Region of Peel
working with you

PROCESS CONTROL NARRATIVE

Facility Name Sewage Pumping Station

Type I/II/III/IV *(select one)*

Physical Address, City

NOTE TO DESIGNER:

- YELLOW highlights identify the fields that need to be updated.
- RED text in this document provides guidelines to designer on adjustment and updates required based on specific project design decisions.
- Facility Name and Type are the fields that are referenced through in various section, once updated on cover page all references are to be updated.
- When updating an existing facility PCN use following color codes:

BLUE	Identifying additions and changes made under the scope of the project
~~**BLUE**~~	Removals proposed under the scope of the project

Version 1.1

REVISION HISTORY

Version	Date	Description of Revision
1.0	July 2021	For Region Review
1.1	May 2022	Revised backup float controls and added VFD min. flow setpoint

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APPENDIXES

1. INTRODUCTION

This document describes the process control narrative for the Facility Name Sewage Pumping Station that is used as the basis of the automatic process control system. The Facility Name Sewage Pumping Station is a Type I/II/III/IV (select one) pumping station, according to the Region of Peel Sewage Pumping Station Design Standards.

1.1 BACKGROUND

The Facility Name Sewage Pumping Station is part of the Region of Peel's municipal sanitary sewage collection system that operates under the following Environmental Compliance Approval (ECA):

- ECA Number: 2960-ALCLTM
- Issue Date: June 22, 2017

1.2 GENERAL SYSTEM DESCRIPTION

Table 1 describes the general specifications of the Facility Name Sewage Pumping Station.

Table 1 Sewage Pumping Station General Specifications

Parameter	Specifications
Station Type:	Type I/II/III/IV (select one)
Rated (Firm) Capacity:	XXX L/s
Number of Pumps:	*Number (n)* Pumps; *Number (n -x)* Duty and *Number (x)* Standby
Number of Wet Well Cells:	*Number (1 or 2)*
Forcemains:	*Number, size, and length of forcemain(s), including discharge location(s)*
Total Volume of Emergency Storage:	*Volume (m^3)*, providing XXX minutes of emergency storage at the firm capacity of XXX L/s.
Overflow	*Size, length, and discharge point of overflow point (if available)*
Standby Power	*Number and rated capacity(ies) of standby power generators (in kW)*

2. EQUIPMENT

2.1 CONTROL EQUIPMENT

2.1.1 PLC/SCADA Architecture

The PLC/SCADA architecture is based on an Ethernet Local Area Network (LAN). Programmable Logic Controller (PLC) controls all automation of the swage pumping station equipment.

The communications link to the Region of Peel's Wide Area Network (WAN) is a (3G/4G/5G wireless/dedicated Fibre Optic Link.) *(Select applicable network arrangement)*

The SCADA system architecture is identified within the Instrumentation (I) drawing set. The architecture identifies automation systems and building services equipment that are connected to the Sewage Pumping Station Local Area Network (LAN).

The following automation and building service systems are connected to the pumping station LAN:

- SPS-ICP-4XX – Main Process Automation Control Panel
- SPS-CCP-4XX – Data Communication Panel *(if installed)*
- SPS-WAN-4XX – WAN Telecom Panel *(if installed)*
- Station Power Monitor
- Sewage Pumps VFD/SS *(Select appropriate starter types)*

The pumping station has been designated the following facility code in accordance with PAIDS:

- Facility Type: SPS
- Facility Code: P4XX
- Facility Name: Facility Name Sewage Pumping Station
- Main PLC processor Tag: P4XX-SPS-PLC-001

2.1.2 Motor Starters

Soft motor starters (SS's) and Variable Frequency Drives (VFDs) *(select appropriate starters)* are required to be connected to the pumping station communications network for status monitoring via the SCADA system.

The starters and VFDs are configured such that the specific data that is intended for remote monitoring is in a contiguous address block to facilitate communications polling. The following table of status information (as a minimum) is provided for remote monitoring via the pumping station PLC automation system via communications:

Table 2 Motor Starter Status Information

Electrical	Power	VFD (Not required for Soft Starters)	Alarms
- Phase Currents (A) - Line Voltage (V) - Frequency (Hz)	- Motor Load (%) - Real Power (kW) - Apparent Power (kVA) - kW Demand - Power Factor	- Speed (Hz) - Speed (%) - Speed (RPM) - Torque (Nm or other acceptable units)	- Fault Status - Alarm Status

{Designer is to update this table as required}

2.1.3 Motor Protection Relays

{Designer is to update this section to suit the facility's design arrangement}

A motor protection relay system is provided for all pump motors equal to or greater than 22.4kW (30hp) in size.

The motor protection relays are connected to the pumping station communications network to facilitate remote status monitoring of discrete and analog signals via the SCADA system.

The protection relays are configured such that specific data that is intended for remote monitoring is made available for communications polling. The following table of status information (as a minimum) is provided for remote monitoring via the pumping station PLC automation system:

Table 3 Motor Protection Relays Status Information

Electrical	Power	Protection	Alarms
- Phase Currents (A) (While Running) - Line Voltage (V) - Frequency (Hz)	- Motor Load (%) - Real Power (kW) (While Running) - Apparent Power (kVA) (While Running) - kW Demand - Power Factor (While Running)	- Delay on Restart Timer Value (Start Inhibit Timer) - RTD 1 Temperature (Stator A) - RTD 2 Temperature (Stator B) - RTD 3 Temperature (Stator C) - RTD 6 Temperature (Motor Out Bearing) - RTD 7 Temperature (Motor In Bearing) - RTD 8 Temperature (Pump Out Bearing) - RTD 9 Temperature (Pump In Bearing) - Vibration - Leakage (when applicable and connected to MPR) - Cause of Last Trip - Starts per Hour Lockout Timer	- Trip Status - Alarm Status - Motor Overload - Drive Fault - Drive Warning - SMC Alarm (For Solid State Drives Only) - SMC Fault (For Solid State Drives Only) - Access Switch - Speed Switch - Spare Switch - Vibration Switch - Leakage Alarm - Emergency Switch - Reset Switch (DRS Reset) - Trip Relay - Alarm Relay - Aux Relay 1 - Aux Relay 2

2.1.4 Overload Relays

{Designer is to update this section to suit the facility's design arrangement; this section is applicable to FVNR starters only}

A smart motor overload relay protection is required for all pumps equipped with Full-Voltage Non-Reversing (FVNR) motor starters.

The smart overload relays are connected to the pumping station communications network to facilitate remote status monitoring of discrete and analog signals via the SCADA system.

The smart overload relays are configured such that specific data that is intended for remote monitoring is made available for communications polling. The following table of status information (as a minimum) is provided for remote monitoring via the pumping station PLC automation system:

Table 4 Smart Motor Overload Relays Status Information

Electrical	Power	Alarms
- Phase Currents (A) - Average Current (A) - Frequency (Hz) - Unbalanced Voltage (V) - Unbalanced Current (A) - Line Voltages (V) - Line Average Voltage (V) - Line-Line Voltages (V) - Line-Line Average Voltages (V)	- Real Power (kW) - Apparent Power (kVA) - Reactive Power (kVAr) - Power Factor - Maximum Total Dynamic Distortion Line Voltages - Maximum Total Dynamic Distortion Phase Currents	- Relay Fault Code - Relay Warning Code

2.2 MOTOR CONTROL CENTERS (MCC)

The Facility Name Sewage Pumping Station MCCs provide power distribution to process and building services equipment. There is qty (#) 600VAC Motor Control Centre(s) (MCC(s)) at the pumping station that include pump motor starters, auxiliary process loads and building services. The MCC process loads are grouped as shown in Table 5.

Table 5 MCC Process Loads

MCC No.	Switch/ MCC Loads	Equipment Tag Number(s)

2.3 PUMPS

Table 6 presents the pumps specification details:

Table 6 Pump Specifications

Pump Tag No.	Equipment Description		Equipment Specifications			
	Design Flow	TDH (m)	Motor Size (kW/ HP)		VFD/SS	Additional Protection (Protection Relay/Smart Overload/Temp and Leak)
SP4XX10						
SP4XX20						
SP4XX30						
SP4XX40						
Sump Pumps						
SUP4XX80					No	No

{Designer is to make adjustment in the table based on station type}

2.4 MOTORIZED VALVES

Table 7 presents the motorized valves specifications details

Table 7 Motorized Valves

Tag Name	Size (mm)	Type	Operation	Position	Location
FV4XX01			Motorized	Normally Open	Forcemain A
FV4XX02			Motorized	Normally Open	Forcemain B
FV4XX03			Motorized	Normally Open	Forcemain A Recirculation
FV4XX04			Motorized	Normally Open	Forcemain B Recirculation
FV4XX11			Motorized	Normally Open	Pump 1 Suction Line
FV4XX12			Motorized	Normally Open	Pump 1 Discharge Line

{Designer is to make adjustment based on station type. Note: Station Types I and II do not have motorized valves per the Standard.}

2.5 INSTRUMENTS

The instrument specifications are presented in Table 8.

Table 8 Instrument Specifications

Tag Name	Equipment Description				Details/Spec
	Instrument	Location	Range		
LIT4XX05	Level Indicating Transmitter	Emergency and Maintenance Storage	0 – TBD/ 0 - 100%	m/%	100% Level @ XXm 0% Level @ XXm Sensor Location @ XXm
LSH4XX85	Level Switch, High	Emergency and Maintenance Storage	-	-	Elevation @ XXm
LSH4XX84	Level Switch, High	Inlet Maintenance Hole	-	-	Elevation @ XXm
LIT4XX01	Radar/ Ultrasonic Level Indicating Transmitter	Wet Well A	0 – TBD/ 0 - 100%	m/%	100% Level @ XXm 0% Level @ XXm Sensor Location @ XXm
LIT4XX02	Hydrostatic Level Indicating Transmitter	Wet Well A	0 – TBD/ 0 - 100%	m/%	100% level @ XXm 0% level @ XXm
LSHH4XX81	Level Switch, High	Wet Well A	-	-	Elevation @ XXm
LSH4XX01	Level Switch, High	Wet Well A	-	-	Elevation @ XXm
LIT4XX03	Radar/Ultrasonic Level Indicating Transmitter	Wet Well B	0 – TBD/ 0 - 100%	m/%	100% Level @ XXm 0% Level @ XXm Sensor Location @ XXm
LIT4XX04	Hydrostatic Level Indicating Transmitter	Wet Well B	0 – TBD/ 0 - 100%	m/%	100% level @ XXm 0% level @ XXm
LSHH4XX82	Level Switch, High	Wet Well B	-	-	Elevation @ XXm
LSH4XX02	Level Switch, High	Wet Well B	-	-	Elevation @ XXm
LIT4XX0X	Level Indicating Transmitter (Virtual)	Master Level	TBD	m	
PIT4XX11	Pressure Indicating Transmitter	Raw Sewage Pump 1 Suction	TBD	kPa	
PIT4XX12	Pressure Indicating Transmitter	Raw Sewage Pump 1 Discharge	TBD	kPa	
PIT4XX21	Pressure Indicating Transmitter	Raw Sewage Pump 2 Suction	TBD	kPa	
PIT4XX22	Pressure Indicating Transmitter	Raw Sewage Pump 2 Discharge	TBD	kPa	
PIT4XX31	Pressure Indicating Transmitter	Raw Sewage Pump 3 Suction	TBD	kPa	
PIT4XX32	Pressure Indicating Transmitter	Raw Sewage Pump 3 Discharge	TBD	kPa	
PIT4XX41	Pressure Indicating Transmitter	Raw Sewage Pump 4 Suction	TBD	kPa	
PIT4XX42	Pressure Indicating Transmitter	Raw Sewage Pump 4 Discharge	TBD	kPa	
PIT4XX01	Pressure Indicating Transmitter	Forcemain A	TBD	kPa	
PIT4XX02	Pressure Indicating Transmitter	Forcemain B	TBD	kPa	

Tag Name	Equipment Description				Details/Spec
	Instrument	Location	Range		
LSH4XX83	Level Switch, High	Valve Chamber	-	-	Elevation @ XXm
LSH4XX8X	Level Switch, High	TBD	-	-	Elevation @ XXm
TT4XX01	Temperature Transmitter	SPS-ICP-4XX Control Panel	TBD	°C	
TT4XX91	Temperature Transmitter	Electrical Room	TBD	°C	
XSH4XX90	Smoke/ Carbon Monoxide Detector	TBD	-	-	
GIT4XX10	Generator Frequency Indicating Transmitter	Generator	TBD	Hz	
JIT4XX10	Generator Load Indicating Transmitter	Generator	TBD	W	
VRSL4XX91	Vacuum Switch, Low	Indoor Diesel Tank	-	-	
LSL4XX91	Level Switch, Low	Indoor Diesel Tank	-	-	Elevation @ XXm
LSH4XX91	Level Switch, High	Indoor Diesel Tank	-	-	Elevation @ XXm
LSHH4XX91	Level Switch, High	Indoor Diesel Tank Containment	-	-	Elevation @ XXm
LIT4XX91	Level Indicating Transmitter	Indoor Diesel Tank	TBD	m/%	100% Level @ XXm 0% Level @ XXm Sensor Location @ XXm
LSL4XX92	Level Switch, Low	Outdoor Diesel Tank	-	-	Elevation @ XXm
LSH4XX92	Level Switch, High	Outdoor Diesel Tank	-	-	Elevation @ XXm
LIT4XX92	Level Indicating Transmitter	Outdoor Diesel Tank	TBD	m/%	100% Level @ XXm 0% Level @ XXm Sensor Location @ XXm

{Designer is to make adjustment in instrument listed in this table based on station type and requirements}

The flow meter specifications are presented in Table 9.

Table 9 Flow Meter Specifications

Tag Name	Equipment Description			
	Location	Pipe Dia. (mm)	Max. Flow (L/s)	Flow Meter Type
FIT4XX03	Inlet Maintenance Hole			
FIT4XX04	Overflow to Environment Channel			
FIT4XX01	Forcemain A			
FIT4XX02	Forcemain B			

{Designer is to make adjustment based on station type}

2.6 SURGE RELIEF VALVES

The surge relief valves specifications are presented in Table 10.

Table 10 Surge Valves Specifications

Tag Name	Equipment Description	Size (mm)	Location
PSV4XX01	Forcemain A Surge Valve		
PSV4XX02	Forcemain B Surge Valve		

{Designer is to make adjustment based on station type}

2.7 MISCELLANEOUS

Miscellaneous equipment and instrumentation for the station is presented in Table 11.

Table 11 Miscellaneous Equipment Specifications

Tag Name	Equipment Description	Location	Equipment Specifications
GRD4XX10	Inlet Grinder 1	Inlet Grinder Channel	
GRD4XX20	Inlet Grinder 2	Inlet Grinder Channel	
MX4XX10	Mixer 1	Wet Well A	
MX4XX20	Mixer 2	Wet Well B	
EEW4XX90	Emergency Eyewash Station		
JSL4XX01	Control Panel Power Relay	SPS-ICP-4XX Control Panel	
PSU4XX01	24VDC Power Supply 1	SPS-ICP-4XX Control Panel	
PSU4XX02	24VDC Power Supply 2	SPS-ICP-4XX Control Panel	
UPS4XX01	UPS	SPS-ICP-4XX Control Panel	
JU4XX01	Power Monitor Unit		
ATS4XX10	ATS		
GEN4XX10	Genset		
DM4XX91	Combustion Damper		
GDP4XX90	Gas Detection System		
HCP4XX90	HVAC System (Use BAS4XX9X when applicable)		
FAP4XX90	Fire Alarm System		
SEC4XX90	Security System		

Tag Name	Equipment Description	Location	Equipment Specifications
FCP4XX01	Float Control Panel		
FAN4XX91	Wet Well Ventilation Fan	Wet Well	

{Designer is to make adjustment based on station type and requirements}

3. CONTROL MODES

3.1 OVERVIEW

The Facility Name Sewage Pumping Station operates on three different modes. The modes are applicable to the PLC and HMI systems with similar designations.

The Local/Remote Mode of operation is typically made by an operator at the device, MCC or a Local Control Panel by using a selector switch. The different modes are summarized in Table 12.

Table 12 Control Modes for Sewage Pumping Station Equipment

Mode	SCADA
Remote	Remote-Manual
	Remote-Auto
Local	Local

The different control modes apply to all major pieces of equipment associated with the operation of the pumping station. The control mode of operation is determined by a selector-switch on the respective control panel starter.

The positions on the pump starter have the following selections: Local and Remote. The PLC registers the position of the selector switch via dedicated auxiliary input contacts.

The control modes are described in more detail in the following subsections.

3.2 CONTROL MODES DESCRIPTION

3.2.1 Local

When the selector switch is in the Local position, Start/Stop control functions can be initiated manually at the respective device via local start/stop push buttons. All PLC automatic control is disabled when the selector switch is in the Local position. Operation via the PLC is available only when the selector switch is in the Remote position.

The equipment is started and stopped separate from the controller through one of the switches described in Section 3.2.3: Switches and Push Buttons.

3.2.2 Remote

The Remote mode is active when the respective selector switch is in the Remote position. Once the selector switch is in the Remote position, PLC control functions or modes are enabled. The PLC monitors the device mode via auxiliary position contacts on the Local/Remote selector switch. The following subsections describe the three Remote modes in more detail.

3.2.2.1 Remote-Manual

REMOTE-MANUAL is the software-generated manual mode of operation. REMOTE-MANUAL mode represents remote SCADA manual control of equipment through the HMI. This mode is selected via the SCADA system or via the local HMI. When a pump or a piece of equipment is in REMOTE-MANUAL mode, automatic process logic is disabled and Start/Stop functions are initiated manually by Operations Staff via the SCADA system or Local HMI. No software interlocks are present in REMOTE-MANUAL mode.

3.2.2.2 Remote-Auto

REMOTE-AUTO is the software generated, standard process pumping automatic mode of operation. REMOTE-AUTO mode operation is selected via the SCADA system or via the local HMI. REMOTE-AUTO initiates a setting change in the respective PLC such that automatic control logic for equipment operation is enabled. When a pump is in the REMOTE-AUTO mode it will operate in response to the typical process pumping auto logic located within the respective local PLC. This mode is typically used for parallel pump applications.

3.2.3 Switches and Push Buttons

Switches and push buttons located on control panels, MCCs and devices are defined below:

LOCAL – Mode selector switch is in the Local position. The device is in local mode and is controlled independently from the equipment control panel. START/OPEN and STOP/CLOSE push buttons are typically separated.

When sewage pumps are controlled in local all safety interlocks such as overload protection, starter failure, thermal and leak protection are bypassed; it is operator's responsibility to assure that pumps are stopped as needed.

REMOTE – Mode selector switch is in the Remote position. The device is controlled via a separate PLC. When in REMOTE, the local START/OPEN and STOP/CLOSE push buttons are disabled.

AUTO – Mode selector switch is in the Auto position. The device is automatically controlled by the equipment's own control panel, and not via the local START/OPEN and STOP/CLOSE push buttons. In this mode of operation, the START/OPEN and STOP/CLOSE functions are initiated by a proprietary interlock or automation logic in the equipment's control panel.

3.2.4 Emergency Stop

An emergency stop (also known as an E-stop) is typically a red push button with a mushroom head located on a control panel or MCC to stop the operation of a specific device. The E-stop button is different from a regular stop button via the following characteristics:

- It is larger in diameter than a regular STOP push button and projects further from the panel/MCC surface thus allowing easier access to the E-stop.
- It stops the operation of a specific device whether it is in LOCAL or REMOTE modes, while a regular stop button will only work if the device is in LOCAL mode.
- It is typically supplied with a lock reset. Until the E-stop button is reset (pulled out), the specific device will remain locked out, i.e., it will not be permitted to operate.

Table 13 summarizes the Sewage Pumping Station's equipment and the different control modes in which they can operate.

Table 13 Control Modes

Equipment Tag	Equipment Description	Local ☑	Remote-Manual ☑	Remote Auto ☑
GRD4XX10	Inlet Grinder 1	✓	✓	✓
GRD4XX20	Inlet Grinder 2	✓	✓	✓
MX4XX10	Wet Well A Mixer	✓	✓	✓
MX4XX20	Wet Well B Mixer	✓	✓	✓
SP4XX10	Raw Sewage Pump 1	✓	✓	✓
SP4XX20	Raw Sewage Pump 2	✓	✓	✓
SP4XX30	Raw Sewage Pump 3	✓	✓	✓
SP4XX40	Raw Sewage Pump 4	✓	✓	✓
SUP4XX80	Emergency & Maintenance Storage Sump Pump	✓	✓	✓
FV4XX01	Forcemain A Discharge Valve	✓	✓	✓
FV4XX02	Forcemain B Discharge Valve	✓	✓	✓
FV4XX03	Forcemain A Recirculation Valve	✓	✓	✓
FV4XX04	Forcemain B Recirculation Valve	✓	✓	✓
FV4XX11	Raw Sewage Pump 1 Suction Valve	✓	✓	✓
FV4XX12	Raw Sewage Pump 1 Discharge Valve	✓	✓	✓

{Designer is to make adjustment based on station type and requirements}

4. EQUIPMENT I/O

Refer to Appendix 1 for the detailed list of SCADA related I/O signals.

5. CONTROL LOGIC

5.1 STANDARD PROCESS CONDITIONS

5.1.1 Inlet Maintenance Hole Flowmeter

The Facility Name Sewage Pumping Station's Inlet Maintenance Hole is equipped with an area velocity flowmeter that provides the following analog signals to SCADA for monitoring:

- Inlet Maintenance Hole Sewage Level (m)
- Inlet Maintenance Hole Sewage Flow Velocity (m/s)
- Inlet Maintenance Hole Sewage Flow Rate (L/s)

Inlet Maintenance Hole Flowmeter data is used to trend influent flow rates into the pumping station.

5.1.1.1 Calculated/Virtual Inlet Flow Rate

In addition to the Inlet Maintenance Hole Flowmeter, inlet flows into the Facility Name Sewage Pumping Station are calculated as a back-up calculation to the measured inlet flowmeter reading. The calculation uses variations in the Wet Well Master Level during the pump off cycle. The variations are measured only within a range that has a known and consistent cross-sectional area, known as the control volume, to eliminate errors due to irregularly shaped wet well components such as benching and sewers. The inlet flow rate is calculated using the following equation during the pump off cycle only:

$$\mathrm{Q}_{IRC} = \frac{\{\mathrm{H}_2 - \mathrm{H}_1\}}{\mathrm{t}} \times A_W \times 1000$$

Where:

- Q_{IRC} = Calculated Inlet flow Rate (L/s)
- H_2 = Wet Well Master Level at the top of the control volume (m)
- H_1 = Wet Well Master Level at the bottom of the control volume (m)
- t = Time for Wet Well Master Level to increase from H_1 to H_2 (s)
- A_W = fixed cross-sectional area of the control volume (m^2)

{Designer to update the above equation as required to suit the facility requirements.}

5.1.2 Inlet Grinder

The Facility Name Sewage Pumping Station is equipped with {one or two} grinder{s} located in the {Designer to indicate location based on Station Type}.

Under normal operating conditions (i.e. REMOTE-AUTO), the grinder always runs. Failure of the grinder does not interlock sewage pumps or any other equipment in the station. {All Station Types except Type IV include one grinder – Designer to update text accordingly}

Detail of operation and various control modes are as follows:

5.1.2.1 Normal Operating Conditions

The grinder control mode can be selected using the LOCAL/AUTO/ PLC selector switch at the Starter/Local Control Panel, GRD-LCP-4XX.

When the selector switch is in LOCAL position, the grinder will be controlled via a REV/STOP/FWD (Reverse / Stop / Forward) selector switch at the Local Control Panel. While running in forward direction, the forward running indicator lamp will illuminate. While running in reverse direction, the reverse running indicator lamp will illuminate. The station's PLC monitors a common run status signal.

When the selector switch is in AUTO position, the grinder runs continuously in the forward direction without manual operator intervention or PLC control.

In PLC Mode, the grinder is controlled (started/stopped) by the station's PLC in SPS-ICP-4XX control panel. In REMOTE-MANUAL: Mode, the grinder is commanded to run in the forward direction as requested by operations.

In normal operating (REMOTE-AUTO) conditions, the grinder runs continuously in the forward direction. There is no automatic stop signal unless the grinder jams and/or fails to clear a jam. The grinder only runs in reverse direction in case a jam condition is detected. Clearing a jam is triggered and controlled by the Local Control Panel and not by the PLC.

5.1.2.2 Grinder Jam Clearing Sequence

The sequence to clear a grinder jam is as follows: When the current sensor detects a jam, the motor forward contactor is momentarily de-energized. The motor reverse contactor then energizes for a predetermined period (4 seconds), then is de-energized. After the reverse contactor is de-energized, the motor forward contactor is re-energized for a predetermined period (2 seconds). This sequence is repeated for a total of 3 reversals to clear the jam condition in a 30-second period.

During the jam clearing sequence, the inrush current is ignored when the motor is energized to avoid an accidental fault condition. This sequence of de-energizing and re-energizing is to push material back and forth inside the grinder until either the jam is cleared, or 30 seconds have passed.

If the jam is not cleared in accordance with this sequence (3 reversals in a 30-second period), a "Grinder Jammed" alarm condition is issued, and the grinder is stopped. Jam condition is reset through the control devices on the grinder starter/control panel. A grinder jammed alarm is displayed on SCADA.

5.1.3 Wet Well Master Level

{This writeup suites Type I and II – Designer to update as required}

The Facility Name Sewage Pumping Station has a single wet well cell that is equipped with two (2) level transmitters for level monitoring, one hydrostatic level transducer and one {radar/laser/ultrasonic} transmitter.

{This writeup suites Type III and IV – Designer to update as required}

The Facility Name Sewage Pumping Station is equipped with two (2) wet well cells. During normal operating conditions (i.e., REMOTE-AUTO), the two (2) wet wells cells are hydraulically connected since the two (2) wet well interconnecting sluice gates are normally open.

Each wet well cell is equipped with two (2) level transmitters for level monitoring, one hydrostatic level transducer and one {radar/laser/ultrasonic} transmitter.

All level transmitters in the wet well are utilized in a Master Level logic that receives all various LIT readings and selects one common reading referred to as the "Master Level" that is used for pump control as well as alarming. In case of a duty Level transmitter failure or loss of signal, the Master Level automatically updates to use other available transmitters.

The Master Level can be obtained from either the selected duty transmitter or from an average value. Through the HMI screen, operators can choose the desired duty level transmitter, enable/disable each transmitter, and assign duty levels to various LITs that are available. HMI screens also allow the operator to select the average mode, which calculates the average value of the enabled level transmitters.

Level readings from various transmitters are compared against the duty level transmitter when the wet well cells are hydraulically connected. The deviation set point is indicated in the Alarm Setpoints Table. If the difference is above a predetermined deviation set point, an alarm is displayed on SCADA, prompting operator intervention.

5.1.4 Raw Sewage Pumps

5.1.4.1 PLC Mode (Master LIT)

{The following is a typical PLC mode control logic for a constant speed pumping system – Designer to update as required to suit the specific facility type and number of pumps}

The Facility Name Sewage Pumping Station is equipped with *number (#)* sewage pumps. The pumps operate in a Duty / Standby fashion. Under normal operating conditions, the pumps are placed in REMOTE-AUTO mode, where the pumps operate based on the Master Level reading and Duty Start/Stop setpoints that are operator-adjustable through HMI screens.

In PLC Mode, the start and stop of pumps is controlled by the PLC according to the following logic:

<u>On rising wet well level:</u>

- If the Master Level is equal to or greater than the Duty *(pump #)* Start Level Setpoint, Duty *(pump #)* Pump is requested to start.

On dropping wet well level:

- As the pump operates and wet well level drops, Duty *(pump #)* Pump stops once the Master Level is equal to or less than the Duty *(pump #)* Stop Level Setpoint.

In the event that a duty pump is called to start, and it fails to start or is unavailable, the standby pump becomes the duty pump and is called to start instead. Duty rotation can be configured by the operator; see Section 5.1.4.5

Following table provides a list of the control setpoints.

Table 14 Raw Sewage Pumps Level Control Setpoints

SCADA Tag Name	Description	Data Type	Unit	Sig. Digit	Input Range		Default Value	Operator Adjust.	Security Level
					Min.	Max.			

Note: Refer to Standard Drawings for more information regarding wet well level setpoints.
{Designer is to add additional pumps to this table as needed}

{Following section applies when pumps are equipped with VFD; designer is to make adjustments as required}

Speed control:

Table 15 shows minimum and maximum speed of the variable speed pump while operating. While the pump is running, the speed is primarily controlled and adjusted based on the level; however a dedicated PID control loop is used to override the level based speed setpoint as needed to ensure the station min-flow requirement are met.

This PID control loop utilizes station's discharge flow(actual value) and minimum flow setpoint(target value) to provide a min.flow-based speed setpoint for pumps. When min flow -based speed setpoint is greater than level-based setpoint, it will override the level speed setpoint.

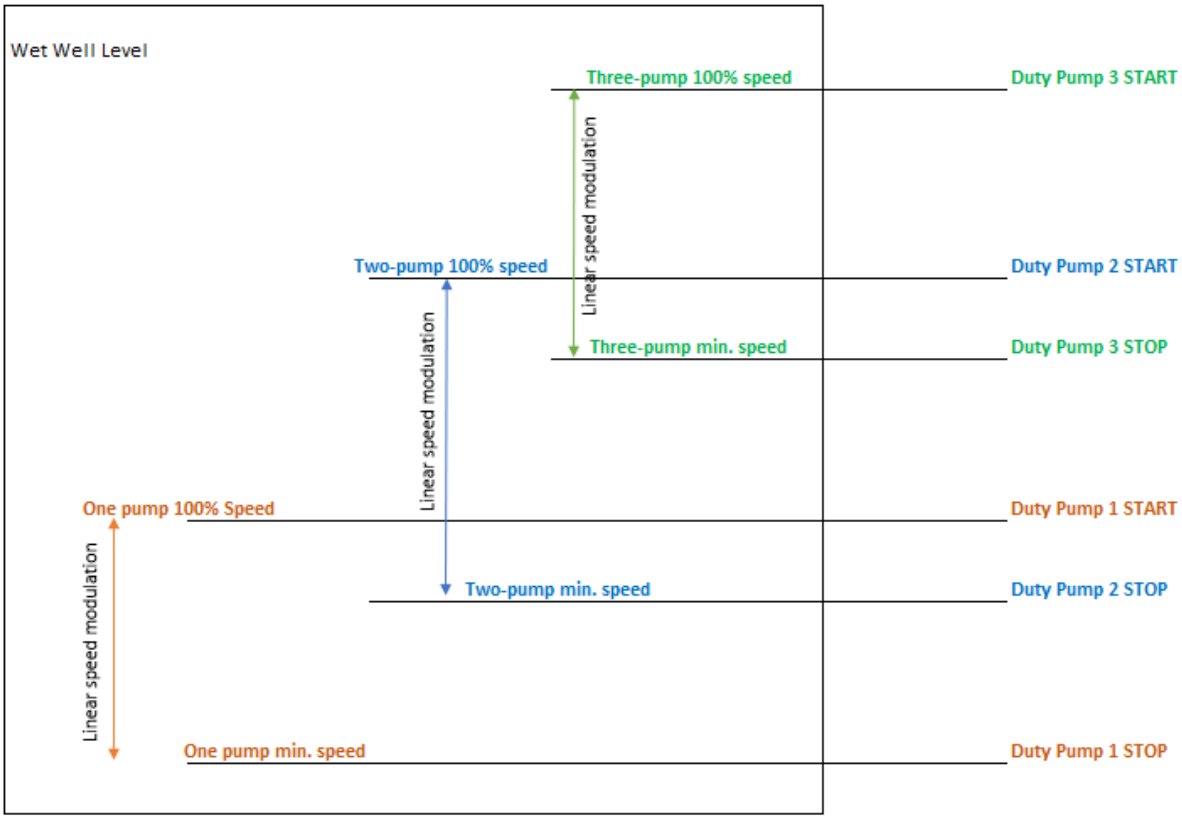
Level-Based Speed control of the VFD Pump is as follows:

- *As the duty pump is requested to start, the VFD pump will start up at minimum speed and will modulate to maximum speed. As the pump runs, the level in the wet well decreases,*

the pump speed will modulate in linear relation with the difference in wet well level between the upper/pump start level setpoint and the lower/pump stop level setpoint.

- *Pumps will run at maximum speed when the wet well level is at or above the pump start level setpoint and will modulate to minimum speed as the level drops to the pump stop level setpoint. Pumps will run in linear relation when in between start and stop level.*
- *Refer to Figure 1 for the overlapping speed operating band between duty pumps.*
- *Two or more duty pumps of the same size running in parallel shall have matching operating speeds according to Table 15.*

Figure 1: Pump Speed modulation between various control bands



1. *This schematic shows control band for variable speed pumping under PLC Auto Control only. Refer to the Region of Peel Standard Drawing SPS-107 for a detailed list of control levels and alarms.*
2. *The schematic is based on Type IV stations with up to 3 duty pumps. Schematic to be adjusted to suit the specific number of duty pumps (excludes standby).*

Table 15 Maximum and Minimum Speed Setpoints of Raw Sewage Pumps

Description	***VFD Pump Speed (%)***		
	Range	***Minimum** Speed*	***Maximum** Speed*
Duty 1 Raw Sewage Pump	*TBD*	*TBD*	*TBD*
Two Duty Raw Sewage Pumps	*TBD*	*TBD*	*TBD*

Description	***VFD Pump Speed (%)***		
	Range	***Minimum** Speed*	***Maximum** Speed*
Three Duty Raw Sewage Pump)	*TBD*	*TBD*	*TBD*

{include only if VFDs are used, designer is to add duty 3 and 4 to table as needed}

The VFDs are configured as shown in Table 16. The pump speed feedback (VFD to PLC analog signal) monitors the full signal range (0-60Hz/ 0-100%); while the speed setpoint (PLC to VFD) is configured in the PLC to prevent pump from operating below the Pump Manufacturer's Minimum Recommended Speed.

Table 16 Speed Configuration of Raw Sewage Pumps VFDs

Description	***VFD Pump** Speed Configuration*		
	***Current** (mA)*	***Speed** (%)*	***Speed (Hz)***
Speed Feedback (from VFD to PLC)	*4 mA*	*0 %*	*0 Hz*
	20 mA	*100 %*	*60 Hz*
Speed Setpoint (from PLC to VFD)	*4 mA*	*Y %*	*X Hz*
	20 mA	*100 %*	*60 Hz*

Where:

X Hz = Minimum VFD Speed
Min VFD speed is determined during commissioning based on the speed of pump when sewage starts flowing in the pipe; all pumps of the same size must have the same min speed; pump max speeds to be always set at 60 Hz(100%).

Y % = Percent value in relation to the X Hz within the 0-60Hz range

i.e: if VFD minimum speed is 30 Hz (X Hz), then Y % would be 50 %.

5.1.4.2 Pump Performance Monitoring

{Note to Designer – Pump Performance Monitoring is only applicable to Pumps with motor sizes equal to or greater than 30 hp which are equipped with Motor Protection Relays and/or a vendor-supplied motor protection system that measures real power}

Individual pump performance is calculated and monitored when the pump is running solo in REMOTE-AUTO to monitor wire-to-water efficiencies over time. The following conditions must be satisfied to calculate the pump specific energy:

- Pump is in REMOTE-AUTO control mode.
- Pump is running as single duty.

- Discharge flowmeter is not faulted.

The following formula is used to calculate the pump specific energy:

$$E = P \div (3.6 \times \mu \times Q)$$

Where:

- E = specific energy of the pump, (kWh/m^3)
- P = measured real power delivered to the pump by the motor protection relay (kW)
- μ = motor efficiency, constant, to be confirmed by the Designer, (fraction)
- Q = discharge flow rate in the forcemain(s) when a single pump runs (L/s)

Specific energy data is calculated during a pump run time and the value is displayed on the HMI and is logged and trended for each pump.

5.1.4.3 Float Back up Control

The Float Control Panel (SPS-FCP-4XX) provides a secondary (back-up) control of the raw sewage pumps in the event of failure of the LITs and/or the PLC.

{The following write up suites Type I and II Stations – Designer to update as required}

The wet well is equipped with the following two (2) level floats:

- Pump Start Float
- Wet Well High-Level Float

{The following write up suites Type III and IV Stations – Designer to update as required}

Each wet well cell is equipped with the following two(2) level floats:

- Pump Start Float
- Wet Well High-Level Float

The level floats are intended to act only in the event of a failure of the electronic equipment (typically the PLC or level transmitters), or under unusually high station flow conditions.

The Pump Start Float in Wet Well A, control Raw Sewage Pumps 1 and 2. The Pump Start Float in Wet Well B, control Raw Sewage Pumps 3 and 4. These floats are wired to the backup float control panel (SPS-FCP-4XX) which will generate hardwired start/ stop commands based on timers to each pump starter circuit. The float signals are also wired to the PLC in SPS-ICP-4XX panel for monitoring purposes.

Should the level in the wet well increase to tip the Pump Start Float (LSH) for the first pre-set period (determined by a hardwired adjustable delay timer located in the FCP), Pump 1 in wet well A or Pump 3 in wet well B is commanded to start through the hardwired circuitry in the Float Control Panel (SPS-FCP-4XX) and direct wiring between float control panel and MCC. Should the level in the wet well remain above the LSH float for a second pre-set period (determined by a hardwired adjustable delay timer located in the FCP), Pump 2 in wet well A or Pump 4 in wet well B starts through the hardwired circuitry between the Float Control Panel and MCC.

Once the pumps are running in Float Backup Control mode (meaning the Start Float tipped to start the pump), the pumps continue to run until the float system stop condition is reached. Backup float stop request in each cell will be generated once the start float is back to normal(hanging) state, one the start float remains hanging for a pre-set period (determined by a hardwired adjustable on-delay timer located in the FCP) Pump 2 in wet well A or Pump 4 in wet well B are commanded to stop through the hardwired circuitry between the Float Control Panel and MCC. As the level remains below the LSH float for an extended period of time Pump 1 in wet well A or Pump 3 in wet well B are commanded to stop through the hardwired circuitry between the Float Control Panel and MCC.

A Bypass/ Backup Active Selector Switch is provided on the float backup control panel; the selector switch must be at “Backup Active” position for the float backup control circuitry to engage. If the selector switch is at “Bypass” position, a signal will be sent to the PLC to alert operators that the float backup control is bypassed; a critical alarm “Backup Float Control Enabled/ Bypassed” will be displayed on SCADA.

Operation of the backup float system can be unlatched/deactivated by manually pushing the reset push button located on the SPS-FCP-4XX.

While the pumps are running on Float Backup Control, the PLC does not control the pumps. The pumps Uncommanded Start/Stop alarms are disabled in the PLC to avoid nuisance alarms and ensure that PLC control can resume automatically given the LIT and PLC are functional.

During the time that backup float system is active/engaged, the pump(s) remain in REMOTE-AUTO mode but are controlled by the Float Backup System circuit. An indicator, “FLOAT” is shown beside the pump on the HMI to indicate which pump is in “FLOAT MODE”. A critical alarm for backup float control mode is displayed on SCADA to notify operators that the wet well is in Float Backup System control.

When the backup float is disengaged, the “FLOAT” indicator on the HMI remains on until the duty pump is started by the PLC in REMOTE-AUTO. When PLC control of the pumps resumes, the critical alarm for “Float control mode active” is cleared

When the Pump Start Float tips to engage “FLOAT MODE”, the PLC starts a timer. If the Pump Stop Request (through the back up float circuit) does not activate within 60 minutes, a critical alarm “Float Mode Failure – LSH4XX0x – Wetwell Cell x Stop Float Condition Did Not Reach (Backup

Mode Running too Long)" is displayed on SCADA. Note that pump performance will deteriorate over time and thus there is a reasonable buffer in the alarm timer. Consequently, this alarm can inform operations of a pumping issue before it becomes serious.

5.1.4.4 Pump Control Scenarios

The table below lists pumps control at various wet well level instruments operating states given that the PLC is functional. In case the PLC fails, the pumps will be controlled through the Float Backup Control Panel.

Table 17 Pump Control and Various Failure Scenarios (applicable to each cell)

Item	Scenarios	Pump Control
1	Normal Operation Both LITs in service	Duty Level (using primary LIT)
2	One LIT failure	Duty Level (using backup LIT)
3	Both LIT failure	Float Backup Control (Relying on LSH to start and stop the pumps based on various timers)
4	PLC failure	Float Backup Control (Relying on LSH to start and stop the pumps based on and various timers)
6	Both LIT failure/PLC failure and backup float LSH is failed	Float Backup Control (LSH failure will start the pumps, pumps will run until an alarm generated to warn the operator about pumps running for too long under backup control)

5.1.4.5 Pump Duty Rotation

The duty rotation of pumps will apply as follows (All of which can be initiated from the HMI):

- Manual Duty Rotation
- Disabled
- All pumps stopped
- Timed Interval

Duty Assignment

Each pumping system consists of a known number of pumps (x). The automation will operate with a known number of Duty Pumps (y) and a known number of Standby Pumps (z). For the pumping systems, there is at least one (1) Standby Pump within each Duty Pump system. The Duty assignments will determine the sequence of operation for the respective pumps.

The Duty Pumps operate as Duty 1, Duty 2, etc., and the standby pumps operate as Standby 1 or Standby 2. Usually there are no more than two (2) standby pumps in a pumping system. The PLC

allows the operator to assign each pump to any duty position or standby position (no duplicate assignments are allowed).

Once the duty assignments have been set, if any Duty Pump fails, is in Delay-on-Restart or is removed from Remote-Auto operation, the PLC will automatically adjust the duty assignments of the remaining available pumps accordingly to replace the failed or unavailable pump. This is accomplished by "bumping up" higher numbered Duty Pumps to replace unavailable pumps.

Pump Availability

Each pump is defined as being available or unavailable as a Duty pump on the SCADA system. Typically, a pump is available if the following conditions exist:

- It is not in Fault
- It is not in Delay Restart (if applicable)
- It is in REMOTE-AUTO mode
- Both the pump inlet and outlet motorized isolation valves are open (applicable to Type Type IV Stations only)
- At least one Forcemain Discharge Valve is open (applicable to Type III or Type IV Stations only)

All Pumps Stopped

If on the duty select screen, "All Pumps Stopped" is selected by the operator from the HMI, rotation will take place each time there is a transition from at least one pump running to all pumps stopped.

When a rotation occurs, the first available pump, starting with the second duty, becomes the first duty pump. If no pump is available, no rotation takes place.

Note that a device can stop either because it has satisfied the process or because there is a failure of the device, either because of interlocks or alarms specific to the device.

Timed Interval

If on the duty select screen "Timed Interval" is selected by the operator from the HMI, pump duty rotation takes place at an operator-selected hour at an operator-selected interval. The interval is a whole number of days (e.g., every 7 days). A count of how many days since the last rotation is maintained and is displayed as "Timed Interval: X days remaining".

When a rotation occurs, the first available pump, starting with the second duty, becomes the first duty pump. If no pump is available, no rotation takes place.

{For VFD pumps, the Designer shall consider rotating the duty based on time to avoid excessive run times on a single pump when modulating speed}

5.1.4.6 Pump Protection

{Designer is to make adjustment based on the motor protection relay (MPR) arrangements and number of sensors installed; NOTE: when possible it is recommended that Leak sensors will be connected to MPR instead of providing a separate leakage protection system}

The pumping equipment will be provided with monitoring equipment to alert operators in the event of an alarm condition and to allow a pump to be shut down to prevent it from being damaged.

All motors greater than 22.4 kW (30 hp) are equipped with RTD temperature sensors. Pump and motor temperatures are monitored at several points, these pumps are equipped with motor protection relays in the respective motor starter and respective RTD temperature sensors are integrated into the motor protection relay. A pump will be shut down in the event of an alarm condition. Upon pump shutdown, the next duty pump start will be initiated.

Table 18 Raw Sewage Pump Monitoring Points

Alarm Event	Quantity per Pump	Trigger Value	Action
Motor outboard bearing	1	High Temperature	Alarm, Stop pump
Motor inboard bearing	1	High Temperature	Alarm, Stop pump
Motor stator windings	3	High Temperature	Alarm, Stop pump
Pump outboard bearing	1	High Temperature	Alarm, Stop pump
Pump inboard bearing	1	High Temperature	Alarm, Stop pump
Vibration monitoring	1	High Vibration	Alarm, Stop pump
Moisture and leakage sensor	2	Leakage detection	Stop pump

The sensors are connected to motor protection relay mounted on the motor starter. The temperature and vibration monitoring points have an “Alarm” (i.e. no shutdown) and a “Stop pump” shut down alarm for each point. The shutdown alarms are hardwired for a controlled shutdown of the motor application.

5.1.5 Forcemains

The Facility Name Sewage Pumping Station is equipped with *number (#)* forcemain(s) that discharges flows to the *name of downstream receiver (maintenance hole number, etc.)*. Table 19 presents the forcemain specifications.

Table 19 Forcemain Specifications

Forcemain	Nominal Size (mm)	Total length (m)	Primary Forcemain Pipe Material and Class	Motorized Isolation Valve?
Forcemain A				
Forcemain B				

{Designer is to make adjustment based on station type. Note: all station types except Type I have two forcemains}

{The following is applicable to Type II stations, designer must select the forcemain A or B as applicable. For Type I, remove reference to two forcemains}

Each forcemain is sized for peak flow. Under normal operating conditions, Forcemain (select A or B) is in operation. Forcemain (select B or A) remains as backup. Operators must manually alternate forcemains to test them and exercise the associated manual valving.

The PLC does not control or monitor which forcemain is in service since the associated isolated valves are manually-operated.

{The following is applicable to Type III and Type IV stations}

Each forcemain is sized for peak flow and is equipped with a motorized isolation valve that is monitored and controlled by the PLC. Under normal operating conditions (i.e., forcemain isolation valves are in REMOTE-AUTO), one of the forcemains is designated as the Duty Forcemain and the other as the Standby Forcemain.

The PLC allows the operator to alternate the duty/standby manually by assigning individual positions (no duplicate assignments are allowed). Operations are also able to select forcemain alternation to be:

- **Disabled -** Once a forcemain is assigned to Duty, the forcemain remains in Duty assignment unless the other forcemain is selected to Duty by the operator through the HMI screen or the forcemain becomes unavailable.
- **Timed Interval** - If on the forcemain duty select screen “Timed Interval” is selected by the operator from the HMI, forcemain duty rotation automatically takes place at an operator-selected hour at an operator-selected interval. The interval is a whole number of days (e.g., every 7 days). A count of how many days since the last rotation is maintained and is displayed as “Timed Interval: X days remaining”.
- **All Pumps Stopped and Valves Closed -** In this case, on a transition when either valve cycles from Open to Closed.

Should the duty forcemain become unavailable for operation (failed), the standby forcemain will become the duty forcemain regardless of the Operator selectable alternation mode. An alarm will be displayed on SCADA to annunciate the forcemain failure.

A forcemain is considered to be unavailable when its associated motorized isolation valve meets one of the following conditions:

- It is in FAULT condition
- It is not in REMOTE-AUTO mode (i.e. LOCAL or OFF)

Forcemains will remain in service/available even if respective flowmeter and pressure transmitter fails.

5.1.6 Raw Sewage Pumps Suction and Discharge Valves

{The following is applicable to Type IV Stations only – Designer to update as required}

The inlet and outlet isolation valves for each dry well pump are equipped with actuators to permit remote monitoring of valve position and to facilitate valve opening and closing. Under normal operation conditions, both inlet and outlet valves are open. The pump inlet and outlet valves are only closed when the associated pump is taken out of service for inspection or removal.

The actuators are normally placed in Local position and there will be no remote operation for these valve actuators, however the status will be monitored by SCADA.

When an inlet or outlet isolation valve is closed, the associated pump is not permitted to start in REMOTE-AUTO mode to avoid damaging the pump.

5.1.7 Forcemain Recirculation Valves

{The following is applicable to Type III and IV Stations only – Designer to update as required}

The discharge header for each forcemain is equipped with a recirculation line that directs flows to the wet well for mixing and resuspending accumulated solids.

The recirculation valve is not permitted to open when:

- Duty 1 not available (no pump available in Remote-Auto)
- Recirculation valve fault, or
- When Duty 2 or Duty 3 pumps are called to start.

The actuators are normally placed in REMOTE-AUTO position. Under typical operating conditions, when the first duty pump is called to start at the beginning of a pump cycle in REMOTE-AUTO mode, the recirculation line valve on the pump's corresponding discharge header fully opens for an operator-adjustable time while the duty 1 pump is running. After a pre-set time period has elapsed, the valve fully closes, and the pump continues operating according to its control logic.

5.1.8 Wet Well Mixers

{The following is applicable to Type III and IV Stations only – Designer to update as required}

Each wet well cell is equipped with a submersible mixer to agitate flows at the onset of a pump cycle. The mixer works in tandem with the recirculation line to maximize flow mixing in the wet well and minimize solids deposition. The wet well mixer is not permitted to start when:

- Duty 1 not available (no pump available in Remote-Auto)
- Mixer fault, or
- When Duty 2 or Duty 3 pumps are called to start.

The mixers are normally placed in REMOTE-AUTO position. Under typical operating conditions, when the first duty pump is called to start at the beginning of a pump cycle in REMOTE-AUTO mode, the mixer located in the pump's corresponding wet well cell operates for an operator-adjustable time while the duty 1 pump is running. After a pre-set time period has elapsed, the mixer stops, and the pump continues operating according to its control logic.

5.1.9 Surge Relief Valves

{Monitoring only, may be applicable only to Type IV, to be determined by the Designer. Only a single point is needed (open status).}

The pressure surge suppression/relief valves are required to prevent the pumping station and forcemains from being damaged by pressure surges that may occur in the event of inappropriate operation or a power failure at the station.

The surge relief valves have been supplied with limit switches such that if a surge relief valve opens to relieve system pressure, a signal will be sent to the SCADA system indicating the valve opening. The valves for the surge relief systems are set to open when the pressure exceeds the maximum allowable pressure, which will be determined by the transient analysis. The surge relief valve opening settings are field adjustable.

5.1.10 Emergency and Maintenance Storage Tank

{Designer to revise the text below to suit the specifics of the facility.}

The Emergency/Maintenance Storage Tank is intended to provide emergency storage of influent sewage flows beyond the capacity of the wet well and inlet sewer in the event of a total station failure. The Emergency/Maintenance Storage Tank is connected to the inlet maintenance hole at an elevation above the inlet sewer. The overflow maintenance hole structure is connected downstream of the Emergency/Maintenance Storage Tank at the critical overflow elevation.

Under normal operating conditions, the Emergency/Maintenance Storage Tank is empty. During a high flow event where the inflow exceeds the pumped flow rate or if all pumps fail to run, wet well level rises above the high-high level alarm; level in the inlet maintenance hole will rise, and flow eventually spills into the tank. An alarm is displayed on SCADA notifying operators once the level in the inlet maintenance hole reaches the Emergency/Maintenance Storage Tank float. This is not considered an overflow event since there is no discharge to the environment at this point and is only indicating that Emergency/Maintenance storage is utilized.

An overflow alarm level float is located in the Emergency/Maintenance Storage Tank at the invert level of the discharge pipe to the environment. When sewage level rises and reaches the float level, an alarm is displayed on SCADA indicating the start of an overflow episode. The overflow level is considered over when the level float is untipped.

Emergency/Maintenance storage tank is also equipped with a level transmitter for monitoring purpose and to indicate the available storage capacity.

{The following section is applicable only where a gravity drain to the wet well is available.}

Although there is a gravity drain from /Maintenance Storage tank to the wet wells, there is a normally closed valve on this line, as such the Emergency/Maintenance Storage Tank is not normally hydraulically connected to the wet well. Therefore, when the wet well level drops and normal pump operations resume, operators need to manually drain the Emergency/Maintenance Storage Tank by opening the manual buried drain valve back to the wet well.

{The following section is applicable where gravity drain to the wet well is not available and a submersible sewage pump is used to drain the Emergency/Maintenance Storage Tank.}

The Emergency/Maintenance Storage Tank is not normally hydraulically connected to the wet well. Therefore, when the wet well level drops, Operators will need to drop a submersible sewage pump in the Emergency/Maintenance Storage Tank to pump the tank back to the inlet maintenance hole.

The pump will be controlled by operators through local controls at the MCC or through the SPS-ICP-4XX PLC in REMOTE-MANUAL; a low level float is installed in the emergency storage tank and an alarm will be displayed on SCADA once it is triggered.

5.1.11 Overflow Maintenance Hole Flowmeter

A flowmeter is installed downstream of the Emergency and Maintenance Storage structure that provides following signals to SCADA for monitoring:

- Overflow Maintenance Hole Sewage Level (m)
- Overflow Flow Velocity (m/s)
- Overflow Sewage Flow Rate (L/s)

The Overflow Flowmeter is used to monitor and quantify any system overflows (discharges to the environment) for purposes of reporting to the MECP.

5.2 INTERLOCK AND PERMISSIVES

An interlock is a condition that must be satisfied before and during device operation. A permissive must only be satisfied before the device is allowed to operate but may change state during operation (having no effect on device operation). All permissives and interlocks must be satisfied prior to device operation. Pumping Stations contain both interlocks and permissives.

5.2.1 Interlocks

In the REMOTE mode, a motor cannot start if any interlock is not satisfied. If a stopped motor is called to start and its interlocks are not satisfied, it will not be started. Similarly, if a running motors interlocks are no longer satisfied, it is called to stop.

Typically, an interlock is used to assure safety or to avoid damage to equipment (e.g., sufficient suction pressure on a pump, overload tripped). Interlocks inherently include the power available signal to the controller such that no motor runs if power is not available.

Table 20 provides a summary of the interlocks at the pumping station.

Table 20 Interlock Summary

Tag	Description	Interlock (Hardwired)	Interlock (Software)
GRD4XX10	Inlet Grinder 1	• Jammed • Motor Overload • Motor High Temp • Emergency Stop	• Fail to Start/ Stop • Uncommanded Start/ Stop
GRD4XX20	Inlet Grinder 2	• Jammed • Motor Overload • Motor High Temp • Emergency Stop	• Fail to Start/ Stop • Uncommanded Start/ Stop
SP4XX10	Raw Sewage Pump 1	• General Failure • Emergency Stop • Wet Well Low Level Float Active	• Fail to Start/ Stop • Uncommanded Start/ Stop • Pump Suction or Discharge valve closed • Forcemain Discharge Pressure High High Alarm • Forcemain Discharge Pressure Low Low Alarm • Both Forcemain Valves Closed (When Available) • Both Forcemain Valves Failed •
SP4XX20	Raw Sewage Pump 2		
SP4XX30	Raw Sewage Pump 3		
SP4XX40	Raw Sewage Pump 4		
FV4XX01	Forcemain A Discharge Valve		• Fail to Open/Close • Uncommanded Open/ Close • Unknown Position
FV4XX02	Forcemain B Discharge Valve		• Fail to Open/Close • Uncommanded Open/ Close • Unknown Position
FV4XX03	Forcemain A Recirculation Valve		• Fail to Open/Close • Uncommanded Open/ Close • Forcemain Discharge Valve Failure

Tag	Description	Interlock (Hardwired)	Interlock (Software)
			• Forcemain Discharge Valve Unknown Position • Duty 1 pump not running
FV4XX04	Forcemain B Recirculation Valve		• Fail to Open/Close • Uncommanded Open/ Close • Forcemain Discharge Valve Failure • Forcemain Discharge Valve Unknown Position • Duty 1 pump not running
MX4XX10	Wet Well A Mixer	• General Failure • Emergency Stop	• Fail to Start/ Stop • Uncommanded Start/ Stop
MX4XX20	Wet Well B Mixer	• General Failure • Emergency Stop	• Fail to Start/ Stop • Uncommanded Start/ Stop

{Designer to add motorized valves interlocks as required}

5.2.2 Permissives

In the REMOTE mode, a motor cannot start if a permission to operate is not satisfied, otherwise known as a permissive (e.g., no lock-out events, power available, etc.). If a stopped motor is called to start and its permissives are not satisfied, it will not be started.

After a motor is started, there is a fixed delay of 240 seconds (per motor) during which no other motor can be started. This is to prevent excessive loads on the mains when recovering from a power failure.

Table 21 includes both permissives that have been hardwired into the control circuits, in addition to permissives that are to be programmed in the software. Interlocks included in the previous table are not included in this table.

Table 21 Permissive Summary

Tag	Description	Permissive (Hardwired)	Permissive (Software) Only for Remote-Auto
SP4XX10	Raw Sewage Pump 1		• Pump Restart inhibit timer Not active (if applicable) • One of the Forcemain Discharge Valves Open (if applicable) • Suction and Discharge valves opened
SP4XX20	Raw Sewage Pump 2		
SP4XX30	Raw Sewage Pump 3		
SP4XX40	Raw Sewage Pump 4		

Tag	Description	Permissive (Hardwired)	Permissive (Software) Only for Remote-Auto
FV4XX03	Forcemain A Recirculation Valve		• Duty 1 pump is in REMOTE-AUTO mode, • Duty 2 AND Duty 3 pumps are not running.
FV4XX04	Forcemain B Recirculation Valve		• Duty 1 pump is in REMOTE-AUTO mode, • Duty 2 AND Duty 3 pumps are not running.
MX4XX10	Wet Well A Mixer		• Duty 1 pump is in REMOTE-AUTO mode, • Duty 2 AND Duty 3 pumps are not running
MX4XX20	Wet Well B Mixer		• Duty 1 pump is in REMOTE-AUTO mode, • Duty 2 AND Duty 3 pumps are not running

{Designer to add motorized valves permissives as required}

5.3 FAULT RESPONSE

For all devices controlled by standard software modules, standard device fault response actions will occur for abnormal device function. These are summarized as follows, for full details refer to the PAIDS Standards.

To place a device into REMOTE-AUTO mode no related alarm conditions can be active and the device's ready to operate permissive must be true. If an alarm condition is active or the ready to operate permissive is not true, the device will be placed back into REMOTE-MANUAL mode.

5.3.1 Inlet Maintenance Hole Flowmeter

Should the Inlet Maintenance Hole flowmeter fail, the flow and total volume information will be unavailable for the flowmeter and an alarm will be displayed on SCADA to notify operations of the instrumentation failure. Pump operation is not impacted.

5.3.2 Inlet Grinder

Should the grinder fail, an alarm will be displayed on SCADA to notify operations. Pump operation is not impacted.

5.3.3 Wet Well Level Transmitters

If one level transmitter fails, then the next available level transmitter will automatically be used for pump level control.

If all level transmitters fail, the PLC will not attempt to start or stop any pumps, as the actual level is unknown in this situation. The pump operation will be carried out by means of the hardwired float switches. Any level transmitter failure is indicated at the HMI through a Loss of Signal Alarm. When neither of the level transmitter is available/selected as a duty for master level, no level transmitter available alarm will be displayed on SCADA.

5.3.4 Raw Sewage Pumps

In the event of a pump failure, an alarm will be displayed on SCADA to notify operations of the failure and the next available pump in the duty table will be called to start.

For a motor, the REMOTE-MANUAL and REMOTE-AUTO start and stop logic is a major part of the device routine. Start permissives must be in place in order for the motor to start. The start output command from the device module is a maintained contact.

Once a motor has been running and is stopped either in REMOTE or LOCAL mode, there is a period of time in which the motor should not be restarted. This is referred to as the “restart inhibit time”.

The following virtual (software generated) alarms are configured for a motor device:

- Fail to Start – Occurs if the running status for the motor is not received after a certain amount of time has elapsed since a request to start in REMOTE mode.
- Fail to Stop – Occurs if the stopped status for the motor is not received after a certain amount of time has elapsed since a request to stop in REMOTE mode.
- Uncommanded Start – Occurs if the pump motor starts in the absence of a request to start in REMOTE mode.
- Uncommanded Stop – Occurs if the pump motor stops but in the absence of a request to stop in REMOTE mode.
- Fail to Reach Speed Setpoint – Occurs if the analog speed feedback for the motor is not achieved after a certain amount of time has elapsed since the speed setpoint in REMOTE mode.

5.3.5 Pump Suction/Discharge Pressure Transmitters

Individual pumps suction/discharge pressure transmitters (if used based on station type) are not used for pump control; however, should a pump suction/discharge pressure transmitter fail, the pump operation will continue running and an alarm will be displayed on SCADA to notify operations of the instrumentation failure.

5.3.6 Forcemain Discharge Pressure Transmitters

Should a forcemain pressure transmitter fail, an alarm will be displayed on SCADA to notify operations of the instrumentation failure. In the event of a high or low pressure alarm recorded by the pressure transmitter, an alarm is displayed on SCADA. However, operation of the pumps is not interrupted.

The failure of forcemain discharge pressure will not interlock the pumps operation.

In type III and IV stations with two redundant discharge forcemain and motorized valves the valves will be cycled by PLC to switch to the second forcemain available. In case of both discharge pressure transmitter failures, an alarm will be displayed on SCADA, however the station will continue operation.

For type II station with two forcemains, since the valves are not motorized, operators must manually cycle the valves to use the alternate forcemain when required.

5.3.7 Forcemain Discharge Flowmeters

In case the forcemain discharge flowmeters fails, an alarm will be displayed on SCADA to notify operations of the instrumentation failure.

In type III and IV stations with two redundant discharge forcemain and motorized valves the valves will be cycled by PLC to switch to the second forcemain available. In case of both discharge flowmeter failures, an alarm will be displayed on SCADA, however the station will continue operation.

For type II station with two forcemains, since the valves are not motorized, operators must cycle the valves to use the alternate forcemain when required.

5.3.8 Pump and Forcemain Discharge Valves

For those valves/ gates that have REMOTE mode of control through the HMI, the PLC logic will inhibit control of the valve in the event that an alarm is generated by the valve and an alarm will be displayed on SCADA.

The following virtual (software generated) alarms are configured for a valve:

- Fail to Open – Occurs if the opened status for the valve is not received after a certain amount of time has elapsed since the request to open in REMOTE mode.
- Fail to Close – Occurs if the closed status for the valve is not received after a certain amount of time has elapsed since the request to close in REMOTE mode.
- Uncommanded Open – Occurs if the opened status for the valve is received in the absence of a request to open in REMOTE mode.
- Uncommanded close – Occurs if the closed status for the valve is received in the absence of a request to close in REMOTE mode.
- Unknown position – Occurs when physically impossible conditions are indicated such as valve is both opened and closed at the same time or is neither opened nor closed at the same time (except during valve travel).
- Fail to Reach Position Setpoint – Occurs if the analog position feedback for the valve is not achieved after a certain amount of time has elapsed since the position setpoint in REMOTE mode.

{The following is applicable to Type IV Stations only. Designer to adjust as required for other types}

In the event of failure of the pump motorized suction or discharge isolation valve, the corresponding pump is removed from the Duty table and becomes unavailable.

In the event that one of the forcemain discharge header motorized valve fails, forcemain duty rotates to the other forcemain. If both forcemain valves fail, then a critical alarm is displayed on SCADA, and an Operator must investigate the conditions on site to ensure that at least one valve is open.

5.3.9 Emergency and Maintenance Storage Tank

Should the Emergency and Maintenance Storage flowmeter fail, the flow and total volume information will be unavailable for the flowmeter and an alarm will be displayed on SCADA to notify operations of the instrumentation failure.

5.3.10 PLC Fault Response

In the event of a PLC failure, the sewage pump(s) will continue to operate based on the backup floats. The SCADA system will generate a critical alarm on SCADA to notify operations of the loss of communications to the PLC.

5.3.11 Communication Failure

In the event of Communication Failure between the sewage pumping station PLC and the SCADA servers, the PLC will continue to run the station in AUTO based on the current setpoints. A critical alarm is displayed on SCADA if the SCADA system loses communication with the local PLC. Note, when only the remote communications are affected by an outage, the local HMI at the pump station will continue to update and be functional monitoring and controlling the station.

5.3.12 Power Failure Response

In the event of a Power Failure, the Generator will automatically start and the Automatic Transfer Switch will transfer the pump station from normal power to generator power. The pumps revert to their previous state - if they were in AUTO, then they will remain in AUTO and start or stop as required based on the level setpoints. Upon transfer of the station back to normal power the generator enters a cool down period before shutting down. If the generator fails to shut down, a time-delayed alarm will be displayed on SCADA to inform the operator of the alarm condition.

Software and Hardwired alarms are suppressed should an Instrument Control Panel (SPS-ICP-4XX) power failure occur to prevent alarm nuisance on the HMI/SCADA system.

Following provides the list of hardwired alarms that are suppressed:

- Pump 1 E-Stop, High Temp, Leak, Vibration alarm, VFD/VSS fault, Motor Protection Trip

- Grinder E-Stop, High Temp, Overload and Jam

{Designer is to provide a preliminary list of alarms to be suppressed during the power failure to make sure various pumps and equipment mode remains in Remote-Auto during the power transition}

5.4 BUILDING SERVICES

5.4.1 Emergency Eyewash Station

If the eye wash station is activated and flow is detected, an alarm is displayed on SCADA , as this may indicate a personnel safety issue. This is defined as a critical alarm; however, it does not impact the process and pump or generator operation.

5.4.2 Smoke/ Carbon Monoxide Detection

In the event of smoke/CO detection in the building, the device will sound locally, and an alarm will be displayed on the SCADA. This is defined as a critical alarm; however, it does not impact the process and pump or generator operation.

5.4.3 Temperature Monitoring

The Sewage Pumping Station is equipped with two temperature transmitters; one is located in the instrument control panel, SPS-ICP-4XX and another in the Electrical Room.

These temperature transmitters are provided for monitoring and alarming only and are not connected to any heating equipment; heating system will be provided by its own dedicated thermostats and temperature sensors.

5.4.4 Sump Pumps/ Flood Protection

The sump pumps are hardwired to high and low level float switches and will start/stop as level float switches are triggered. Station PLC does not control or monitor the operating or fault conditions of the sump pumps; however, a flood float is provided and is monitored by the PLC to alarm on SCADA in case the sump pumps fail to operate.

Wet well pump operation will not be impacted by flood, and they will continue to operate based on wet well level.

5.4.5 Gas Detection

{Designer to remove this section if not applicable or adjust/add details if needed}

The station is provided with a gas detection system that monitors presence of hazardous and explosive gases in the station. The SCADA system does not monitor the value of individual gas concentrations. Refer to the gas detection panel system specifications for details.

If any of the monitored gases exceeds the specified limit in the gas detection panel, the gas detection system will activate the station general gas alarm which will create a warning on SCADA and will activate horns/strobes

Station PLC monitors the following signals:

- Station General Gas Alarm
- Station Gas Panel General Fault

5.4.6 Heating and Ventilation System

{Designer to update this section as required to suit the facility type if not applicable or adjust/add details if needed. Note that in Type IV stations, additional DI points may be required for the HVAC system to monitor the status of individual supply and exhaust fans, or air conditioning, RTU or AHU units. A wet well fan is required for Type III and Type IV stations only.}

Station PLC only monitors the following from ventilation system:

- Wet Well Fan Running Status
- Wet Well Fan General Fault
- HVAC System Running Status
- HVAC System General Fault

5.4.7 Fire Alarm Monitoring

{Designer to remove this section if not applicable or adjust/add details if needed}

A vendor supplied fire alarm panel is the primary means for alarming and monitoring of fire alarm conditions. The fire alarm system monitors the station using smoke and heat sensors installed in various locations; in case of a fire detection, separate fire alarm contacts are wired from fire alarm panel to PLC panel, HVAC panel and Security system panel.

The station PLC monitors the following signals from the Fire Alarm System:

- Station Fire Alarm
- Station Fire Alarm System Fault

Fire alarms will be displayed on SCADA . HVAC system will close all the dampers and shutdown the supply fans to stop air supply to the station. In case of an alarm condition in the station all the doors will be unlocked by security system.

Fire Alarm system is also monitored by authorized monitoring company that will dispatch the fire department to the station.

5.4.8 Security System

Building Security is managed by an Access Control System. Local control and monitoring is provided by a security system controller located in the Security System Control Panel (SPS-SEC-4XX). Each exterior door is monitored for open/ close status and is provided with a card reader for swipe access. Exterior doors use an electric strike which is released upon approved card credentials. A motion detector is installed on the interior side of these doors for unalarmed egress.

Hatches are monitored with magnetic contacts. To open access hatches, the operator must swipe into the exterior control panel doors and disable security to these devices by switching the "hatch contacts" selector switch to "disarm". The key switch operates with a single turn to the right which will toggle between armed and disarmed states. The hatches will need to be armed once work is done to secure the hatches.

The PLC monitors the following signal from the Security System Control Panel:

- Station Intrusion Alarm

5.5 EMERGENCY POWER OPERATION

The sewage pumping station will be provided with one (1) diesel generator which provides emergency power in case of a utility power outage, the generator has a prime rating of XXX kW and is sized to run all the loads in the station.

Upon utility power failure, an automatic transfer switch will sense the utility power failure, sends a run request to generator and once the emergency power is available it will transfer to feed the station from generator power.

During the power transition, PLC will mask the alarms from individual devices and equipment to avoid redundant/nuisance alarms. Alarm masking is done based on the Control Panel Power Failure Status, ATS normal and emergency power availability. Following alarms will be masked during the power transition (when wired Normally close):

- Grinder High Temperature
- Individual pump Failures
- Individual pump E-Stop

{Designer must provide the list all individual alarms masked/suppressed during power transition}

5.5.1 Fuel System

{This section is primarily applicable to diesel fuel. Designer to remove this section if not applicable or adjust/add details if needed for natural gas or dual fuel generator systems.}

6. HMI/SCADA TAGS

6.1 TAG NUMBERS

The P&IDs show each piece of equipment as having a unique tag number. All tag numbers on all equipment labels should match the tag numbers in the process schematic.

6.1.1 Discrete Status Statistics

Discrete status events that are monitored and/or controlled by the SCADA system shall be recorded, annunciated, and controlled as follows:

- Run time shall be calculated based on discrete run status for all equipment
- Discrete alarm status including but not limited to equipment failure, level switches, float switches, shall be time and date stamped as part of the alarm logging

6.1.2 Instrumentation

All process instrumentation equipped with analog signal output to the SCADA system (hard wired or via communications network) have the following programmed functions:

- Current value
- Current and Previous day minimum
- Current and Previous day maximum
- Current and Previous day average

For all flow transmitters, the following additional functions are programmed:

- Current day total
- Previous day total

Each analog signal is historically and instantaneously trended; and has adjustable high and low alarm settings complete with reset values as a minimum requirement.

6.1.2.1 HART Capable Instrumentation

HART is to be enabled for all channels in the PLC program that HART capable devices are wired to. The following parameters are to be monitored:

- Current Value (Instantaneous Value)
- Total Value (Flowmeters Only)
- Instrument Fault

6.1.3 Runtime Accumulators

The runtime for each pump is continuously accumulated. The runtime counter counts in hours and rolls over at 100,000 hours to maintain accuracy. For each pump, daily runtime hours are totalized and kept in the controller for a minimum of eight (8) days for transfer to the reporting system.

6.2 CONTROL SETPOINTS

Following table provides control setpoints for the pumping station:

Table 22 Control Setpoints

Tag Name	Description	Unit	Input Range		Default Value	Details	Operator Adjustable	Security Level
			Min	Max				

{Designer to adjust/add instruments as needed}

6.3 ALARM SETPOINTS

Following table provides alarm setpoints for the pumping station:

Table 23 Analog Instrument Setpoints

Alarm Description	Tag	Unit	Low Low			Low			High			High High			Operator Adjustable	Security Level
			DLY	DEF	PRI	DLY	DEF	PRI	DLY	DEF	PRI	DLY	DEF	PRI		
Wet Well A Level	LIT4XX01	m/%													Yes	Operator
Wet Well Master Level	LIT4XX0X	m/%													Yes	Operator

{Designer to add instruments and identify alarm delay, priorities and default values as needed}

6.4 CRITICAL ALARMS

Following table provides a list of the critical alarms for the pumping station.

Table 24 Critical Alarms

Tag	Description
GRD4XX10_MAH	Inlet Grinder 1 Failed to Start Alarm
GRD4XX10_MAL	Inlet Grinder 1 Failed to Stop Alarm
GRD4XX10_WAH	Inlet Grinder 1 Jammed
GRD4XX10_TAH	Inlet Grinder 1 Motor Winding High Temp
GRD4XX10_IAH	Inlet Grinder 1 Overload
GRD4XX10_HAN	Inlet Grinder 1 E-Stop
LIT4XX01_LOE	Wet Well A Level Transmitter 1 Loss of Echo
LIT4XX01_XAOC	Wet Well A Level Transmitter 1 Open Circuit
LIT4XX01_XALLL	Wet Well A Level Transmitter 1 Out Of Range Lo
LIT4XX01_XAHHH	Wet Well A Level Transmitter 1 Out Of Range Hi
LIT4XX02_XAOC	Wet Well A Level Transmitter 2 Open Circuit
LIT4XX02_XALLL	Wet Well A Level Transmitter 2 Out Of Range Lo
LIT4XX02_XAHHH	Wet Well A Level Transmitter 2 Out Of Range Hi
ML4XXXX_XA_XA	Master Wet Well Level No Transmitter Available Alarm
LIT4XX0X_XAHH	Master Wet Well Level HiHi Alarm
LIT4XX0X_XALL	Master Wet Well Master Level LoLo Alarm
FCP4XX01_ENB	Backup Float Control Enabled/ Bypassed
SP4XX10_FLOAT	Raw Sewage Pump 1 in Float Mode
SP4XX10_MAH	Raw Sewage Pump 1 Failed to Start
SP4XX10_MAL	Raw Sewage Pump 1 Failed to Stop
SP4XX10_MUAH	Raw Sewage Pump 1 Uncommanded Start
SP4XX10_MUAL	Raw Sewage Pump 1 Uncommanded Stop
SP4XX10_ZHXA	Raw Sewage Pump 1 Failed to Reach Speed Setpoint (if applicable)
SP4XX10_XA	Raw Sewage Pump 1 Overload/ VFD/SS Fault
SP4XX10_HAN	Raw Sewage Pump 1 Emergency Stop
SP4XX10_FAL	Raw Sewage Pump 1 Leak Alarm
SP4XX10_VAH	Raw Sewage Pump 1 Vibration Alarm
SP4XX10_TAH	Raw Sewage Pump 1 High Temp Alarm
SP4XX10_SAOC	Raw Sewage Pump 1 Speed Feedback Open Circuit (if applicable)
SP4XX10_SAHHH	Raw Sewage Pump 1 Speed Feedback Out of Range High (if applicable)
SP4XX10_SALLL	Raw Sewage Pump 1 Speed Feedback Out of Range Lo (if applicable)
SP4XX20_FLOAT	Raw Sewage Pump 2 in Float Mode
SP4XX20_MAH	Raw Sewage Pump 2 Failed to Start

Tag	Description
SP4XX20_MAL	Raw Sewage Pump 2 Failed to Stop
SP4XX20_MUAH	Raw Sewage Pump 2 Uncommanded Start
SP4XX20_MUAL	Raw Sewage Pump 2 Uncommanded Stop
SP4XX20_ZHXA	Raw Sewage Pump 2 Failed to Reach Speed Setpoint (if applicable)
SP4XX20_XA	Raw Sewage Pump 2 General Failure
SP4XX20_HAN	Raw Sewage Pump 2 Emergency Stop
SP4XX20_FAL	Raw Sewage Pump 2 Leak Alarm
SP4XX20_VAH	Raw Sewage Pump 2 Vibration Alarm
SP4XX20_TAH	Raw Sewage Pump 2 High Temp Alarm
SP4XX20_SAOC	Raw Sewage Pump 2 Speed Feedback Open Circuit (if applicable)
SP4XX20_SAHHH	Raw Sewage Pump 2 Speed Feedback Out of Range High (if applicable)
SP4XX20_SALLL	Raw Sewage Pump 2 Speed Feedback Out of Range Lo (if applicable)
PSV4XX01_ZSO	Feedermain A Surge Relief Valve Open Status
PSV4XX02_ZSO	Feedermain B Surge Relief Valve Open Status
LSH4XX85_LAH	Emergency and Maintenance Storage High Level Alarm
LSH4XX83_LAH	Valve Chamber Flood Alarm
JSL4XX01_JAL	Control Panel SPS-ICP-4XX Power Failure
UPS4XX01_XA	Control Panel SPS-ICP-4XX UPS Fault
PLC001_COMMS_ERROR	Loss of Communication to 10 Peel
PLC001_FAULT	PLC Controller Faulted
LSH4XXX01_FLOAT_XA	Float Mode Failure – Wetwell Cell A Stop Float Condition Did Not Reach (Backup Mode Running too Long)
LSH4XXX02_FLOAT_XA	Float Mode Failure – Wetwell Cell A Stop Float Condition Did Not Reach (Backup Mode Running too Long)

{Above list does not include all the critical alarms; designer is to evaluate alarm priorities during alarm management planning and propose the list of critical alarms(to be called out) for approval based on the site requirement; variable speed related alarms for pumps to be maintained only if VFDs are used; }

APPENDIX 1

I/O TABLE

APPENDIX 1 – I/O Table

{The following I/O table is provided as reference only and does not include all the input/output tags; this list must be updated to include all tags including but not limited to pumps, grinders, valves, instruments, and control and communication system tags and alarms. designer is to make adjustments in this based on station type, alarm management plans (i.e. alarming, priorities and delays) to suit the site requirement}

INPUTS/OUTPUTS (I/O)

Real/ Virtual	Type	Tag Name	Description	Event Logging	Alarming/PRI	PLC Alarm Delay	Trending	Historical Data Logging
REAL	AI	FIT4XX03_XICOND	Inlet Maintenance Hole Sewage Flow				✓	✓
VIRTUAL	DI	FIT4XX03_XA	Inlet Maintenance Hole Sewage Flowmeter Fault					
VIRTUAL	DI	FIT4XX03_XAHH	Inlet Maintenance Hole Sewage Flow HiHi Alarm		✓/TBD	TBD		
VIRTUAL	DI	FIT4XX03_XAH	Inlet Maintenance Hole Sewage Flow Hi Alarm					
VIRTUAL	DI	FIT4XX03_XAL	Inlet Maintenance Hole Sewage Flow Lo Alarm					
VIRTUAL	DI	FIT4XX03_XALL	Inlet Maintenance Hole Sewage Flow LoLo Alarm					
VIRTUAL	AI	FIT4XX03_XCHH	Inlet Maintenance Hole Sewage Flow HiHi Setpoint	✓				
VIRTUAL	AI	FIT4XX03_XCH	Inlet Maintenance Hole Sewage Flow Hi Setpoint	✓				
VIRTUAL	AI	FIT4XX03_XCL	Inlet Maintenance Hole Sewage Flow Lo Setpoint	✓				
VIRTUAL	AI	FIT4XX03_XCLL	Inlet Maintenance Hole Sewage Flow LoLo Setpoint	✓				
VIRTUAL	DI	FIT4XX03_XAOC	Inlet Maintenance Hole Sewage Flow Open Circuit		✓/TBD	TBD		
VIRTUAL	DI	FIT4XX03_XAHHH	Inlet Maintenance Hole Sewage Flow Out Of Range Hi		✓/TBD	TBD		
VIRTUAL	DI	FIT4XX03_XALLL	Inlet Maintenance Hole Sewage Flow Out Of Range Lo		✓/TBD	TBD		

Real/ Virtual	Type	Tag Name	Description	Event Logging	Alarming/PRI	PLC Alarm Delay	Trending	Historical Data Logging
VIRTUAL	DI	FIT4XX03_XARC	Inlet Maintenance Hole Sewage Flow Rate Of Change Alarm		✓/TBD	TBD		
VIRTUAL	AI	FIT4XX03_XCRC	Inlet Maintenance Hole Sewage Flow Rate Of Change Setpoint	✓				
VIRTUAL	AI	FIT4XX03_TMX	Inlet Maintenance Hole Sewage Flow Maximum Today					
VIRTUAL	AI	FIT4XX03_YMX	Inlet Maintenance Hole Sewage Flow Maximum Yesterday					
VIRTUAL	AI	FIT4XX03_TMN	Inlet Maintenance Hole Sewage Flow Minimum Today					
VIRTUAL	AI	FIT4XX03_YMN	Wet Well A Level Minimum Yesterday					
VIRTUAL	AI	FIT4XX03_TAV	Inlet Maintenance Hole Sewage Flow Average Today					
VIRTUAL	AI	FIT4XX03_YAV	Inlet Maintenance Hole Sewage Flow Average Yesterday					
VIRTUAL	AI	FIT4XX03_TTT	Inlet Maintenance Hole Sewage Flow Total Today					
VIRTUAL	AI	FIT4XX03_YTT	Inlet Maintenance Hole Sewage Flow Total Yesterday					
REAL	AI	FIT4XX03_LI_XICOND	Inlet Maintenance Hole Sewage Flow- Level				✓	✓
REAL	AI	FIT4XX03_SI_XICOND	Inlet Maintenance Hole Sewage Flow-Speed				✓	✓
REAL	DI	GRD4XX10_YN	Inlet Grinder 1 Control Mode	✓				
REAL	DI	GRD4XX10_MN	Inlet Grinder 1 Running Status	✓				
VIRTUAL	DI	GRD4XX10_REQYNA	Inlet Grinder 1 Rem-Auto Mode Request	✓				
VIRTUAL	DI	GRD4XX10_REQYNM	Inlet Grinder 1 Rem-Manual Request	✓				
VIRTUAL	DI	GRD4XX10_YNA	Inlet Grinder 1 Rem-Auto Mode Status	✓				

Real/ Virtual	Type	Tag Name	Description	Event Logging	Alarming/PRI	PLC Alarm Delay	Trending	Historical Data Logging
VIRTUAL	DI	GRD4XX10_YNM	Inlet Grinder 1 Rem-Manual Mode Status	✓				
VIRTUAL	DI	GRD4XX10_MAH	Inlet Grinder 1 Failed To Start Alarm		✓/TBD	TBD		
VIRTUAL	DI	GRD4XX10_MAL	Inlet Grinder 1 Failed To Stop Alarm		✓/TBD	TBD		
VIRTUAL	DI	GRD4XX10_MUAH	Inlet Grinder 1 Uncommanded Start Alarm		✓/TBD	TBD		
VIRTUAL	DI	GRD4XX10_MUAL	Inlet Grinder 1 Uncommanded Stop Alarm		✓/TBD	TBD		
REAL	DI	GRD4XX10_IAH	Inlet Grinder 1 Motor Overload Alarm		✓/TBD	TBD		
REAL	DI	GRD4XX10_TAH	Inlet 1 Motor Winding High Temperature		✓/TBD	TBD		
REAL	DI	GRD4XX10_XA	Inlet Grinder 1 General Failure		✓/TBD	TBD		
REAL	DI	GRD4XX10_HAN	Inlet Grinder 1 E-Stop		✓/TBD	TBD		
REAL	DI	GRD4XX10_WAH	Inlet Grinder 1 Over Torque Alarm		✓/TBD	TBD		
VIRTUAL	DI	GRD4XX10_VAH	Inlet Grinder 1 Vibration High Alarm					
VIRTUAL	DI	GRD4XX10_PAH	Inlet Grinder 1 Pressure High Alarm					
VIRTUAL	DI	GRD4XX10_FAL	Inlet Grinder 1 Low Flow Alarm					
VIRTUAL	DI	GRD4XX10_NA	Inlet Grinder 1 Not Available Status	✓				
VIRTUAL	DI	GRD4XX10_NAXA	Inlet Grinder 1 Not Available Alarm					
VIRTUAL	DI	GRD4XX10_YUXA	Inlet Grinder 1 Alarm Reset Request	✓				
REAL	DO	GRD4XX10_MH	Inlet Grinder 1 Start Command	✓				
REAL	DO	GRD4XX10_ML	Inlet Grinder 1 Stop Command	✓				
VIRTUAL	AI	GRD4XX10_KQI	Inlet Grinder 1 Running Hours					✓
VIRTUAL	AI	GRD4XX10_YQN	Inlet Grinder 1 Number of Starts					
VIRTUAL	AI	GRD4XX10_TKQI	Inlet Grinder 1 Running Hours Today					

Real/ Virtual	Type	Tag Name	Description	Event Logging	Alarming/PRI	PLC Alarm Delay	Trending	Historical Data Logging
VIRTUAL	AI	GRD4XX10_TYQN	Inlet Grinder 1 Number of Starts Today					
VIRTUAL	DI	GRD4XX10_KQC	Inlet Grinder 1 Running Hours Reset Request	✓				
VIRTUAL	DI	GRD4XX10_YQC	Inlet Grinder 1 Number of Starts Reset Request	✓				
REAL	AI	LIT4XX01_XICOND	Wet Well A Level 1				✓	✓
VIRTUAL	DI	LIT4XX01_XAHH	Wet Well A Level 1 HiHi Alarm					
VIRTUAL	DI	LIT4XX01_XAH	Wet Well A Level 1 Hi Alarm					
VIRTUAL	DI	LIT4XX01_XAL	Wet Well A Level 1 Lo Alarm					
VIRTUAL	DI	LIT4XX01_XALL	Wet Well A Level 1 LoLo Alarm					
VIRTUAL	AI	LIT4XX01_XCHH	Wet Well A Level 1 HiHi Setpoint					
VIRTUAL	AI	LIT4XX01_XCH	Wet Well A Level 1 Hi Setpoint					
VIRTUAL	AI	LIT4XX01_XCL	Wet Well A Level 1 Lo Setpoint					
VIRTUAL	AI	LIT4XX01_XCLL	Wet Well A Level 1 LoLo Setpoint					
VIRTUAL	DI	LIT4XX01_XAOC	Wet Well A Level 1 Open Circuit		✓/TBD	TBD		
VIRTUAL	DI	LIT4XX01_XAHHH	Wet Well A Level 1 Out Of Range Hi		✓/TBD	TBD		
VIRTUAL	DI	LIT4XX01_XALLL	Wet Well A Level 1 Out Of Range Lo		✓/TBD	TBD		
VIRTUAL	DI	LIT4XX01_XARC	Wet Well A Level 1 Rate Of Change Alarm		✓/TBD	TBD		
VIRTUAL	AI	LIT4XX01_XCRC	Wet Well A Level 1 Rate Of Change Setpoint	✓				
VIRTUAL	AI	LIT4XX01_TMX	Wet Well A Level 1 Maximum Today					
VIRTUAL	AI	LIT4XX01_YMX	Wet Well A Level 1 Maximum Yesterday					
VIRTUAL	AI	LIT4XX01_TMN	Wet Well A Level 1 Minimum Today					
VIRTUAL	AI	LIT4XX01_YMN	Wet Well A Level Minimum Yesterday					

Real/ Virtual	Type	Tag Name	Description	Event Logging	Alarming/PRI	PLC Alarm Delay	Trending	Historical Data Logging
VIRTUAL	AI	LIT4XX01_TAV	Wet Well A Level 1 Average Today					
VIRTUAL	AI	LIT4XX01_YAV	Wet Well A Level 1 Average Yesterday					
REAL	DI	LIT4XX01_LOE	Wet Well A Level 1 Transmitter Loss Of Echo		✓/TBD	TBD		
VIRTUAL	AI	LIT4XX0X_XICOND	Wet Well Master Level				✓	✓
VIRTUAL	DI	LIT4XX0X_XAHH	Wet Well Master Level HiHi Alarm		✓/TBD	TBD		
VIRTUAL	DI	LIT4XX0X_XAH	Wet Well Master Level Hi Alarm		✓/TBD	TBD		
VIRTUAL	DI	LIT4XX0X_XAL	Wet Well Master Level Lo Alarm		✓/TBD	TBD		
VIRTUAL	DI	LIT4XX0X_XALL	Wet Well Master Level LoLo Alarm		✓/TBD	TBD		
VIRTUAL	AI	LIT4XX0X_XCHH	Wet Well Master Level HiHi Setpoint	✓				
VIRTUAL	AI	LIT4XX0X_XCH	Wet Well Master Level Hi Setpoint	✓				
VIRTUAL	AI	LIT4XX0X_XCL	Wet Well Master Level Lo Setpoint	✓				
VIRTUAL	AI	LIT4XX0X_XCLL	Wet Well Master Level LoLo Setpoint	✓				
VIRTUAL	DI	LIT4XX0X_XAOC	Wet Well Master Level Open Circuit					
VIRTUAL	DI	LIT4XX0X_XAHHH	Wet Well Master Level Out Of Range Hi					
VIRTUAL	DI	LIT4XX0X_XALLL	Wet Well Master Level Out Of Range Lo					
VIRTUAL	AI	LIT4XX0X_TMX	Wet Well Master Level Maximum Today					
VIRTUAL	AI	LIT4XX0X_YMX	Wet Well Master Level Maximum Yesterday					
VIRTUAL	AI	LIT4XX0X_TMN	Wet Well Master Level Minimum Today					
VIRTUAL	AI	LIT4XX0X_YMN	Wet Well Master Level Minimum Yesterday					
VIRTUAL	AI	LIT4XX0X_TAV	Wet Well Master Level Average Today					
VIRTUAL	AI	LIT4XX0X_YAV	Wet Well Master Level Average Yesterday					

Real/ Virtual	Type	Tag Name	Description	Event Logging	Alarming/PRI	PLC Alarm Delay	Trending	Historical Data Logging
REAL	DI	MX4XX10_YN	Wet Well A Mixer Remote Mode	✓				
REAL	DI	MX4XX10_MN	Wet Well A Mixer Running Status	✓				
VIRTUAL	DI	MX4XX10_REQYNA	Wet Well A Mixer Rem-Auto Mode Request	✓				
VIRTUAL	DI	MX4XX10_REQYNM	Wet Well A Mixer Rem-Manual Request	✓				
VIRTUAL	DI	MX4XX10_YNA	Wet Well A Mixer Rem-Auto Mode Status	✓				
VIRTUAL	DI	MX4XX10_YNM	Wet Well A Mixer Rem-Manual Mode Status	✓				
VIRTUAL	DI	MX4XX10_MAH	Wet Well A Mixer Failed To Start Alarm		✓/TBD	TBD		
VIRTUAL	DI	MX4XX10_MAL	Wet Well A Mixer Failed To Stop Alarm		✓/TBD	TBD		
VIRTUAL	DI	MX4XX10_MUAH	Wet Well A Mixer Uncommanded Start Alarm		✓/TBD	TBD		
VIRTUAL	DI	MX4XX10_MUAL	Wet Well A Mixer Uncommanded Stop Alarm		✓/TBD	TBD		
VIRTUAL	DI	MX4XX10_IAH	Wet Well A Mixer Motor Overload Alarm					
VIRTUAL	DI	MX4XX10_TAH	Wet Well A Mixer High Temperature					
REAL	DI	MX4XX10_XA	Wet Well A Mixer General Fault	✓	✓			
REAL	DI	MX4XX10_HAN	Wet Well A Mixer E-Stop	✓	✓			
VIRTUAL	DI	MX4XX10_WAH	Wet Well A Mixer Over Torque Alarm					
VIRTUAL	DI	MX4XX10_VAH	Wet Well A Mixer Vibration Alarm					
VIRTUAL	DI	MX4XX10_PAH	Wet Well A Mixer Pressure High Alarm					
VIRTUAL	DI	MX4XX10_FAL	Wet Well A Mixer Leak Alarm					
VIRTUAL	DI	MX4XX10_NA	Wet Well A Mixer Not Available Status	✓				
VIRTUAL	DI	MX4XX10_NAXA	Wet Well A Mixer Not Available Alarm					
VIRTUAL	DI	MX4XX10_YUXA	Wet Well A Mixer Alarm Reset Request	✓				

Real/ Virtual	Type	Tag Name	Description	Event Logging	Alarming/PRI	PLC Alarm Delay	Trending	Historical Data Logging
REAL	DO	MX4XX10_MH	Wet Well A Mixer Start Command	✓				
REAL	DO	MX4XX10_ML	Wet Well A Mixer Stop Command	✓				
VIRTUAL	AI	MX4XX10_KQI	Wet Well A Mixer Running Hours					
VIRTUAL	AI	MX4XX10_YQN	Wet Well A Mixer Number of Starts					
VIRTUAL	AI	MX4XX10_TKQI	Wet Well A Mixer Running Hours Today					
VIRTUAL	AI	MX4XX10_TYQN	Wet Well A Mixer Number of Starts Today					
VIRTUAL	DI	MX4XX10_KQC	Wet Well A Mixer Running Hours Reset Request	✓				
VIRTUAL	DI	MX4XX10_YQC	Wet Well A Mixer Number of Starts Reset Request	✓				
REAL	DI	LSH4XX01_LAH	Raw Sewage Pump 1 Start Float Active	✓				
REAL	DI	LSH4XX01_LAHH	Raw Sewage Pump 2 Start Float Active	✓				
REAL	DI	LSH4XX01_LAL	Raw Sewage Pump 1 Stop Float Active	✓				
REAL	DI	LSH4XX01_LALL	Raw Sewage Pump 2 Stop Float Active	✓				
REAL	DI	LSH4XX02_LAH	Raw Sewage Pump 3 Start Float Active	✓				
REAL	DI	LSH4XX02_LAHH	Raw Sewage Pump 4 Start Float Active	✓				
REAL	DI	LSH4XX02_LAL	Raw Sewage Pump 3 Stop Float Active	✓				
REAL	DI	LSH4XX02_LALL	Raw Sewage Pump 4 Stop Float Active	✓				
REAL	DI	FCP4XX01_ENB	Backup Float Control Enabled/ Disabled	✓				
REAL	AI	SP4XX10_SI	Raw Sewage Pump 1 Speed Feedback (if applicable)				✓	✓
REAL	DI	SP4XX10_YN	Raw Sewage Pump 1 Remote Mode	✓				
REAL	DI	SP4XX10_MN	Raw Sewage Pump 1 Running Status	✓				

Real/ Virtual	Type	Tag Name	Description	Event Logging	Alarming/PRI	PLC Alarm Delay	Trending	Historical Data Logging
VIRTUAL	DI	SP4XX10_REQYNA	Raw Sewage Pump 1 Rem-Auto Mode Request	✓				
VIRTUAL	DI	SP4XX10_REQYNM	Raw Sewage Pump 1 Rem-Manual Request	✓				
VIRTUAL	DI	SP4XX10_YNA	Raw Sewage Pump 1 Rem-Auto Mode Status	✓				
VIRTUAL	DI	SP4XX10_YNM	Raw Sewage Pump 1 Rem-Manual Mode Status	✓				
VIRTUAL	DI	SP4XX10_MAH	Raw Sewage Pump 1 Failed To Start Alarm		✓/TBD	TBD		
VIRTUAL	DI	SP4XX10_MAL	Raw Sewage Pump 1 Failed To Stop Alarm		✓/TBD	TBD		
VIRTUAL	DI	SP4XX10_MUAH	Raw Sewage Pump 1 Uncommanded Start Alarm		✓/TBD	TBD		
VIRTUAL	DI	SP4XX10_MUAL	Raw Sewage Pump 1 Uncommanded Stop Alarm		✓/TBD	TBD		
VIRTUAL	DI	SP4XX10_ZHXA	Raw Sewage Pump 1 Failed to Reach Speed Setpoint (if applicable)		✓/TBD	TBD		
VIRTUAL	DI	SP4XX10_SAOC	Raw Sewage Pump 1 Speed Feedback Open Circuit (if applicable)		✓/TBD	TBD		
VIRTUAL	DI	SP4XX10_SAHHH	Raw Sewage Pump 1 Speed Feedback Out of Range Hi (if applicable)		✓/TBD	TBD		
VIRTUAL	DI	SP4XX10_SALLL	Raw Sewage Pump 1 Speed Feedback Out of Range Lo (if applicable)		✓/TBD	TBD		
REAL	DI	SP4XX10_IAH	Raw Sewage Pump 1 Motor Overload Alarm		✓/TBD	TBD		
REAL	DI	SP4XX10_TAH	Raw Sewage Pump 1 High Temperature		✓/TBD	TBD		
REAL	DI	SP4XX10_XA	Raw Sewage Pump 1 Overload/ VFD/ SS Fault		✓/TBD	TBD		
REAL	DI	SP4XX10_XA2	Raw Sewage Pump 1 Protection Relay Trip		✓/TBD	TBD		
REAL	DI	SP4XX10_HAN	Raw Sewage Pump 1 E-Stop		✓/TBD	TBD		
VIRTUAL	DI	SP4XX10_WAH	Raw Sewage Pump 1 Over Torque Alarm					
REAL	DI	SP4XX10_VAH	Raw Sewage Pump 1 Vibration Alarm		✓/TBD	TBD		

Real/ Virtual	Type	Tag Name	Description	Event Logging	Alarming/PRI	PLC Alarm Delay	Trending	Historical Data Logging
VIRTUAL	DI	SP4XX10_PAH	Raw Sewage Pump 1 Pressure High Alarm					
REAL	DI	SP4XX10_FAL	Raw Sewage Pump 1 Leak Alarm		✓/TBD	TBD		
VIRTUAL	DI	SP4XX10_NA	Raw Sewage Pump 1 Not Available Status	✓				
VIRTUAL	DI	SP4XX10_NAXA	Raw Sewage Pump 1 Not Available Alarm					
VIRTUAL	DI	SP4XX10_YUXA	Raw Sewage Pump 1 Alarm Reset Request	✓				
REAL	DO	SP4XX10_MH	Raw Sewage Pump 1 Start Command	✓				
REAL	DO	SP4XX10_ML	Raw Sewage Pump 1 Stop Command	✓				
REAL	AO	SP4XX10_SC	Raw Sewage Pump 1 Speed Setpoint (if applicable)					
VIRTUAL	AI	SP4XX10_YNMS	Raw Sewage Pump 1 Manual Speed Setpoint (if applicable)	✓				
VIRTUAL	AI	SP4XX10_YNAS	Raw Sewage Pump 1 Automatic Speed Setpoint (if applicable)					
VIRTUAL	AI	SP4XX10_KQI	Raw Sewage Pump 1 Running Hours					✓
VIRTUAL	AI	SP4XX10_YQN	Raw Sewage Pump 1 Number of Starts					
VIRTUAL	AI	SP4XX10_TKQI	Raw Sewage Pump 1 Running Hours Today					
VIRTUAL	AI	SP4XX10_TYQN	Raw Sewage Pump 1 Number of Starts Today					
VIRTUAL	DI	SP4XX10_KQC	Raw Sewage Pump 1 Running Hours Reset Request	✓				
VIRTUAL	DI	SP4XX10_YQC	Raw Sewage Pump 1 Number of Starts Reset Request	✓				
REAL	AI	FIT4XX01_XICOND	Forcemain A Discharge Flow				✓	✓
REAL	AI	FIT4XX01_FQ	Forcemain A Total Discharge Flow					✓

Real/ Virtual	Type	Tag Name	Description	Event Logging	Alarming/PRI	PLC Alarm Delay	Trending	Historical Data Logging
REAL	DI	FIT4XX01_XA	Forcemain A Discharge Flowmeter Fault		✓/TBD	TBD		
VIRTUAL	DI	FIT4XX01_XAHH	Forcemain A Discharge Flow HiHi Alarm					
VIRTUAL	DI	FIT4XX01_XAH	Forcemain A Discharge Flow Hi Alarm					
VIRTUAL	DI	FIT4XX01_XAL	Forcemain A Discharge Flow Lo Alarm					
VIRTUAL	DI	FIT4XX01_XALL	Forcemain A Discharge Flow LoLo Alarm					
VIRTUAL	AI	FIT4XX01_XCHH	Forcemain A Discharge Flow HiHi Setpoint					
VIRTUAL	AI	FIT4XX01_XCH	Forcemain A Discharge Flow Hi Setpoint					
VIRTUAL	AI	FIT4XX01_XCL	Forcemain A Discharge Flow Lo Setpoint					
VIRTUAL	AI	FIT4XX01_XCLL	Forcemain A Discharge Flow LoLo Setpoint					
VIRTUAL	DI	FIT4XX01_XAOC	Forcemain A Discharge Flow Open Circuit		✓/TBD	TBD		
VIRTUAL	DI	FIT4XX01_XAHHH	Forcemain A Discharge Flow Out Of Range Hi		✓/TBD	TBD		
VIRTUAL	DI	FIT4XX01_XALLL	Forcemain A Discharge Flow Out Of Range Lo		✓/TBD	TBD		
VIRTUAL	DI	FIT4XX01_XARC	Forcemain A Discharge Flow Rate Of Change Alarm		✓/TBD	TBD		
VIRTUAL	AI	FIT4XX01_XCRC	Forcemain A Discharge Flow Rate Of Change Setpoint	✓				
VIRTUAL	AI	FIT4XX01_TMX	Forcemain A Discharge Flow Maximum Today					
VIRTUAL	AI	FIT4XX01_YMX	Forcemain A Discharge Flow Maximum Yesterday					
VIRTUAL	AI	FIT4XX01_TMN	Forcemain A Discharge Flow Minimum Today					
VIRTUAL	AI	FIT4XX01_YMN	Forcemain A Discharge Minimum Yesterday					
VIRTUAL	AI	FIT4XX01_TAV	Forcemain A Discharge Flow Average Today					

Real/ Virtual	Type	Tag Name	Description	Event Logging	Alarming/PRI	PLC Alarm Delay	Trending	Historical Data Logging
VIRTUAL	AI	FIT4XX01_YAV	Forcemain A Discharge Flow Average Yesterday					
VIRTUAL	AI	FIT4XX01_TTT	Forcemain A Discharge Flow Total Today					
VIRTUAL	AI	FIT4XX01_YTT	Forcemain A Discharge Flow Total Yesterday					
REAL	DI	FV4XX01_YN	Forcemain A Discharge Valve Control Mode	✓				
VIRTUAL	DI	FV4XX01_YNA	Forcemain A Discharge Valve Rem- Auto Mode Status	✓				
VIRTUAL	DI	FV4XX01_YNM	Forcemain A Discharge Valve Rem-Manual Mode Status	✓				
REAL	DI	FV4XX01_ZSO	Forcemain A Discharge Valve Opened Status (Forcemain A in Service)	✓				
REAL	DI	FV4XX01_ZSC	Forcemain A Discharge Valve Closed Status	✓				
VIRTUAL	DI	FV4XX01_ZX	Forcemain A Discharge Valve Intermediate Status	✓				
REAL	DI	FV4XX01_NA	Forcemain A Discharge Valve Not Available	✓				
VIRTUAL	DI	FV4XX01_ZXA	Forcemain A Discharge Valve General Alarm	✓				
VIRTUAL	DI	FV4XX010_REQYNA	Forcemain A Discharge Valve Rem-Auto Request	✓				
VIRTUAL	DI	FV4XX01_REQYNM	Forcemain A Discharge Valve Rem-Manual Request	✓				
REAL	DO	FV4XX01_VC	Forcemain A Discharge Valve Close Request	✓				
REAL	DO	FV4XX01_VO	Forcemain A Discharge Valve Open Request	✓				
VIRTUAL	DI	FV4XX01_YQC	Forcemain A Discharge Valve Cycle Counts Reset Request	✓				
VIRTUAL	DI	FV4XX01_YUXA	Forcemain A Discharge Valve Alarm Reset Request	✓				
VIRTUAL	DI	FV4XX01_ZAH	Forcemain A Discharge Valve Failed To Open Alarm		✓/TBD	TBD		

Real/ Virtual	Type	Tag Name	Description	Event Logging	Alarming/PRI	PLC Alarm Delay	Trending	Historical Data Logging
VIRTUAL	DI	FV4XX01_ZAL	Forcemain A Discharge Valve Failed To Close Alarm		✓/TBD	TBD		
VIRTUAL	DI	FV4XX01_ZUAH	Forcemain A Discharge Valve Uncommanded Open Alarm		✓/TBD	TBD		
VIRTUAL	DI	FV4XX01_ZUAL	Forcemain A Discharge Valve Uncommanded Close Alarm		✓/TBD	TBD		
VIRTUAL	DI	FV4XX01_ZUXA	Forcemain A Discharge Valve Unknown Position Alarm		✓/TBD	TBD		
VIRTUAL	DI	FV4XX01_NAXA	Forcemain A Discharge Valve Not Available Alarm		✓/TBD	TBD		
VIRTUAL	AI	FV4XX01_YQN	Forcemain A Discharge Valve Cycle Counts					✓