thickener feed pump motor are furnished with a normally closed thermal switch in the motor windings to detect a high motor temperature, and a seal leak sensor in the pump casing to detect a leakage of water into the oil chamber. The thermal switch and the seal leak sensor will be wired in series to a pump supervision relay located in the pump monitoring panel. This relay will sense the current in the loop. A low current will indicate a high temperature condition in the motor, and a high current will indicate a seal leak. PLC-OP will provide alarm monitoring for each pump as follows:

1) The high temperature circuit has a normally open contact that changes state when the relay is powered and the temperature is normal. This contact will be wired to PLC-OP. If a high motor temperature occurs, the PLC will shut down the pump. When this occurs, a “Pump Motor High Temp” alarm message shall be displayed on the operator interface, and a pump motor high temp alarm shall be displayed by the HMI software.

2) If a high current is sensed by the relay, a seal leak contact in the relay will close. This contact will be wired to PLC-OP. If a seal leak occurs, the PLC will shut down the pump. When this occurs, a “Pump Seal Leak” alarm message shall be displayed on the operator interface, and a pump seal leak alarm shall be displayed by the HMI software.

h. A push/pull type emergency stop push button will be provided on the rotary thickener control panel to provide for an emergency shutdown of the rotary thickener. When the push button is pressed, the rotary thickener conditioning tank, dewatering drum, spray wash pump, feed pump and

polymer system will be immediately shut down. Pulling the emergency stop button will restore power to the control circuit and will enable the system to be re-started. When an emergency stop is initiated, a "Rotary Thickener Emergency Stop" alarm message shall be displayed on the operator interface, and an emergency stop alarm shall be displayed by the HMI software.

i. The following alarms shall be paralleled in PLC-OP for a common alarm shut down of the rotary thickener:

1) Conditioning Tank Failure
2) Dewatering Drum Failure
3) Spray Wash Pump Failure
4) Spray Wash Pump Motor High Temp
5) Low Spray Wash Pressure
6) Thickener Feed Pump Failure
7) Thickener Feed Pump High Temp

j. An alarm reset button is provided on the rotary thickener control panel to reset the alarm logic in the PLC after an alarm occurs.

k. A lamp test button is provided on the rotary thickener control panel to test the operation of the lights on the panel. When the lamp test button is pushed, PLC-OP will energize all of the pilot lights for five seconds.

7. Rotary Thickener Alarms

a. The following alarms for the Rotary Thickener shall be displayed on the operator interface located on the Operations Building PLC Panel, and shall be displayed and logged by the HMI software:

1) Rotary Thickener Conditioning Tank Failure
2) Rotary Thickener Dewatering Drum Failure
3) Rotary Thickener Spray Wash Pump Failure
4) Rotary Thickener Spray Wash Pump Motor High Temp
5) Rotary Thickener Spray Wash Pump Seal Leak
6) Rotary Thickener Low Spray Wash Pressure
7) Rotary Thickener Feed Pump Failure
8) Rotary Thickener Feed Pump VFD Fault
9) Rotary Thickener Feed Pump Motor High Temp
10) Rotary Thickener Feed Pump Seal Leak
11) Rotary Thickener Emergency Stop

T. COMPOSITE SAMPLING

1. General Description

   a. The existing automatic composite sampler located at the UV channel outside of the Operations Building will sample the plant effluent.

   b. Each composite sampler will be the air/vacuum type incorporating the sampling sequence logic consisting of sample line purge, vacuum pickup, and purge again to dewater the line. The sampler will contain its own air compressor system, solenoid valves, timers, ejectors, refrigeration unit, and flow totalizer for automatic sampling.

2. Programmable Controller PLC-OP Outputs

   a. The pacing signal for the plant effluent composite sampler will be output from PLC-OP located in the Operations Building PLC Panel.

   b. Analog Outputs (4-20mA):

	Description	Destination Point
1)	Plant Effluent Composite Sampler Pacing Signal	Plant Effluent Composite Sampler

3. Description of Operation

   a. The plant effluent composite sampler will be flow paced by the plant effluent flow signal originating from the post EQ pump discharge flow meter. PLC-OP will output a 4-20mA pacing signal equivalent to the post eq pump discharge flow to the plant effluent composite sampler.

U. FLOODING SENSORS

1. General Description

   a. A flooding sensor consisting of a normally closed mechanical float switch will be installed in the EQ Return Flow Control Vault and in the Utility Water Pump Station Valve Vault to sense a flooding condition. Each float switch will be suspended 1-inch above the vault floor.

2. Programmable Controller PLC-IP Inputs

   a. The flooding sensors will be wired to PLC-IP located in the Influent Pump Control Panel.

   b. Digital Inputs (24vdc):

	Description	Origination Point
1)	EQ Return Flow Control Vault Flooding	Flooding Float Switch in Vault
2)	Utility Water Pump Station Valve Vault Flooding	Flooding Float Switch in Vault

3. Description of Operation

   a. If flooding occurs in a vault and water builds up on the floor to the elevation of the flooding float switch, a "Vault Flooding" alarm message shall be displayed on the operator interface located on the Influent Pump Control Panel, and a vault flooding alarm shall be displayed by the HMI software.

4. Flooding Sensor Alarms

   a. The following alarms for the flooding sensors shall be displayed on the operator interface located on the Influent Pump Control Panel, and shall be displayed and logged by the HMI software:

      1) EQ Return Flow Control Vault Flooding
      2) Utility Water Pump Station Valve Vault Flooding

V. MAIN DISTRIBUTION SWITCHBOARD POWER MONITORING

1. General Description

   a. A Main Distribution Switchboard (MDS) will be provided in the Control Building Electrical Room (formerly the Generator Room) to distribute electrical power to the treatment plant.

   b. A digital power monitor will be provided in the switchboard to provide for complete electrical metering and to monitor the incoming power to the switchboard.

   c. A surge protective device (SPD) will be housed in the switchboard to protect the switchboard from transient voltages that may occur due to lightning or surges on the incoming power line.

2. Programmable Controller PLC-SBR Inputs

   a. The programmable controller inputs for Main Distribution Switchboard will be wired to PLC-SBR located in the SBR Control Panel.

   b. Digital Inputs (120VAC):

	Description	Origination Point
1)	Main Distribution Switchboard Power Failure	Alarm Contact in Power Monitor
2)	Main Distribution Switchboard SPD Alarm	Alarm Contact in SPD

   c. Analog Inputs (4-20mA):

	Description	Origination Point
1)	Main Distribution Switchboard KW	Power Monitor in Switchboard

3. Description of Operation

   a. A microprocessor based digital power monitor will be provided in the switchboard to provide electrical metering and to monitor the voltage on the main bus. The power monitor will have a normally open alarm contact that will close with a phase loss, phase unbalance, phase reversal, overvoltage, or undervoltage condition occurs. This alarm contact will be wired to PLC-SBR. If a voltage alarm occurs, this contact will close, a “Main Distribution Switchboard Power Failure” alarm message shall be displayed on the operator interface located on the SBR Control Panel, and a switchboard power failure alarm shall be displayed by the HMI software.

   b. The surge protective device located in the switchboard will be furnished with a normally open alarm contact. This contact will be wired to PLC-SBR. If a surge alarm occurs, this contact will close, a “Main Distribution Switchboard SPD Alarm” message shall be displayed on the operator interface, and a switchboard SPD alarm shall be displayed by the HMI software.

4. Main Distribution Switchboard Power Monitoring Alarms

   a. The following alarms for Main Distribution Switchboard Power Monitoring shall be displayed on the operator interface located on the SBR Control Panel, and shall be displayed and logged by the HMI software:

1) Main Distribution Switchboard Power Failure
2) Main Distribution Switchboard SPD Alarm

W. MCC-CH POWER MONITORING

1. General Description

   a. A digital power monitor will be provided in MCC-CH to provide for electrical metering for the MCC.

   b. A surge protection device (SPD) will be provided in MCC-CH to protect the MCC from transient voltages that may occur due to lightning or surges on the incoming MCC feeder.

2. Programmable Controller PLC-IP Inputs

   a. The programmable controller input for the MCC-CH Power Monitoring will be wired to PLC-IP located in the Influent Pump Control Panel.

   b. Digital Inputs (24vdc):

	Description	Origination Point
1)	MCC-CH Power Failure	Alarm Contact in MCC Power Monitor
2)	MCC-CH Surge Failure	Alarm Contact in SPD

3. Description of Operation

   a. The MCC power monitor will be furnished with a normally open alarm contact. This contact will be wired to PLC-IP. If a power failure occurs, this contact will close, and an “MCC-H Power Failure” alarm message alarm shall be displayed on the operator interface located on the Influent Pump Control Panel, and an MCC-CH power failure alarm shall be displayed by the HMI software.

   b. The surge protective device will be furnished with a normally open alarm contact. This contact will be wired to PLC-IP. If a surge alarm occurs, this contact will close, and an “MCC-CH SPD Failure” alarm message alarm shall be displayed on the operator interface, and an MCC-CH SPD failure shall be displayed by the HMI software.

4. MCC-CH Power Monitoring Alarms

   a. The following alarms for the MCC-CH Power Monitoring shall be displayed on the operator interface located on the Influent Pump Control Panel, and shall be displayed and logged by the HMI software:

      1) MCC-CH Power Failure
      2) MCC-CH SPD Failure

X. EMERGENCY GENERATOR

1. General Description

   a. A new 750 KW diesel emergency generator will be pad mounted outside in a weatherproof sound-attenuated housing to provide standby power for the treatment plant loads. The generator will be furnished with a double-wall sub-base fuel tank.

   b. An automatic transfer switch will be provided in the main distribution switchboard to sense a failure of the normal utility power and transfer the plant loads to the emergency generator.

   c. The transfer switch will be furnished with a position indication contact to indicate when the transfer switch is in the "emergency" position. This contact will be wired to PLC-SBR for switch position monitoring by the PLC.

2. Programmable Controller PLC-SBR Inputs

   a. The programmable controller inputs for the Emergency Generators will be wired to PLC-SBR located in the SBR Control Panel.

   b. Digital Inputs (120VAC):

	Description	Origination Point
1)	Automatic Transfer Switch Emergency Position	Automatic Transfer Switch in Main Distribution Switchboard
2)	Emergency Generator Running	Run Relay in Generator Control Panel
3)	Emergency Generator Not in Auto	Alarm Relay in Generator Control Panel
4)	Emergency Generator Common Alarm	Alarm Relay in Generator Control Panel
5)	Emergency Generator Low Fuel Level	Alarm Relay in Generator Control Panel
6)	Emergency Generator Fuel Tank Leak	Alarm Relay in Generator Control Panel

3. Description of Operation

   a. The automatic transfer switch will continuously monitor the incoming power source. When a failure of the utility power source occurs, control logic in the transfer switch will start the emergency generator. When the generator is putting out the required voltage and frequency, the transfer switch will transfer the treatment plant loads to the generator. When the transfer switch transfers to the emergency position, a normally open contact on the switch will close. This contact will be wired to PLC-SBR for monitoring of the transfer switch position by the programmable controller.

   b. A generator run relay will be provided in the generator control panel. A normally open contact on this relay will be wired to PLC-SBR for generator run status monitoring by the programmable controller. If the generator is running, an "Emergency Generator Running" alarm message shall be displayed on the operator interface located on the SBR Control Panel, and an emergency generator

running alarm shall be displayed by the HMI software.

c. An alarm relay will be provided in the generator control panel to indicate a generator not in auto alarm. A normally open contact on this relay will be wired to PLC-SBR. If the generator is not in auto, an "Emergency Generator Not in Auto" alarm message shall be displayed on the operator interface, and an emergency generator not in auto alarm shall be displayed by the HMI software.

d. A common alarm relay will be provided in the generator control panel to indicate a generator alarm. A normally open contact on this relay will be wired to the PLC-SBR. If a generator alarm occurs, an "Emergency Generator Common Alarm" message shall be displayed on the operator interface, and an emergency generator common alarm shall be displayed by the HMI software.

e. A low level switch will be installed in the generator fuel tank to indicate a low level in the tank. This switch will be wired to a fuel tank low level alarm relay in the generator control panel. A normally open contact on this relay will be wired to PLC-SBR. If a low level alarm occurs, an "Emergency Generator Low Fuel Level" alarm message shall be displayed on the operator interface, and an emergency generator low fuel level alarm shall be displayed by the HMI software.

f. A fuel tank leak sensor will be installed in the generator fuel tank to indicate a leak in the tank. This sensor will be wired to a fuel tank leak alarm relay in the generator control panel. A normally open contact on this relay will be wired to PLC-SBR. If a fuel tank leak alarm occurs, an "Emergency Generator Fuel Tank Leak" alarm message shall be displayed on the operator interface, and an emergency generator fuel tank leak alarm shall be displayed by the HMI software.

4. Emergency Generator Alarms

a. The following alarms for the Emergency Generator shall be displayed on the operator interface located on the SBR Control Panel, and shall be displayed and logged by the HMI software:

1) Emergency Generator Running
2) Emergency Generator Not in Auto
3) Emergency Generator Common Alarm
4) Emergency Generator Low Fuel Level
5) Emergency Generator Fuel Tank Leak

Y. CONTROL PANEL POWER MONITORING

1. General Description

   a. A surge protective device (SPD) will be provided in each control panel and PLC panel to protect the panel components from transient voltages caused by surges on the incoming power line.

   b. A power failure relay will be provided in each control panel and PLC panel to monitor the incoming power to the panel.

2. Programmable Controller PLC-IP Inputs

   a. The programmable controller inputs for the Control Panel Power Monitoring in the Influent Pump Control Panel will be wired to PLC-IP located in that panel.

   b. Digital Inputs (24vdc):

	Description	Origination Point
1)	Influent Pump Control Panel SPD Alarm	Alarm Contact in SPD
2)	Influent Pump Control Panel Power Failure	Power Failure Relay in Control Panel

3. Programmable Controller PLC-SBR Inputs

   a. The programmable controller inputs for the Control Panel Power Monitoring in the SBR Control Panel will be wired to PLC-SBR located in that panel.

   b. Digital Inputs (120VAC):

	Description	Origination Point
1)	SBR Control Panel SPD Alarm	Alarm Contact in SPD
2)	SBR Control Panel Power Failure	Power Failure Relay in Control Panel

4. Programmable Controller PLC-OP Inputs

   a. The programmable controller inputs for the Control Panel Power Monitoring in the Operations Building PLC Panel will be wired to PLC-OP located in that panel.

   b. Digital Inputs (24vdc):

	Description	Origination Point
1)	Operations Building PLC Panel SPD Alarm	Alarm Contact in SPD

2)	Operations Building PLC Panel Power Failure	Power Failure Relay in PLC Panel

5. Description of Operation

   a. A surge protective device (SPD) will be provided in each control panel and PLC panel. Each SPD will have a normally closed alarm contact that will be wired to its corresponding PLC. If a surge alarm occurs, the alarm contact will open and a “Control Panel Surge Alarm” message shall be displayed on the corresponding operator interface, and a Control Panel surge alarm shall be displayed by the HMI software.

   b. A power failure relay will be provided in each control panel and PLC panel. Each relay will be energized continuously by the main incoming power to the panel. The PLC will provide power failure monitoring for the Control Panel as follows:

      1) A normally open contact on each power failure relay will be wired to its corresponding PLC. Under normal circumstances, the relay will be energized and this contact will be closed. If the main incoming power supply fails, the relay contact will open and a “Control Panel Power Failure” alarm message shall be displayed on the corresponding operator interface, and a Control Panel power failure alarm shall be displayed by the HMI software.

6. Control Panel Power Monitoring Alarms

   a. The following alarms for the Control Panel Power Monitoring shall be displayed on the corresponding operator interface, and shall be displayed and logged by the HMI software:

      1) Influent Pump Control Panel Surge Alarm
      2) Influent Pump Control Panel Power Failure
      3) SBR Control Panel Surge Alarm
      4) SBR Control Panel Power Failure
      5) Operations Building PLC Panel Surge Alarm
      6) Operations Building PLC Panel Power Failure

Z. 24VDC POWER SUPPLIES

1. General Description

   a. Two 24vdc power supplies will be provided in each PLC Panel and Control Panel to provide power for the 24vdc programmable controller inputs and the 2-wire instruments. The power supplies will be wired in parallel through a redundancy module so that if one power supply fails, the other power supply will continue providing 24vdc power.

2. Programmable Controller PLC-IP Inputs

   a. The programmable controller inputs for the 24vdc Power Supplies in the Influent Pump Control Panel will be wired to PLC-IP located in that panel.

   b. Digital Inputs (24vdc):

	Description	Origination Point
1)	Influent Pump Control Panel 24vdc Power Supply No. 1 Failure	24vdc Power Supply in Influent Pump Control Panel
2)	Influent Pump Control Panel 24vdc Power Supply No. 2 Failure	24vdc Power Supply in Influent Pump Control Panel

3. Programmable Controller PLC-SBR Inputs

   a. The programmable controller inputs for the 24vdc Power Supplies in the SBR Control Panel will be wired to PLC-SBR located in that panel.

   b. Digital Inputs (120VAC):

	Description	Origination Point
1)	SBR Control Panel 24vdc Power Supply No. 1 Failure	24vdc Power Supply in SBR Control Panel
2)	SBR Control Panel 24vdc Power Supply No. 2 Failure	24vdc Power Supply in SBR Control Panel

4. Programmable Controller PLC-OP Inputs

   a. The programmable controller inputs for the 24vdc Power Supplies in the Operations Building PLC Panel will be wired to PLC-OP located in that panel.

b. Digital Inputs (24vdc):

	Description	Origination Point
1)	Operations Building PLC Panel 24vdc Power Supply No. 1 Failure	24vdc Power Supply in Operations Building PLC Panel
2)	Operations Building PLC Panel 24vdc Power Supply No. 2 Failure	24vdc Power Supply in Operation Building PLC Panel

5. Description of Operation

a. Each PLC will provide failure monitoring for the 24vdc power supplies in its panel as follows:

1) A normally open contact on each power supply will be wired to its corresponding PLC. When the power supply is operating, this contact will be closed. If a power supply fails, this contact will open, and a "24vdc Power Supply Failure" alarm message shall be displayed on the corresponding operator interface, and a 24vdc power supply failure alarm shall be displayed by the HMI software.

6. 24vdc Power Supply Alarms

a. The following alarms for the 24vdc Power Supplies shall be displayed on the corresponding operator interface, and shall be displayed and logged by the HMI software:

1) Influent Pump Control Panel 24vdc Power Supply No. 1 Failure
2) Influent Pump Control Panel 24vdc Power Supply No. 2 Failure
3) SBR Control Panel 24vdc Power Supply No. 1 Failure
4) SBR Control Panel 24vdc Power Supply No. 2 Failure
5) Operations Building PLC Panel 24vdc Power Supply No. 1 Failure
6) Operations Building PLC Panel 24vdc Power Supply No. 2 Failure

AA. UNINTERRUPTIBLE POWER SUPPLIES

1. General Description

   a. An uninterruptible power supply (UPS) will be provided in each PLC and Control Panel to provide continuous power for the equipment in the control panel.

2. Programmable Controller PLC-OP Inputs

   a. The programmable controller inputs for the UPS in the Operations Building PLC Panel will be wired to PLC-OP located in that panel.

   b. Digital Inputs (24vdc):

	Description	Origination Point
1)	UPS on Battery Power	UPS in Operations Building PLC Panel
2)	UPS Replace Battery	UPS in Operations Building PLC Panel
3)	UPS Failure	UPS Failure Relay in Operations Building PLC Panel

3. Programmable Controller PLC-IP Inputs

   a. The programmable controller inputs for the UPS in the Influent Pump Control Panel will be wired to PLC-IP located in that panel.

   b. Digital Inputs (24vdc):

	Description	Origination Point
1)	UPS on Battery Power	UPS in Influent Pump Control Panel
2)	UPS Replace Battery	UPS in Influent Pump Control Panel
3)	UPS Failure	UPS Failure Relay in Influent Pump Control Panel

4. Programmable Controller PLC-SBR Inputs

   a. The programmable controller inputs for the UPS in the SBR Control Panel will be wired to PLC-SBR located in that panel.

   b. Digital Inputs (120VAC):

	Description	Origination Point
1)	UPS on Battery Power	UPS in SBR Control Panel

2)	UPS Replace Battery	UPS in SBR Control Panel
3)	UPS Failure	UPS Failure Relay in SBR Control Panel

5. Description of Operation

   a. Each UPS will be furnished with a normally open contact that will close when the UPS is operating on battery power. This contact will be wired to the PLC in the corresponding panel. When normal power fails and the UPS is operating on battery power, a timer in the programmable controller will be started. If this timer times out and the UPS is still on battery power, a "UPS on Battery Power" alarm message shall be displayed on the corresponding operator interface, and a UPS on battery power alarm shall be displayed by the HMI software.

   b. Each UPS will be furnished with a normally open contact that will close when the UPS battery needs replaced. This contact will be wired to the PLC in the corresponding panel. If the battery needs replaced, a timer in the programmable controller will be started. If this timer times out and the UPS battery still needs replaced, a "UPS Replace Battery" alarm message shall be displayed on the corresponding operator interface, and a UPS battery needs replaced alarm shall be displayed by the HMI software.

   c. A UPS failure relay will be provided for each UPS in the corresponding panel. This relay will be energized continuously by the UPS. The programmable controller will provide failure monitoring for the UPS as follows:

      1) A normally open contact on the UPS failure relay will be wired to the programmable controller. When the UPS in the control panel is operating, the relay will be energized and this contact will be closed. If the UPS fails, the relay contact will open and a "UPS Failure" alarm message shall be displayed on the corresponding operator interface, and a UPS failure alarm shall be displayed by the HMI software.

   d. Each UPS failure relay will have two normally open contacts and two normally closed contacts in addition to the normally closed contact being utilized for failure monitoring of the UPS. The UPS will be wired through two normally open relay contacts, and the 120 VAC power will be wired through two normally closed relay contacts. If the UPS fails, the UPS failure relay will be de-energized and the 120 VAC power will power the control panel.

6. Uninterruptible Power Supply Alarms

   a. The following alarms for the Uninterruptible Power Supplies shall be displayed on the corresponding operator interface, and shall be displayed and logged by the HMI software:

      1) Operations Building PLC Panel UPS on Battery Power
      2) Operations Building PLC Panel UPS Replace Battery
      3) Operations Building PLC Panel UPS Failure
      4) Influent Pump Control Panel UPS on Battery Power
      5) Influent Pump Control Panel UPS Replace Battery
      6) Influent Pump Control Panel UPS Failure
      7) SBR Control Panel UPS on Battery Power
      8) SBR Control Panel UPS Replace Battery
      9) SBR Control Panel UPS Failure

BB. OPERATOR INTERFACE TERMINALS

1. General Description

   a. A programmable operator interface terminal will be provided on the following PLC and Control Panels to display graphic screens and alarm messages for the area of the plant where the panel is located:

      1) Influent Pump Control Panel
      2) SBR Control Panel
      3) Operations Building PLC Panel
      4) Disk Filter Control Panel
      5) UV System Control Center

2. Description of Operation

   a. Whenever an alarm occurs, a corresponding alarm message will be displayed on each operator interface as previously described in the Description of Operation.

   b. An alarm message will remain in the system until its corresponding alarm is cleared. The operator shall be able to acknowledge and clear the alarms from the operator interface.

END OF SECTION 25 50 50

SECTION 01 14 00
SPECIAL REQUIREMENTS

PART 1 GENERAL

1.1 DESCRIPTION

A. The Contractor shall provide labor, materials, equipment and services, and perform all operations required for completion of Work of this Contract as specified and as indicated on the Contract Drawings.

B. This section supplements the General Requirements provided by Section 01 00 00.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 MAINTENANCE OF PLANT OPERATIONS

A. New Metering Manhole
   1. The installation of the new metering manhole on the existing 15-inch plant influent line will require bypass pumping from the existing screens to Manhole 3. The bypass pump capacity shall be 1,569 gpm.

B. New Chemical Building
   1. The Contractor shall construct the new Chemical Building prior to commissioning new equipment at the Influent Equalization Tank and Pre-Anoxic Tank. Electrical gear for this equipment and for the new Influent Pumping Station Pumps is located in the Chemical Building and must be installed prior to commissioning of that equipment.

C. New Influent Equalization Tank
   1. The new Influent Equalization Tank, Pre-Anoxic tank, associated yard piping, and pinch valve and metering vault shall be constructed and commissioned prior to taking one of the SBR tanks out of service for renovations or bypassing the influent pumping station wet well. With concurrence from the Owner, the Contractor may choose to utilize the new Influent Equalization Tank to receive raw wastewater and serve as the bypass pumping wet well during work at the existing Influent Pumping Station and SBRs.

D. Influent Pumping Station Upgrades
   1. The Contractor shall construct and commission the new Pre-Anoxic Tank, new Influent Equalization Tank, pinch valve and metering vault, and associated process equipment prior to working on the existing Influent Pumping Station.
   2. The Influent Equalization Pumps must be installed and operational prior to working on the existing Influent Pumping Station, valve vault or SBRs.
   3. The installation of the new sanitary metering manhole on the plant influent line and tie-in of new Pre-Anoxic influent piping into the existing 15-inch plant influent will require bypass pumping from Manhole 3A to the Influent Pumping Station. The bypass pump capacity shall be 1,569 gpm.
   4. Currently, one MRAS pump operates at a time so that MRAS is continuously flowing to the Influent Pumping Station. Connection to the existing buried MRAS line from the new Pre-Anoxic Tank must be completed prior to taking the IPS out of service so that the Biomag recovery system

can remain in service. This connection must be scheduled with the WWTP during a time when sludge wasting is not required for up to 24 hours. The Contractor shall have 8 hours to make this connection.

5. The replacement of the existing Influent Pumping Station Pumps and valves will require bypass of the influent pumping station wet well and valve vault. Bypass pumping will be from the new Influent Equalization Tank and from the Pre-Anoxic tank to the SBRs. The tie-in of the new 16-inch line from the new Pre-Anoxic Tank to the Influent Pumping Station shall also occur at this time. The bypass of the influent pumping station wet well shall take place when one SBR is out of service (as described below) to simplify bypass pumping. The bypass pumping shall be configured to allow storage in the Influent Equalization tank to allow the batch cycle to the SBR to continue to the extent possible with feed from the new Influent Equalization Tank to the SBR only during fill mode unless the water level in the Equalization Tank reaches the Equalization Tank high water level. The Contractor shall be required to provide temporary pump controls for the new Influent Equalization Pumps to accomplish this. Bypass pumps shall also be used to pump from the Pre-Anoxic tank to the SBR and these pumps shall operate continuously to convey MRAS. The bypass of the influent pumping station wet well shall occur after the new plant influent flow meter has been installed and commissioned. The design capacity of the bypass pumps conveying flow from the new Influent Equalization Tank to the SBR shall be 1569 gpm. The design capacity of the bypass pump system conveying flow from the Pre-Anoxic zone to the SBR shall have a peak capacity 611 gpm with typical operation at 200 gpm.
6. The Contractor shall submit a comprehensive work plan for the Influent Pumping Station Upgrade. No work shall occur until the plan is approved.

E. SBR Tanks and New Blowers:

1. The Contractor shall install the new SBR control panel prior to taking either SBR out of service for demolition of existing equipment and installation of new equipment.
2. The Contractor shall install the new blowers and air piping to the top of the air piping drop-legs prior to beginning demolition of existing SBR equipment. The new blower VFDs shall be installed at this time as well. The new blowers must be operational by the time installation of new equipment is complete in the first SBR to be taken out of service for upgrades.
3. Only one SBR tank shall be out of service at any one time. A SBR tank may be out of service for up to three weeks. The Contractor shall allow for two weeks' time duration per SBR tank for taking each SBR out of service. The Contractor shall be responsible for transferring the MLSS from one SBR tank to the other.
4. The Contractor shall provide bypass pumps configured to pump from the new Influent Equalization Tank to the SBR. The bypass pumping shall be configured to allow storage in the Influent Equalization tank for the batch cycle to the SBR to continue to the extent possible with feed from the new Influent Equalization Tank to the SBR only during fill mode unless the water level in the Equalization Tank reaches the Equalization Tank high water level. The design capacity of the bypass pumps conveying flow from the new Influent Equalization Tank to the SBR shall be 1569 gpm.
5. The Contractor shall submit a comprehensive work plan for the SBR Upgrades. No work shall occur until the plan is approved.

F. Control Building Modifications
   1. The Contractor shall furnish a temporary generator while demolition in generator room occurs for the installation of new electrical equipment. The temporary generator shall remain in service until the new generator is installed, operational and accepted.

G. Operations Building Modifications:
   1. Only one Post-Equalization pump shall be out of service at one time. Each pump and corresponding VFD shall be replaced in turn.
   2. Bypass pumping is required for the replacement of Post-Equalization pump discharge valves and flow meter. Bypass pumping from the post-equalization wet well to the filters is required and shall be provided by the Contractor. The design flow for the bypass system is 1,569 gpm.
   3. Only one Disc Filter tank shall be out of service for interior coating at one time.
   4. The Contractor shall submit a comprehensive work plan for the Operations Building Upgrades. No work shall occur until the plan is approved.

H. UV Disinfection:
   1. The existing UV channel shall be taken out of service during the installation of the new system.
   2. The Contractor shall provide a portable UV treatment system, as shown in Appendix A, Drawing No. PM-17, and as described in the contract specifications. Tie into the existing filter bypass piping with a gate valve and tee running temporary piping into the portable UV system. Run 12" temporary piping from the portable UV system to the utility water manhole.
   3. The portable UV system will be used while the new UV system is being installed within the existing channels.

I. Maintenance of Electrical Power.
   1. Electrical power must be maintained to the treatment plant process equipment at all times. If the main electrical service power is interrupted, standby power must be on-line. The maximum duration of the utility power can be off-line is four (4) hours.
   2. Before the existing standby generator is taken out of service, the new standby generator must be fully operational.
   3. If temporary electrical generators are being utilized, provide an adequate fuel supply at all times and generator power output cables must be connected to the power distribution equipment at all times. Temporary electrical generation equipment must be protected from and able to operate in inclement weather.
   4. All temporary electrical power distribution equipment and electrical generation equipment must be properly grounded.
   5. The Contractor is responsible for providing temporary wiring as necessary to maintain operation of plant equipment
   6. The Contractor shall plan the electrical work described in the documents to the sequence of construction described in this section.
   7. The Contractor shall submit a written plan for review by the Owner and Engineer for all planned power outages, describing outage durations, affected equipment, and temporary measures being provided to keep process equipment operational. Describe safety procedures, grounding methods, and cable testing that will be provided. Electrical testing shall be performed in accordance with Specification Section 26 90 00 before placing equipment into service.

J. General:
   1. The Contractor shall maintain operator access to all treatment plant processes at all times.
   2. No tanks or process system shall be taken out of service without the Owner's written approval. The Contractor shall submit a written request to the Owner and give the Owner a minimum of three (3) weeks, unless otherwise noted, prior notice to coordinate and revise plant operational procedures to accommodate the change, thereby enabling approval of the Contractor's request.
   3. Under no circumstances will the Contractor allow raw or improperly treated wastewater to be discharged on the construction site or surrounding grounds. Any accidental discharge shall be reported to the Owner immediately.
   4. The above items have listed the major portions of the suggested procedures necessary to maintain operation of the treatment facility. There may be additional instances where temporary measures (Equipment, piping, wiring, bypass pumping, temporary bulkheads, etc.) are necessary to maintain plant operations and/or the construction sequence. The Contractor is responsible for all costs to provide these temporary measures and these costs shall be included in the Contractor's lump sum price for this project.
   5. The Contractor shall submit a written description and time schedule for maintaining plant operations.

K. New Utility Water Pump Station Manhole
   1. The installation of the new utility water pump station manhole on the existing 12-inch plant effluent line will require bypass pumping from the existing filter bypass piping to existing effluent manhole 1. Connect to existing filter bypass piping as shown on drawing PM-17 for use with portable UV system. The bypass pump capacity shall be 1,615 gpm.
   2. The new utility water pump station manhole must be installed and operational prior to operation of the portable UV system.

3.2 EXISTING TANK DEWATERING AND CLEANOUT

A. The Contractor will be responsible for the dewatering of all tanks to be taken out of service for renovation. The Contractor will drain or pump liquid from the tanks. Liquid remaining in the SBRs below the decant level will be pumped into the adjacent SBR. The rate of tank drain flow shall be coordinated with the Owner so as to not exceed a flow rate that would upset the plant process. The Contractor will be responsible for removal of liquid sludge and grit remaining in the bottom of the units. The Contractor will be responsible for providing the necessary manpower, pumps, hoses, squeegees, etc. to slurry and push liquid to existing drains, sumps, or low points so that it can be removed.

B. Grit and packed inert materials, if found, shall not be slurried and drained from the tanks. Such materials shall be physically hauled from the tanks by the Contractor and either drained or bulked with approved inert materials to achieve landfill disposal requirements. The Contractor shall provide its own dumpsters for material disposal. For solids materials removed during the cleaning operation the Contractor may dispose of this material at the Washington County Landfill. Use of the Owner's permit is allowed given the following conditions are met:
   1. The material may not contain free liquids.
   2. The material must pass the paint filter test.

3. Certified weight slips for all residuals removed from the plant on a daily basis are to be provided to the Owner.
4. The Contractor must set up its own payment terms with the landfill. All costs of disposal are to be included in the lump sum bid for the Contract.
5. The Owner will provide a signed manifest upon visual examination of each load to verify there is no free-standing water.
6. If the Washington County Landfill is not used as a disposal site, the Contractor must provide certification documents indicating disposal compliance with Federal, State and local regulations for any other site receiving the solids.

C. Once all liquid, sludge, and grit have been removed, the Contractor shall clean the interior walls and floor, including hoppers, of each tank by squeegeeing and hosing with water to remove all sludge, grease, and dirt deposits to the satisfaction of the Owner's representative. The Contractor shall also thoroughly flush all drain lines.

D. The following is a list of assumed volumes of grit and inert materials remaining in the tank or pit after completion of dewatering by the Contractor and for which the Contractor will be responsible for its removal:

Structure	Volume of Material to be Removed (Cubic Yards)
SBR 1	90
SBR 2	90
Influent PS Wet Well	1

END OF SECTION 01 14 00

SECTION 01 54 00
BYPASS PUMPING

PART 1 GENERAL

1.1 DESCRIPTION

A. The Contractor is required to furnish all materials, labor, equipment, power, maintenance, etc., to implement a temporary bypass pumping system for the purpose of diverting the existing sewage flow around the work area for the time that is required to install a section of pipeline.

1.2 QUALITY ASSURANCE

A. The design, installation and operation of the temporary bypass pumping system shall be the Contractor's responsibility. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.

B. The temporary primary bypass pumping system will be required to convey flows up to 1569 GPM of wastewater.

C. The Contractor shall include one standby pump at each pumping location. The standby pump unit shall be piped into the inflow and to the bypass piping so that, upon starting the engine or motor, the standby pump will pick up the flow.

D. The Contractor shall provide necessary sound abatement to meet a 70 dB sound level.

1.3 JOB CONDITIONS

A. The Contractor will provide all necessary means to safely convey the normal flows past the work area. The Contractor will not be permitted to stop or impede the main or any sideline flows under any circumstances.

B. The Contractor must give written notice of utility interruption as per Section 01 00 00.

1.4 SUBMITTALS

A. General: Submit in accordance with Section 01 30 00.

B. The Contractor shall prepare a specific detailed description of the proposed bypass pumping system; the submittal shall include a written description of the plan and shall address the quantity, capacity, and location of all pumping equipment. All pumping equipment submitted shall include the pump's performance curves. The size, type and routing of all suction and discharge pipes and the means of connecting the system shall also be included. This information shall be submitted to the Engineer for review; no bypass pumping shall take place until reviewed by the Engineer.

1.5 SPECIAL PRECAUTIONS

A. If any surface spills of raw wastewater occur due to the failure of the Contractor to maintain the temporary pumping when needed. The Contractor shall be responsible for any fines levied on the Owner by the state, federal or any other applicable agency.

B. The Contractor shall be solely responsible for and libel for any basement flooding caused by a failure to perform this function properly.

C. Place all pumping equipment, fuel tanks and accessories in containment facilities to prevent the leakage of sewage, oil, fuel, grease, etc. onto the ground. Remove and properly dispose of spilled material

routinely from the containment facility to prevent an overflow.

PART 2 PRODUCTS

2.1 PUMPS

A. The pumps and drives shall be rated for continuous duty and shall be capable of pumping the specified flow range without surging, cavitation, or vibration. The pump shall not overload the driver at any point on the pump operating curve. The pump shall be suitable for use with raw unscreened sewage and trash. The pump shall be a self-contained unit, designed for temporary use.

B. All pumps used shall be fully automatic self-priming units that do not require the use of foot-valves or vacuum pumps in the priming system or they can be submersible pumps. The pumps shall be diesel or electrically powered. All pumps used must be constructed to allow dry running for long periods of time to accommodate the cyclical nature of effluent flows.

C. Pumps that are engine driven shall be on skid bases with a centralized lifting bracket and integral fuel tank. The pump shall be direct coupled to an electric start diesel engine. Provide an integral belt driven compressor to operate the air ejector priming system. Submersible pumps shall be powered by an electric generator.

D. Contractor shall provide the necessary start/stop controls for each pump.

2.2 PIPING

A. In order to prevent the accidental spillage of flows, all discharge system must be constructed of either sound hose or rigid pipe with positive, leak-proof connections.

B. Pipe 12 inches and larger shall be high density polyethylene pipe with fused joints for a leak-proof piping system.

2.3 TEMPORARY PLUGS

A. Plugs shall be inflatable plugs constructed of specially treated industrial fabric and reinforced neoprene. Plugs shall be equipped with steel pull rings and aluminum end clamps.

B. All plugs shall be firmly attached to a stationary object at ground level by a steel cable in order to prevent loss of plug in the pipeline.

PART 3 EXECUTION

3.1 TEMPORARY INSTALLATION

A. Installation shall include furnishing oil, fuel, grease, lubricants, tools and spare parts that may be required to maintain the operation of the pump throughout the construction period, as recommended by the manufacturer. The Contractor shall be solely responsible for maintaining the temporary bypass pumps and appurtenances. At the end of the construction period, the Contractor shall remove the pump and appurtenances.

B. The pumps shall be installed for temporary use only. The Contractor shall be responsible for proper operation of the complete pumping system, which includes pump, driver, controls and appropriate pipe connections, during the construction period.

C. Adequate hoisting equipment for each pump and accessories shall be maintained on the site.

D. The Contractor shall insure that the temporary bypass pumping system is properly maintained and a responsible operator shall be on hand at all times when pumps are operating.

E. The temporary pumping system shall be placed in service a minimum of 24 hours before any work may begin. It shall remain operable for at least 72 hours after the repairs are completed and its removal is approved by the Owner in writing.

F. Once written permission is issued, the Contractor shall remove all components of the temporary pumping system. The Contractor shall perform all restoration work to the satisfaction of the Owner.

END OF SECTION 01 54 00

SECTION 05 50 00
MISCELLANEOUS METALS

PART 1 GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Furnish labor, materials, tools, equipment, services, supervision required to complete miscellaneous metalwork including all incidental and complementary work shown, specified, or necessary to complete work as indicated.
   2. No attempt is made to enumerate each item required, but to indicate parts and describe general construction and certain special items; perform work in strict conformity with the Contract Drawings, approved Shop Drawings, and the Specifications; obtain field measurements of adjoining work required to locate and fit work.

1.2 QUALITY ASSURANCE

A. Standards:
   1. Aluminum Association (AA)
   2. American Society for Testing and Materials (ASTM):
      a. Steel Castings, Carbon, for General Application
      b. Carbon Structural Steel
      c. Pipe Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
      d. Zinc Coating (Hot-Dip) on Iron and Steel Hardware
      e. Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
      f. Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
      g. Stainless Steel Bars and Shapes
      h. Low and Intermediate Tensile Strength Carbon Steel Plates
      i. Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
      j. High-Strength Bolts for Structural Steel Joints
      k. Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements
      l. Stainless Steel Bolts, Hex Cap Screws, and Studs
   3. American Institute of Steel Construction (AISC)
   4. American Welding Society (AWS)
   5. OSHA Standards
   6. Steel Structures Painting Council (SSPC)

B. Welder, Welding Operator and Tacker Qualifications: Each welder, welding operator and tacker shall be qualified in accordance with the applicable requirements of AWS D1.1.

1.3 SUBMITTALS

A. General: Submit in accordance with Section 01 30 00.

B. Shop Drawings (Miscellaneous Steel Fabrications, Pipe Bollards, and Anchor Bolts):

1. Submit complete, detailed shop and erection drawings of all work for approval before starting fabrication and installation of materials.
2. Show details of construction and placement including hardware, fittings and fastenings, anchorages, types and gauges of metals being used.

C. Design Drawings (Handrail Systems, Metal Stairs, Aluminum Grating, Aluminum Plate, and Vertical Ladders):
1. Prior to fabrication, manufacturer shall submit design and erection drawings.
2. Design drawings shall bear the seal and signature of a Professional Engineer registered in the state in which the Project is located.

D. Welder Qualifications: Submit evidence of qualifications for welders, welding operators and tackers.

1.4 JOB CONDITIONS

A. Field paint exposed steel in addition to shop coats and mill finishes.

B. Protect aluminum in contact with masonry or concrete with coating of bituminous paint, asphalt emulsion, zinc chromate primer, or equal.

1.5 PRODUCT DELIVERY, HANDLING AND STORAGE

A. Deliver all materials in good condition. Store in dry place, off ground; keep dry at all times. Handle materials to prevent damage to product or structure.

PART 2 PRODUCTS

2.1 MATERIALS

A. General: Metals free from defects impairing strength, durability and appearance; best commercial quality for purposes specified, structural properties to safely withstand strains and stresses to which subjected.

B. Steel Materials:
1. Structural Steel: ASTM A283 or A36, as applicable.
2. Cold Finished Steel: Mild steel, rolled, drawn, ASTM A568.
3. Steel Pipe: Black, Schedule 40, ASTM A53 as indicated on the Contract Drawings.
4. Steel Bolts, Nuts, Washers: ASTM A307, Grade A, General Use and Grade B, Flanges galvanized in accordance with ASTM A153.
5. High Tension Bolts: ASTM A325 Type 3 for corrosive locations.
6. Anchor Bolts: Stainless steel, ASTM F593 or as indicated on the Contract Drawings.

C. Castings:
1. Steel: ASTM A27, Grade 65-35, Class 1 and Class 2.
2. Gray Iron Castings: ASTM A48, Class 30.
3. Ductile Iron Castings: ASTM A536, Grade 60-40-18, Grade 70-50-05 for pipe fittings.

D. Stainless Steel Materials:
1. Stainless and heat resisting steel bars and shapes: ASTM A276, Class A, Type 304.
2. Stainless and heat resisting steel plate, sheet, strip: ASTM F593.
3. Stainless steel bolts: ASTM A193, Type 304.
4. Stainless steel nuts: Heavy hex, ASTM A194, Type 304.

E. Gratings:

1. Metal bar grating manual for steel and aluminum gratings: ANSI/NAAMM MBG532.
2. Grating, metal, bar type: Federal Specification RR-G-661C.
3. Grating, metal, other than bar type: Federal Specification RR-G-1602.

F. Aluminum-Alloy Materials:
1. Uniform quality, free from injurious defects, and meet properties and standards of the Aluminum Association (AA).
a. Aluminum and Aluminum-Alloy Sheet and Plate: ASTM B209, Alloy 6061
b. Aluminum and Aluminum-Alloy Extruded Bars, Rods, Shapes and Tubes: ASTM B221, Alloy 6061
c. Aluminum-Alloy Extruded Structural Pipe and Tube: ASTM B429, Alloy 6063-T6
d. Aluminum-Alloy Sand Castings: ASTM B26, Alloy 356.0
e. Aluminum-Alloy Bolts, Nuts and Screws: Alloy 6061 produced from material conforming to ASTM B211
f. Aluminum-Alloy Washers: ASTM B209, Alloy Alclad 2024

2.2 STEEL SHOP PRIMER

A. Preparation: SSPC SP-2 and SP-1.
B. Acceptable Primers:
1. Rust Inhibitive Alkyd Resin; VOC content of unthinned product shall not exceed 2.8 lbs./gallon.
2. Products:
a. Series 88HS Azeron H.S. Primer as produced by Tnemec Company
b. Sherwin-Williams
c. Southern Coatings
d. Glidden
e. Rust-Oleum Corp.
f. Con-Lux.
g. Or equal.

C. Application:
1. Apply with spray only for metal fabrications exposed to public view.
2. Apply primer free of runs and other irregularities that may require modification to achieve the specified finish appearance.
3. Provide a minimum dry film thickness of 2 mils per coat.

2.3 FABRICATION

A. General:
1. Form and finish metalwork to shape and size with sharp angles and lines.
2. Metalwork that becomes bent by shearing or punching may be straightened and used if approved by the Engineer.
3. Grind exposed edges of work smooth; construct joints exposed to weather to exclude water.

B. Hardware:
1. Countersink metalwork to receive the required hardware and to provide the proper bevels and clearances.

2. Provide welded backup plates for mounting hardware; drill or punch holes for bolts and screws; conceal fastenings wherever practicable.
3. Provide brackets, lugs, and similar accessories required for installation as a part of the metal item.

C. Shop and Field Welding:
1. In accordance with recommendations of American Welding Society (AWS) Standard D1.
2. Welds solid and homogeneously a part of metals joined for full area indicated or necessary to develop required strength of joint.
3. Welds free from pits or incorporated slag or scale; surfaces of welds smooth and regular.

D. Workmanship Class 1:
1. Exposed Surfaces: Sandblast surfaces smooth with pits, mill marks, nicks and scratches filled or ground off. Defects shall not show when painted.
2. Welds: Conceal welds where possible. Where exposed, grind welds to small radius with uniform sized cove. When painted, welds shall be undetectable.
3. Bolts: Use only flat head countersunk bolts in exposed locations.
4. Straightness: Distortions visible to the eye will be rejected.
5. Joints: Fit joints to hairline finish.

E. Workmanship Class 2:
1. Exposed Surfaces: Moderate irregularities not visible at 30' may remain. Mill marks may remain.
2. Welds: Grind welds to small radius with uniform sized cove.
3. Bolts: Use only flat or oval head countersunk bolts where exposed to view.
4. Straightness: Minor distortions will be permitted.
5. Joints: Provide maximum gap of 1/16".

F. Workmanship Class 3:
1. Exposed Surfaces: No improvement from mill finish required except preparation for galvanizing or priming.
2. Welds: Grinding not required.
3. Bolts: Exposed bolts permitted.

2.4 GRATINGS

A. Open grating of a design, material thickness and strength to support all dead loads plus a uniform live load of 100#/sq.ft. with maximum 1/4" deflection. Minimum grating thickness shall be as indicated on the Drawings.

B. Grating shall be of the aluminum swage locked type with serrated bars for maximum slip resistance.

C. Where Drawings call for grating to have a solid cover plate, provide deck plate type grating consisting of a single piece extruded aluminum with structural ribs being an integral part of the upper surface. Design grating to support all dead loads plus a uniform live load of 100 pounds per square foot with a maximum 1/4 inch deflection. Provide a solid surface plate having a
1. 0 deep cross hatched serrations for multi-directional slip resistance and complying with Fed. Spec. 1212-G-1602-C. Provide a retractable handle on each side of each grating section to facilitate the lifting and removal of each section. Minimum grating thickness shall be as indicated on the Drawings.

D. Anchor angle frames to the supporting construction. Fabricate grating in convenient lengths for handling. Maximum allowable weight of each removable grating section is 40 pounds. Band grating along entire perimeter and at holes or other openings.
E. Grates shall be galvanized after fabrication in accordance with ASTM A123 and all hardware shall be galvanized in accordance with ASTM A153.

2.5 PIPE RAILINGS

A. Railing:
   1. Aluminum: Pipe railings shall be fabricated of standard 6061-T6 alloy, Schedule 40 extruded aluminum structural pipe, in accordance with ASTM B429; pipe shall be nominal 1-1/2", with 1.9" O.D. and 0.145" wall thickness.
B. Railing shall be a two-rail system designed to meet OSHA standards. Provide additional intermediate rails where indicated on the Drawings. Unless otherwise noted on the Drawings, the centerline of top rail shall be 3'-6" above walking surface and the second rail shall be installed at mid-height.
C. Provide minimum 3" clearance on single pipe stairway handrails supported on brackets from a wall.
D. Post spacing shall be adequate to meet loading requirements but shall not exceed 6'-0" o.c. maximum.
E. Railings shall be of the welded joint type or mechanical joint type. All welded connections shall be continuously filet welded and ground smooth. Mechanical joint type shall have all fasteners countersunk.
F. Posts shall not interrupt the continuation of the top rail at any point along the railing, including corners and end terminations. The top surface of the top railing shall be smooth and shall not be interrupted by projecting fittings.
G. Provide removable stainless steel chains with snap hooks where indicated.
H. Provide for expansion and contraction in the railing. Expansion joints must align with those in the structure to which the handrail is attached. Post spacing shall be located 1'-0" maximum to the right or left of expansion and contraction joints.
I. Railings and connections shall be capable of withstanding a uniform loading of 50 plf or a concentrated load of at least 200 pounds applied in any direction at any point on the rail.
J. Handrail post shall be base flange mounted unless otherwise noted on the Drawings.
K. Stringer connections shall be determined by stair fabricator subject to approval by the Engineer.
L. Removable Setting: Railings shall be set in close-fitting sleeves, bolted to tops or sides of concrete walls or walkways or aluminum walkway support structure as indicated on drawings.
M. Design mounting flange and anchoring system to meet the loading requirements with a minimum safety factor of 4.
N. Permanent setting shall have posts welded to base plates which in turn are bolted to the concrete with stainless steel expansion bolts on adhesive type stainless steel anchor bolts.
O. All metal railings shall be aluminum unless steel is specifically called for on the Drawings or where new railing is designed to connect to and/or match existing steel railing.
P. Finish:
   1. Aluminum: Clear anodized, AA-M21C22A41. Ship the railing plastic wrapped. Remove plastic wrap after erection.

2.6 HANDRAIL WALL BRACKETS

A. Provide wall brackets, where required, 4'-0" on center maximum.
B. Material:
   1. Aluminum:
      a. Wrought material the same composition as railing.

2.7 METAL STAIRS

A. Aluminum or steel as indicated on the Drawings.
B. Fabricate metal stairways, including stringers, stair treads, handrails, landing decks and fasteners, as indicated on the Drawings. Provide open grating non-slip stair treads for exterior stairs.
C. Shop fabricated welded or bolted installation; bolted stair treads; field cutting or burning not permitted; bolt holes drilled or punched; draw bolts tight, not protruding more than 1 thread, cut off and file smooth. All bolts and fasteners shall be stainless steel.
D. Design, fabricate and install stairs to comply with the requirements of Articles 1910.23 and 1910.24 of OSHA Standards for fixed industrial stairs, stairway railings and guards; construct
   1. stair members to support dead loads, minimum additional live loads of 125#/sq.ft., and a moving concentrated load of 1,000 pounds, without exceeding maximum permissible working stresses. Provide all intermediate support beams and vertical support members required.
   2. Submit structural drawings and calculations of stair member and platform design and anchorage system as part of the Design Drawings submittal for the stair and platform systems.

2.8 TOE BOARDS

A. Provide toe boards a minimum of 6" high at the following locations:
   1. Where stairs or stairways are exposed with open areas below.
   2. Where platforms, runways or catwalks crossover open areas or open tanks.
   3. Where indicated on the Drawings.
B. Toe boards shall be minimum 6" high extruded aluminum and attached to the posts with clamps or brackets which allow for lateral movement due to expansion and contraction between posts. Toe boards shall be set 1/4" above the walking surface. Notch toe boards as required at post base plates.
C. Where toe board sections terminate, splice toe board sections using a minimum 4" long bracket. The splice connection shall be a snap fit to allow expansion and contraction. Bolt, rivet, etc. type fasteners at the splice shall not be permitted. Provide a gap between the adjoining toe board sections at the splice of the dimension recommended by the manufacturer for the installation temperature.

2.9 VERTICAL LADDERS

A. Ladders shall conform to OSHA/ANSI A14.3 standards for fixed wall ladders. Manufacturers shall provide a certification of compliance.
B. Ladders, unless otherwise shown on drawings, shall be 16" clear between stringers with maximum rung spacing of 12".
C. Mounting brackets shall be bent plates not less than 2-1/2" x 3/8" of dimensions to allow a 7" clearance from wall; brackets shall be spaced not more than 6' centers.
D. Aluminum Ladder
   1. Stringers either 3" channels with minimum thickness of .125" or flats 2-1/2" x 3/8", alloy 6061-T6.
   2. Provide 1-1/8" round, serrated rungs, secured to stringer.

3. All ladder components alloy 6061-T6.
4. Standard mill finish.
5. All anchor bolts for aluminum ladders shall be stainless steel, Type 304.

2.10 ACCESS HATCHES

A. Access hatch shall be manufactured by Halliday or approved equal and must meet the dimensional requirements and specifications as called out on the project plans.
B. Door panels shall be ¼" aluminum diamond plate, reinforced to withstand a live load of 300 lbs. psf.
C. Uniform live load with maximum allowable deflection of 1/150 of the span.
D. Doors shall open 90° and automatically lock with T-316 stainless steel hold open arms with aluminum release handles. Doors shall close flush with frame and have a 316 stainless steel slam lock with removable key and non-corrosive locking bar used in conjunction with an owner supplied padlock.
E. Hinges and all fastening hardware shall be T-316 stainless steel.
F. Units shall carry a lifetime guarantee against defects in material and/or workmanship.
G. Finish: Standard mill finish.
H. Shop coat portions of the frame which may contact or be embedded in concrete with a heavy coat of bituminous paint.
I. Rectangular Hatches
   1. Aluminum, flush, channel frame type; single or double leaf as indicated on the drawings.
   2. Cover shall be equipped with stainless steel spring assist.
   3. Unit shall have a neoprene cushion/gasket unless indicated otherwise on the project drawings.
   4. Provide 1/4" extruded aluminum channel frame with anchoring flange, alloy 6063-T6. 1-1/2" channel drain.

2.11 PIPE BOLLARDS

A. Provide Schedule 40 black steel pipe of size and height indicated as detailed on the Drawings.
B. Permanent Setting: Set posts in concrete to a depth of 3'-0"; footing diameter minimum 3 times post diameter. Fill posts completely with concrete and dome on top.
C. Removable Setting: Close bottom of steel pipe with 8 gauge welded plate. Fill pipe with concrete. After curing, cap top of pipe with 8 gauge welded plate. Furnish sleeves for installation into concrete.
D. Bollard Sleeve: 1/4" thick polyethylene thermoplastic sleeve.
   1. Color: Safety yellow sleeve and cap.
E. Finish: Painted as specified in Section 09 90 00.

2.12 MISCELLANEOUS STEEL FABRICATIONS

A. Lintels:
   1. Provide steel lintels for masonry openings 18" or wider. (, except where indicated otherwise on Drawings.)
   2. Provide shop primed angles for lintels, unless otherwise indicated.
   3. For brick veneer with steel stud backup, galvanized or stainless steel lintel and shelf angles.
B. Door Guards:
   1. Provide 4" x 4" x 1/4" galvanized steel angle guards on exterior jambs, where shown on Drawings.
   2. Anchor door guard 12" on center with cinch type anchors.

2.13 ANCHOR BOLTS

A. Unless otherwise noted on the Drawings, furnish stainless steel anchor bolts and associated fasteners for interior and exterior applications. Anchor bolt sizing to be as shown on Drawings. Anchor bolt sizes not shown on Drawings shall be as recommended by manufacturer of equipment being anchored. Minimum anchor bolt embedment is 6 inches. Provide a minimum of 1/2" bolt projection beyond anchor bolt nut. Furnish flat washer with each anchor bolt. Unless otherwise indicated, all anchor bolts to be embedded type. Set prior to concrete placement.

B. Expansion type anchor bolts may be utilized where indicated on the Drawings. Expansion bolts shall meet the requirements above, except bolts shall have a 4" minimum embedment and conform to Federal Specification FF-S-325, Group II, Type 4, Class I for concrete expansion anchors.

2.14 ADHESIVE ANCHORS

A. Adhesive anchor shall consist of threaded anchor rod, nut, and washer, and two component injectable adhesive material. Anchor rods shall be stainless steel meeting AISI 304.

B. At hollow masonry and cavity wall applications also provide cylindrical wire mesh screen tube. Screen tube shall be low carbon steel with zinc electroplating manufactured with mesh size, length and diameter as specified by the adhesive manufacturer.

C. Acceptable Products:
   1. HIT HY20 by HILTI
   2. Foil-Fast by Rawl
   3. Or equal.

2.15 ALUMINUM PLATE

A. Aluminum checkered plate shall be 1/4" thick with diamond pattern plate, 6061-T6.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean dirt, debris, oil, grease and other foreign substances from surfaces to receive metal items.

B. Where aluminum components contact concrete or lime mortar, paint surfaces with alkaline-resistant coatings such as heavy-bodied bituminous paint.

C. Dissimilar Materials: Isolate dissimilar materials to prevent electrolytic actions by neoprene gaskets, asphaltum paint or other materials.

3.2 WORKMANSHIP

A. General: Refer to the Drawings for items required; items require the following workmanship classes and finishes.
   1. Concealed Items: Class 3.
   2. Exposed Items in Utility Areas: Class 2.
   3. Exposed Items in Finished Areas: Class 1.
   4. Steel Items Subject to Contact with Moisture: Galvanized finish.
   5. Steel Items not Subject to Contact with Moisture: Primed finish.

B. Details and connections shall be carefully made and fitted, with special care exercised to produce a thoroughly neat appearance; make pieces in accordance with detail shop drawings; members shall be true to length so assembling may be done without fillers, except where required by details; allow no projecting edges or corners where different members are assembled; do mitering and blocking precisely.

C. Set built-up parts true to line and without sharp bends, twists or kinks.

3.3 BURNING AND WELDING

A. Burning: Burning of holes in field shall not be permitted without consent; if consent is given, burned members shall be finished to an appearance equal to sheared finish; burning shapes to length with standard flame-cutting machine will be permitted.

B. Perform both shop and field welding in accordance with recommendations of American Welding Society. Welds shall be solid and homogeneously a part of metals joined, free from pits or incorporated slag or scale; surfaces of welds shall be smooth and regular, of full area indicated or necessary to develop required strength of joint.

3.4 INSTALLATION

A. Erect work to lines and levels, plumb and true, in correct relation to adjoining work; secure parts in rigid, durable manner. Provide concealed connections wherever possible.

B. Provide anchors and inserts in sufficient number for proper fastening of metal items; embed anchors in concrete so as to accurately align metalwork at proper level.

C. Built-in Anchors: Provide strap iron anchors welded to steel or iron frames or miscellaneous member for attaching to concrete or masonry.
   1. Minimum Anchor Size: 1-1/2" wide x length required to embed 2" into substrate.
   2. Minimum Anchor Thickness:
      a. Concrete Substrates: 1/4".
      b. Masonry Substrates: 1/8".
   3. Maximum Anchor Spacing:
      a. Concrete Substrates: 32" on center, unless noted otherwise.
      b. Masonry Substrates: 32" on center; match joint locations.

D. Anchors not Built-in: Provide cinch type anchors with machine bolts or screws, where built-in anchors cannot be used.

E. Where necessary to secure miscellaneous metalwork to structure by means of expansion bolts, cinch anchors and similar connections, do work of laying out, installing such connections, installing miscellaneous work, and bolting up.

F. Throughout work, provide anchors, inserts wherever possible for building adjoining work; where lugs are shown or specified for building into adjoining masonry, erect parts having lugs before masonry is built; elsewhere, bring work to building in as large pieces as practicable, attach to anchors or inserts during erection.

G. Connections made to sleeve inserts, except where noted removable, install members into sleeves, wedged tight with metal wedges; pour surrounding space full of expanding grout; caulk to finish flush with adjoining surface.

3.5 RAILINGS AND WALL BRACKETS

A. Railing and Wall Bracket shall be fabricated and installed to withstand a 200 lb. point load applied in any direction per OSHA requirement.

B. Removable Setting: Railings shall be set in close-fitting sleeves; sleeves set in concrete; sleeves shall be 1" less in length than thickness of concrete. Weld 3" flanges to posts at floor level.

C. Bolted Setting: Flanges shall be 3" and welded to bottom of posts; flanges bolted to floor with expansion type fasteners.

D. Permanent Setting:

1. Concrete: Set posts in sleeves, and securely wedge and grout (expanding/non-shrink) in place; sleeves shall be 1" less in length than thickness of slab.

3.6 CONNECTIONS

A. Unless otherwise specified, all shop connections shall be welded or riveted; framing connections made in field shall be made with high tension steel bolts; other connections may be made by any of the above methods, or with standard strength bolts.

B. All connections shall develop strength required for members involved; in no case less than AISC standard.

C. Provide lugs, clips, connections, rivets, bolts, necessary for complete fabrication, erection; bolts remaining in finished, exposed work shall be hexagon head bolts with hexagon nuts; bolts shall be of proper length to permit full thread in nut, but not project more than 1/4" beyond face of nut. Rivets, both shop and field, power driven; shall provide 100 lbs. per sq. in. at hammer minimum.

D. High Tension Steel Bolts: Furnish and install in accordance with ”Specification for Structural Joints using ASTM A325 or A490 Bolts” of AISC, as amended to date.

3.7 FIELD PAINTING

A. Where shop coat is abraded or burned by welding, clean and touch-up.

B. Repair surfaces of zinc coating that have been damaged during delivery, storage or installation by thoroughly wire brushing the damaged areas and removing all loose and cracked zinc coating, then paint the cleaned areas with 2 coats of zinc-dust, zinc-oxide primer; touch-up zinc-dust coated surfaces with the same material as the coating.

C. Field paint in accordance with the requirements of Section 09 90 00.

3.8 CLEAN UP

A. All work shall be left in clean condition, and all debris and rubbish cleaned up and removed from site by Contractor.

END OF SECTION