THE CITY OF WINNIPEG
WATER AND WASTE DEPARTMENT

BANNATYNE FLOOD PUMPING STATION
2023 UPGRADES
PROCESS CONTROL NARRATIVE
PLC AND HVAC

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Professional Seal

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1.0 OVERVIEW

This document is intended to provide a description of the PLC functionality for the Bannatyne Flood Pumping Station. It is written from a technical perspective, and is intended to be read along with the associated Process & Instrument Diagram (P&ID) drawings.

1.1 Associated Documents

The associated Automation drawings and Process and Instrumentation diagram drawings are listed below.

Drawing Number	Rev	Description
1-0118F-A0005-001	00	I/O Wiring Control Panel CP-F81 Discrete Inputs Rack 00, Mod 04
1-0118F-A0006-001	00	I/O Wiring Control Panel CP-F81 Discrete Inputs Rack 00, Mod 05
1-0118F-A0007-001	00	I/O Wiring Control Panel CP-F81 Discrete Outputs Rack 00, Mod 06
1-0118F-A0008-001	00	I/O Wiring Control Panel CP-F81 Discrete Outputs Rack 00, Mod 07
1-0118F-A0009-001	00	I/O Wiring Control Panel CP-F81 Analog Inputs Rack 00, Mod 09
1-0118F-A0010-001	00	I/O Wiring Control Panel CP-F81 Analog Inputs Rack 00, Mod 10
1-0118F-A0011-001	00	I/O Wiring Control Panel CP-F81 Analog Output Rack 00, Mod 11
1-0118F-P0001-001	00	Process & Instrumentation Diagram HVAC System
1-0118F-P0002-001	00	Process & Instrumentation Diagram Flood Pumping
1-0118F-P0002-002	00	Process & Instrumentation Diagram Flood Pumping

1.2 Definitions

Abbreviation	Description
AI	Analog Input
AO	Analog Output
DI	Discrete Input
DNP3	Distributed Network Protocol
DO	Discrete Output
HMI	Human Machine Interface
HVAC	Heating, Ventilation and Air Conditioning
I/O	Input / Output
MCC	Motor Control Centre
P&IDs	Process & Instrumentation Diagrams
PLC	Programmable Logic Controller
PSTN	Public Switched Telephone Network
RTU	Remote Terminal Unit

SCADA	Supervisory Control And Data Acquisition

2.0 GENERAL

2.1 Human Machine Interface

See the City of Winnipeg - Water & Waste Department - HMI Layout and Animation Plan for details.

2.2 Program Language

Function block is to be used for all programming. Permission must be given by the Contract Administrator before using any language other than function block.

2.3 Tagname Convention

In case the Contractor is required to create internal PLC tags that are not defined in this document, refer to the City of Winnipeg – Water & Waste Department - Tagname Identification Standard for the tag naming convention.

2.4 Equipment and System General Requirements

2.4.1 I/O Signal Addresses

Refer to the Bannatyne I/O List - PLC-F81 (691232-0000-48EL-0001) for I/O signal addresses.

2.4.2 HMI Interface Points

Not all points between the HMI and PLC are necessarily specified or listed under the HMI-PLC interface lists. In many cases the points listed as PLC I/O might also be part of the HMI-PLC interface. The requirement is based upon the HMI logging or display requirements.

2.4.3 HMI Interface Type Codes

Code	Description
R	HMI Read
RA	HMI Read, Alarmed
R/W	HMI Read/Write
W	HMI Write
W1	HMI Write, PLC will immediately reset to 0

2.4.4 HMI Display Codes

HMI Display Code	Description
-	Do not show on the HMI screen
A	Alarm Banner
DD-T	Show as text on the data display.
EF-G	Show as graphic on the faceplate, which will popup when the operator clicks on the specific piece of equipment
EF-L	Show as an indicator light on the equipment faceplate.
EF-T	Show as a text display on the faceplate
EF-TE	Show as a text entry on the faceplate
GD-A	Show as an animation on the graphic display.
GD-G	Show as a graphic on the graphic display.
GD-L	Show as an indicator light on the graphic display.
GD-T	Show as text on the graphic display.
SW-T	Show as text on a settings window.
T	Trend

Example:

HMI Display Code

Tag	Type	Description	0 State	1 State	Display
P-F01.Rdy	DI	Starter Ready	Not Ready	Ready	GD-T
P-F01.HS_Auto	DI	Starter in Automatic Mode	Not Auto	Auto	GD-T
P-F01.Run	DI	Starter is Running	Stopped	Running	GD-T

2.4.5 HMI Control Code

HMI Control Code	Description
-	Not Applicable
EF-PB	Show as a button on the equipment faceplate
EF-TE	Show as a text entry on the equipment faceplate
SW-CB	Show as a checkbox on the equipment settings window.
SW-TE	Show as a text entry on the equipment settings window.

2.4.6 Security Code

Security Code	Description
N	None
L	Low (Accessible to operator security level)
M	Medium (Accessible to mid level maintenance technicians)
H	High (Accessible to senior personnel only)

2.5 Input Map and Output Map (Signal Conditioning) Routines

Provide an Input Map routine to map physical inputs to internal PLC tags. For analog instruments, scale the physical transmitter and internal PLC tag using DFB (Derived Function Block) to the same engineering units.

Provide an Output Map routine to map internal PLC tags to physical outputs.

In most cases the physical equipment or instrument tag (eg. LSH-F101) is different from the PLC internal tag (eg. LAH_F101) to differentiate between the physical and software signals which have a time delay or scaling factor applied. Additionally, the physical equipment and instrument tags will utilize the hypen ("-") character whereas software tags utilize the underscore ("_") character.

The I/O type (DI, DO, AI, AO) is listed in the "Physical I/O" sub-sections of this Functional Requirements Specification, and indicates the instrument scaling. This information is also provided on the I/O List.

2.6 SCADA Alarm Priority

Priority	Description
1	High Priority
2	Medium Priority
3	Low Priority

Note: The SCADA Alarm Priority is applicable to the City's SCADA HMI System at the McPhillips Control Centre.

2.7 Networked Signals

The internal PLC tags are monitored by the SCADA system at the McPhillips Control Centre. It is the responsibility of the Contractor to configure DNP3 addresses for all internal PLC tags so that they can be read by the SCADA system. Some of the DNP3 addresses are indicated on the I/O List for physical I/O signals, but it is the responsibility of the Contractor to define DNP3 addresses for PLC internal tags and signals that are generated by the PLC. Submit a listing of all DNP3 addresses to the Contract Administrator at least two (2) weeks prior to commissioning to allow the City to configure their SCADA system. These signals include, but are not limited to:

- All statuses, analog values, and alarms within the PLC.

2.8 Key Operating Parameters

Activation of the Bannatyne Flood Pumping Station is based on the water surface level of the Red river at approximately 226.330 metres above sea level. Once the station is activated by a selector switch on the front of Control Panel CP-F81, the controls are set to automatically start and stop the pumps. Key elevations for the Bannatyne Flood Pumping Station are shown below:

Description		Geodetic Elevation (metres above sea level)	Reference Elevation Above Transducer Zero (metres)
Activation Level (River Level)		226.330	
Wet Well Transducer Head Elevation		228.448	5.03
High High Wet Well Alarm Level		227.710	4.292
High Wet Well Alarm Level		226.860	3.442
Wet Well Duty 1	- Start	226.26	2.842
	- Stop	225.64	2.222
	- Differential	0.62	
Wet Well Duty 2	- Start	226.41	2.992
	- Stop	225.80	2.382
	- Differential	0.61	
Wet Well Duty 3	- Start	226.56	3.142
	- Stop	225.95	2.532
	- Differential	0.61	
Wet Well Duty 4	- Start	226.71	3.292
	- Stop	226.10	2.682
	- Differential	0.61	
Wet Well Transducer Zero Elevation		223.418	0

When referring to the controls for the pump start and stop settings, the following items should be noted:

- When the pumps shutdown there is an effect on the flow in the sewers. The sudden stopping causes water to surge in the upstream branches. If more than one pump stops at the same time this effect

can be dramatic enough to cause water to surge in toilets in the upstream branches. This typically occurs under power failure conditions, and is unavoidable. Under normal operating conditions pumps should be turned off one (1) at a time, according to water levels in the Wet Well, with a minimum of one (1) minute interval before shutting off another pump. As there is no electrical interlocks to accomplish the delay in shutting down the pumps, this must be done within the software logic.

- Pumps are electrically interlocked using interval timing relays to ensure the pumps have a staggered start up operation in order to reduce risk tripping out the 600V power. A delay of approximately ten (10) seconds is the time before another pump can start up if one (1) was previously called to run. This also prevents multiple pumps from starting at the same time from the PLC control logic (following a power failure but with a high Wet Well level high enough to call for more than one pump).

3.0 IMPLEMENTATION

3.1 Graphic Displays

3.1.1 HVAC Graphic Tab

Create a graphic (process mimic) display containing a representation of the process HVAC as shown on P&ID 1-0118F-P0001 Sheet 001. Specific requirements include, but are not limited to:

- Show status of dampers FV-F601, FV-F602 and FV-F603 as percentages open i.e. '25% OPEN'. Any damper status shall be shown as 'CLOSED' when percentage is '0'. Refer to drawing 1-0118F-A0029 for damper status signals.
- Display the current main floor room temperature in degrees Celsius from TT-F691, i.e. 'MAIN FLOOR TEMPERATURE: 23°C'.
- Display the current dry well temperature in degrees Celsius from TT-F692, i.e. 'DRY WELL TEMPERATURE: 23°C'.
- Show alarms and status for supply fan SF-F62 in the dry well.
- Show alarm status for duct air filter FIL-F63.

Provide access to the Maintenance Screen

3.1.2 Pump Graphic Tab

Create a graphic (process mimic) display containing a representation of the process flood pumping as shown on P&ID 1-0118F-P0002 Sheets 001 and 002. Specific requirements include, but are not limited to:

- Animate the wet well level using vertical fill animation. Also display the level value in the center of wet well in relative and geodetic absolute units. Display the wet well level setpoint as an animated slider on the side of the wet well.
- Provide access to the following controller faceplates:
    - LX-F100 – Wet Well Level Conditioning Function
    - LC-F100 – Wet Well Level Controller
    - YC-F001 – Pump Duty Sequencer
- Provide access to the Maintenance Screen.

3.1.3 Settings Window

- Create a settings window with settings as indicated in Section 3.0.

3.1.4 Data Display Screen

Display the runtime hours and off time hours for each pump.

Display the pump seal water flow switch status for each pump.

3.2 Trend Displays

3.2.1 Trends

Create, at minimum, the following trend displays, with the indicated pens.

- Pump Trend:
    - Pens:
        - LI_F100, Wet Well Level
        - YLR_F010_S, Pump 1 Running Status
        - YLR_F020_S, Pump 2 Running Status
        - YLR_F030_S, Pump 3 Running Status
        - YLR_F040_S, Pump 4 Running Status
    - Sample Rate: 5 seconds
    - Vertical Scale: 223m – 229m on left / 0 – 100% on right
    - Horizontal Scale: 30 minutes

- HVAC Trend:
    - Pens:
        - YLR_F62, Supply Fan Running Status
        - TT_F691, Motor Room Temperature
        - ZT_F601, Damper Position
        - ZT_F602, Damper Position
        - ZT_F603, Damper Position
    - Sample Rate: 1 minute
    - Vertical Scale: 0 – 300
    - Horizontal Scale: 10 hours

3.2.2 Logging Settings

The following is applicable to Vijeo Touchscreen HMIs.

Create a new log file each day, and keep log files for 14 days.

3.3 Networked Signals

There are some signals between the McPhillips control centre and the station that will be via the communication network. Set up and implement these signals. These signals include, but are not limited to:

- All statuses, analog values and alarms within the PLC.

4.0 EQUIPMENT AND SYSTEM REQUIREMENTS

4.1 Wet Well Level

The geodetic Wet Well level is based on the reading from the ultrasonic level transmitter, LIC-F100, which is mounted on Control Panel CP-F81 door. The Controller also commands the duty pumps to run based on wet well level from LIC-F100 and the float switch (LSHH-F101) in the Wet Well.

4.1.1 HMI I/O

Physical Tag	PLC Tag	Description	PLC Location	I/O Type	Range	Range States	HMI Code	HMI Display
ESL-F721	EAL_F721	600V Power Present	Module: 04 Point: 07	DI	0, 1	0 = No 1 = Yes	R	EF-T
LIC-F100	LI_F100	Wet Well Level	Module: 10 Point: 00	AI	4 - 20 mA	4 mA = 0 m 20 mA = 4.92 m	R	EF-T
-	LI_F100_P	Wet Well Level in Percent	-	-	0 – 100	0 = 0% 100 = 100%	R	EF-T
LSH-F100	LAH_F100	Wet Well Level High	Module: 04 Point: 02	DI	0, 1	0 = No 1 = Yes	R	EF-T
LSH-F101	LAHH_F101	Wet Well Level High High	Module: 04 Point: 03	DI	0, 1	0 = No 1 = Yes	R	EF-T

4.1.2 Internal Constants

Tagname	Description	Range	Initial Setpoint	HMI Code	HMI Display	Security Code
Duty1_Start	Duty 1 Start Setpoint	0 – 5.0 m	2.842 m	RW	EF-TE	M
Duty1_Stop	Duty 1 Stop Setpoint	0 – 5.0 m	2.222 m	RW	EF-TE	M
Duty2_Start	Duty 2 Start Setpoint	0 – 5.0 m	2.992 m	RW	EF-TE	M
Duty2_Stop	Duty 2 Stop Setpoint	0 – 5.0 m	2.382 m	RW	EF-TE	M
Duty3_Start	Duty 3 Start Setpoint	0 – 5.0 m	3.142 m	RW	EF-TE	M
Duty3_Stop	Duty 3 Stop Setpoint	0 – 5.0 m	2.532 m	RW	EF-TE	M
Duty4_Start	Duty 4 Start Setpoint	0 – 5.0 m	3.292 m	RW	EF-TE	M
Duty4_Stop	Duty 4 Stop Setpoint	0 – 5.0 m	2.682 m	RW	EF-TE	M

4.1.3 Internal Variables

Tagname	Description	Type	Range	Range States
LI_F100_Geodetic	Geodetic Wet Well Level	Real	0 – 228.338 m	-

Duty1_Run	Duty 1 Run	Boolean	0, 1	0 = Off 1 = Run
Duty2_Run	Duty 2 Run	Boolean	0, 1	0 = Off 1 = Run
Duty3_Run	Duty 3 Run	Boolean	0, 1	0 = Off 1 = Run
Duty4_Run	Duty 4 Run	Boolean	0, 1	0 = Off 1 = Run

4.1.4 Discrete Alarms

Tagname	Description	Logic	Mask	SCADA Alarm Priority	Reset
LAH_F100	Wet Well Level High	LAH_F100 for > 5 sec	-	2	Auto
LIC_F100_FAF	Wet Well Level Transmitter LIC-F100 Failure	(YAF_F100 OR (LI_F100 < 4mA or > 20mA)) > 5 sec	-	2	Auto

4.2 Pump Control

Control of the pumps will be based on the ultrasonic level transmitter and electric motors. In order for the electric motors to start up, the following two (2) conditions must be met:

1. 585 VAC power is present at the pump starter, and
2. A duty start level has been reached indicating a water level rise in the Wet Well.

LI_F100 is the Wet Well level from ultrasonic level transmitter/controller LIC-F100.

Compute the geodetic Wet Well level as: LI_F100_Geodetic = LI_F100 + 223.418.

Start and stop the duty pumps based on Wet Well level and the duty pump start/stop Range States, Duty1_Start, Duty1_Stop, Duty2_Start, Duty2_Stop, Duty3_Start, Duty3_Stop, Duty4_Start and Duty4_Stop. The Duty pump run signals are Duty1_Run, Duty2_Run, Duty3_Run and Duty4_Run. Do not run the duty pumps if LIC_F100_FAF is TRUE.

4.2.1 Internal Variables

Tagname	Description	Type	Range	Range States	HMI Code	HMI Display
P_F01_CmdRun	Pump P-F01 Run Command	Boolean	0, 1	0 = Off 1 = Run	R	EF-L
P_F02_CmdRun	Pump P-F02 Run Command	Boolean	0, 1	0 = Off 1 = Run	R	EF-L
P_F03_CmdRun	Pump P-F03 Run Command	Boolean	0, 1	0 = Off 1 = Run	R	EF-L

P_F04_CmdRun	Pump P-F04 Run Command	Boolean	0, 1	0 = Off 1 = Run	R	EF-L

4.2.2 Control Narrative

If a duty pump is called to start, start the physical pump that has been off the longest. If a duty pump is called to stop, stop the physical pump that has been running the longest.

4.3 Flood Pump P-F01 Control

P-F01 is a flood pump driven by a soft starter, complete with a bypass contactor when the pump is at full speed. The pump is driven by an electric motor only. Implement all I/O as listed in the I/O list and on the P&IDs. To clarify, the HMI system will not be used for manual control of the pumps – the pumps will be manually controlled from the pilot switches on the MCC enclosure.

4.3.1 HMI I/O

Physical Tag	PLC Tag	Description	PLC Location	Type	Range	Range States	HMI Code	HMI Display
YL-F010	YL_F010	Ready	Module: 05 Point: 00	DI	0, 1	0 = Not Ready 1 = Ready	R	GD-L
YLR-F010	YLR_F010	Running	Module: 05 Point: 01	DI	0, 1	0 = Off 1 = Running	R	GD-L
YAF-F010	YAF_F010	Soft Starter Fault	Module: 05 Point: 02	DI	0, 1	0 = Fault 1 = Normal	R	GD-L
HS-F010-4A	HS_F010_4A	Auto Mode	Module: 05 Point: 03	DI	0, 1	0 = Not Auto 1 = Auto Mode	R	EF-L
HS-F010-4M	HS_F010_4M	Manual Mode	Module: 05 Point: 04	DI	0, 1	0 = Not Manual 1 = Manual Mode	R	GD-L EF-L
FSL-F011	FSL_F011	Low Seal Water Flow	Module: 05 Point: 05	DI	0, 1	0 = No Flow 1 = Flow	R	GD-L
YCR-F010	YCR_F010	Run Command	Module: 07 Point: 01	DO	0, 1	0 = Off 1 = Run	R	GD-L
IT-F010	IT_F010	Motor Current	Module: 10 Point: 01	AI	4 - 20 mA	4 mA = 0 A 20 mA = 200 A	R	EF-T

4.3.2 Alarms

Tagname	Description	Logic	Mask	Priority	Reset
P_F01_RunFlt	P-F01 Run Fault	YS_F508_2 AND NOT EAL_F721 AND HS_F010_4A AND ((YCR_F010 AND NOT YLR_F010) for 2 seconds OR NOT HS_F010_4M AND (NOT YCR-F010 AND YLR_F010) for 8 sec)	N/A	1	Auto
YAF_F01	P-F01 Soft Starter Fault	YAF_F010	N/A	1	Auto
FAL_F011	P-F01 Low Seal Water Flow	(YLR_F010 AND NOT FSL_F011) for 5 seconds	N/A	1	Auto
P_F01_NotRdy	P-F01 Not Ready	HS_F523 AND NOT YL_F010	N/A	1	Auto

4.3.3 Interlocks

Initiating Event	Action	Description
NOT YL_F010	Stop	Pump Not Ready
YAF_F010	Stop	Soft Starter Fault
P_F01_RunFlt	Stop	Stop Pump on Run Fault

To clarify, do not stop the pump upon a Low Seal Water Flow alarm. The pump is to continue running even if a seal water alarm is present.

4.3.4 Control Narrative

Operating states are as follows:

1. Pump not in Auto mode

   The PLC does not have control of the pump, therefor turn off the run and speed outputs.

2. Pump in Auto mode

   Utilize the signals from wet well level LI_F100 and start if the pump has been off the longest. Shutdown pump if running longest.

4.4 Flood Pump P-F02 Control

P-F02 is a flood pump driven by a soft starter, complete with a bypass contactor when the pump is at full speed. The pump is driven by an electric motor only. Implement all I/O as listed in the I/O list and on the P&IDs.

4.4.1 HMI I/O

Physical Tag	PLC Tag	Description	PLC Location	Type	Range	Range States
YL-F020	YL_F020	Ready	Module: 05 Point: 16	DI	0, 1	0 = Not Ready 1 = Ready
YLR-F020	YLR_F020	Running	Module: 05 Point: 17	DI	0, 1	0 = Off 1 = Running
YAF-F020	YAF_F020	SS Fault	Module: 05 Point: 18	DI	0, 1	0 = Fault 1 = Normal
HS-F020-4A	HS_F020_4A	Auto Mode	Module: 05 Point: 19	DI	0, 1	0 = Not Auto 1 = Auto Mode
HS-F020-4M	HS_F020_4M	Manual Mode	Module: 05 Point: 20	DI	0, 1	0 = Not Manual 1 = Manual Mode
FSL-F021	FSL_F021	Low Seal Water Flow	Module: 05 Point: 21	DI	0, 1	0 = No Flow 1 = Flow
YCR-F020	YCR_F020	Run Command	Module: 07 Point: 02	DO	0, 1	0 = Off 1 = Run
IT-F020	IT_F020	Motor Current	Module: 10 Point: 02	AI	4 - 20 mA	4 mA = 0 A 20 mA = 150 A

4.4.2 Alarms

Tagname	Description	Logic	Mask	Priority	Reset
P_F02_RunFlt	P-F02 Run Fault	YS_F508_2 AND NOT EAL_F721 AND HS_F020_4A AND ((YCR_F020 AND NOT YLR_F020) for 2 seconds OR NOT HS_F020_4M AND (NOT YCR_F020 AND YLR_F020) for 8 sec)	N/A	1	Auto
YAF_F02	P-F02 Soft Starter Fault	YAF_F020	N/A	1	Auto
FAL_F021	P-F02 Low Seal Water Flow	(YLR_F020 AND NOT FSL_F021) for 5 seconds	N/A	1	Auto
P_F02_NotRdy	P-F02 Not Ready	HS_F523 AND NOT YL_F020	N/A	1	Auto

4.4.3 Interlocks

Initiating Event	Action	Description
NOT YL_F020	Stop	Pump Not Ready
YAF_F020	Stop	Soft Starter Fault

P_F02_RunFlt	Stop	Stop Pump on Run Fault

To clarify, do not stop the pump upon a Low Seal Water Flow alarm. The pump is to continue running even if a seal water alarm is present.

4.4.4 Control Narrative

Operating states are as follows:

1. Pump not in Auto

   The PLC does not have control of the pump, so turn off the run and speed outputs.

2. Pump in Auto

   Utilize the signals from wet well level LI_F100 and start if the pump has been off the longest. Shutdown pump if running longest.

4.5 Flood Pump P-F03 Control

P-F03 is a flood pump driven by a soft starter, complete with a bypass contactor when the pump is at full speed. The pump is driven by an electric motor only. Implement all I/O as listed in the I/O list and on the P&IDs.

4.5.1 HMI I/O

Physical Tag	PLC Tag	Description	PLC Location	Type	Range	Range States
YL-F030	YL_F030	Ready	Module: 06 Point: 00	DI	0, 1	0 = Not Ready 1 = Ready
YLR-F030	YLR_F030	Running	Module: 06 Point: 01	DI	0, 1	0 = Off 1 = Running
YAF-F030	YAF_F030	SS Fault	Module: 06 Point: 02	DI	0, 1	0 = Fault 1 = Normal
HS-F030-4A	HS_F030_4A	Auto Mode	Module: 06 Point: 03	DI	0, 1	0 = Not Auto 1 = Auto Mode
HS-F030-4M	HS_F030_4M	Manual Mode	Module: 06 Point: 04	DI	0, 1	0 = Not Manual 1 = Manual Mode
FSL-F031	FSL_F031	Low Seal Water Flow	Module: 06 Point: 05	DI	0, 1	0 = No Flow 1 = Flow
YCR-F030	YCR_F030	Run Command	Module: 07 Point: 03	DO	0, 1	0 = Off 1 = Run
IT-F030	IT_F030	Motor Current	Module: 10 Point: 03	AI	4 - 20 mA	4 mA = 0 A 20 mA = 200 A

4.5.2 Alarms

Tagname	Description	Logic	Mask	Priority	Reset
P_F03_RunFlt	P-F03 Run Fault	YS_F508_2 AND NOT EAL_F721 AND HS_F030_4A AND ((YCR-F030 AND NOT YLR_F030) for 2 seconds OR NOT HS_F030_4M AND (NOT YCR-F030 AND YLR_F030) for 8 sec)	N/A	1	Auto
YAF_F030	P-F03 Soft Starter Fault	YAF_F030	N/A	1	Auto
FAL_F031	P-F03 Low Seal Water Flow	(YLR_F030 AND NOT FSL_F031) for 5 seconds	N/A	1	Auto
P_F03_NotRdy	P-F03 Not Ready	HS_F523 AND NOT YL_F030	N/A	1	Auto

4.5.3 Interlocks

Initiating Event	Action	Description
NOT YL_F030_Rdy	Stop	Pump Not Ready

YAF_F030	Stop	Soft Starter Fault
P_F03_RunFlt	Stop	Stop Pump on Run Fault

To clarify, do not stop the pump upon a Low Seal Water Flow alarm. The pump is to continue running even if a seal water alarm is present.

4.5.4 Control Narrative

Operating states are as follows:

1. Pump not in Auto

   The PLC does not have control of the pump, so turn off the run and speed outputs.

2. Pump in Auto

   Utilize the signals from wet well level LI_F100 and start if the pump has been off the longest. Shutdown pump if running longest.

4.6 Flood Pump P-F04 Control

P-F04 is a flood pump driven by a soft starter, complete with a bypass contactor when the pump is at full speed. The pump is driven by an electric motor only. Implement all I/O as listed in the I/O list and on the P&IDs. To clarify, the HMI system will not be used for manual control of the pumps – the pumps will be manually controlled from the pilot switches on the MCC enclosure.

4.6.1 HMI I/O

Physical Tag	PLC Tag	Description	PLC Location	Type	Range	Range States	HMI Code	HMI Display
YL-F040	YL_F040	Ready	Module: 06 Point: 16	DI	0, 1	0 = Not Ready 1 = Ready	R	GD-L
YLR-F040	YLR_F040	Running	Module: 06 Point: 17	DI	0, 1	0 = Off 1 = Running	R	GD-L
YAF-F040	YAF_F040	Soft Starter Fault	Module: 06 Point: 18	DI	0, 1	0 = Fault 1 = Normal	R	GD-L
HS-F040-4A	HS_F040_4A	Auto Mode	Module: 06 Point: 19	DI	0, 1	0 = Not Auto 1 = Auto Mode	R	EF-L
HS-F040-4M	HS_F040_4M	Manual Mode	Module: 06 Point: 20	DI	0, 1	0 = Not Manual 1 = Manual Mode	R	GD-L EF-L
FSL-F041	FSL_F041	Low Seal Water Flow	Module: 06 Point: 21	DI	0, 1	0 = No Flow 1 = Flow	R	GD-L
YCR-F040	YCR_F040	Run Command	Module: 07 Point: 04	DO	0, 1	0 = Off 1 = Run	R	GD-L
IT-F040	IT_F040	Motor Current	Module: 10 Point: 04	AI	4 - 20 mA	4 mA = 0 A 20 mA = 200 A	R	EF-T

4.6.2 Alarms

Tagname	Description	Logic	Mask	Priority	Reset
P_F04_RunFlt	P-F04 Run Fault	YS_F508_2 AND NOT EAL_F721 AND HS_F040_4A AND ((YCR-F040 AND NOT YLR_F040) for 2 seconds OR NOT HS_F040_4M AND (NOT YCR-F040 AND YLR_F040) for 8 sec)	N/A	1	Auto
YAF_F02	P-F04 Soft Starter Fault	YAF_F040	N/A	1	Auto
FAL_F041	P-F04 Low Seal Water Flow	(YLR_F040 AND NOT FSL_F041) for 5 seconds	N/A	1	Auto
P_F04_NotRdy	P-F04 Not Ready	HS_F523 AND NOT YL_F040	N/A	1	Auto

4.6.3 Interlocks

Initiating Event	Action	Description
NOT YL_F040	Stop	Pump Not Ready
YAF_F040	Stop	Soft Starter Fault
P_F04_RunFlt	Stop	Stop Pump on Run Fault

To clarify, do not stop the pump upon a Low Seal Water Flow alarm. The pump is to continue running even if a seal water alarm is present.

4.6.4 Control Narrative

Operating states are as follows:

1. Pump not in Auto mode

   The PLC does not have control of the pump, so turn off the run and speed outputs.

2. Pump in Auto mode

   Utilize the signals from wet well level LI_F100 and start if the pump has been off the longest. Shutdown pump if running longest.

4.7 Alarm Test Mode

4.7.1 Control Narrative

Block all alarms from reaching the McPhillips Control Centre when Alarm Test Mode is active. Alarm Test Mode is selected via a physical switch on the front of the Control Panel CP-F81. This switch allows personnel to test alarms at the Station without having the alarms transmitted to the McPhillips Control Centre. The alarms

shall still be shown on the local HMI even when Alarm Test mode is active. This functionality is achieved by providing separate tags with a "_DNP3" suffix that are held in the normal state when Alarm Test mode is active.

4.8 Miscellaneous HMI Alarms Table

The following physical I/O is to be displayed on an HMI Alarms Table. Note that some of the I/O listed in the Sections above are also associated with the HMI Alarms Table.

4.9 Physical I/O Alarms

PLC Tag	Description	PLC Location	Type	Range	Range/States	Logic	HMI Code	HMI Display
HS_F522	Alarm Test Mode	Module: 04 Point: 00	DI	0, 1	0 = Normal 1 = Alarm Test	HS-F522	R	EF-T
LAH_S529	Weir Overflow Chamber #1	Module: 04 Point: 01	DI	0, 1	0 = Alarm 1 = Normal	NOT LSH-S529 for > 0.5 sec	R	EF-T
LAH_F100	Wet Well High Level	Module: 04 Point: 02	DI	0, 1	0 = Alarm 1 = Normal	NOT LSH-F100 for > 3 sec	R	EF-T
LAHH_F101	Wet Well High Level Flood	Module: 04 Point: 03	DI	0, 1	0 = Alarm 1 = Normal	NOT LSHH-F101 for > 3 sec	R	EF-T
LAH_F501	Dry Well Flooding	Module: 04 Point: 04	DI	0, 1	0 = Alarm 1 = Normal	NOT LAH-F501 for > 3 sec	R	EF-T
YAF_F100	Loss of Echo	Module: 04 Point: 06	DI	0, 1	0 = Alarm 1 = Normal	NOT YAF-F100 for > 3 sec	R	EF-T
EAL_F721	600 VAC Power Fail	Module: 04 Point: 07	DI	0, 1	0 = Alarm 1 = Normal	NOT ESL-F721 for > 0.5 sec	R	EF-T
EAL_F528	120 VAC Power Fail	Module: 04 Point: 08	DI	0, 1	0 = Alarm 1 = Normal	NOT ESL-F528 for > 0.5 sec	R	EF-T
XA_F711	MCC-F71 TVSS Status	Module: 04 Point: 09	DI	0, 1	0 = Alarm 1 = Normal	NOT XS-F711 for > 0.5 sec	R	EF-T
YA_F543	UPS Alarm	Module: 04 Point: 11	DI	0, 1	0 = Normal 1 = Alarm	YA-F543	R	EF-T
YS_F543_1	UPS on Battery	Module: 04 Point: 12	DI	0, 1	0 = Normal 1 = On Battery	YS-F543-1	R	EF-T
YS_F543_2	UPS Battery Charging	Module: 04 Point: 13	DI	0, 1	0 = Normal 1 = On Battery	YS-F543-2	R	EF-T
YS_F508_2	PLC Mode	Module: 04 Point: 14	DI	0, 1	0 = Not PLC 1 = PLC Mode	YS-F508-2	R	EF-T
HS_F523	Station Enabled	Module: 04 Point: 16	DI	0, 1	0 = Off 1 = Station Enabled	HS-F523	R	EF-T
YC_F508_3	Reset	Module: 04 Point: 17	DI	0, 1	-	HS-F508-3	-	-

YA_F523	Station Enabled, Pumps Not in Auto Alarm	-	-	0, 1	0 = Normal 1 = Alarm	HS_F523 AND NOT (HS_F010_4A AND HS_F020_4A AND HS_F030_4A AND HS_F040_4A)	R	GD-L
HS_F600	Station Occupied	Module: 04 Point: 18	DI	0, 1	0 = Disabled 1 = Enabled	HS-F600	R	EF-T
PDSH_F611	Motor Room Supply Fan Air Filter Plugged	Module: 04 Point: 22	DI	0, 1	0 = Plugged 1 = Normal	NOT PDSH-F611 for > 0.5 sec	R	EF-T
PAL_F526	Seal Water Supply Loss	Module: 04 Point: 23	DI	0, 1	0 = Alarm 1 = Normal	PSL-F526 for > 0.5 sec	R	EF-T
YA_F620	Supply Fan SF-F62 Overload	Module: 06 Point: 24	DI	0, 1	1 = Fault 0 = Normal	YA_F620 for > 0.5 sec	R	GL-L
TAH_F691	Main Floor High Temperature	Module: 09 Point: 00	AI	4 – 20 mA	4mA = -40°C 20mA = +60°C	TT-F691 >= +30°C	R	GL-L
TAL_F691	Main Floor Low Temperature	Module: 09 Point: 00	AI	4 – 20 mA	4mA = -40°C 20mA = +60°C	TT-F691 <= 5°C	R	GL-L
TAH_F692	Dry Well High Temperature	Module: 09 Point: 01	AI	4 – 20 mA	4mA = -40°C 20mA = +60°C	TT-F692 >= +30°C	R	GL-L
TAL_F692	Dry Well Low Temperature	Module: 09 Point: 01	AI	4 – 20 mA	4mA = -40°C 20mA = +60°C	TT-F692 <= 5°C	R	GL-L

Note, hand switch HS-F508-3 (PLC tag YC_F508_3) has no functional control and is intended for any future requirements.

4.10 Miscellaneous HMI Status Table

The following physical I/O is to be displayed on an HMI Status Table.

4.10.1 Physical I/O

PLC Tag	Description	PLC Location	Type	Range	Range States	Logic	HMI Code	HMI Display
HS_F522	Alarm Test Mode	Module: 04 Point: 00	DI	0, 1	0 = Normal 1 = Alarm Test	HS-F522	R	EF-T
YS_F543_2	UPS Battery Charging	Module: 04 Point: 13	DI	0, 1	0 = Normal 1 = On Battery	YS-F543-2	R	EF-T
YC_F508_2	Station PLC Mode	Module: 04 Point: 14	DI	0, 1	0 = Local Mode 1 = PLC Mode	YC-F508-2	R	EF-T
HS_F523	Station Enabled	Module: 04 Point: 16	DI	0, 1	0 = Disabled 1 = Enabled	HS-F523	R	EF-T
HS_F600	Station Occupied	Module: 04 Point: 18	DI	0, 1	0 = Disabled 1 = Enabled	HS-F600	R	EF-T
YLR_F620	Supply Fan SF-F62 Running	Module: 06 Point: 23	DI	0, 1	1 = Running 0 = Off	YLR-F620	R	GL-L
TT_F691	Main Floor Low Temperature	Module: 09 Point: 00	AI	4 – 20 mA	4mA = -40°C 20mA = +60°C	TT-F691	R	EF-T
TT_F692	Dry Well High Temperature	Module: 09 Point: 01	AI	4 – 20 mA	4mA = -40°C 20mA = +60°C	TT-F692	R	EF-T
ZT_F601	Ventilation Intake Damper Status	Module: 09 Point: 02	AI	0-10 V	0V = Closed 10V = Open	ZT-F601	R	EF-T
ZT_F602	Ventilation Return Damper Status	Module: 09 Point: 03	AI	0-10 V	0V = Open 10V = Closed	ZT-F602	R	EF-T
ZT_F603	Ventilation Exhaust Damper Status	Module: 09 Point: 04	AI	0-10 V	0V = Closed 10V = Open	ZT-F603	R	EF-T

4.11 Miscellaneous I/O and Alarms

4.11.1 Control Narrative

Implement all I/O as listed in the I/O list and on the P&IDs.

4.12 PLC Mode Okay

4.12.1 Control Narrative

Set the PLC Mode input to "ON" if the PLC Mode Okay output is "ON." While in “PLC Model” write a logical “1” to the PLC Mode Okay output, if the PLC is not in fault the PLC Mode is “On,” else (PLC in fault) PLC Mode is “Off.” System to transition to Local Mode during PLC failure. See drawing A0012 for control schematics details.