LUGGAGE POINT INLET STRUCTURE UPGRADE PROJECT

1.1 Background

Luggage Point Sewage Treatment Plant (STP) serves the S1 catchment that encompasses approximately half of the population of the City of Brisbane. The plant is located at 200 Main Beach Rd, Pinkenba. The plant receives flow from a combination of domestic and industrial sources but is principally treating domestic sewage.

Prior to the inlet structure upgrade project, the inlet works operated on mechanically raked bar screens. Their primary purpose was to remove coarse solids and rags from the influent stream to protect downstream equipment. The inlet screens and associated mechanical/civil structure consisted of;

- Main stilling chamber
- Four inlet channels
- Eight coarse screens (15mm aperture) with mechanically raked drives, two per inlet channel
- Four outlet penstocks
- Screenings conveyor and screenings press

A feasibility study was undertaken to assess options to address the need for better screening removal at the inlet works to prevent blockages at downstream pumps and valves and to avoid the impacts of ragging on downstream processes within the STP.

The feasibility report recommended the installation of new fine screen units to the existing inlet works structure and upgrade the inlet works for an ultimate hydraulic load of 11,600 L/s, with provision to bypass the new fine screens in the event of screen failure.

Other objectives included;

- Eliminate current WH&S issues
- Maximise the hydraulic capacity of the inlet structure, while satisfying the design criteria, for both screen flows and bypass flows.
- Improve screenings removal efficiency (for downstream operation)
- Meet fine screening requirements as per Development Approval Permit, and
- Be able to retrofit odour control (at a later date).

The inlet screen upgrade project was carried out by Stirloch Constructions Pty Ltd between December 2013 and early 2015.

Section 1: Background, Overview, Format, Index

1.2 OVERVIEW OF THE UPGRADED SYSTEM

The Luggage Point STP inlet screens process removes gross solids from the incoming sewage and handles the screening until it is loaded into transportable storage bins.

The inlet works consists of following main process sections:

- 8 x Inlet Screens with 8 associated Inlet and 4 associated outlet penstocks.
- 2 x transfer water sluices.
- 2 x splitter boxes.
- 3 x wash presses for de-watering of the screenings.
- 3 x storage bins for screenings storage and off-site disposal.
- 2 x drainage pumps.
- 1 x wash water pressure system.

Luggage Point STP Inlet Works is designed with a common deep receiving bay where the three pipelines from Eagle Farm Pumping Station discharge Raw Sewage. From this compartment, influent enters the fore bay or stilling area, which comprises four wide individual channels.

These four channels are then split by divider walls to make eight individual 1980mm wide channels where eight band screens are located. Each of the eight inlet channels is isolated, upstream of the screen, by a double isolation package comprising an electrically actuated penstock and a manually inserted stop board.

Each channel has an ANDRITZ AQUA SCREEN which captures and removes the rubbish and debris from the raw sewage in the inlet works. The eight screens are labelled SC-0210-001 to SC-0210-008 and are staggered to form two banks, (Bank A and Bank B). Screenings are automatically removed from the continuous perforated plates of the screens by spraying service water, which is initiated by the backwash cycle of the screens.

Channels 1 and 2, 3 and 4, 5 and 6, 7 and 8 merge downstream of the screens to make four wider channels followed by a penstock in each of these four wider channels.

There are bypass weirs downstream of the screens SC-0210-001, SC-0210-003, SC-0210-005 and SC-0210-007 cut into the divider walls. In the event of the screens become blinded or flow exceeds the screen capacity, the incoming flows overtop the bypass weirs and flow passes to the adjacent inlet channel upstream of SC-0210-002, SC-0210-004, SC-0210-006 and SC-0210-008 respectively.

The screens 1, 3, 5 and 7 (Bank A) drop their screenings onto Screenings Sluice No.1 (SL-0210-001). The spray water provided during the screen backwashing cycle transports the screenings along the sluice launder to discharge into Splitter Box No.1 (DG0210-001). The Splitter Box can direct the screenings to either Wash Press No.1 (WPR-0220-001) or alternatively to Wash Press No.3 (WPR-0220-003).

The screens 2, 4, 6 and 8 (Bank B) drop their screenings onto Screenings Sluice No.2 (SL-0210-002). The spray water provided during the screen backwashing cycle transports the screenings along the sluice launder to discharge into Splitter Box No.2 (DG0210-002). The Splitter Box can direct the screenings to either Wash Press No.2 (WPR-0220-002) or alternatively to Wash Press No.3 (WPR-0220-003).

The Wash Presses wash and compress the screenings and discharge them into an associated Storage Bin. The de-watered screenings from Wash Press 1 is transferred to Storage Bin 1 (BN-0220-001) and from Wash Press 2 to the Storage Bin 2 (BN-0220-002).

Normal operation is for the screenings from Bank A to be delivered to Wash Press 1 and for the screenings from Bank B to be delivered to Wash Press 2. Wash Press 3 and Storage Bin 3 are used as a standby storage destination for both Bank A and Bank B, while the full Storage Bins 1 or 2 are removed and replaced by empty bins.

The Splitter Boxes are arranged so that screenings from both Bank A and Bank B can be diverted to Wash Press 3 at the same time.

A pressure booster pump station is provided for effluent wash water supply to the inlet screening equipment. These pumps are controlled by VSD to maintain constant pressure in the spray and wash water line. This equipment is located remotely from the Inlet Works at the north side of Stage 1A between PST1 and Bioreactor 1.

A drain water sump with two level-controlled submersible pumps return the drain water from the wash presses and floor drains to the inlet collection chamber.

1.3 Format of the O&M Manual(s):

The O&M Manual has been split up into 6 folders/sections. Folder 1 acts as a directory for the O&M utilizing an overall index of what is contained in each section/folder.

Folder 1 provides an overall picture of the project and includes the functional specification which describes the operation of the plant.

Folders 2, 3, 4 & 5 provide specific installation, operation & maintenance documentation from specific vendors and suppliers and also include factory testing, test certificates and commissioning checksheets and procedures.

Folder 6 contains IOM documentation on free issue materials provided by QUU. This information has been included in the Stirloch manuals for the convenience of the QUU operators.

1.4 INDEX:

FOLDER 3: BOOSTER PUMP STATION O&M MANUAL (TMS832)

FOLDER 4: WASH PRESS AND SLUICE LAUNDER O&M MANUAL (TMS833)

Section 1: Equipment Lists, Table of Contents, Commissioning Plan

Section 2: Wash Press Operating Instructions

Section 3: Wash Press Control Concept

Section 4: Motox Gearbox Operating Instructions

Section 5: Siemens Low Voltage Motors Operating Instructions

Section 6: Wash Press Solenoid Valves Operating Instructions

Section 7: Sluicing Launder

Section 8: Distribution Box - Festo Cylinder Information

Section 9: Installation and Acceptance ITP's, FAT Documents

Section 10: Drawings

FOLDER 5: MISCELLANEOUS ITEMS – VALVES, FLOWMETER, PENSTOCKS (TMS834)

Section 1: AWE Double Isolation Module O&M

Section 2: AWE Double Isolation Module Drawings

Section 3 : ABB Flowmeter Data Sheet + Calibration Certificates

Section 4: ABB Flowmeter User Guide

Section 5: ABB Flowmeter Transmitter Guide

Section 6: Swingflex Check Valve Data Sheet + IOM

Section 7: Resilient Seat Gate Valve Data Sheet + IOM

Section 8: Heavy Duty Knifegate Valve Data Sheet + IOM

Section 9: SS316 Ball Valve Data Sheet + IOM

Section 10: ARI Combination Air Valve Data Sheet + IOM

FOLDER 6: QUU SUPPLIED INFORMATION (TMS835)

Section 1-9: ANDRITZ Screens O&M Manual

Section 12-15: Spirac Bin and Retractable Chute IOM + Miscellaneous Info

Section 2: Functional Specification

Luggage Point STP Inlet Screens Upgrade

PLC-21 Functional Specification

Document Change History

Version History

Version	Author	Issue Purpose	Signature	Date
O	Neelesh Rampurkar	Issued for Tender		15/7/2013
1	Paul Gellatly	Updated to suit equipment changes		23/5/2014
2	Paul Gellatly	Reviewer comments added		02/06/14

Review By

Version	Name	Position	Signature	Date
O	Graeme Moulton Julie Tom	Project Manager Senior Electrical Eng.		18/6/2013 17/7/2013
1	Harald Kemmetmuller	Mechanical Engineer		26/05/14
1	Scott Adams	Snr Control Systems Officer		27/05/14
1	Chris Loch	Technical Specialist		27/05/14

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Name	Gavin Flood		
Position	Principal Engineer Civil Design		
Signature		**Date**	

Approved By

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Signature		**Date**	

Approved By

Name	Ken Vaheesan		
Position	Manager Engineering Services		
Signature		**Date**	

Contents

1 Glossary

LCP	Local Control Panel
LS	Level Switch
OWS	Operator Work Station
P&ID	Process and Instrumentation Diagram
PLC	Programmable Logic Controller
SCADA	Supervisory Control and Data Acquisition
UPS	Uninterruptible Power Supply
VSD	Variable Speed Drive

2 Introduction

2.1 Process Overview

The Luggage Point STP inlet screens process removes gross solids from the incoming sewage and handles the screening until it is loaded into transportable storage bins. The inlet works consists of following main process sections:

- 8 x Inlet Screens with 8 associated Inlet and 4 associated outlet penstocks.
- 2 x transfer water sluices.
- 2 x splitter boxs.
- 3 x wash presses for de-watering of the screenings.
- 3 x storage bins for screenings storage and off-site disposal.
- 2 x drainage pumps.
- 1 x wash water pressure system.

Luggage Point STP Inlet Works is designed with a common deep receiving bay where the three pipelines from Eagle Farm Pumping Station discharge Raw Sewage. From this compartment, influent enters the fore bay or stilling area, which comprises four wide individual channels.

These four channels are then split by divider walls to make eight individual 1980mm wide channels where eight band screens are located. Each of the eight inlet channels is isolated, upstream of the screen, by a double isolation package comprising an electrically actuated penstock and a manually inserted stop board.

Each channel has an ANDRITZ AQUA SCREEN which captures and removes the rubbish and debris from the raw sewage in the inlet works. The eight screens are labelled SC-0210-001 to SC-0210-008 and are staggered to form two banks, (Bank A and Bank B). Screenings are automatically removed from the continuous perforated plates of the screens by spraying service water, which is initiated by the backwash cycle of the screens.

Channels 1 and 2, 3 and 4, 5 and 6, 7 and 8 merge downstream of the screens to make four wider channels followed by a penstock in each of these four wider channels.

There are bypass weirs downstream of the screens SC-0210-001, SC-0210-003, SC-0210-005 and SC-0210-007 cut into the divider walls. In the event of the screens become blinded or flow exceeds the screen capacity, the incoming flows overtop the bypass weirs and flow passes to the adjacent inlet channel upstream of SC-0210-002, SC-0210-004, SC-0210-006 and SC-0210-008 respectively.

The screens 1, 3, 5 and 7 (Bank A) drop their screenings onto Screenings Sluice No.1 (SL-0210-001). The spray water provided during the screen backwashing cycle transports the screenings along the sluice launder to discharge into Splitter Box No.1 (DG0210-001). The Splitter Box can direct the screenings to either Wash Press No.1 (WPR-0220-001) or alternatively to Wash Press No.3 (WPR-0220-003).

The screens 2, 4, 6 and 8 (Bank B) drop their screenings onto Screenings Sluice No.2 (SL-0210-002). The spray water provided during the screen backwashing cycle transports the screenings along the sluice launder to discharge into Splitter Box No.2 (DG0210-002). The Splitter Box can direct the screenings to either Wash Press No.2 (WPR-0220-002) or alternatively to Wash Press No.3 (WPR-0220-003).

The Wash Presses wash and compress the screenings and discharge them into an associated Storage Bin. The de-watered screenings from Wash Press 1 is transferred to Storage Bin 1 (BN-0220-001) and from Wash Press 2 to the Storage Bin 2 (BN-0220-002).

Normal operation is for the screenings from Bank A to be delivered to Wash Press 1 and for the screenings from Bank B to be delivered to Wash Press 2. Wash Press 3 and Storage Bin 3 are used as a standby storage destination for both Bank A and Bank B, while the full Storage Bins 1 or 2 are removed and replaced by empty bins. However, Storage Bin 3 should not be allowed to be left with some screenings in it for long periods of time, so the plant operator must be mindful of how long the screenings have been stored and should allow for Bin 3 to be completely filled only when Bins 1 and 2 have sufficient vacant space to allow for the removal time and replacement time for Bin 3.

The Splitter Boxes are arranged so that screenings from both Bank A and Bank B can be diverted to Wash Press 3 at the same time. However, this is not intended to be a normal arrangement because the wash press has an upper limit of receiving screenings from FIVE screens at any one time and no more than five.

A pressure booster pump station is provided for effluent wash water supply to the inlet screening equipment. These pumps are controlled by VSD to maintain constant pressure in the spray and wash water line. This equipment is located remotely from the Inlet Works at the north side of Stage 1A between PST1 and Bioreactor 1.

A drain water sump with two level-controlled submersible pumps return the drain water from the wash presses and floor drains to the inlet collection chamber.

Booster pumps and drain pumps are vendor packages with their own independent control systems. Drive running and fault feedbacks of the pumps and few other alarm signals are interfaced with the new PLC-03 for display on SCADA.

2.2 P&IDs and Previous Documentation

MWH Consulting Engineers prepared the original version of this document, and it was edited by QUU following changes to the items of equipment supplied by the installation contractor; Stirloch Constructions P/L. Information sourced from the Andritz operating manual for the screens, and from Green Process P/L for the wash presses, was also used in this revised document.

P&IDs relating to PLC-21 controlled areas are as follows:

New P&IDs

Process & Instrumentation Diagram Legend (486/5/5/-0199-300)

Process & Instrumentation Diagram Screens 1 To 4 (486/5/5/-0199-301)

Process & Instrumentation Diagram Screens 5 To 8 (486/5/5/-0199-302)

Process & Instrumentation Diagram Conveyors and Wash Presses (486/5/5/-0199-303)

Process & Instrumentation Diagram Distribution conveyor and storage bins (486/5/5/-0199-304)

Previous documentation additionally used in development of this Functional Specification by MWH:

Luggage Point WWTP - PLC-01 Stage 1 Primary Treatment Functional Specification Ver 1.0.

2.3 Inlet Screens Switchboard and Local Control Panel

The new switchboards and LCPs that service the Inlet Screens equipment are listed below:

Raw Sewage Screens Switchboard 1

Raw Sewage Screens Switchboard 2

Andritz Aqua Screens 1 to 8 Local Control Panels

Enclosures / panels for 8 nos. of Ultrasonic Level transmitters for screens

Splitter Box 1 and 2 Local Control Panels

Wash Press 1 and 2 Local Control Panels

Storage Bins 1 and 2 Local Control Panels

Drainage Pumps Local Control Panel

2.4 PLC IO List

The PLC IO List is included in the MS Excel spreadsheet:

83500743-IC-DS-001, Rev E (dated 17 March 2014)

2.5 Electrical Drawings

Electrical schematics were prepared by TEW Solutions P/L and include approximately eighty drawings in the following series:

486/5/5-0199-500 to 599

3 Inlet Penstocks

3.1 Inlet Penstocks Process Overview

There are eight new actuated penstocks associated with the inlet channels which combined with additional manual stop-boards, provide safe double-isolation for the screens.

3.2 Equipment

The following penstocks are associated with the inlet channels:

Inlet Penstock 1 (Upstream of Channel 1)	PK-0210-001
Inlet Penstock 2 (Upstream of Channel 2)	PK-0210-002
Inlet Penstock 3 (Upstream of Channel 3)	PK-0210-003
Inlet Penstock 4 (Upstream of Channel 4)	PK-0210-004
Inlet Penstock 5 (Upstream of Channel 5)	PK-0210-007
Inlet Penstock 6 (Upstream of Channel 6)	PK-0210-008
Inlet Penstock 7 (Upstream of Channel 7)	PK-0210-009
Inlet Penstock 8 (Upstream of Channel 8)	PK-0210-010

3.3 Operation

Operation of the Inlet Penstocks is in one of three modes – Local/Manual, Remote/Manual or Remote/Auto

3.3.1 Local Operation

Each Penstock can be switched to Local mode on the respective actuator control panel, enabling it to be operated locally. The Inlet Penstocks can be opened or closed to any intermediate position using the Local Controls on the actuator control panel. The Fully open / fully closed or the actual intermediate position will be displayed on the OWS. The Inlet Penstocks can also be opened or closed manually by physically lowering or raising the valve spindle using the actuator handwheel.

3.3.2 Remote/Manual Operation

When the Penstock control is switched to Remote mode on the respective actuator control panel, it can be set to either Remote/Manual or Remote/Auto mode via the SCADA equipment faceplate. In Remote/Manual mode, the operator enters a required penstock position (%) and the penstock is driven to that position. The penstock will remain in that position until a new position is selected or control mode is changed.

Note: The penstock will send the actual position signal as an analogue input to PLC and by comparing it with the setpoint position input by the operator, the PLC will send analogue output to the penstock actuator to attain the required position.

3.3.3 Remote/Auto Operation

When the control mode is set to Remote/Auto, the penstock will be automatically opened or closed based on whether its associated Screen is online or offline. If the screen is placed online, the penstock will be opened to 100% position. If the screen switches to offline, the penstock will be closed to the 0% position.

3.3.4 Alarms/Failure Responses

In Remote/Manual mode, an alarm is triggered if the Inlet Penstocks fail to 'Open' or 'Close' to the commanded position. A 'fault' signal is raised at the OWS if the Penstocks fail to open or close within 180 seconds of a command being issued. The Inlet Penstocks will fail in position. Details are given below.

	Alarm Description	Source	Latched	Action
1.	Inlet Penstock # position fault	The analogue position feedback of penstock # is not within +/- 5% of the commanded position within 180 sec.	Latched	Alarm only

3.3.4.1 Penstock Actuator Fault

All the eight inlet penstocks have latched faults and an alarm will be raised when a fault is detected. The alarm is triggered by the actuator internal fault signal. On power loss or actuator fault, the penstock could be operated manually using hand wheel.

3.4 SCADA Information

3.4.1 Display

The operator can view the following:

For each Inlet Penstock

Actual Position (%)
Control Mode: Local/Manual, Remote/Manual, or Remote/Auto
Penstock Status (Healthy/Fault)

3.4.2 Control

For each Inlet Penstock, the operator can enter the following control function:

Required Penstock Position (%) Setpoint when in Remote/Manual.

4 Outlet Penstocks

4.1 Outlet Penstocks Process Overview

There are four existing actuated penstocks associated with the common outlet channels.

4.2 Equipment

The following penstocks are associated with the outlet channels:

Outlet Penstock 1 (Downstream of screens 1 and 2) PK-0210-005

Outlet Penstock 2 (Downstream of screens 3 and 4)	PK-0210-006
Outlet Penstock 3 (Downstream of screens 5 and 6)	PK-0210-011
Outlet Penstock 4 (Downstream of screens 7 and 8)	PK-0210-012

4.3 Operation

Each Penstock can be operated in either Local/Manual, Remote/Manual, or Remote/Auto mode. The outlet penstocks can remain in the open position whether the associated screens are online or not, and for this reason it may be prudent to leave them in Local/Manual or Remote/Manual mode.

4.3.1 Local Operation

When the Penstock has been selected for LOCAL operation it can be opened and closed via the controls located on the actuator. In this mode no "Failed to Open" or "Failed to Close" alarms will be generated by the PLC, however, the OWS will indicate when the Penstock is fully open or fully closed based on the state of the digital position inputs. This mode of operation does NOT require PLC-21 to be operational. The Outlet Penstocks can also be opened or closed manually by physically lowering or raising the valve spindle using the manual handwheel.

4.3.2 Remote/Manual Operation

When selected to REMOTE at the actuator, either Remote/Manual or Remote/Auto can be set at the OWS. When set for Remote/Manual the Penstock can be opened or closed via buttons on the OWS. The Penstock cannot be positioned partway through its travel.

4.3.3 Remote/Auto Operation

When set to Remote/Auto the penstock will automatically open whenever either of its associated Inlet Screens have been placed online, (either of the screens is in Remote/Auto mode and its associated inlet penstock is open).

In both Remote modes, "Failed to Open" or "Failed to Close" alarms will be generated if the appropriate input has not turned on within 180 seconds of the request to move. When the Penstock is requested to open, its 'Open' output will not be turned off until the 'Open' Limit Switch input turns on, at which time the output will turn off. (Similarly for the 'Close' output).

4.3.4 Alarms/Failure Responses

The Outlet Penstocks will fail in their current position. Details are given below.

	Alarm Description	Source	Latched	Action
1.	Screen Outlet Penstock # Failed to Open	'Open' input not ON within 180 sec of request to open	Latched	Alarm and turn off output
2.	Screen Outlet Penstock # Failed to Close	'Closed' input not ON within 180 sec of request to close	Latched	Alarm and turn off output

4.4 SCADA Information

4.4.1 Display

For each Outlet Penstock:

Control Mode: Local/Manual, Remote/Manual, or Remote/Auto
Penstock Position (Open/Close)

4.4.2 Control

For each Outlet Penstock:

Control Mode Selection REMOTE/AUTO or REMOTE/MANUAL
Penstock Position Selection (Open/Close) (when in REMOTE/MANUAL)

5 Inlet Screens

5.1 Inlet Screens Process Overview

There are eight new Andritz in-channel perforated panel travelling belt Aqua Screens. Each Aqua Screen comprises a variable speed driven main screen drive, cleaning brush drive, and spray water solenoid. The screens are controlled as a group by the difference between upstream and downstream water levels, such that when any one online screen triggers a backwash due to high differential level, all online screens will be backwash in a single sequence.

5.2 Equipment

The following equipment comprises the Inlet Screen Control System:

Channel 1 Inlet Level Sensor/transmitter	LIT-0210-001
Channel 1 Outlet Level Sensor/transmitter	LIT-0210-002
Channel 2 Inlet Level Sensor/transmitter	LIT-0210-003
Channel 2 Outlet Level Sensor/transmitter	LIT-0210-004
Channel 3 Inlet Level Sensor/transmitter	LIT-0210-005
Channel 3 Outlet Level Sensor/transmitter	LIT-0210-006
Channel 4 Inlet Level Sensor/transmitter	LIT-0210-007
Channel 4 Outlet Level Sensor/transmitter	LIT-0210-008
Inlet screen 1 Main Drive with VSD	SC-0210-001
Inlet screen 1 Brush Drive	BR-0210-001
Inlet screen 1 Spray Water Solenoid	V-0210-001
Inlet screen 2 Main Drive with VSD	SC-0210-002
Inlet screen 2 Brush Drive	BR-0210-002

Inlet screen 2 Spray Water Solenoid	V-0210-002
Inlet screen 3 Main Drive with VSD	SC-0210-003
Inlet screen 3 Brush Drive	BR-0210-003
Inlet screen 3 Spray Water Solenoid	V-0210-003
Inlet screen 4 Main Drive with VSD	SC-0210-004
Inlet screen 4 Brush Drive	BR-0210-004
Inlet screen 4 Spray Water Solenoid	V-0210-004
Inlet screen 5 Main Drive with VSD	SC-0210-005
Inlet screen 5 Brush Drive	BR-0210-005
Inlet screen 5 Spray Water Solenoid	V-0210-005
Inlet screen 6 Main Drive with VSD	SC-0210-006
Inlet screen 6 Brush Drive	BR-0210-006
Inlet screen 6 Spray Water Solenoid	V-0210-006
Inlet screen 7 Main Drive with VSD	SC-0210-007
Inlet screen 7 Brush Drive	BR-0210-007
Inlet screen 7 Spray Water Solenoid	V-0210-007
Inlet screen 8 Main Drive with VSD	SC-0210-008
Inlet screen 8 Brush Drive	BR-0210-008
Inlet screen 8 Spray Water Solenoid	V-0210-008

5.3 Operation

Each of the screens can be operated in one of four modes – Off, Local/Manual, Remote/Manual, or Remote/Auto.

The main screen drive, brush drive start, and solenoid open/close for each Aqua screen is initiated locally from the Local Control Panel (LCP) when their respective selector switches on the LCP are selected to Local mode. The solenoid will open when the selector is placed in Local and will close when the selector is turned to Off. For both the Screen and Brush drives, the selector switch must be momentarily turned to the Start position, (the switch spring-returns to Local), to start the drive. The drive will be stopped when the selector is turned to the Off position.

These drives and solenoid can be operated in Local mode with the PLC offline, since their local circuits are all hard-wired. Any fault conditions that occur will stop the drives and the fault must be reset before the drive can be restarted.

When the mode selectors are placed in the Remote position the equipment can be operated either in Remote/Manual or Remote/Auto mode as selected by the SCADA equipment faceplate.

In Remote/Manual mode, the drives can be started and stopped, and the solenoid valve opened and closed, via buttons on the SCADA equipment

faceplate. For the Screen drive, the operator may also adjust the speed of the drive via a setpoint on the faceplate. Note that Remote/Manual for these three devices is a GROUP function, such that the Brush Motor and Water Solenoid will operate automatically if the Screen is started in Remote/Manual mode. In Remote/Manual the Screen is run once for the period of time set for the Manual Runtime (in seconds), and then stopped.

In Remote/Auto, start-ups and shutdowns are initiated by the screen differential level, or by a 'Minimum Cycle Timer' as described in section 5.3.3.6.

Selection to LOCAL or REMOTE modes for the drives and solenoids are made using the LCP mounted respective 'Remote/Off/Local' selector switches.

5.3.1 Local Operation

To start the Screen Drive in LOCAL the following steps must be carried out:

Place the selector switch for main motor at LCP in the Local position, and then momentarily rotate it to the "Start" position then release it. The screen motor will start and run at the speed set via the VSD faceplate (located on the front of the MCC in the Inlet Works switchroom). Note: the VSD uses Setup 2 when Local Mode has been selected, and Setup 2 to reads the speed reference from the VSD keypad.

If a fault occurs, the FAULT lamp will illuminate on the switchboard, but only if the PLC is operational. If the FAULT lamp is lit, the VSD may require resetting which can be done by pressing the RESET pushbutton at the Switchboard. The FAULT lamp should extinguish.

If the PLC is operational, the Brush Motor mode selector is in the Remote position, and it is selected to Remote/Auto mode on the SCADA faceplate, as soon as the main motor starts, brush motor will also start. However, if the Brush Motor mode selector is in the Off or Local position, the Brush Motor will not start.

If the PLC is operational, the Wash Spray Solenoid is in the Remote position, and it is selected to Remote/Auto mode on the SCADA faceplate, as soon as the main motor starts, solenoid will be opened. However, if the Wash Spray Solenoid mode selector is in the Off or Local position, the solenoid will not open.

CAUTION: Local mode is for service and emergencies only. The brush drive should be running when the screen drive is running, or damage to the brush may result.

If the PLC is not operational, neither the Brush Motor will start or the solenoid open when the Screen is started in Local mode, so the operator must start the brush motor and open the wash water solenoid immediately upon starting the screen drive.

To start the Brush Motor on its own, place its mode selector in Local and then momentarily rotate the switch to the Start position then release it. The Brush Motor will run until the selector switch is turned to Off.

To open the Wash Spray Solenoid, place its mode selector in Local. To close it switch its mode selector to Off.

Upon a fault associated with the screen drive, the screen will stop, and a fault associated with the brush motor will stop the brush motor.

5.3.2 Remote/Manual Operation

If the drives and solenoid are set to Remote at the selector switches on the LCP they may be operated remotely from the SCADA as follows:

Ensure that there are no FAULTS displayed for the drive. If a fault is present it will have to be corrected before the drives can be started. Once fault is corrected, hit the 'reset' button on the switchboard.

Select MANUAL control mode on the SCADA interface.

Start and stop the screen drives and solenoid via the buttons on the SCADA.

The drives will also stop upon fault.

5.3.3 Remote/Auto Operation

When the mode selectors on the screens LCP for the screen, brush, and solenoid have been placed in the Remote position and the operator has set the mode to Remote/Auto for each device on the SCADA equipment faceplates, a screen will start and stop under automatic PLC control as described below.

5.3.3.1 Number of Screens Online

The number of screens to be online can be controlled in one of several operator-selectable modes. They are:

1. Manual Mode
2. Normal Mode
3. Wet Weather Mode

A screen is considered to be online when all of the following conditions prevail, (note: "available" means in Remote/Auto mode and no active faults):

- The Screen Drive is available;
- The Brush Motor is available;
- The Spray Water Solenoid is available;
- The screens' Inlet Penstock is open, (it may be in any mode or even faulted, with its Open LS activated or its position signal at > 10% open);
- The screens' associated Outlet Penstock is open, (it may be in any mode or even faulted, with its Open LS activated);

The SCADA page will display the "Online" or Offline" status for each of the eight screen trains.

5.3.3.2 Number of Screens Online - Manual Mode

When Manual Mode has been selected, the control system will not automatically place screens online or take screens offline. In this mode, the plant operator must decide when each screen train is to be placed online or taken offline.

5.3.3.3 Number of Screens Online - Normal Mode

When Normal Mode has been selected, the control system will automatically set screen trains online or offline on a duty rotation based on two duty groups.

Each duty group has eight tick boxes, one for each screen train. If a screen train is unavailable, it's tick box will be 'greyed-out'. An available screen train must have it's screen main drive, brush motor, and wash solenoid in Remote/Auto mode, plus its Inlet Penstock in Remote/Auto mode. Its Outlet Penstock may be closed and in Remote/Auto mode, or fully open and in any mode.

The plant operator may tick on an available screen train and the tick will toggle from the other duty group such that a screen can only be selected in ONE group at any one time.

If the operator wishes to run less than four screens at one time, certain screens can be placed offline and they will not be used in the auto duty changeover or be automatically started.

Automatic duty change-over will occur when the "Auto Duty Change-over Time" timer has timed-out AND a backwash sequence is not be carried out. If the timer times-out when a backwash sequence is in progress, the sequence is to be completed normally, and the duty changeover is to be effected at the end of the last step in the sequence.

5.3.3.4 Number of Screens Online – Wet Weather Mode

Wet Weather Mode can be manually selected by the operator, or it can be automatically triggered by the Influent Flowrate exceeding a setpoint value.

When in Manual Mode or Normal Mode, if the toggle for "Auto Switch to Wet Weather Mode" has been set to "Yes", the control system will continuously monitor the Total Plant Influent. This is the combined rate from the three Inflow Syphon flowmeters, plus the flow from the Fisherman's Island pipeline, and the Supernatant Pump Station, as read via the network from PLC-01. If the flowrate exceeds the setpoint for a continuous ten minutes, the system will change into Wet Weather Mode. In this mode, all screens that are available will be automatically placed online, all screens and brush motors will be started, and all spray solenoids will be opened and will run continuously.

If "Auto Return from Wet Weather Mode" has been set to "No", the screens will continue to operate until the plant operator manually changes the mode back

to either Normal or Manual Mode. If "Auto Return from Wet Weather Mode" has been set to "Yes", the control system will continuously monitor the Influent Flowrate. When it drops below a setpoint value for a continuous 30 minutes, the system will automatically revert back to the mode it was in prior to the switch to Wet Weather Mode, (either Normal or Manual Mode).

5.3.3.5 Level Sensors

There are four upstream level sensors located on the inlet side of the pairs of inlet penstocks. There are four downstream level sensors located in the common trough on the downstream side of screens, upstream of the four outlet penstocks.

Each of the eight level sensors is able to be placed Online or Offline via a SCADA toggle button. This allows individual sensors to be taken offline for cleaning or maintenance.

Inlet Level Sensors

For the inlet level, if all four sensors are available, (online and healthy) the four level values are to be averaged. If any sensors are offline or have out-range faults they are to be ignored in the averaging calculation.

The SCADA displays the value from each sensor and also the value of the average of all available sensors, however, only the average value will be used in the calculation to determine the level differential across the screens.

Outlet Level Sensors

The values from the outlet level sensors are also to be averaged for all sensors that are available, however there is also an additional important condition for each sensor that will restrict whether it's value is used in the averaging calculation or not: It's associated outlet penstock MUST be open. If the outlet penstock adjacent to an outlet level sensor is not on its "open" limit switch, its reading is to be ignored in the averaging calculation.

PLC01 has a function for selecting reversing flow detection through the screens via a NEGATIVE level differential across the screens. To allow this function to work the differential value must be able

5.3.3.6 Backwash Triggers

Screen backwash sequences can be triggered in one of three ways:

- Manual Force Backwash
- Auto backwash on Differential Level
- Auto Backwash on Minimum Cycle Time

When a backwash sequence is triggered, **ALL** online screens will be backwashed in a sequence. They do not individually backwash. When the sequence is completed all of the online screens will be clean.

Backwash Triggers

(i) A backwash can be manually triggered by the plant operator via a button on the Inlet Screens setpoint popup;

(ii) The difference between the upstream average level value and the downstream average level value is continuously tested. If the value exceeds the setpoint for Differential level Trigger for a continuous 10 seconds, a backwash sequence will be triggered;

(iii) If, during low flow conditions, the screens have not blinded sufficiently enough to trigger a backwash on differential level, and the time since the last backwash sequence exceeds the setpoint for Minimum Backwash Cycle Time, a backwash sequence will be triggered.

5.3.3.7 Backwash Sequence

When a backwash sequence has been triggered, ALL of the online screens will be backwashed as part of a sequence. During the sequence the differential level trigger test will be disabled and it will only be re-enabled 30 seconds after the last screen has been backwashed.

The backwash sequence is to start with screen number 8 working back to screen number 1, (this is to ensure screenings are discharged into the water sluice evenly and not on top of screenings already being washed down the sluice).

In the first step, a minimum of two screens must be backwashed, (this is to ensure the flowrate through a newly cleaned screen does not exceed the limit of a single screen while the other screens are still blinded). If either Screen 7 or Screen 8 is offline, then the first step may include the online Step 1 screen plus whatever screens are online in step 2. This means that the first step may include THREE screens backwashing at the same time.

After the first step, up to two screens are to be backwashed at a time.

There is to be up to four steps in the sequence:

- Step 1: Screens 7 and 8,
- Step 2: Screens 5 and 6,
- Step 3: Screens 3 and 4,
- Step 4: Screens 1 and 2.

From Step 2 onwards, if one of the screens in a step is offline, then that step will involve only the single online screen. If both screens in a step are offline, then that step is to be skipped. At each step, the following sequence will be carried out:

(i) The screen drive and brush motor are to start together and run for the time period set in the Backwash Time setpoint. (Note: the backwash time period and screen drive speed are to be arranged to ensure that the entire blinded section of the screen are backwashed. Changing either of these setpoints will affect the other setpoint);

(ii) When the screen and brush motor start, a timer is to start which on timeout will energise the Spray Wash Solenoid, (this is the time for the mat to reach the drop-off point);

(iii) When the backwash time has elapsed, the screen drive and brush motor will stop and a run-on timer will delay the de-energising of the Spray Wash Solenoid;

(iv) When the run-on timer has elapsed the next step in the sequence will immediately begin at (i) above.

When all online screens have been backwashed and a 30 second delay period has elapsed, the level differential test will be re-enabled. If at that time, the level differential is still above the trigger setpoint for a continuous 10 seconds, the backwash sequence will again be triggered. During high flow periods that are still below the wet weather inflow trigger setpoint, the screens may be continuously performing backwash sequences with 40 second triggering delays between.

When the plant influent flowrate rises above the Wet Weather Mode trigger setpoint, for a continuous 10 minutes, and Auto Switch to Wet Weather Mode has been set to "Yes", Wet Weather Mode will be enabled. Refer to section 5.3.3.4 for further details. In Wet Weather Mode, all screens that are available will be automatically placed online, all screens and brush motors will be started, and all spray solenoids will be opened and will run continuously.

5.3.4 Interlocks

When a screen is selected to Remote/Auto mode, and it is placed online, (either manually or automatically – refer to sections 5.3.3.1 to 5.3.3.4), its associated Inlet Penstock will be automatically opened if it is in Remote/Auto mode. When the screen is taken offline, the Inlet Penstock closes if it is in Remote/Auto mode.

When at least one of a pair of screens is online, its associated Outlet Penstock will automatically open if it is in Remote/Auto mode. When BOTH of a pair of screens is offline, its associated Outlet Penstock will automatically close if it is in Remote/Auto mode.

There are no interlocks between the screenings retrieval system, (Wash Presses and Storage Bins), and the screen themselves. The screens will continue to operate no matter what equipment faults may be present in the screenings retrieval system.

5.3.5 Alarms/Failure Responses

5.3.5.1 Power Loss / PLC Failure

On loss of power, or PLC failure, the screen Drives will stay in their current position until power is restored. In the case of PLC failure with power still available, the screens may be operated in Local/Manual mode.

5.3.5.2 Screen Drives Failure/Fault

The following list of alarms is provided for the screen drive, brush motor and spray solenoid:

	Equipment	Alarm Description	Action	Latching?
1.	Screen Drive	Control supply not available	Stop drive	No
2.	Screen Drive	Drive isolated (from Field Circuit Available input)	Stop drive	Yes
3.	Screen Drive	VSD Fault or Estop activated	Stop drive	Yes
4.	Screen Drive	Drive failed to start	Stop drive	Yes
5.	Screen Drive	Drive failed to stop	Stop drive	Yes
6.	Brush Motor	Control supply not available	Stop drive	No
7.	Brush Motor	Drive isolated (from Field Circuit Available input)	Stop drive	Yes
8.	Brush Motor	Motor Thermal Overload (from Start Fault input)	Stop drive	Yes
9.	Brush Motor	Drive failed to start	Stop drive	Yes
10.	Brush Motor	Drive failed to stop	Stop drive	Yes

NOTE: When an Emergency Stop button is pressed on a screen drive, the SCADA animation will indicate “Off” mode even if the control selector on the LCP is still in “Local” or “Remote”.

5.3.5.3 Level Sensor Alarms

All eight level sensors have “Out-of-Range” alarms that will be posted on the SCADA alarm page. In addition, the average inlet level reading is to have a “High Level / Bypass Imminent Warning” and a “High/High Level Bypass in Progress” alarm, the latter being set to a value that indicates that there is flow passing through the screen bypass slots. If a sensor is placed offline, its alarms will be inhibited.

5.3.6 Inlet Screens High Flow Bypass

During an extreme wet weather event the flowrate into the inlet works could exceed the throughput capabilities of the available screens even when they are continuously backwashing. In this case, the upstream level will continue to rise and the “Bypass Imminent” alarm will be posted on the SCADA alarm page.

The inlet works structure has been designed to allow bypass between pairs of inlet channels, however it is crucial that certain penstocks are open when a high flow event occurs. The flow from inlet channel 2 can pass over the high level bypass cut-out into inlet channel 1, but for this bypass flow to work both Inlet Penstock 2 (PK-0210-002) and Outlet Penstock 1 must be fully open. Bypass through this pair of channels can then occur even if one or both of the screens (SC-0210-001 or SC-0210-002) are unavailable and blinded.

The following four combinations are required to ensure the inlet works bypass capability is available for pending high flow conditions:

Channel pair	**MUST BE FULLY OPEN**	**MUST BE FULLY OPEN**
Inlet Channels 1/2	Inlet Penstock 2 (PK-0210-002)	Outlet Penstock 1 (PK-0210-005)
Inlet Channels 3/4	Inlet Penstock 4 (PK-0210-004)	Outlet Penstock 2 (PK-0210-006)
Inlet Channels 5/6	Inlet Penstock 6 (PK-0210-008)	Outlet Penstock 3 (PK-0210-011)
Inlet Channels 7/8	Inlet Penstock 8 (PK-0210-010)	Outlet Penstock 4 (PK-0210-012)

The number of bypass streams that will be required is dependent on how many screens are operational.

When the inlet level rises to the "Bypass Imminent" level in addition to the alarm post a flashing red text warning will appear in a prominent position on the Inlet Works page displaying the following message:

"BYPASS IMMINENT – ENSURE SUFFICIENT PENSTOCKS ARE FULLY OPEN TO ALLOW PLANT BYPASS"

5.4 SCADA Information

5.4.1 Display

For each Inlet Screen:

Main drive, brush drive and solenoid control mode status:
Off, Local/Manual, Remote/Manual, or Remote/Auto
Main drive and brush drive Fault/Healthy status
Differential Level (mm) – for each pair of Inlet Screens, plus average
Inlet Level (4), plus average inlet level (displayed as RL x.xxx m)
Outlet Level (4), plus average outlet level (displayed as RL x.xxx m)

5.4.2 Control

Screen Drive Control Mode (when selector on LCP is set to Remote) Remote/Manual, Remote/Auto
Brush Motor Control Mode (when selector on LCP is set to Remote) Remote/Manual, Remote/Auto
Spray Water Solenoid Control Mode (when selector on LCP is set to Remote) Remote/Manual, Remote/Auto
For each of the four inlet level sensors Online/Offline (toggle)

Screen Drive in Remote/Manual mode	Start/Stop
Brush Motor in Remote/Manual mode	Start/Stop
Spray Water Solenoid in Remote/Manual mode	Open/Close
Normal screen main drive speed set point	70 % (min 30%, max 100%)
(used in both Remote/Manual and Remote/Auto modes, but not in Local/Manual mode);	
Wet Weather screen main drive speed set point	100 % (min 30%, max 100%)
(used when Wet Weather Mode has been enabled)	
Minimum Backwash Cycle time	30 mins (min 10, max 120)
Spray Water Solenoid energize delay	5 sec (min 1, max 20)
Spray Water Solenoid run-on time	10 sec (min 0, max 60)
Screen Remote/Manual mode run time	10 sec (min 5, max 180)
'Number of Screens Online' mode	Manual / Normal / Wet Weather
For each of the eight Inlet Screen Trains	Online/Offline (toggle)
Auto Duty Changeover Time	24 hrs (min 6, max 96)
Auto Switch to Wet Weather Mode	Yes / No (toggle)
Auto Return from Wet Weather Mode	Yes / No (toggle)
Force backwash Sequence	button
Differential Level setpoint (backwash trigger)	100 mm (min 50, max 300)
(four setpoints, one for each outlet level sensor, ie; Screens 1/2, 3/4, 5/6 and 7/8)	

The above set points are operator adjustable on the SCADA Inlet Works Setpoints popup.

6 Screenings Receival System

6.1 Overview

There are three screenings receival trains consisting of three Wash Presses, three Storage Bins, and two Splitter Boxes to divert the screenings from the two Screenings Sluices to the three screenings receival trains.

For each Splitter Box the operator can toggle between two destinations:

For Splitter Box 1: Wash Press 1 or Wash Press 3

For Splitter Box 2: Wash Press 2 or Wash Press 3

If the splitter boxes can automatically divert screenings to the adjacent wash screenings train if the system detects that a storage bin is full or that a wash press has high/high chute level, or if equipment faults occur to make a screenings train unavailable.

6.2 Equipment

The following equipment comprises the screenings receival system:

Screenings Sluice 1 (Bank A)	SL-0210-001
Screenings Sluice 2 (Bank B)	SL-0210-002

Splitter Box 1 (Bank A)	DF-0220-001
Splitter Box 2 (Bank B)	DF-0220-002
Wash Press 1	WPR-0220-001
Wash Press 2	WPR-0220-002
Wash Press 3	WPR-0220-003
Storage Bin 1	BN-0220-001
Storage Bin 2	BN-0220-002
Storage Bin 3	BN-0220-003

7 Screenings Sluices and Splitter Boxes

7.1 Screenings Sluice Overview

There are two screenings sluices that receive screenings from each of the screens during a backwash sequence. The sluices are sloped so that they drain towards the splitter boxes. Bank A collects screenings from screens 1, 3, 5, and 7. Bank B collects screenings from screens 2, 4, 6, and 8. The sluices transport the screenings to the splitter boxes located at the northern side of the inlet works structure.

Normally there is sufficient water provided from the screen spray wash solenoid during a backwash sequence to transport the screenings all the way along the sluice, however, if necessary the plant operator may open a manual water valve located at the southern (highest) end of each sluice to provide additional transport medium.

7.2 Splitter Box Overview

Splitter Box 1 is located at the end of Screenings Sluice 1, (Bank A). It is used to divert the screenings to either Wash Press 1 or Wash Press 3. Splitter Box 2 is located at the end of Screenings Sluice 2, (Bank B). It is used to divert the screenings to either Wash Press 2 or Wash Press 3.

The splitter boxes comprise a rotating "nozzle" that is moved via pneumatic rams actuated by solenoid valves. The "nozzle" discharges into two chutes whose outlets are connected to the inlet hoppers of the wash presses.

Wash Press 3 is normally used as a "standby" for Wash Press 1 and Wash Press 2.

IMPORTANT NOTE:

If wet weather conditions are pending, the plant operator is advised to ensure that Storage Bins 1 and 2 are not close to full prior to the high inflow event occurring. Otherwise there may be insufficient screens available to handle the inflow, or if the maximum of five screens discharging to Wash Press 3 is manually bypassed, the wash press may become overloaded.

7.3 Operation

The Screenings Sluices have no operating modes since they simply transport the screenings using water from the screens wash solenoids as the transport medium.

The Splitter Boxes are able to be operated in one of four modes: Off, Local/Manual, Remote/Manual, or Remote/Auto. Selection is made at the local control panels located near the splitter boxes.

7.3.1 Local Operation

To operate Splitter Box 1 in Local mode, set the selector switch to "Local" and then press the "to Wash Press 1" button to divert the screenings to Wash press 1, or press the "to Wash Press 3" button to divert the screenings to Wash press 3.

To operate Splitter Box 2 in Local mode, set the selector switch to "Local" and then press the "to Wash Press 2" button to divert the screenings to Wash press 2, or press the "to Wash Press 3" button to divert the screenings to Wash press 3.

Indicator lamps on the LCP's show the current position of the splitter box nozzles derived from end-of-travel limit switches.

NOTE: The PLC is not required to be operational for the splitter box actuators to run, so long as power is available. Sufficient plant instrument air pressure is also required to move the rams.

7.3.2 Remote/Manual Mode

When the local mode selector is set to "Remote", the splitter box may be operated in either Remote/Manual or Remote/Auto mode via selection on the SCADA equipment faceplate. When Remote/Manual is selected, the operator may select the screenings destination: For Splitter Box 1: Wash Press 1 or 3, for Splitter Box 2: Wash Press 2 or 3.

In this mode, the control system will NOT automatically divert the screenings should the destination wash press chute become blocked, (sensed as overflow level in the wash press hopper).

7.3.3 Remote/Auto Mode

The normal control mode is Remote/Auto. In this mode, the control system will automatically divert the screenings based on signals received from the wash presses.

If the destination wash press has an overflow level alarm for a continuous 30 seconds, and the adjacent wash press is available and does not have an overflow level alarm, the system will automatically divert the screenings to the adjacent wash press. If both wash presses have an overflow level alarm, the splitter box will not automatically reposition.

Note: "Available" for a wash press means the wash is press is in Remote/Auto mode and has no active alarms.

The wash press's associated storage bin is normally required to be available as well, however, the control system does not make this condition mandatory. This allows the wash press to discharge screenings directly onto the concrete hard-stand for later removal by bobcat in the rare event that a full storage bin has not been able to be replaced in a timely fashion.

7.3.4 Alarms/Failure Responses

7.3.4.1 Power Loss / PLC Failure

On loss of power, loss of plant air pressure, or PLC failure, the splitter boxes will remain to their current position.

7.3.4.2 Alarm List

The following list of alarms is provided for each splitter box:

	Equipment	Alarm Description	Action	Latching?
1.	Splitter Box x	Control supply not available	Alarm only	No
2.	Splitter Box x	Failed to move to Position 1	Turn off output & alarm	Yes
3.	Splitter Box x	Failed to move to Position 2	Turn off output & alarm	Yes

7.4 SCADA Information

7.4.1 Display

Control mode status: Off, Local/Manual, Remote/Manual, or Remote/Auto
Fault/Healthy

7.4.2 Control

Control mode selection: Remote/Auto or Remote/Manual
When in Remote/Manual or Remote/Auto:
Splitter Box 1 Destination: Wash Press 1 or Wash Press 3
Splitter Box 2 Destination: Wash Press 2 or Wash Press 3

8 Wash Presses and Storage Bins

8.1 Wash Press Process Overview

The three Wash Presses, WPR-0220-001, 002, and 003, normally operate with Wash Presses 1 and 2 on duty and Wash Press 3 on standby. The wash press consists of a screw drive and four wash spray solenoids.

The screenings received in the inlet hopper from the splitter box chutes are washed by sprayed water and then the screenings are dewatered in the compaction zone and compressed as they are progressively pushed up the long "goose-neck" to discharge the dewatered screenings into an associated storage bin.

Liquid removed during the compaction process is gathered in the drain pan below the wash press and drains under gravity to the Drain Pit.

An ultrasonic level sensor is located above the inlet hopper, and this sensor provides the trigger for the wash press to begin a dewatering cycle.

8.2 Storage Bins Overview

There are three storage bins, one associated with each wash press. The bins are Spirac 'Spirotainer' STU355 with 20m^3 capacity. Each bin has an inlet chute and a screw feeder located along the top of the bin to spread the screenings along the full length of the bin. The bins are designed to be easily lifted on to a purpose-made truck and transported off-site.

Mounted above the inlet chute is a pneumatically operated retractable chute that directs screenings from the outlet of the wash press 'goose-neck' into the inlet chute of the storage bin. There are travel limit switches in the raised and lowered positions for the retractable chute.

Each bin has two level switches located at the far end of the bin and the controls and power connections are made via pin and socket connectors.

8.3 Operation

The wash presses and storage bin screw motors can be operated in one of four modes: Off, Local/Manual, Remote/Manual, or Remote/Auto. The retractable chutes for the storage bins are only able to be operated in Local Mode.

8.3.1 Local Operation

To start a Wash Press in local set the control mode selector on the MCC in the Inlet Works switchroom to Local. Out at the LCP near the wash press, the press can then be started in the forward direction by turning the switch on the LCP to "Forward".

The spray wash solenoid selector should also be turned to Local (or "Hand") to provide wash water while the press is running. If the PLC is operational and the mode selector for the water solenoid is in Remote/Auto mode, when the wash press "running" input turns on, the PLC will automatically turn on the water solenoid and run it continuously while the "running" input is on.

If a blockage occurs or the electronic shear pin trips due to high torque, the press may be run in the reverse direction for a short time by turning the switch on the LCP to "Reverse". To avoid damage to the press, operation in reverse must be limited to short periods of only a few seconds.

The retractable chutes for the storage bins are operated by the truck driver or plant operator using the 'Raise' or 'Lower' buttons located on the LCP adjacent to the inlet end of the storage bin. The chute must be fully raised before a full storage bin can be withdrawn by the truck. When the new empty bin is located in the correct position, the chute must be lowered. The button must be held in until the pneumatic ram automatically stops moving when its travel limit switch operates.

The storage bin screw drive can be run in local mode by selecting Local at the LCP beside the inlet end of the bin, and then using the start and stop pushbuttons to run the drive. In local mode if there is a High/High level alarm active or the electronic shear pin has activated, the drive will NOT be able to be started.

In LOCAL mode, the PLC is not required to be operational.

8.3.2 Remote/Manual Operation

The Wash Press may be operated manually from the SCADA when the control mode selector on the MCC is placed in the Remote position. Clicking on the 'Start Forward' button on the equipment faceplate will start the wash press batch sequence in cycles until the 'Stop' is pressed. Ensure that the wash water solenoids are placed in Remote/Auto mode and they will be automatically cycled on and off. The screw drive will not run-on when stopped, (as it does in Remote/Auto mode).

The wash press may be run in reverse by clicking on the 'Start Reverse' button. The press will run for only two seconds and then stop.

The wash press spray wash solenoids (4 off) can be opened via a button on the OWS when they are placed in Remote/Manual mode.

The storage bin screw drive can be started and stopped from the OWS in Remote/Manual mode.

8.3.3 Remote/Auto Operation

When selected to Remote/Auto mode the operator must select which Wash Press is on Duty at the OWS. Wash press 1 is normally on duty for screen bank 'A', and wash press 2 is normally on duty for screen bank 2.

Duty Changeover

When all three presses and both splitter boxes are set to Remote/Auto and are available, duty changeover of the screening storage trains is performed automatically by the control system.

Duty changeover can be performed in one of three ways:

(i) Manual changeover via operator toggle on the OWS;

(ii) Automatic changeover when the associated storage bin reaches High/High Level;

(iii) Automatic changeover if the duty wash press develops a fault condition, has an inlet hopper overflow level alarm for a continuous 30 seconds, or its mode is changed from Remote/Auto.

NOTE: There is no automatic or daily duty cycling of the storage bins. For storage bin 1 and 2, it is intended that when a wash press/storage bin train is selected, it will remain selected until the storage bin becomes full. This is not necessarily the case for storage bin 3 which intended to be a standby for bins 1 and 2, however, bin 3 should not be left partially filled for long periods and so should also be deliberately filled and replaced by a new bin at regular intervals, but only when bin 1 and 2 are not near their full position.

The manual changeover toggle button on the OWS will be 'greyed-out' if the adjacent wash press is not available, or the associated splitter box is not available.

When an associated storage bin reaches its High Level alarm point, a flashing warning will appear on the Inlet Works main page, warning the plant operator that the bin is close to needing replacement. The operator may manually toggle the splitter destination to the adjacent wash press/storage bin train, when the truck arrives to replace the full bin.

However, if the bin continues to fill and reaches its High/High Level alarm point for a continuous 3 minutes, and the adjacent wash press/storage bin train is available, the control system will automatically switch the screenings destination to the adjacent train. In addition to the alarm being posted on the OWS alarm page, a large flashing alarm message will appear on the Inlet Works main page advising that the bin is full and must be replaced.

If a duty wash press develops a fault condition or is taken out of Remote/Auto mode, and the adjacent wash press is available, the control system will automatically toggle the destination to the adjacent wash press. This will also occur if the duty wash press has an overflow level alarm in its inlet hopper for a continuous 30 seconds.

Each wash press inlet hopper has a level transmitter installed. Based on the start level and high level settings, there are two modes of operation of the wash press.

Wash Press Normal Cycle

When the level in the inlet hopper rises to the start level setpoint, a normal dewatering cycle is triggered. The "Normal" cycle consists of twelve steps as shown in the following table:

Step No.	Process	Screw Drive	Water Sol 1	Water Sol 2	Water Sol 3	Water Sol 4	Sec #	Duration (secs)
1	Fill	Forward ON	Closed	Closed	Closed	Closed	0 -10	10
2	Fill	Forward ON	Open	Open	Closed	Closed	10-15	5

3	Wash	Stopped	Open	Closed	Open	Closed	15-25	10
4	Wash	Reverse ON	Open	Closed	Open	Closed	25-28	3
5	Wash	Stopped	Closed	Closed	Open	Closed	28-38	10
6	Wash	Forward ON	Open	Closed	Closed	Closed	38-42	4
7	Wash	Stopped	Open	Closed	Open	Closed	42-48	6
8	Wash	Reverse ON	Open	Closed	Open	Closed	48-51	3
9	Wash	Stopped	Closed	Closed	Open	Closed	51-57	6
10	Discharge	Forward ON	Open	Closed	Closed	Closed	57-67	10
11	Discharge	Forward ON	Closed	Closed	Closed	Closed	67-77	10
12	Discharge	Stopped	Closed	Closed	Closed	Open	77-97	20

Operator-adjustable durations:

Steps 3, 5	min 5, max 15
Steps 7, 9	min 2, max 10
Step 12	min 20, max 30

If, at the end of the normal cycle, the wash press inlet hopper level is still above the start level setpoint, another normal cycle will begin again at Step 1. Up to five normal cycles may be repeated if the start level still exists.

Wash Press Continuous Operation Cycle

If, at the end of the five normal cycles (operator-adjustable), the wash press inlet hopper level is still above the start level setpoint, or the high level setpoint is reached at any time during the normal cycle, a "Continuous Operation Cycle" will immediately begin.

The "Continuous Operation" cycle consists of nine steps as shown in the following table:

Step No.	Screw Drive	Water Sol 1	Water Sol 2	Water Sol 3	Water Sol 4	Sec #	Duration (secs)
1	Forward ON	Open	Closed	Closed	Closed	0 -5	5
2	Forward ON	Closed	Closed	Closed	Closed	5-20	15
3	Forward ON	Closed	Open	Closed	Closed	20-25	5
4	Forward ON	Closed	Closed	Closed	Closed	25-40	15
5	Forward ON	Closed	Closed	Open	Closed	40-45	5
6	Stopped	Closed	Closed	Closed	Closed	45-46.5	1.5

7	Reverse ON	Closed	Closed	Closed	Closed	46.5-49.5	3
8	Stopped	Closed	Closed	Closed	Open	49.5-54.5	5
9	Stopped	Closed	Closed	Closed	Closed	54.5-114.5	60

If, at the end of the continuous operation cycle, the wash press inlet hopper level is still above the high level setpoint, another "Continuous Operation" cycle will immediately start at Step 1.

8.3.4 Wash Press Wash Water Solenoids

Each Wash Press has four wash water solenoid valves. The valves can be operated in one of three modes: When the associated Wash Press is selected for 'Local' operation, the 'Wash Solenoid On/Off' switch on the LCP can be used to open or close the solenoid valves together.

When the associated Wash Press is selected for 'Remote' operation, the Wash Solenoid Valves can be operated in either Remote/Manual or Remote/Auto mode. In Remote/Manual, the valves can be opened and closed via buttons on the OWS or as per the batch sequence cycle. In Remote/Auto mode, the solenoids will be operated as per the sequence detailed by the finalized vendor in his operating philosophy.

For each wash press, a flow switch is used to detect a no flow condition if the solenoid open command is active and the flow switch has not indicated normal flow within five seconds. If no-flow is detected, an alarm is raised and the wash press becomes unavailable.

8.3.5 Storage Bins

A Storage Bin is considered available when its 'Lowered' proximity switch is on and its screw drive is in Remote/Auto mode and has no fault conditions. The Drive Isolated fault will be activated when the control cable is disconnected from a bin that is being removed and replaced. However, this alarm will be self-resetting so will disappear from the alarm list when the cable for the new bin is plugged in. (The alarm is to be auto-acknowledging in the alarm configuration).

The storage bin screw drive will be started whenever its associated wash press is running, and it will run-on for 30 seconds after the wash press has stopped.

When the bin high level switch turns on, an alarm will post on the SCADA alarm page and also display on the Inlet Works main page a prominent flashing message: "STORAGE BIN x FULL – PLEASE REPLACE". The associated wash press will continue to transport screenings to this bin until the high/high level switch turns on. The high/high level alarm will automatically stop the storage bin screw in all control modes, and in Remote/Auto mode it will stop the associated wash press and trigger a duty changeover to the adjacent press (if it is available).

8.3.6 Interlocks

When in Remote/Auto mode, the Duty selected Wash Press will start up based on the level detected by the hopper level transmitter either in normal mode or continuous mode.

A Wash Press may discharge screenings even if its associated storage bin is not indicating that it is available. This allows the system to continue retrieval of screenings from the inlet screens even if there has been a problem associated with one of the storage bins, even though it may mean that screenings are being discharged onto the concrete because of a missing bin.

8.3.7 Alarms List

The following list of alarms is provided for each wash press and storage bin:

	Equipment	Alarm Description	Action	Latching?
1.	Wash press x	Control supply not available	Alarm & stop	No
2.	Wash press x	Drive Isolated	Alarm & stop	Yes
3.	Wash press x	Failed to run forward	Alarm & stop	Yes
4.	Wash press x	Failed to stop forward	Alarm	Yes
5.	Wash press x	Failed to run reverse	Alarm & stop	Yes
6.	Wash press x	Failed to stop reverse	Alarm	Yes
7.	Wash press x	Thermal Overload	Alarm & stop	Yes
8.	Wash press x	No-flow Alarm (5 sec after sol. on)	Alarm & stop	Yes
9.	Wash press x	Flow Fault (flow on 5 sec after all sol. Off)	Alarm	No
10.	Wash press x	Inlet Hopper High Level	Alarm	No
11.	Wash press x	Inlet Hopper Overflow Level	Alarm & switch duty	No
12.	Storage Bin x Screw Conveyor	Control supply not available	Alarm & stop	No
13.	Storage Bin x Screw Conveyor	Drive Isolated	Alarm & stop	Yes
14.	Storage Bin x Screw Conveyor	Failed to run	Alarm & stop	Yes
15.	Storage Bin x Screw Conveyor	Failed to stop	Alarm	Yes
16.	Storage Bin x Screw Conveyor	Drive Fault	Alarm & stop	Yes

17.	Storage Bin x	High Level warning	Warning only	No
18.	Storage Bin x	High/High level alarm	Alarm & switch wash press duty	No

8.4 SCADA Information

8.4.1 Display

For each Dewatering Wash Press:

Equipment Running/Stopped
Control mode status: Local/Manual, Remote/Manual, or Remote/Auto
Screens Bank A Wash Press Duty (1/3)
Screens Bank B Wash Press Duty (2/3)
Storage Bin x Available/Not available
Wash Press x Inlet Hopper Level xxxx mm

8.4.2 Control

For the wash press and storage bin screw drives:

When in Remote mode at LCP:	Manual or Auto
When in Remote/Manual mode:	Start or Stop
Screens Bank 1 Wash Press Duty Selection	Press 1 or Press 3
Screens Bank 2 Wash Press Duty Selection	Press 2 or Press 3
Wash Press 1 Start Level Setpoint	600mm (min 100, max 1000)
Wash Press 1 High Level Setpoint	1000mm (min 500, max 1200)
Wash Press 1 Overflow Level Setpoint	1100mm(min 1000, max 1200)
(Ditto level setpoints for Wash Presses 2 and 3)	
Wash press normal cycle Step 3 duration	10 sec (min 5, max 15)
Wash press normal cycle Step 5 duration	10 sec (min 5, max 15)
Wash press normal cycle Step 7 duration	6 sec (min 2, max 10)
Wash press normal cycle Step 9 duration	6 sec (min 2, max 10)
Wash press normal cycle Step 12 duration	20 sec (min 20, max 30)
Wash press number of wash repetitions	5 (min 1, max 10)
Storage bin screw drive run-on time	30 sec (min 10, max 300)

9 Wash Water Booster Pumps and Filter

9.1 Overview

Supply water for the screenings sluices and wash presses is sourced from the site Effluent Water System. A new Grundfos booster pump package consisting of four pumps and Grundfos MPC pressure control system has been installed at the existing Effluent Pump Station, located outside the north-east corner of Primary Settling Tank 1. In addition, an Amiad 3-BE-SAF3 auto backwashing filter package has been installed at the delivery of the booster pumps.

The vendor package maintains a setpoint pressure value that is entered via the MPC panel.

The vendor control packages provide status signals that are connected to PLC03 which is located at the eastern end of Stage 1A Bioreactor. There are no setpoints or control functions available on the OWS for either the booster pumps or the filter. The following status signals are connected and provide animation and alarms on the Effluent page on the OWS:

Equip. No.	Name	Description (0/1)	Type	Rack	Slot	Channel
	Inlet Screens Filter Package	Normal / Any Filter Flushing	Digital Status	Exp 3	6	15
	Inlet Screens Filter Package	Normal / Faulted	Digital Alarm	Exp 3	6	16
	Inlet Screens Booster Pump 1	Stopped / Running	Digital Status	Exp 3	5	9
	Inlet Screens Booster Pump 2	Stopped / Running	Digital Status	Exp 3	5	10
	Inlet Screens Booster Pump 3	Stopped / Running	Digital Status	Exp 3	5	11
	Inlet Screens Booster Pump 4	Stopped / Running	Digital Status	Exp 3	5	12
	Inlet Screens Booster Pump 1	Normal / Faulted	Digital Alarm	Exp 3	5	13
	Inlet Screens Booster Pump 2	Normal / Faulted	Digital Alarm	Exp 3	5	14
	Inlet Screens Booster Pump 3	Normal / Faulted	Digital Alarm	Exp 3	5	15
	Inlet Screens Booster Pump 4	Normal / Faulted	Digital Alarm	Exp 3	5	16
	Inlet Screens Booster Pumps	Flowrate (range 0 to 100L/s tbc)	Analog Status	Exp 1	3	7
	Inlet Screens Booster Pumps	Delivery Pressure (range 0 to 700kPa tbc)	Analog Status	Exp 1	3	8

QUU Internal note:

Section 9 is to be transferred to the Functional Specification for PLC03 at a later date.

10 Drainage Sump Pumps

10.1 Overview

The Drainage Sump receives drain water from the wash presses and storage bins. The sump has two submersible sump pumps which pump the liquid up into

the inlet works upstream of the inlet penstocks. The sumps are operated by discrete level controls included in a vendors' electrical package.

"Running" and "Fault signals are available for each pump and provide animation and alarms on the OWS. In addition a High/High Level Alarm will also be posted on the OWS.

10.2 Equipment

Drain Pump 1	PU-0220-003
Drain Pump 2	PU-0220-004
Drain Pit Hi/Hi Level Switch	LSHH-0220-001

10.3 Operation

The pumps may operate in either Duty/Standby mode or Duty/Follow mode. This is dependent on the vendor control package and is to be confirmed after site commissioning and the FS updated accordingly.

10.4 Alarms List

The following list of alarms is provided for drainage pumps:

	Equipment	Alarm Description	Action	Latching?
1.	Drainage Pump 1	Drive Faulted	Alarm only	No
2.	Drainage Pump 2	Drive Faulted	Alarm only	No
3.	Drainage Pit	High/High Level Alarm	Alarm only	No

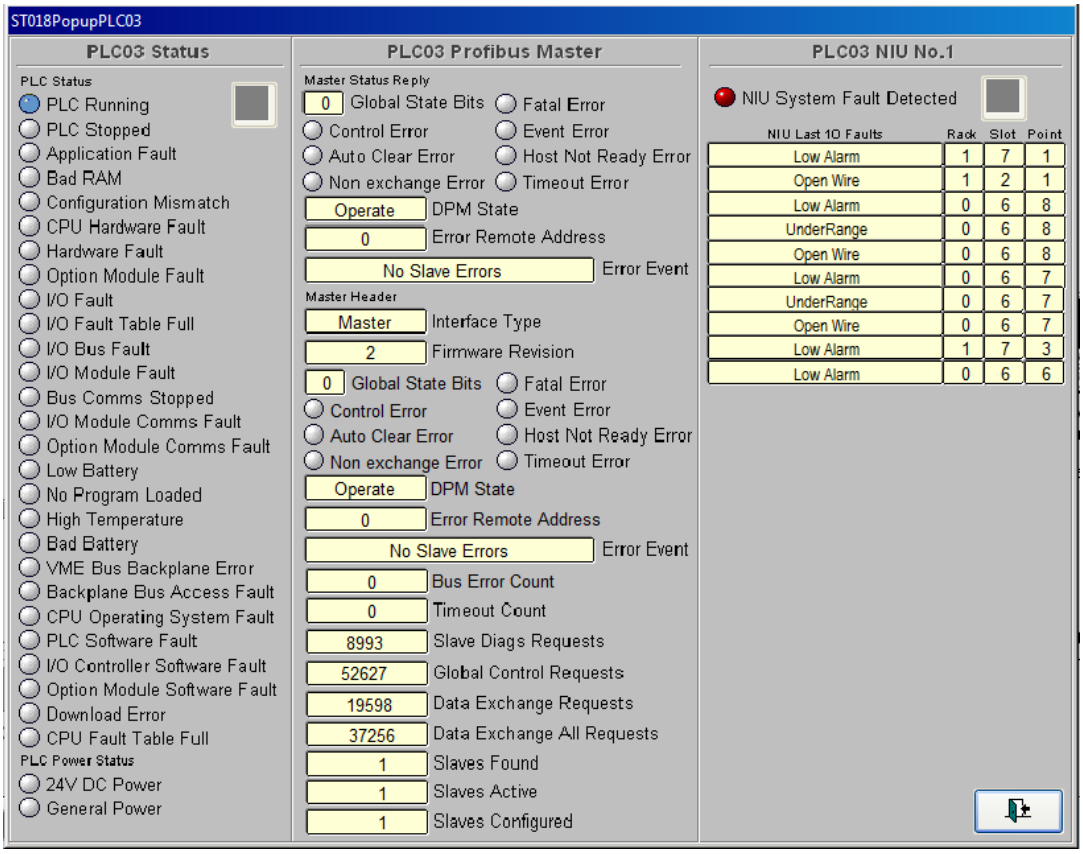
11 UPS Inputs

The power supply to PLC21 racks and IO circuits are backed up by a Powerware Uninterruptible Power Supply, (UPS). It is located inside the PLC cubicle of SB1. Status signals are connected from the UPS relay output board across to PLC digital inputs and these status signals provide alarm messages on the OWS.

Source	Description	PLC Tag	Off State	On State
UPS Status	Line Okay	PLC03UPSStatusdILineOK	Line Failure	Line Okay
UPS Status	Battery Normal	PLC03UPSStatusdIBatteryOK	Low Volts	Normal
UPS Status	UPS On / Okay	PLC03UPSStatusdIUPSOK	Alarm	On / Okay
UPS Status	UPS Normal / On Inverter	PLC03UPSStatusdIOnInverter	On Bypass	On Inverter
24vDC Power Supply	Healthy	PLC03Powerdi24VDCHealthy	Fault	Healthy

12 PLC21 Status

PLC21 has been added to the "Communications" page on the OWS and is located between PLC01 and PLC02. Clicking on the PLC icon will display the following typical PLC Status popup:



13 PLC21 Inter-PLC Dependencies

The following data is being transferred via the SCADA plant network using Ethernet Global Data functions:

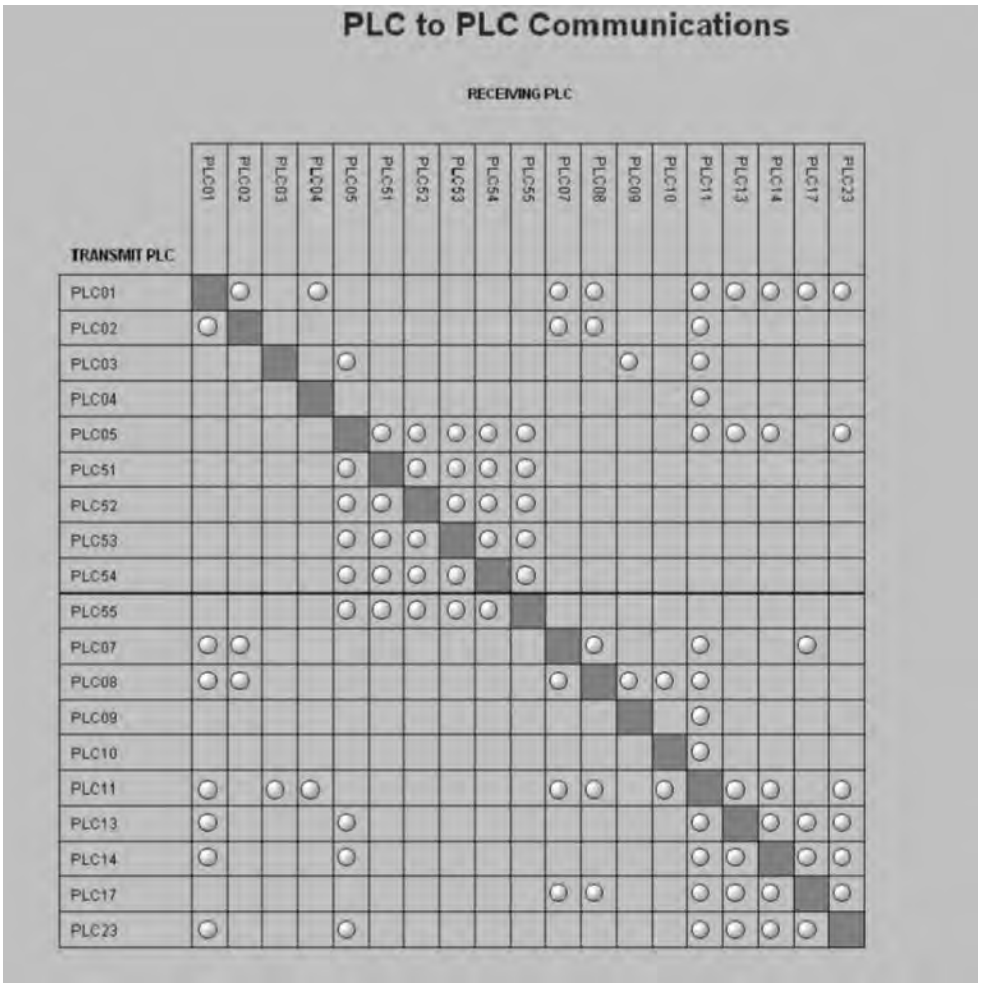
PLC21 → PLC01

For control of the existing inlet syphon valves, if the reverse flow detection by inlet screen level difference test is enabled on the OWS, then PLC01 will read the four differential levels for channels 1-2, 3-4, 5-6, 7-8, which is being calculated in PLC21 and sent to PLC01.

PLC01 → PLC21

For checking whether high flow conditions exist to switch the inlet screens into wet weather mode, PLC01 transfers the Total Plant Influent value to PLC21.

The "PLC to PLC Communications" page on the OWS has been modified to include PLC21 with transmission dots added for PLC01 → PLC21, and PLC21 → PLC01.



Section 3: As Constructed Drawings

Section 4: Commissioning Plan/Program

Luggage Point STP Inlet Works Screen Upgrade

Commissioning Plan

A	25.06.2014	Draft	M May		
REV	**DATE**	**DESCRIPTION**	**PREPARED**	**CHECKED**	**APPROVED**

CONTENTS

ABBREVIATIONS

ANSI	American National Standard Institute
AS/NZS	Australian Standards/New Zealand Standards
DMP	Design Management Plan
ECM	Energy Control Measures
EN	European standard
EPA	Environmental Protection Agency
EPDM	Ethylene Propylene Diene Terpolymer
FAT	Factory Acceptance Test
FDS	Functional Design Specification
HAZID	Hazard Identification
H&S	Health and Safety
IFC	Issued For Construction
O&M	Operation & Maintenance
ISO	International Organisation for Standardisation
ITP	Inspection Test Plan
MCC	Motor Control Centre
MDR	Manufacturer's Data Report
MSDS	Material Safety Data Sheet
NCR	Non Conformance Report
NDT	Non Destructive Testing
OD	Outside Diameter
P&ID	Piping and Instrumentation Diagram
PLC	Programmable Logic Controller
PT	Performance testing
QA	Quality Assurance
SAT	Site Acceptance Test
SCADA	Supervisory Control and Data Acquisition
SLD	Single Line Drawing
SS	Stainless steel
SWMS	Safe Work Method Statements
TBA	To Be Advised
VT	Vendor testing
WS-SPEC	Water Services Specification

1 PURPOSE

The purpose of this document is to identify, plan and resource the activities necessary to commission the components of the Luggage Point Inlet Screens Project.

This document sets out the overall commissioning plan and explains how the commissioning will be implemented including testing and pre-commissioning, commissioning and performance and reliability testing.

Furthermore the plan describes the process applied in demonstrating and verifying the deliverables as spelled out in the Functional Description the resources, communication links, management structures and plans which will be established to manage commissioning procedures to meet the following objectives:

- preserve the health and safety of employees;
- comply with legal and statutory requirements;
- minimise environmental impact;
- delivery and hand-over of the new plant to Queensland Urban Utilities in a condition which is fit for its successful operation and maintenance; and
- achieve time and performance targets

2 REFERENCES

- Functional Specification
- Site Safety Management Plan
- Energy Control & Management Plan (Including Electrical Safety Management)

3 SCOPE

Commissioning will broadly cover all aspects of setting the installation to work along with verifying documentation. This will include factory acceptance tests (FAT's), various site acceptance tests (SAT's), and site based testing and commissioning. Works include but are not limited to:

- various newly energised live electrical installations;
- instrumentation;
- monitoring and control systems (supplied by Queensland Urban Utilities);
- mechanical and pumped installations;
- working with pressures and flows; and
- performance testing including screens which is not Stirloch supply

The Commissioning Plan will form part of the suite of documents that provides all relevant documented information for the completed project. Preparation of the Commissioning Plan, associated appendices and specifically prepared Safe Work Method Statements (SWMS's), checklists and other record documentation & verification systems may in part directly carry through and be adopted into the O&M Manual.

Due to the importance of ensuring safe operation, integration of commissioning various multiple systems, adjustments and/or maintenance works, and appropriate SWMS's will be prepared. This applies to specific and broad context activities irrespective of a component operating independently or as part of a complex interrelated system. Individual

tasks will as a minimum follow various checklists (commissioning and/or operations), inspection & test plans (ITP's), and SWMS's. Similarly individual components, their respective status, state and condition, will be documented and verifiable check list items within work packs prior to taking any active part in activities comprising Pre-Commissioning, Pre Start-Up, or Commissioning and Performance Testing.

Health and Safety Management will follow and be in accordance with the Site Safety Management Plan.

It is not the aim of this document to replicate all the information that is located in or sourced from other documents - only to reference or clarify them. General background information will be provided for clarity, always refer to the root sources for further clarification and explanation.

For clarity "The Luggage Pt Screens Upgrade Project is made up of elements that are free issue and/or designed from Queensland Urban Utilities and Stirloch supplied and installed equipment and electrical services. This commissioning plan is written to cover all elements of the project; however Stirloch is not responsible for the FAT's commissioning and performance testing of the free issue equipment (installed by Stirloch) nor the function and implementation of the control system (PLC/SCADA) which has been designed and installed separate to this contract, by Queensland Urban Utilities.

To ensure continuity of the commissioning process, this document is based on the premise that the free issue equipment will function as designed and the PLC/SCADA functionality is in accordance with the specification. Any malfunction of these elements is not the responsibility of Stirloch and could cause delays to the program.

Stirloch's responsibility during commissioning, in this instance, is limited to equipment testing (or pre-commissioning) to make the equipment available to be operated via the SCADA system. Integrated systems and process commissioning (when raw sewage is introduced) is to be carried out by Queensland Urban Utilities staff.

4 COMMISSIONING OVERVIEW

4.1 Expectations of Commissioning

Commissioning is a multi-stage and integrated activity that delivers an operational plant to the client. Commissioning is a disciplined activity involving careful testing, calibrating and proving of all systems within the project scope boundary. This ensures nothing is left to chance, so that when buttons are pushed all logic interlocks are fully proved and operate correctly and problems, if they occur, will be design (or process) failures, not wiring, specification, software, communication, instrumentation or functional errors.

The central focus of commissioning is to demonstrate to the client that the installation complies with the FDS as a complete system. In this way the FDS is the guiding document for what commissioning must demonstrate.

The FDS is the overarching document and describes in detail the desired outcome of the system. It describes how the system is controlled to achieve the required performance of the system. For every point where the FDS states that the system as a whole will perform a function or produce an outcome, there will be a test that demonstrates that performance.

Performance Testing is the term given to those tests which demonstrate compliance with the FDS. The development of top-down commissioning procedures and method of developing commissioning & performance tests progresses through the following steps as indicated below:

- Quantify stated performance outcomes
- Identify every mode of operation or plant configuration by which the stated performance can be achieved.

- Identify which modes of operation or plant configuration will be tested and which can be verified by a less demanding activity such as a design review or pre-commissioning tests.
- Identify the required initial configuration of the system for each process test to ensure that the stated outcome is based on a pre-determined system state.
- Transfer all the above data into individual commissioning procedures which state clearly which system parameters, e.g. pressure, flow, will be used to demonstrate the contracted performance.
- Identify any particular test equipment and the required accuracy to ensure that results are valid.

4.2 Acceptance Criteria

The fundamental acceptance criteria for all tests and commissioning procedures, is whether the intent of the design can be demonstrated in the as-built system. During the development of the testing at all levels, pass or fail criteria will be included in the individual tests. In particular, individual acceptance criteria for Performance Tests will be found in the FDS and these will be transferred to the body of the particular Performance Test that demonstrates the particular element of the design. Individual acceptance criteria for the FAT and SAT tests will have formed part of the contracted scope with equipment suppliers.

5 COMMISSIONING PLAN CONTENT

The following shall be covered in this Plan;

- Emergency and contingency procedures during commissioning activities;
- A detailed programme for commissioning (dictating order, ID, SWMS, checklist & critical points);
- Check lists to be completed prior to commencing commissioning;
- Performance criteria and the outputs to be measured;
- Non-conformances and corrective action procedures;
- Inspection & test points proposed and their timing (QA);
- Experience and responsibilities of personnel and resources;
- Proposed training programme for the operators;
- How the testing programme is to be managed; and
- Clear and defined communication channels for all design, construction and operational personnel to follow during the commissioning stage.

The definitions of the interfaces between systems and accurate performance measurement of each system shall be defined.

5.1.1 Specific Requirements

The Plan shall clearly detail all the actions, methods, procedures, personnel and testing required during the commissioning stage.

The plan shall define the systems of the works that will be commissioned and the plan shall be submitted for approval prior to the development of detailed Inspection and Test Plans (ITP) for commissioning.

Stirloch shall submit the ITP, commissioning procedures and programme for each system to be commissioned for approval prior to the commencement of any commissioning activities.

The results of all tests will be recorded and documented by Stirloch and copies of the results will be provided within the O&M manual.

5.1.2 Structure

The Plan shall also address the following:

- A logical sequence to bring the plant on line (refer program);
- Steps to be taken to shut down the plant when required
- Log & Check sheets which will allow the operators to track critical parameters (SCADA trending outputs acceptable).

Note that at all times the Commissioning Team may refer to various additional sources of information to guide the decision making process. The FDS and P&ID's serve to assist in determining if systems or plant are operating satisfactorily, and if required, adjust tests and procedures accordingly for approval and implementation.

5.1.2.1 Emergency and Contingency

The Plan shall include an Emergency and Contingency Plan which addresses:

- Threat to human life;
- Injury to personnel;
- Threat to the environment;
- Breach of law/license provision;
- Emergency external to site;
- Equipment breakdown;
- Contingencies relating to mechanical and/or electrical commissioning;
- Threat to equipment or infrastructure owner by associated stakeholders

Please refer *Appendix A – Emergency and Contingency.*

5.1.2.2 Programme

The Plan shall include the part of the project delivery schedule that clearly defines the start times, milestones and expected completion times of each system stage. Major interdependencies and expected durations shall be shown on the programme. Please refer *Appendix B – Commissioning Program.*

6 COMMISSIONING TEAM PERSONNEL

The Stirloch commissioning team will include the following key personnel:-

- Commissioning engineer/mechanical engineer
- Electrical and instrumentation engineer
- Commissioning training co-ordinator
- Quality Assurance inspector

It is required that the support personnel will be available to attend site at various times during the commissioning period.

The commissioning team will also be supported by:-

- The Stirloch Safety Manager
- Queensland Urban Utilities Control & Operational Staff;
- Stirloch design team; and
- Vendor specialists.

The roles and responsibilities of the team can be found in Appendix A.

7 COMMUNICATION

It is imperative that a failsafe method of communication is implemented when the new equipment is being commissioned.

8 DOCUMENTATION

Documentation that records all tests and commissioning operations shall be written in such a way that testers and operators are specifically instructed as to how to perform each step, each step is separated from others and sign off of each step is recorded.

The following points are a feature of the documentation:

- Clear instructions of what actions are required;
- Clear identification of the piece of equipment which is to be operated;
- Clear identification of explanatory comments and directions;
- Only one action to be performed at each step;
- A check-off box in which comments can be added;

The following documentation will at all times be available at the Stirloch site office.

- Commissioning Plan
- Commissioning record log sheets and check sheets
- FDS
- Full Project IFC drawings, DRAFT ‘As-Built’ mark up plans
- All equipment, instrument, valve and electrical schedules
- Vendor Specific (and commissioning) Documentation
- DRAFT Operation and Maintenance Manuals; and
- Punch List (Defect list).

9 DELIVERY

This should be read in conjunction with the Programmed Schedule of Activities.

Completion of Pre-Commissioning activities:

- Service water pipework
- Service water pumps
- Service water filter

- Washpress units
- Screenings bins
- Drain pumps
- Instrumentation
- Penstocks
- Stoplogs
- Inlet screens

Commissioning activities:

- Stage 1
- Stage 2
- Stage 3

Performance Testing

- Stage 4

10 PROGRESS & RECORDS

Stirloch will prepare and table a weekly report of progress, current and proposed future activities, defects and any other emergent issues. This report will be formally tabled and directly discussed at a suitable forum with Queensland Urban Utilities at weekly intervals.

Stirloch shall maintain a daily “Commissioning Diary” to record progress of activities, problems, faults, delays and solutions. A Daily Action List shall be maintained and filled out by commissioning personnel, when required, to record any defects with equipment or equipment installation; together with actions required to avoid or limit delays in commissioning.

The results from all commissioning activities and tests shall be documented and collated for inclusion as an appendix to the O & M manual.

11 ELECTRICAL SAFETY & ACCESS PROCEDURES

Stirloch, in consultation with the Queensland Urban Utilities, shall ensure an appropriate documented procedure is in place to provide a safe working environment, commissioning permits and access control systems applicable for all site personnel during the commissioning phase of the Project.

Positive isolation control and access permit controls must be enacted to ensure that under no circumstance any personnel are placed in a potentially hazardous situation during preparatory, commissioning, testing or post hand over operational stages.

The procedures shall, as a minimum requirement, address the following issues:-

- Controlled access and isolation of Energy – hydraulic, mechanical, electrical or any other energy commonly located within electrical apparatus, switch rooms, control rooms and pump/pipework or pit or building installations. Only trained and authorised personnel to be granted access through a permit and tagging system;
- Provision of a system of locks, warning notices, warning tags and tape barriers to advise the status of equipment (assume all items to be “live”) and protect the authorised personnel who may be working on equipment;
- Maintaining a register of locked out and/or tagged out components or systems; and;

- Maintenance and safety of using any equipment, temporary systems e.g. electrical construction power supplies, electrical equipment, operator's keys etc

12 MATERIALS HANDLING

During the commissioning period no specific chemical systems will be used. Stirloch shall ensure that normal lubricants or other materials used or stored on site are handled in accordance with the approved Material Safety Data Sheets (MSDS) incorporated into O&M Manual, and ensure that any stored materials or containment & safety equipment required is available.

13 VENDOR SPECIALISTS

Vendor specialist will be attending various commissioning & training activities as required.

14 ORDER OF COMMISSIONING

The commissioning activities will broadly comprise the following stages in the following order:

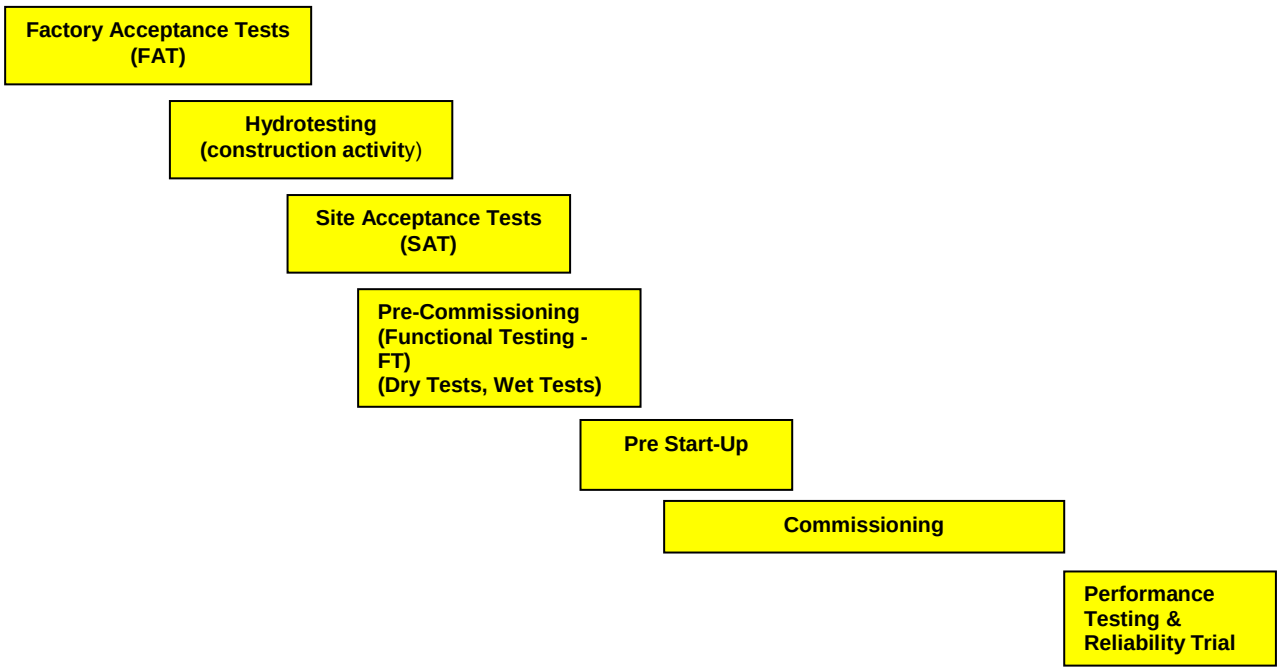
- **Pre-commissioning** - this includes:
  - Factory Acceptance Tests (FAT)
  - Site Acceptance Tests (SAT, including pipework hydro testing)
  - Pre-Commissioning: Installation Checks and Snagging, Function Tests Dry Commissioning & Wet Testing
- **Pre Start-Up**
- **Commissioning**
- **Performance Testing** (PT)

Once commissioning and all other works and deliverables complete;

- **Hand-Over**

This methodology is to ensure that the overall system demonstrates operation consistent with the FDS. It is not practical or feasible to exhaustively test the operating system but it is necessary to exhaustively test the control system during bench testing (FAT) to ensure that forbidden modes of operation are permanently prohibited by relevant lockouts. Hence functional testing must be completed and corrections made as necessary prior to process testing.

A general indicative order of testing routines is provided below. Variations within the general limits are possible in such circumstances as catering for defects or repairs (punch list), and/or re-sequencing of milestone or pre-requisite works where these conflict.



14.1 Preparatory Works

14.1.1 Factory Acceptance Tests (FAT)

These will have demonstrated that the equipment is manufactured according to the functional specification as far as this can be demonstrated at the factory.

FAT shall be carried on the following as a minimum:

- Screens (Queensland Urban Utilities)
- Pumps (Stirloch)
- Screenings Washpresses (Stirloch)
- Electrical equipment (Stirloch)
- Instrumentation, including flow meters, etc;(Stirloch & Queensland Urban Utilities);
- SCADA/PLC systems and software (Queensland Urban Utilities); and
- Screenings Bins (Queensland Urban Utilities).

14.1.2 Report

A FAT and Inspection Report will be submitted as part of document handover which shall include all ITP's, material certificates and performance details.

14.1.3 Site Acceptance Tests (SAT)

- SAT demonstrate that the equipment and/or installations have been installed as per the manufacturer's instructions & requirements. In the case of electrical equipment and installations, that these installations are safe to energise. A subset of FAT testing may be done at SAT to verify no change in system performance has occurred from FAT.
- Good record keeping of SAT data provides essential information to assist in commissioning of integrated systems.

14.1.4 Pre-commissioning Installation Tests and Defects

Pre-commissioning is the preparation of plant and equipment so that it is in a safe and proper condition and ready for wet testing, pre start-up and commissioning (operation). It includes all aspects of plant operation such as safety, electrical equipment, mechanical equipment and instrumentation.

During pre-commissioning, the plant and equipment will be demonstrated to the Client by Stirloch that the plant is ready for commissioning and Stirloch will provide ten days notice that Pre-Commissioning in any area will commence.

The testing phase will ensure all appropriate certification, access permits and approvals have been obtained to operate equipment, and all appropriate signage and occupational health and safety equipment is in place to enable safe operation of the equipment.

Any areas or items of plant that fail their prescribed test shall be placed on a Punch List (Defects List).

Stirloch shall ensure the following are available prior to commissioning of any item of plant or equipment:

- Test plan and procedures for the pre-commissioning stage (dry tests and wet tests) of plant performance testing, covering all items of plant and equipment;
- Draft O&M documentation;
- As-Built drawings including Process and Instrumentation Diagrams;
- Spare parts inventory; and
- Familiarization – training sessions.

Tests will be carried out on site to ascertain all plant and equipment performs satisfactorily under minimum, normal and maximum operational conditions. Normal operational conditions include stoppages due to simulated power failure.

14.1.5 Dry Tests

Inspection and testing during the dry tests shall, as a minimum, include the following:

- Check access to valves and equipment;
- Check lifting facilities;
- Check completeness of installation;
- Check conformance of equipment to requirements of the Contract;
- Check electrical continuity and electrical earthing;
- Ensure all equipment is correctly lubricated and lubrication reservoirs are charged with adequate quantities of a suitable lubricant;
- Check the direction of rotation (visually) and performance of electric motors;
- Check clearance, end play and operation of major bearings;
- Check alignment of drive systems;
- Test feedback, control and overload equipment, including safety checks;
- Check tightness of all parts;
- Correct installation of guards, railings, ladders, platforms and other personnel safety equipment;

- Check valve positions, particularly bleed valves and pressure relief valves;
- Prime all pumps prior to wet testing (where possible);
- Dry-run functional tests;
- Calibrate and test all instruments;
- Simulate fault condition tests;
- Check PLC and SCADA logic (Queensland Urban Utilities); and
- Emergency isolation functions at all locations.

14.1.5.1 Test Reports

Following successful testing of each piece of plant a report shall be prepared confirming that the items have been satisfactorily tested. The report shall contain all the check sheets filled out in full.

Test reports will contain but not be limited to the following documents

- Supplier factory test reports;
- Pipework pressure test reports;
- Noise level test reports for testing at 1m from nominated equipment and receptor boundaries;
- Electrical test reports;
- Running test reports; and
- PLC input and output signals test reports (Queensland Urban Utilities).

Refer to the appendices for typical testing, pre-commissioning, commissioning and performance testing report sheets.

14.1.5.2 Queensland Urban Utilities Involvement

Queensland Urban Utilities shall be informed of any tests being carried out 24 hours prior to the event. This shall ensure Queensland Urban Utilities personnel have the opportunity to witness and verify results. Where possible Queensland Urban Utilities operators and maintenance staff will be involved in informal training of systems where this does not hinder the commissioning process. The PLC/SCADA system is designed and installed by Queensland Urban Utilities; as such Queensland Urban Utilities will carry out all testing and verification prior to wet commissioning.

14.1.5.3 Equipment Hand Over (takeover)

As areas of plant complete, these items may proceed to the next phase, not withstanding overlap or that other areas of equipment have yet to complete the phase.

14.1.5.4 Electrical Checks and Tests

Some tests can only be carried out once power has been applied. This will include all loop testing, satisfactory installation of plant etc. All equipment energisation tests necessary before the application of electrical power to a system will be classified as Construction Verification.

Please refer *Appendix C – Electrical Testing and Pre-Commissioning*.

14.1.5.5 Pre-Commissioning – Electrical

Once electrical power has been applied to a system or sub-system Pre-Commissioning shall be deemed to have started. These will include all tests that can be performed up to and including those carried out using water should this be considered necessary. This will provide the opportunity to assess overall performance and reliability of the plant systems prior to the pumping of flows.

Please refer *Appendix C – Electrical Testing and Pre-Commissioning*.

14.1.5.6 Punch List

Items that fail their prescribed test or are deemed unacceptable shall be placed on a Punch List (also referred to as a defect list). It shall be the responsibility of Stirloch to action the remedial works highlighted on the list and to assess the overall condition of the plant and systems prior to operation.

If a defect is due to a vendor supplied item being defective, it shall be repaired or replaced by application of defect liability mechanisms separate from minor punch list items.

14.1.5.7 Methodology of Testing and Commissioning

Typical examples of methodologies relevant to each level of testing and commissioning are tabulated below. The table is to serve as a check list of the required deliverables following each level of testing described on an item by item basis.

Asset Type	Commissioning Baseline	Method
Service water pipework	Commissioning against FDS.	Commissioning Tests (PT). Site Acceptance Test (SAT). • Pipeline instrumentation
Grundfos service water pump set (Pump, Motor, VFD, instrumentation, SCADA interface)	Testing of the pumps consisting of pump, VSD motors and controls assembled as a functioning unit, to demonstrate conformity with specifications.	Observed and verified during commissioning tests involving water transfer. FAT and SAT Functional Tests post installation to record and verify compliance with FDS and manufacturers' instructions of: • Correct installation (or VT) • Correct fill of lubricants • Alignment prior to start-up • Alarms and Interlocks • Vibration and noise compliance (PT) • Seals • Guaranteed performance or duty (PT)
Xylem drain pump set (Pump, Motor, instrumentation, SCADA interface)	Testing of the pumps consisting of pump, motors and controls assembled as a functioning unit, to demonstrate conformity with specifications.	Observed and verified during commissioning tests involving water transfer. FAT and SAT Functional Tests post installation to record and verify compliance with FDS and manufacturers' instructions of: • Correct installation (or VT) • Correct fill of lubricants • Alignment prior to start-up • Alarms and Interlocks • Pump health sensors i.e. water in oil • Seals • Guaranteed performance or duty (PT)
Amiad filter	Testing of the filter, consisting of motor and controls assembled as a functioning unit, to demonstrate conformity with specifications.	Observed and verified during commissioning tests involving water transfer. FAT and SAT Functional Tests post installation to record and verify compliance with FDS and manufacturers' instructions of: • Correct installation (or VT) • Correct fill of lubricants • Alignment prior to start-up • Alarms and Interlocks
Instruments	Functional Specifications (FDS)	Manufacturer's FAT and SAT, verify the technical details of the FDS.
Washpress units (Motor, instrumentation, SCADA interface)	Testing of the Washpress consisting of motors and controls assembled as a functioning unit, to demonstrate conformity with specifications.	Observed and verified during commissioning tests involving water and screenings. FAT and SAT Functional Tests post installation to record and verify compliance with FDS and manufacturers' instructions of: • Correct installation (or VT) • Correct fill of lubricants • Alignment prior to start-up • Service water

Asset Type	Commissioning Baseline	Method
		• Automatic valves • Alarms and Interlocks • Guaranteed performance or duty (PT)
Andritz step screen, (Motor, instrumentation, SCADA interface)	Testing of the screens consisting of motors and controls assembled as a functioning unit, to demonstrate conformity with specifications.	Observed and verified during commissioning tests involving water and screenings. FAT and SAT Functional Tests post installation to record and verify compliance with FDS and manufacturers' instructions of: • Correct installation (or VT) • Correct fill of lubricants • Alignment prior to start-up • Alarms and Interlocks • Service water • Automatic valves • Instrumentation • Guaranteed performance or duty (PT)
Screenings bins (Motor, instrumentation, SCADA interface)	Testing of the screenings bins of motors and controls assembled as a functioning unit, to demonstrate conformity with specifications.	FAT and SAT Functional Tests post installation to record and verify compliance with FDS and manufacturers' instructions of: • Correct installation (or VT) • Correct fill of lubricants • Alignment prior to start-up • Alarms and Interlocks • Instrumentation • Guaranteed performance or duty (PT)
Channel isolation penstocks	Testing of the actuators and controls assembled as a functioning unit, to demonstrate conformity with specifications.	FAT and SAT Functional Tests post installation to record and verify compliance with FDS and manufacturers' instructions of: • Correct installation (or VT) • Correct fill of lubricants • Alignment prior to start-up • Alarms and Interlocks • Instrumentation • Guaranteed performance or duty (PT)

14.2 Wet Testing

Wet Testing & Commissioning is the broad stage of works describing preparation of plant and equipment for continuous operation to facilitate Pre Start-Up and Commissioning. It includes various aspects of plant operation such as safety, electrical equipment, mechanical equipment and instrumentation.

Wet Testing & Commissioning of an equipment area cannot commence until Pre-Commissioning for that area has been completed and approved.

In summary, prior to the Wet Test Period, the following work will have been completed:

- Pressure testing or witnessing of all pipework, valves and filters for leaks
- All alarms and control functions are operable
- Functional check on interlocks and control systems
- All instruments have been calibrated and test/calibration sheets have been completed
- Dry tests for all plant and equipment including but not limited to all mechanical and electrical equipment, instrumentation, control and SCADA systems, alarm annunciators, set points
- Check electrical integrity, including electrical tests for insulation, earth leakage, resistance to high voltage
- Check integration of controls systems particularly with off-site equipment
- PLC, SCADA and Control system operation

Wet tests shall be carried out on all items of plant and equipment together with their associated support systems within the system, and rectify any deficiencies found, to ensure they meet the requirements of the Contract, and they are safe and ready for pre start-up, start up, and commissioning.

Wet Testing with respect to the use of water is especially relevant to the following installations:

- Instrumentation (water level, pressure and flow sensing elements)
- Pumps
- Filter
- Pipework
- Washpress
- Drainage
- Penstocks and stoplogs

14.3 Commissioning

Due to the need to continue operating with some of the existing screens in place, commissioning has been split into the following phases:

- Stage 1: Service water pumps, drain pumps, Washpress units 1 & 3, screenings bins and inlet screens 007 & 008 and relevant penstocks and level instruments
- Stage 2: Inlet screens 005 & 006 and relevant penstocks and level instruments
- Stage 3: Inlet screens 001 to 004, wash press 2, screenings bin 2 and relevant penstocks and level instruments

Commissioning will only take place after all Pre-Commissioning, Wet Testing and Pre Start-Up have been successfully completed in the relevant areas. Prior to any installations being accepted for Pre Start-Up or Commissioning activities, an acceptance inspection will be carried out by Stirloch. The purpose of this inspection is to ensure installations are suitably prepared and safe, and that appropriate documentation confirming these states and completion of construction activities and Pre-Commissioning acceptance has been attained.

Performance Testing is the term given to those tests which demonstrate compliance with the FDS.

During the Commissioning period, Stirloch shall ensure that the entire system is fully operational and reliable and that the following work has or have been completed:

- Activation of alarms by inducing simulated fault conditions where actual faults not feasible
- Functional check on interlocks and control system
- Calibration of all instruments
- Testing and commissioning of equipment electrics, instrumentation, control systems, alarms and set-points etc.
- Check completeness of entire installation, paying particular attention to integration of all sub-systems
- Check integration of control systems
- Emergency Systems fully functional
- Undertake simulated fault condition tests (this includes “Black” stop/start conditions)
- Service water quality as intended
- Process commissioning to verify plant and equipment performance equals or exceeds the specified performance parameters; and
- Boundary noise testing.

Queensland Urban Utilities personnel shall be invited to participate in the Commissioning process.

15 NON-CONFORMANCES AND CORRECTIVE ACTION

The test plans and procedures for the various stages of plant performance testing shall define how non-conformances shall be managed and rectified. Should processes or equipment not perform to the design or Contract specifications/requirements during any test, such failure

shall be deemed a defect and Stirloch shall initiate the non-conformance and corrective (rectification) action procedures required by the Quality Assurance System.

Defects shall be defined as major, moderate or minor. Guidelines for the classification of defects are as follows:

MAJOR These are defects that require shutdown of the system or the sub-system or for them to be placed under continual monitoring and/or manual control by the operators. These include but not limited to repeated failures of equipment or controls, crash of the controls or SCADA failure or equipment failure (where SCADA does not recover automatically), or failure of any pipeline component.

MODERATE These are defects which potentially can affect the plant operation but which can be compensated for by plant operation changes. These require intervention by the operator to keep the plant operational and must be able to be rectified before Practical Completion. These defects include but not limited to programming faults which do not create the correct sequencing and response e.g. SCADA failure, where SCADA recovers automatically.

MINOR These are defects which do not affect the operation of the plant or outcomes. These include equipment failures where the standby equipment starts up automatically. These failures must be such that they could be attended to in the Defects Liability Period.

Defects shall require the following action to be taken:

MAJOR Testing and/or trials to discontinue, urgent action required. Commissioning, Performance Test or Trial Operating Period shall restart from the beginning following the rectification of defects.

MODERATE Testing to continue. Timely action required prior to Practical Completion to which the test applies. Repeat only such tests as considered necessary where initial results brought into question, as designated.

MINOR Testing to continue and action required within 7 days of the Date of Practical Completion.

In the case of ambiguity or uncertainty as to the classification of defects during Operation Trials and/or Performance Testing, Stirloch shall classify the defect and make a determination, and recommend an alternative procedure.

16 PERFORMANCE TESTING AND RELIABILITY TRIAL

Performance testing will be carried out to prove that the entire system is capable of achieving the specified performance parameters. Performance testing can only occur after Stirloch and Queensland Urban Utilities agree that commissioning has been successfully completed.

Prior to performance testing Stirloch shall submit a detailed test protocol along with a list of any outstanding defects with action plan. Three days notice shall be given by Stirloch prior to beginning the performance testing phase.

Performance Testing shall include a 14 day continuous reliability trial. During this period the entire system will be operated by Queensland Urban Utilities under the direction of Stirloch.

If during the performance test phase any of the following occur;

- Any mechanical and electrical equipment does not operate as specified (except where there are duty and stand-by equipment, then both need to fail); and
- Any manual and/or automatic function fails to operate as required; then;

The testing period shall then be extended for a further three days, or the period taken to resume normal operation (whichever is the greater), after the necessary rectification work has been completed. Consideration needs to be given and agreement reached on the level or implications of any activity or fault during the 14 days period that causes the completion of the trial to be temporary stopped or extended

Luggage Point STP Inlet Works Screen Upgrade
Commissioning

APPENDIX A

EMERGENCY AND CONTINGENCY

Luggage Point STP Inlet Works Screen Upgrade
Commissioning

CONTENTS

1 APPENDIX A – EMERGENCY AND CONTINGENCY

1.1 Emergency

The Emergency Response Plan is enacted to mitigate and control the potential for risks, damage or injury to personnel, public, community, stakeholders, plant & equipment, or the environment generally in its various forms.

Additional and specific documentation such as Safe Work Method Statements, Job Hazard Analysis, Isolation Procedures and Field Work Permit Systems shall be engaged and incorporated specifically for individual tasks or commissioning processes.

Potential threats:

- Threat to human life;
- Injury to personnel;
- Threat to the environment;
- Breach of obligation, law/license provisions;
- Emergency condition at or adjacent to site or workplace(s);
- Breakdown of Plant, Equipment, new or existing Installations or Infrastructure;

This appendix identifies and includes the ***Emergency Response Plan*** (ERP) implemented by Stirloch for any emergency response situation. The ERP is strictly a 'post-event' process.

In the event of an emergency, the aforementioned and attached procedure must be enacted.

The ERP in broad descriptive terms governs the response actions as follows;

- Responsibilities and Delegation
- Emergency Alert Protocols
- Communication Protocols
- Specific Actions to be enacted during an emergency event
- Event Management & Control
- Emergency Classification and Assessment
- Rescue & Recovery
- Evacuation and Muster
- Incident Investigation

1.2 Contingency

Contingency interpretation herein refers to:

1. General Contingency (Operational or Methodology) – a situation which may necessitate or precipitate an unavoidable change in the planned works.
2. Spares Contingency (Material Spares) – Spare parts

1.2.1 General Contingency

Should there be a breakdown of a system, installation or any other associated equipment, works shall be reconfigured, reorganised and re-planned and coordinated.

Such specific contingency methodology shall be as determined, directed or delegated by Stirloch in consultation with Queensland Urban Utilities.

Should at any time between pre-start up and completion of commissioning activities and hand-over an *unintended event or function occur as a deviation from the planned functionality or output or process or operation,* any such specific event shall be immediately logged and brought to the attention of Stirloch and Queensland Urban Utilities for assessment, classification and action.

Event Classification:

MAJOR These are events that require immediate controlled shutdown of the system and/or the sub-system or failure of any critical component. Any potential for injury, death or damage or other significant un-intended outcome or near-miss requires this obligatory classification.

MODERATE These are events or defects which can potentially affect the plant operation but which can be compensated for by plant operation changes. These require intervention by the operator and the operational process may be kept operational. If the event or defect could potentially result in damage or injury, reclassification must be made as *Major.*

MINOR These are events or defects which do not affect the operation of the plant or outcomes and may be logged, monitored and attended later as part of normal punch listing works. If there is any potential for defect or event to escalate, reclassify as *Moderate.*

Contingency Implementation

SWMS will be provided within the Operations & Maintenance Manual for all maintenance related activities relevant to the infrastructure in whole of system, sub-system, and component level.

Troubleshooting

For specific troubleshooting techniques and logic, refer to the *Operations & Maintenance Manual.*

1.2.2 Spares Contingency

As a mitigation measure, key *long lead time* components which were identified as critical have been procured so as to permit relatively rapid replacement.

Various other components were determined to be available *off the shelf,* or not critical, or not otherwise relevant due to low expected exposure to wear, low risk, or cost & practicality issues. In all cases the vendor recommended spared were adopted and procured.

Compilation of the final spares list is an ongoing process that is unlikely to be finalised until procurement, construction, commissioning and asset disposal processes are wholly complete.

The current spares list, (including commissioning spares such as gaskets, pressure transducers, valves etc) will be available from Stirloch.

Critical Major Spares

-

Minor Spares

Details will be provided in a comprehensive Schedule of Spare Parts, separately identified within the O&M manual.

Spares Maintenance

Various major and minor spares have specific storage requirements. For example, rubber seals, gaskets and lubricants may not be stored in hot enclosed environments, spare electric motors require routine ‘turning’ to prevent bearing and shaft damage.

Such requirements are similarly identified in the aforementioned handover documentation.

APPENDIX B

COMMISSIONING PROGRAM

Luggage Point STP Inlet Works Screen Upgrade
Commissioning

Contents

Luggage Point STP Inlet Works Screen Upgrade
Commissioning

Luggage Point STP Inlet Works Screen Upgrade
Commissioning

1 COMMISSIONING PROGRAM

Commissioning works will commence immediately following completion and handover of all of the following activities completed. These will include:

- All construction works completed
- Civil works
- Mechanical works
- Structural works
- Pipe work
- Electrical works (LV power distribution systems and services)
- Control systems (SCADA, communications systems)
- Instrumentation

1.1 Pre-Commissioning

Carried out and completed for the following systems

- All mechanical, electrical, instrumentation and digital control systems associated with the inlet screens installation

1.2 Documentation Deliverables

These will be available prior to or progressively completed during commissioning:

- Commissioning Plan and associated appendices
- Functional Design Specification (IFC revisions)
- FAT and SAT
- Draft O & M manuals
- As-Built drawings
- Programmed Schedule of Activities (to be included in Detailed Commissioning Programme)
- Safe Work Method Statements, MSDS
- Inspection and Test Plans
- Isolation registry system
- Relevant RFIs and NCRs closed out prior to commissioning
- Installation is Safe to Energise (as per Electrical Safety Act)
- Installation is Safe to Operate (as per Electrical Safety Act)
- Performance tests (performance criteria)

1.3 Commissioning Program

Commissioning will be carried out to the Commissioning Program and Plan within the timeframe of July 2014 to December 2014. Final detailed program will be issued prior to commencement.

2 COMMISSIONING STAGES

2.1 Stage 1

It is assumed that service water (final effluent) will be available in unlimited quantities from the existing system.

Commissioning will commence with the service water being introduced to the Grundfos service water pumpset and the Amiad filter. Water will then be pumped to the screenings handling area for the commissioning of the Washpress units.

The service water will drain from the Washpress units into the drain sump. This will give the opportunity to commission the Xylem drain pumps. If the Washpress units are not available, the service water can be pumped directly into the drain sump via temporary pipework.

Unscreened raw sewage will not be introduced into Andritz screens 007 & 008 until Stirloch and Queensland Urban Utilities are satisfied with the operation of the new screens and the screenings handling plant.

Order of commissioning:

- Service water pump station
    - Introduce final effluent to the pumpset
    - Grundfos service water pumps
    - Amiad filter
    - ABB flowmeter
- Drainage pump station
    - Introduce drain water to the drain sump
    - Level instruments
    - Xylem drainage submersible pumps
- Washpress units 001 & 003 and launder
    - Introduce service water to the units
    - Washpress service water system
    - Distribution boxes
    - Washpress drive motors
    - Washpress instruments
- Veolia screenings bins 001 & 003
    - Introduce service water to the bins
    - Retractable chutes
    - Level sensors
    - Drive motors
- Andritz screens 007 & 008
    - Introduce service water to the screens
    - Introduce drain water to the channels via the drain pumps
    - Inlet and outlet channel level sensors
    - Drive motor step screen
    - Drive motor wash brush

    - Washwater solenoid valve
- Channel inlet and outlet penstocks 009, 010 & 012
    - Rotork actuators
    - Leakage
    - Double isolation stoplogs

2.1.1 Stage 1 Contingency

Stage 1 assumes that all of the above plant has been installed and commissioned. Should the Washpress units not be available for commissioning, the Andritz screens will be commissioned with service water.

2.1.2 Stage 1 Opportunity

There may be an opportunity to commission the new Washpress units with screenings from the existing screenings launder. This option will be explored further as construction and pre-commissioning continues.

2.2 Stage 2 Commissioning

Stage 2 will commence only after Stirloch and Queensland Urban Utilities are satisfied with the operation of the plant commissioned in Stage 1. The following will be commissioned under Stage 2:

- Andritz screens 005 & 006
    - Introduce service water to the screens
    - Introduce drain water to the channels via the drain pumps
    - Inlet and outlet channel level sensors
    - Drive motor step screen
    - Drive motor wash brush
    - Washwater solenoid valve
- Channel inlet and outlet penstocks 007, 008 & 011
    - Rotork actuators
    - Leakage
    - Double isolation stoplogs

2.3 Stage 3 Commissioning

Stage 2 will commence only after Stirloch and Queensland Urban Utilities are satisfied with the operation of the plant commissioned in Stages 1 and 2. The following will be commissioned under Stage 3:

- Andritz screens 001, 002, 003 & 004
    - Introduce service water to the screens
    - Introduce drain water to the channels via the drain pumps
    - Inlet and outlet channel level sensors
    - Drive motor step screen
    - Drive motor wash brush

    - Washwater solenoid valve
- Channel inlet and outlet penstocks 001, 002, 003, 004, 005 & 006
    - Rotork actuators
    - Leakage
    - Double isolation stoplogs
- Veolia screenings bin 002
    - Introduce service water to the bins
    - Retractable chutes
    - Level sensors
    - Drive motors

3 PERFORMANCE TESTING AND RELIABILITY

Luggage Point STP Inlet Works Screen Upgrade
Commissioning

ATTACHMENT A – PROGRAM

3470 1330 17448

REF POINT SETOUT DATUM

EXISTING SCREW CONVEYOR TO BIN

EXISTING SCREENINGS BIN

EXISTING BELT CONVEYOR

SCREENS BANK B REFER TO DRG 486/5/5-0199-152

STIRLOCH COMMISSIONING AREA STAGE 1 (INCLUDES BOOSTER PUMP/WASH WATER SYSTEM)

EXISTING LIVE PLANT

LAUNDER No. 1

LAUNDER No. 2

SC-0210-008 SC-0210-006 SC-0210-004 SC-0210-002

SC-0210-007 SC-0210-005 SC-0210-003 SC-0210-001

PK-0210-010 PK-0210-009 PK-0210-008 PK-0210-007 PK-0210-004 PK-0210-003 PK-0210-002 PK-0210-001

DOUBLE ISOLATION PACKAGE. NOTE 1

WALKWAY

SCREENINGS BIN (NEW) BN-0220-003

SCREENINGS BIN (NEW) BN-0220-001

ROOF PLATFORM EXTENSION REFER TO DRG 486/5/5-0199-130 FOR DETAILS.

DRAIN PIT PUMP STATION

4389

17264

NOTES

1. DETAILS OF DOUBLE ISOLATION PENSTOCK BY PACKAGE SUPPLIER
2. HOSE REEL LOCATIONS TO BE CONFIRMED
3. FOR BIN SETOUT DETAILS REFER TO DWG 486/5/5-0199-211
4. FOR DRAIN PIT PUMP STATION REFER TO DWG 486/5/5-0199-212
5. DRAWINGS TO BE READ IN CONJUNCTION WITH PROCESS AND INSTRUMENTATION DIAGRAMS. REFER 486/5/5-0199-300 TO 304
6. REMOVED
7. REMOVED
8. BY PASS WEIR.
9. CABLE TRAY.
10. LEVEL INSTRUMENT LOCATION REFER TO 486/5/5-0199-354.
11. LOCATION TO BE CONFIRMED ON SITE.
12. CONVEYOR SUPPORT LEGS POSITIONS BY VENDOR.
13. PIPEWORK LAYOUT TO BE CONFIRMED ON SITE.
14. PUMP STATION DETAILS BY VENDOR.
15. EXISTING CONCRETE PAVING. NOT PART OF SCOPE OF DESIGN.
16. REFER TO 486/5/5-0199-102 FOR ACCESS DETAILS.

FOR CONSTRUCTION

LEGEND

EXISTING STRUCTURE

NEW STRUCTURE

0 0.5 1 2 3
Full Size 1:50 ; Half Reduction 1:100
SCALE (m)

STAGE 1 COMMISSIONING PLAN

INLET WORKS PLAN

SCALE 1:50 (A1 SHEET)

FLOOR GRATING NOT SHOWN FOR CLARITY

AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.

SIGNED: DATE:

NAME of SIGNATORY:

RPEQ No. or LICENCE:

COMPANY NAME:

START DATE: FINISH DATE:

MWH

NAME SIGNATURE DATE

QUEENSLAND URBAN UTILITIES DELEGATE
(AUTHORISED FOR 12 MONTHS FROM DATE SHOWN)

QUEENSLAND Urban Utilities

No.	DATE	AMENDMENT	DRAFTED	DESIGNED	RPEQ NO.	APPROVED
C	23.4.14	BINS & PS LAYOUT REVISED	B.S	D.D	3325	
B	6.03.14	EQUIPMENT LAYOUT REVISED	B.S.	D.D	3325	A.T
A	17.1.14	ISSUED FOR CONSTRUCTION	BH	MH	3532	JGC

FUNDING: DESIGN W.O. No. | CONSTRUCTION W.O. No. | FUNDED BY Q.U.U. (✓) EXTERNAL ( )

DRAFTED	B HUMPHRIES	M HOLMES		17.1.14
DRAFTING CHECK	D ASHWELL	DESIGN	R.P.E.Q. No.	DATE
CAD FILE	550199150.dwg	S MOORE	3532	17.1.14
Q.U.U. FILE No.		DESIGN CHECK	R.P.E.Q. No.	DATE

APPROVED BY SIGNATURE DATE

CONSTRUCTION MANAGER SIGNATURE DATE

ASSET/PROJECT: LUGGAGE POINT STP INLET WORKS SCREENS UPGRADE

DRAWING TITLE: MECHANICAL GENERAL ARRANGEMENT PLAN

SHEET No. OF

QUEENSLAND URBAN UTILITIES DRAWING No. 486/5/5-0199-150

AMEND. C

3470 1330 17448

REF POINT SETOUT DATUM

EXISTING SCREW CONVEYOR TO BIN

EXISTING SCREENINGS BIN

EXISTING BELT CONVEYOR

SCREENS BANK B REFER TO DRG 486/5/5-0199-152

NEW COMMISSIONED PLANT AREA LIVE & OPERATED BY QUU

STIRLOCH COMMISSIONING AREA STAGE 2

EXISTING LIVE PLANT

LAUNDER No. 1

LAUNDER No. 2

SC-0210-008 SC-0210-006 SC-0210-004 SC-0210-002

SC-0210-007 SC-0210-005 SC-0210-003 SC-0210-001

PK-0210-010 PK-0210-009 PK-0210-008 PK-0210-007 PK-0210-004 PK-0210-003 PK-0210-002 PK-0210-001

DOUBLE ISOLATION PACKAGE, NOTE 1

WALKWAY

SCREENINGS BIN (NEW) BN-0220-003

SCREENINGS BIN (NEW) BN-0220-001

ROOF PLATFORM EXTENSION REFER TO DRG 486/5/5-0199-130 FOR DETAILS.

DRAIN PIT PUMP STATION

4389

17264

NOTES

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7. REMOVED
8. BY PASS WEIR.
9. CABLE TRAY.
10. LEVEL INSTRUMENT LOCATION REFER TO 486/5/5-0199-354.
11. LOCATION TO BE CONFIRMED ON SITE.
12. CONVEYOR SUPPORT LEGS POSITIONS BY VENDOR.
13. PIPEWORK LAYOUT TO BE CONFIRMED ON SITE.
14. PUMP STATION DETAILS BY VENDOR.
15. EXISTING CONCRETE PAVING, NOT PART OF SCOPE OF DESIGN.
16. REFER TO 486/5/5-0199-102 FOR ACCESS DETAILS

FOR CONSTRUCTION

STAGE 2 COMMISSIONING PLAN

LEGEND

EXISTING STRUCTURE

NEW STRUCTURE

0 0.5 1 2 3
Full Size 1:50 ; Half Reduction 1:100
SCALE (m)

INLET WORKS PLAN

SCALE 1:50 (A1 SHEET)

FLOOR GRATING NOT SHOWN FOR CLARITY

AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.

SIGNED: DATE:

NAME of SIGNATORY:

RPEQ No. or LICENCE:

COMPANY NAME:

START DATE: FINISH DATE:

MWH

NAME SIGNATURE DATE

QUEENSLAND URBAN UTILITIES DELEGATE
(AUTHORISED FOR 12 MONTHS FROM DATE SHOWN)

QUEENSLAND Urban Utilities

No.	DATE	AMENDMENT	DRAFTED	DESIGNED	RPEQ NO.	APPROVED
C	23.4.14	BINS & PS LAYOUT REVISED	B.S	D.D	3325	
B	6.03.14	EQUIPMENT LAYOUT REVISED	B.S.	D.D	3325	A.T
A	17.1.14	ISSUED FOR CONSTRUCTION	BH	MH	3532	JGC

FUNDING	
DESIGN W.O. No.	
CONSTRUCTION W.O. No.	
FUNDED BY Q.U.U. (✓)	EXTERNAL ( )

DRAFTED	B HUMPHRIES		
DRAFTING CHECK	D ASHWELL		
CAD FILE	550199150.dwg		
Q.U.U. FILE No.			
M HOLMES			17.1.14
DESIGN	R.P.E.Q. No.	3532	DATE 17.1.14
S MOORE			
DESIGN CHECK	R.P.E.Q. No.		DATE

APPROVED BY	SIGNATURE	DATE
CONSTRUCTION MANAGER	SIGNATURE	DATE

ASSET/PROJECT: LUGGAGE POINT STP INLET WORKS SCREENS UPGRADE

DRAWING TITLE: MECHANICAL GENERAL ARRANGEMENT PLAN

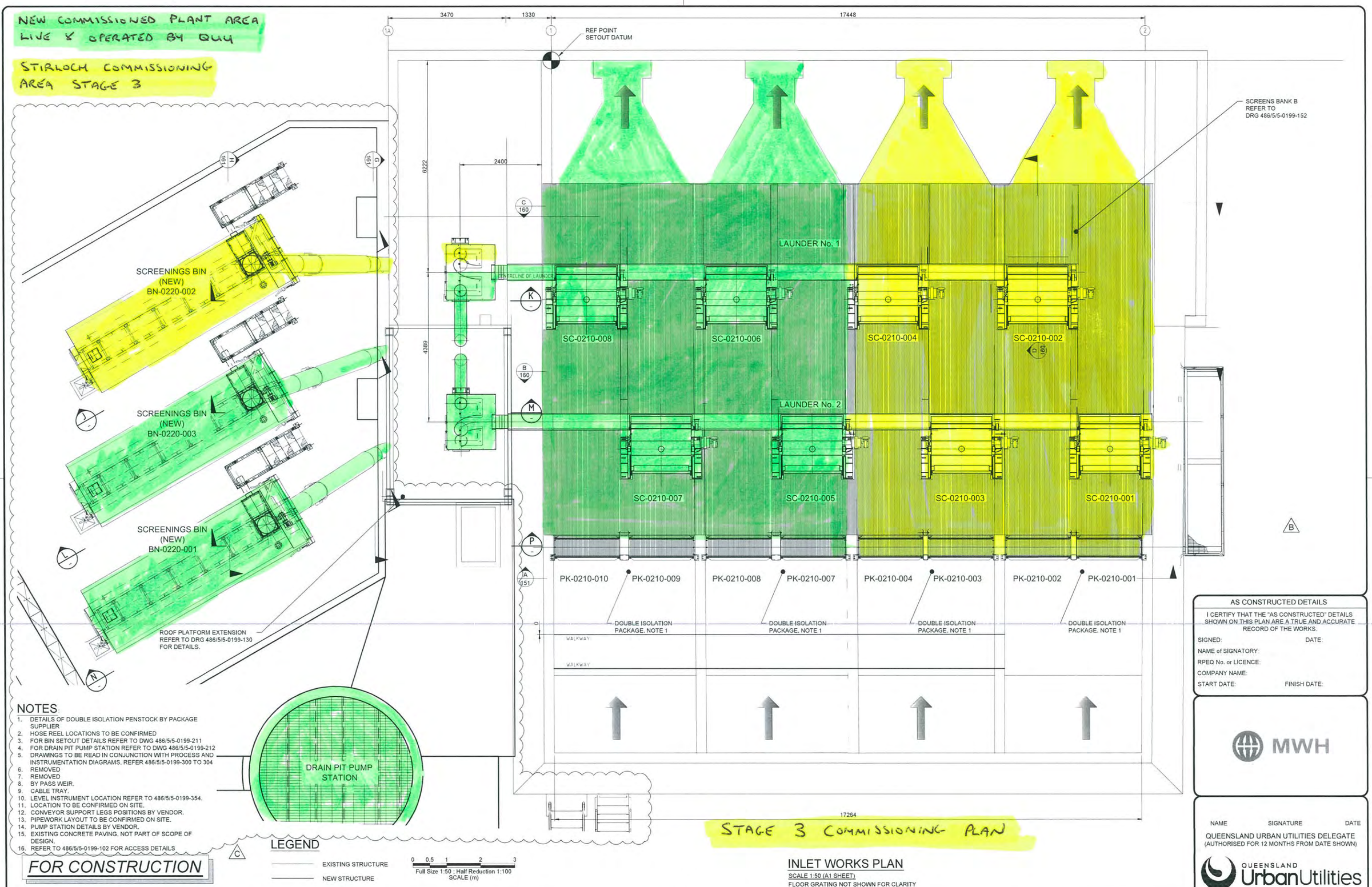
SHEET No. OF

QUEENSLAND URBAN UTILITIES DRAWING No. 486/5/5-0199-150

AMEND. C

NEW COMMISSIONED PLANT AREA
LIVE & OPERATED BY QUU

STIRLOCH COMMISSIONING
AREA STAGE 3



NOTES

1. DETAILS OF DOUBLE ISOLATION PENSTOCK BY PACKAGE SUPPLIER
2. HOSE REEL LOCATIONS TO BE CONFIRMED
3. FOR BIN SETOUT DETAILS REFER TO DWG 486/5/5-0199-211
4. FOR DRAIN PIT PUMP STATION REFER TO DWG 486/5/5-0199-212
5. DRAWINGS TO BE READ IN CONJUNCTION WITH PROCESS AND INSTRUMENTATION DIAGRAMS. REFER 486/5/5-0199-300 TO 304
6. REMOVED
7. REMOVED
8. BY PASS WEIR.
9. CABLE TRAY.
10. LEVEL INSTRUMENT LOCATION REFER TO 486/5/5-0199-354.
11. LOCATION TO BE CONFIRMED ON SITE.
12. CONVEYOR SUPPORT LEGS POSITIONS BY VENDOR.
13. PIPEWORK LAYOUT TO BE CONFIRMED ON SITE.
14. PUMP STATION DETAILS BY VENDOR.
15. EXISTING CONCRETE PAVING, NOT PART OF SCOPE OF DESIGN.
16. REFER TO 486/5/5-0199-102 FOR ACCESS DETAILS

FOR CONSTRUCTION

LEGEND

EXISTING STRUCTURE
NEW STRUCTURE

Full Size 1:50 ; Half Reduction 1:100
SCALE (m)

STAGE 3 COMMISSIONING PLAN

INLET WORKS PLAN
SCALE 1:50 (A1 SHEET)
FLOOR GRATING NOT SHOWN FOR CLARITY

AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.

SIGNED: DATE:
NAME of SIGNATORY:
RPEQ No. or LICENCE:
COMPANY NAME:
START DATE: FINISH DATE:

MWH

NAME SIGNATURE DATE
QUEENSLAND URBAN UTILITIES DELEGATE
(AUTHORISED FOR 12 MONTHS FROM DATE SHOWN)

QUEENSLAND UrbanUtilities

No.	DATE	AMENDMENT	DRAFTED	DESIGNED	RPEQ NO.	APPROVED
C	23.4.14	BINS & PS LAYOUT REVISED	B.S	D.D	3325	
B	6.03.14	EQUIPMENT LAYOUT REVISED	B.S.	D.D	3325	A.T
A	17.1.14	ISSUED FOR CONSTRUCTION	BH	MH	3532	JGC

FUNDING
DESIGN W.O. No.
CONSTRUCTION W.O. No.
FUNDED BY Q.U.U. (✓) EXTERNAL ( )

DRAFTED	B HUMPHRIES				
DRAFTING CHECK	D ASHWELL				
CAD FILE	550199150.dwg				
Q.U.U. FILE No.					

M HOLMES			17.1.14		
DESIGN	R.P.E.Q. No.	3532	DATE	APPROVED BY	SIGNATURE DATE
S MOORE			17.1.14		
DESIGN CHECK	R.P.E.Q. No.		DATE	CONSTRUCTION MANAGER	SIGNATURE DATE

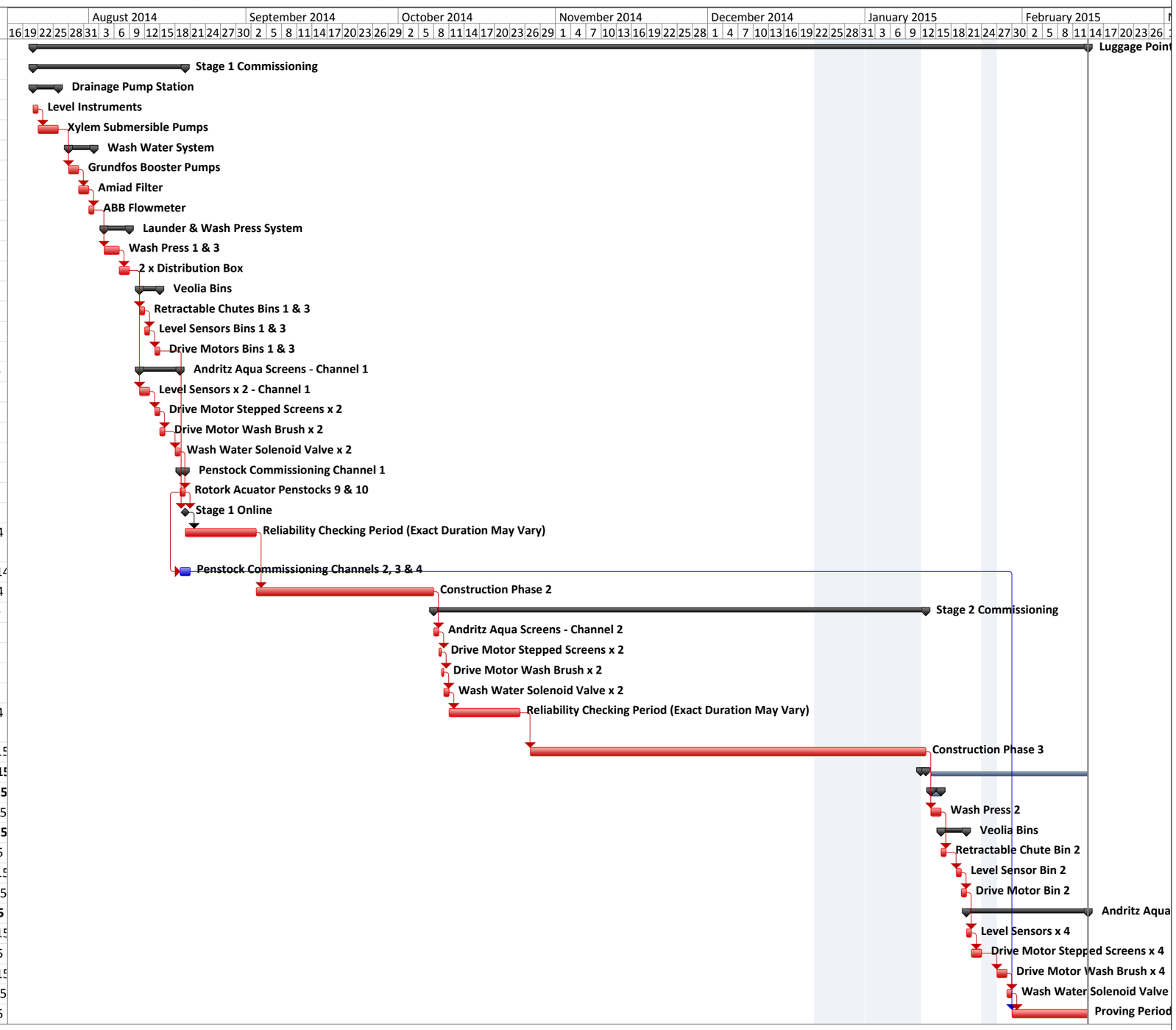
ASSET/PROJECT
LUGGAGE POINT STP
INLET WORKS
SCREENS UPGRADE

DRAWING TITLE
MECHANICAL
GENERAL ARRANGEMENT
PLAN

SHEET No. OF
QUEENSLAND URBAN UTILITIES DRAWING No. 486/5/5-0199-150
AMEND. C

LUGGAGE POINT STP INLET SCREENS UPGRADE
STIRLOCH CONSTRUCTIONS PTY LTD

ID	Task Name	Duration	Start	Finish
1	Luggage Point STP Inlet Screens Upgrade	131 days?	Mon 21/07/14	Fri 13/02/15
2	Stage 1 Commissioning	21 days	Mon 21/07/14	Tue 19/08/14
3	**Drainage Pump Station**	5 days	Mon 21/07/14	Fri 25/07/14
4	Level Instruments	1 day	Mon 21/07/14	Mon 21/07/14
5	Xylem Submersible Pumps	4 days	Tue 22/07/14	Fri 25/07/14
6	**Wash Water System**	5 days	Mon 28/07/14	Fri 1/08/14
7	Grundfos Booster Pumps	2 days	Mon 28/07/14	Tue 29/07/14
8	Amiad Filter	2 days	Wed 30/07/14	Thu 31/07/14
9	ABB Flowmeter	1 day	Fri 1/08/14	Fri 1/08/14
10	**Launder & Wash Press System**	5 days	Mon 4/08/14	Fri 8/08/14
11	Wash Press 1 & 3	3 days	Mon 4/08/14	Wed 6/08/14
12	2 x Distribution Box	2 days	Thu 7/08/14	Fri 8/08/14
13	**Veolia Bins**	3 days	Mon 11/08/14	Thu 14/08/14
14	Retractable Chutes Bins 1 & 3	1 day	Mon 11/08/14	Mon 11/08/14
15	Level Sensors Bins 1 & 3	1 day	Tue 12/08/14	Tue 12/08/14
16	Drive Motors Bins 1 & 3	1 day	Thu 14/08/14	Thu 14/08/14
17	**Andritz Aqua Screens - Channel 1**	5 days	Mon 11/08/14	Mon 18/08/14
18	Level Sensors x 2 - Channel 1	2 days	Mon 11/08/14	Tue 12/08/14
19	Drive Motor Stepped Screens x 2	1 day	Thu 14/08/14	Thu 14/08/14
20	Drive Motor Wash Brush x 2	1 day	Fri 15/08/14	Fri 15/08/14
21	Wash Water Solenoid Valve x 2	1 day	Mon 18/08/14	Mon 18/08/14
22	**Penstock Commissioning Channel 1**	1 day	Tue 19/08/14	Tue 19/08/14
23	Rotork Acuator Penstocks 9 & 10	1 day	Tue 19/08/14	Tue 19/08/14
24	**Stage 1 Online**	0 days	Tue 19/08/14	Tue 19/08/14
25	Reliability Checking Period (Exact Duration May Vary)	14 edays	Tue 19/08/14	Tue 2/09/14
26	Penstock Commissioning Channels 2, 3 & 4	2 days	Tue 19/08/14	Wed 20/08/14
27	Construction Phase 2	24 days	Wed 3/09/14	Tue 7/10/14
28	**Stage 2 Commissioning**	53 days	Wed 8/10/14	Mon 12/01/15
29	Andritz Aqua Screens - Channel 2	1 day	Wed 8/10/14	Wed 8/10/14
30	Drive Motor Stepped Screens x 2	0.5 days	Thu 9/10/14	Thu 9/10/14
31	Drive Motor Wash Brush x 2	0.5 days	Thu 9/10/14	Thu 9/10/14
32	Wash Water Solenoid Valve x 2	1 day	Fri 10/10/14	Fri 10/10/14
33	Reliability Checking Period (Exact Duration May Vary)	14 edays	Fri 10/10/14	Fri 24/10/14
34	Construction Phase 3	40 days	Mon 27/10/14	Mon 12/01/15
35	**Stage 3 Commissioning**	**1 day?**	**Mon 12/01/15**	**Mon 12/01/15**
36	**Launder & Wash Press System**	**2 days**	**Wed 14/01/15**	**Thu 15/01/15**
37	Wash Press 2	2 days	Wed 14/01/15	Thu 15/01/15
38	**Veolia Bins**	**3 days**	**Fri 16/01/15**	**Tue 20/01/15**
39	Retractable Chute Bin 2	1 day	Fri 16/01/15	Fri 16/01/15
40	Level Sensor Bin 2	1 day	Mon 19/01/15	Mon 19/01/15
41	Drive Motor Bin 2	1 day	Tue 20/01/15	Tue 20/01/15
42	**Andritz Aqua Screens - Channels 3 & 4**	**17 days**	**Wed 21/01/15**	**Fri 13/02/15**
43	Level Sensors x 4	1 day	Wed 21/01/15	Wed 21/01/15
44	Drive Motor Stepped Screens x 4	2 days	Thu 22/01/15	Fri 23/01/15
45	Drive Motor Wash Brush x 4	2 days	Tue 27/01/15	Wed 28/01/15
46	Wash Water Solenoid Valve x 4	1 day	Thu 29/01/15	Thu 29/01/15
47	Proving Period	15 edays	Thu 29/01/15	Fri 13/02/15



Project: C1. Luggage Point Comm
Date: Wed 2/07/14

Task	Milestone	Rolled Up Progress	Deadline	Duration-only			
Task Progress	Summary	Split	Inactive Task	Manual Summary Rollup			
Critical Task	Rolled Up Task	External Tasks	Inactive Milestone	Manual Summary			
Critical Task Progress	Rolled Up Critical Task	Project Summary	Inactive Summary	Start-only			
Slack	Rolled Up Milestone	Group By Summary	Manual Task	Finish-only			

Page 1

Luggage Point STP Inlet Works Screen Upgrade
Commissioning

APPENDIX C

INSTRUMENT & ELECTRICAL INSPECTION & TEST PLAN

Luggage Point STP Inlet Works Screen Upgrade
Commissioning

CONTENTS

1. PURPOSE

The purpose of this Inspection and Test Plan is to define for the Electrical and Instrument equipment items the following:

1. How the various equipment items will be inspected and tested during the project construction and commissioning phases to verify compliance with the design and operational requirements.
2. The boundary limits of the various equipment items and systems which will be subjected to the pre-commissioning process.
3. The scope of the pre-commissioning process and the methodology that will be used during its execution.
4. The acceptance criteria that will demonstrate that the pre-commissioning process has been successfully completed and the facilities can safely transition into commissioning.
5. The pre-commissioning organisation, along with the various roles and responsibilities of each of the parties involved.
6. The handover documentation that will be used to verify the Electrical & Instrument installation is complete and in accordance with the project requirements.

2. REFERENCE DOCUMENTATION & SYSTEMS

The documentation the facility will be pre-commissioned against is the Queensland Urban Utilities approved Process & Instrumentation drawings and the FDS.

All testing done on site will use the following systems;

- Site Deviation and Non –Conformance Reporting System
- Site Punch list and Defects list systems.

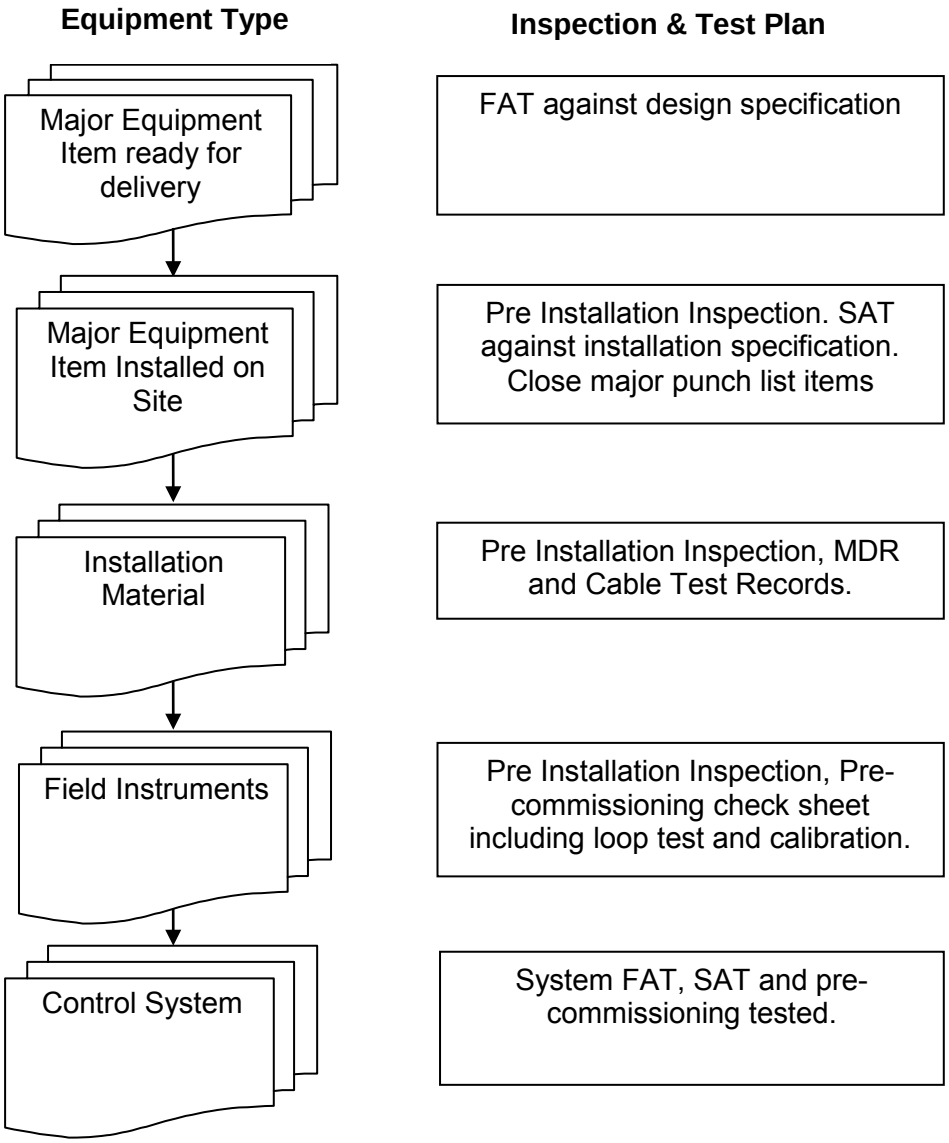
3. MAJOR EQUIPMENT ITEMS

The following are the major E&I equipment items.

- 415V MCC
- Service water pumps
- Filtrate return pumps
- Service water filter
- Inlet screens
- Screenings washing (Washpress units)
- Screenings bins
- PLC control & SCADA systems (Queensland Urban Utilities)
- Various field instruments including flow, pressure and level transmitters

4. INSPECTION & TEST WORK FLOW

The following is the high level project work flow detailing the E&I Inspection and Test Plan which runs throughout the duration of the project.



Based upon the ITP above the following test documents will be generated to document the various stages of testing.

1. Pre-installation Inspection Check sheets.
2. FAT Test Documents (by vendors).
3. Cable test sheets.
4. Installation Inspection Check sheets.
5. SAT Test Documents (by vendors)
6. Pre-commissioning Test Sheets

The extent of FAT / SAT testing and the electrical and instrument equipment items that will be subjected to these tests will extend to:

- 415V MCC
- Service water pumps
- Filtrate return pumps
- Service water filter
- Inlet screens
- Screenings washing (Washpress units)
- Screenings bins
- PLC control & SCADA systems
- Various field instruments including flow, pressure and level transmitters

5. ADMINISTRATION

Documentation

The documentation required during pre-commissioning includes check sheets, equipment data sheets, P&ID's, wiring drawings, punch lists, third party test certificates and handover documents. These documents need to be presented and signed off for each system being pre-commissioned before it can be handed over to commissioning. An approved work pack for each system is required before a pre-commissioning phase can commence. In addition to the documents mentioned earlier, these may also include JHAs, MSDS and isolation permits where applicable.

Status Monitoring

A master set of pre-commissioning drawings will be maintained with all cables that have been tested and energised highlighted. As items are energised a general warning label will be attached to the equipment item stating the device is now live. Once the plant has been fully energised at the end of pre-commissioning the warning labels will be removed and the plant handed for over commissioning.

6. HEALTH & SAFETY

Prior to the commencement of pre-Commissioning a Hazard & Risk review will be conducted to access the particular risks associated with pre-commissioning. This will be used to support the various JHA's that will be raised and ensure all parties involved in pre-commissioning are aware of the risks.

Once a board is ready for pre-commissioning the lock on the main isolator will be removed, locks applied to all other downstream isolators on the board and a warning tag applied stating that the board is being subjected to pre-commissioning. As equipment items are energised then they will also have pre-commissioning warning labels applied.

Exposure to accidental contact with electrical power may result in fatal injuries. At all times the basic five safety rules must be observed when dealing with voltage levels outside of extra low voltages, e.g. 24VDC.These are:

- Disconnect the system taking care to also disconnect auxiliary circuits.
- Protect against re-connection, i.e. apply personnel protective locks
- Make sure the equipment is at zero voltage with any entrained energy, (e.g. in capacitors) discharged.
- Ground and short circuit the supply terminals on the equipment being worked on.
- Cover or enclose any adjacent components that are still live.

7. E&I SYSTEMS

The Electrical and Instrument equipment for pre-commissioning is broken down into the following sections:

Section 1 – 415V Control Systems & Associated Equipment

415V MCC

Service water pumps local control panel

Service water pumps control panel 3 phase power supply

Service water pumps panel single phase power supply

Section 2 – Control Systems

PLC SAT

SCADA SAT

Communications to service water pump station local control panel

Section 3 – Field Instrumentation

FE 001	Service water pumps discharge flow
LIT 001	Screens inlet channel level
LIT 002	Screens outlet channel level
LIT 003	Screens inlet channel level
LIT 004	Screens outlet channel level
LIT 005	Screens inlet channel level
LIT 006	Screens outlet channel level
LIT 007	Screens inlet channel level
LIT 008	Screens outlet channel level

Section 4 – Vendor Package Instrumentation

Instrumentation within each vendor package will be pre-commissioned by the vendor.

8. PRE-COMMISSIONING DOCUMENTATION

The Pre-Commissioning documentation will be used to capture and verify that all required pre-commissioning inspections and testing have been successfully completed for that system and will include the following:

- A Description of the system;
- A copy of the applicable System P&IDs, piping isometrics
- The construction inspection, test and certification plan
- Copies of relevant Job Hazard Analyses (JHAs) required for pre-commissioning activities,
- Any relevant Material Safety Data Sheets,
- A list, or lists, of all required equipment, materials and resources to perform the pre-commissioning of the system,

- A list of the required mechanical and electrical isolations with sign-off to verify these isolations are in place prior to commencement of pre-commissioning,
- All required pre-commissioning procedures for the system and any component equipment therein,
- A punch list to capture any issues requiring resolution/completion before commissioning can commence on that system.
- A signoff sheet including Stirloch approval.

9. COMMISSIONING

Once the Pre-commissioning has been signed-off and accepted by Queensland Urban Utilities the relevant systems are handed over to the Commissioning team.

Start-up and Commissioning of the facilities will be performed using the approved Commissioning Plans & Procedures. Stirloch will provide field support staff on an as required basis to assist during the commissioning phase, as well as the performance and operational trial period as necessary.

10. RESPONSIBILITY

Responsibility for the planning and execution of the various pre-commissioning activities is detailed in the table below. P = Planning, E = Execute, A = Assist

Luggage Point Screens		Stirloch	Suppliers	QUU
1	Electrical infrastructure	**P & E**	**A[2]**	
2	PLC for process control (QUU)	**P & E**	**A[1]**	**P&E[1]**
3	Service water pumps	**P & E**	**A[3]**	
4	Filtrate return pumps	**P & E**	**A[4]**	
5	Telemetry	**P & E**	**A[1]**	**P&E[1]**
6	Field Instrumentation	**P & E**		
7	Inlet screens	**P & E**	**A[5]**	
8	Service water filtration	**P & E**	**A[6]**	
9	Screenings washing	**P & E**	**A[7]**	
10	Inlet penstocks	**P & E**	**A[8]**	

Notes:

1. Queensland Urban Utilities are responsible for the commissioning of the PLC and telemetry/SCADA
2. [JPR] TEW are the supplier of the switchboard.
3. Grundfos are the supplier of the service water pump set
4. Xylem are the supplier of the filtrate return pumps
5. Andritz are the supplier of the inlet screens

6. Amiad are the supplier of the service water filtration system
7. Green Process are the supplier of the screenings washing system
8. AWE are the supplier of the inlet penstocks

11. E&I PRE-COMMISSIONING SEQUENCE OF TESTING

Following on from the completion of construction, the pre-commissioning sequence for the E&I systems shall be as follows.

1. Confirm that all construction MDR and test records are complete and approve where required.
2. Energise the switchboard
3. Energise the service water pumps local control panel
4. Energise the 24VDC power supplies
5. Ensure the PLC interfaces are operational and complete the SAT (Queensland Urban Utilities)
6. Ensure SCADA is operational. (Queensland Urban Utilities)
7. Test the systems in their numeric sequence.
8. Verify data transfer between the various systems and site instruments.
9. Complete all testing, noting areas where tests failed and remedial action is required.

12. CHECK SHEETS & PROCEDURES

The check sheet templates along with execution procedures are contained in the Appendices at the rear of this document. The check sheets will be required to be completed across the various systems. These check sheets templates will be pre-filled with specific device information and compiled into the pre-commissioning test packs for each system as previously detailed.

Note that the testing required by the check sheets will consist of verification of data / testing contained in the construction MDR's along with field testing of the various equipment items where required.

Luggage Point STP Inlet Works Screen Upgrade
Commissioning

ATTACHMENT A – ELECTRICAL & INSTRUMENT REFERENCE DRAWINGS

The E&I reference drawings used in the inspection and testing of the installation will be:

- Electrical Single Line Diagrams
- Cable Schedules
- Cable Termination Drawings (supplied by TEW)
- Switchboard Vendor drawings
- PLC I/O lists
- Motor control schematics

Luggage Point STP Inlet Works Screen Upgrade
Commissioning

ATTACHMENT B – INSPECTION, TEST & CERTIFICATION PLAN

The Inspection, Test and Certification Plan is the control document that defines the level of testing and documentation and will cover the following:

- 415V Switchboard MCC
- 415V local control panel service water pumps
- PLC for Process Control & SCADA (Queensland Urban Utilities)
- Instrumentation

ATTACHMENT C – FIELD INSPECTION TEST RECORDS

The check sheets define the specific level of testing and inspection to be performed on an individual equipment item or sub-assembly.

Check sheets to be used include:

- Equipment Conduit Installation Inspection
- Control Cable Conformance Specification
- Earthing Impedance Test
- Earthing Installation Inspection
- Field Isolator Local Control Station
- Instrument Conduit Inspection
- Instrument Install Inspection
- Field Junction Box
- MCC Installation Inspection
- MCC Busbar Insulation & Continuity
- Motor Installation Inspection
- Power Cable Resistance Tests
- Power Cable Glanding & Termination Inspection
- Power Cable Installation Inspection
- Power Cable Insulation & Earth Continuity Inspection
- Power Cable Small Power
- Push Button Local Control Station
- Underground Conduit & Trench Installation

Luggage Point STP Inlet Works Screen Upgrade
Commissioning

ATTACHMENT D – INSTRUMENT PRE-INSTALLATION INSPECTION REPORT

The instrumentation subjected to this inspection, which will be a combination of visual and limited power up checks are the

- Flow Transmitters
- Level Transmitters
- Pressure Transmitters
- Pressure Gauges

The test results shall be recorded on the appropriate Instrument Pre-Installation Inspection Reports.

ATTACHMENT E – INSTRUMENT PRE-COMMISSIONING INSPECTION REPORT

The instrumentation subjected to this inspection, which will include loop testing and field calibration verification are:

- Flow Transmitters
- Level Transmitters
- Pressure Transmitters
- Pressure Gauges

The test results shall be recorded on the appropriate Instrument Pre-Commissioning Inspection Reports.

Luggage Point STP Inlet Works Screen Upgrade
Commissioning

APPENDIX D

MECHANICAL DRY PRE-COMMISSIONING

CONTENTS

1. MECHANICAL PRE–COMMISSIONING: INTRODUCTION

Upon completion of installation, pipework hydrotesting and preliminary post-construction compliance checking, the Mechanical Pre-commissioning must be carried out and satisfactorily completed prior to Pre Start-Up and subsequent Commissioning.

This appendix refers to activities which cover *aspects* of Site Acceptance Testing (SAT), and Pre-Commissioning, for various mechanical installations. Certain installations as supplied, installed and certified by external vendors, or materials may otherwise only have been subjected to FAT, and SAT upon delivery - but not functionally or mechanically checked 'as-installed' until suitably complete, e.g. drain pumps guide rail installation.

It is the intention that all mechanical installations be subjected to a thorough pre-commissioning check over to ensure that there are no mechanical operational or defect punch list items which would otherwise conflict with intended safe operation as per intent.

It is acknowledged that certain installations cannot be fully checked as a *mechanical installation in operation* until the actual infrastructure is commissioned. In such instances the Inspection & Test Plan shall be structured accordingly to ensure verification is carried out.

Mechanical installations are generalized as per below:

- Valve & pipework installations
- Pumps (Service water and drain)
- Filter (Amiad)

1.1 General Methodology

Pre-Commissioning works and associated checks must be carried out in strictly in accordance with the documented requirements as indicated by the designer and/or the supplier / vendor's Installation, O & M requirements - always refer to the O & M Manual for additional information.

All tasks must be carried out in accordance with approved procedures and documentation systems for verification.

The pre-commissioning checks and testing shall, as a minimum, include the following:

- Completeness of installation
- Functionality of operation
- Ensure all equipment is correctly lubricated and lubrication reservoirs are charged with adequate quantities of lubricant in accordance with the manufacturer's instructions, using the recommended products, to the appropriate approved procedures
- Direction of rotation of all pump and drive motors verified separately
- Seals on mechanical couplings
- Alignment of pumps and drives
- Pump and drive guarding
- Motor and pump bearing temperatures

- Noise & vibration
- Valve operation; all valves are in their correct position, open/close, rotation of gearbox & spindle correct & moving freely, indicators correct, bump stops
- Instrumentation – all instruments are correctly and rigidly installed, free of leakage (following filling or bleeding out), indicating appropriate output (pressure gauges)

1.2 Inspection and Test Points

Record keeping and the inspection and test points are detailed on the “Dry Pre-Commissioning Inspection and Test Plan”.

Following successful inspection and/or testing of equipment the inspection and test sheets shall be prepared confirming that all the items have been satisfactorily tested. The report shall contain all the check sheets filled out in full.

Service Water, Drain Pumps and Filter
Mechanical Dry Pre-Commissioning Inspection and Test Points

TASK No.	TASK	VALVE POSITION NO = NORMALLY OPEN NC = NORMALLY CLOSED	ACCEPTABLE	
			YES ✓	NO ✘
	Xylem drain pumps PU-02220-003/004			
1	Check the alignment of the pump guide rails			
2	Check the installation of the pumps pedestals and the sealing of the pump to the pedestal			
3	Check the fixings of the pump pedestal to the concrete base			
4	Valves NRV-0220-004 & 005 operate correctly	NC		
5	Valves HV-0220-0047 & 0049 open and close	NO		
6	Valves HV-0220-0048 & 0050 open and close	NO		
7	Vent to the tank is clear and not blocked			
8	Level instrument LS001 is correctly installed			
9	Level instrument LS002 is correctly installed			
10				
11				

Service Water, Drain Pumps and Filter
Mechanical Dry Pre-Commissioning Inspection and Test Points

TASK No.	TASK	VALVE POSITION NO = NORMALLY OPEN NC = NORMALLY CLOSED	ACCEPTABLE	
			YES ✓	NO ✘
	Amiad Water filter			
21	Valve HV-0210-0015 open and close	NO		
22	Flowmeter FE001 is installed correctly			
23	Valves HV-0210-0018 & 0019 open and close	NO		
24	Valve HV-0210-0030 opens and closes	NO		
25	Valves HV-0210-0051 & 0052 open and close	NO		
26	Differential pressure instrument DP001 is correctly installed			
27	Valves HV-0210-0020 & 0021 open and close	NC		
28	Valve NRV-0210-003 operates correctly	NC		
29	Valve HV-0210-0053 opens and closes	NO		
30	Filter baseframe is correctly fixed to the concrete slab			
31				
32				

Service Water, Drain Pumps and Filter
Mechanical Dry Pre-Commissioning Inspection and Test Points

TASK No.	TASK	VALVE POSITION NO = NORMALLY OPEN NC = NORMALLY CLOSED	ACCEPTABLE	
			YES ✓	NO ✘
	Grundfos service water pump set			
40	Valve HV-0210-0008 opens and closes	NO		
41	Valves HV-0210-009, 0010, 0016, 0017, 0011, 0012, 0013, & 0014 open and close	NO		
42	Valve HV-0210-0012 open and close	NC		
43	Valve V-221-021 opens and closes	NO		
44	Ensure pumps are correctly lubricated and charged with adequate quantities of lubricant in accordance with the manufacturer's instructions, using the recommended products			
45	Pressure indicator PIT 001 correctly installed			
46	Pressure gauge PG 001 correctly installed			
47	Pumpset baseframe is correctly fixed to the concrete slab			
48				
49				
50				

Section 5: Equipment List & Asset Register

Section 6: Electrical Installation - O&M (Draft)

Operating and Maintenance Manual

Luggage Point STP

Inlet Screens Upgrade

CONTRACT NO. 83500743
Construct, Commission and Handover of Inlet Works Upgrade

Stage 1 Commissioned {INSERT MONTH}, 2014.

Stage 2 Commissioned {INSERT MONTH}, 2014.

Stage 3 Commissioned {INSERT MONTH}, 2014.

Contents

Contact Details

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Revisions

Revised Page No.	Revision	Revision Status	Revision Date	Approved	Verified
	0	Draft Issue	21/06/2014	C. Griffiths	

PART 1
INTRODUCTION AND BACKGROUND INFORMATION

1.0 Introduction

This document is intended for engineering staff and provides the information necessary to safely operate and maintain the Electrical and Instrument System. It includes: Electrical Drawings, Switchboard Components and Spare Parts.

2.0 Location Details & Map

Figure 1 – Map Luggage Point STP

3.0 Description of Equipment and Process

Luggage Point Sewage Treatment Plant (STP) serves the S1 catchment that encompasses approximately half of the population of the City of Brisbane. The plant is located at 200 Main Beach Rd, Pinkenba. The plant receives flow from a combination of domestic and industrial sources but is principally treating domestic sewage.

The existing primary treatment system, installed, has been upgraded to a modern treatment system to fulfil the required life expectancy of the installation. The E&I alongside the Mechanical upgrade comprises of the following:

1. 1 x 250A rated Motor Control Centre:
   a. Main incomer including surge protection and metering.
   b. 4 x 1.5kW Variable Speed Drives.
   c. 8 x DOL starters including 2 x reverse starters.
   d. 12 x Electrical Actuator Supplies.
   e. 32A Supply for Drain Package Plant.
   f. UPS back-up.
   g. Extra-low Voltage Distribution Board.
   h. PLC cabinet.
2. 1 x 63A rated Motor Control Centre:
   a. Main incomer including surge protection and metering.
   b. 4 x 1.5kW Variable Speed Drives.
   c. 6 x DOL starters including 1 x reverse starters.
3. Field Local Control Stations for each drive.
4. Channel Level Transducers including Field Mounted Displays (level instruments supplied by others).
5. Wash Press Level Transducers (level instruments supplied by others).
6. Electrical and Instrumentation Test and commissioning of Primary Treatment System.
7. Includes integration with End Clients SCADA/PLC Designer and Progrmmer.

4.0 Design Details

4.1 Proprietary Equipment Register

Supplier/ Sub-Contractors	Proprietary Equipment	Contact Information	Website
B&R Enclosures	MCC, Field Instrument Enclosures, Local Screen Control Stations.	51 Stradbroke Street, Heathwood QLD, 4110 (07) 3714 1000	www.brenclosures.com.au
Kraus & Namier	Local Control Stations, Control Selector Switches	22 Brookes Street, Bowen Hills, Qld 4006 (07) 3252 8344	www.krausnaimer.com.au/
Danfoss	VSD	3/42 Deakin St, Brendale QLD 4500 (07) 3881 3666	http://electronicpowersolutions.com/
Tsubaki Australia	Electonic Shear Pin Relay	Unit 4, 19 Murdoch Circuit Acacia Ridge QLD 4110 Ph. 07 3273 0600	http://tsubaki.com.au/index.php
Control Logic	GE PLC	25 Lavarack Ave Eagle Farm QLD Australia 4009 07 3623 1212	http://www.control-logic.com.au/
NHP	Power Distribution, Motor Control and Protection, Control and interface Relays, Terminations, Ducting and Enclosure Climate Control	16 Riverview Pl, Murarrie QLD 4172	www.nhp.com.au

4.2 Data Sheets

Equipment Identifier	RWSB1 & 2
Equipment Type	Switchboard B & R
Model Number	Signature SE

Data Sheet	
Description	**Detail**
Form of Segregation	Minimum 3BI
Degree of Protection	IP54
Design Ambient Temperature	40 Degrees Celsius
Design Temperature Rise	50 Degrees Celsius
Earth System	MEN
Construction	2mm Zinc Anneal, Polyester Powder Coated, 40 Micron Min, X15 Orange
Ventilation	Forced Cooling, Mesh Gauze, Removable Filter Material
Lock System	3 Point Locking
Type Testing	AS 3439.1, BS EN 60439.1, IEC 439.1
Fault Rating	50kA
Operating Voltage	3 Phase, 50 Hz – 415 Volts
Rated Insulation Voltage	1000 Volts
Rated Impulse Withstand Voltage	6kV on all functional units, 16 kV on horizontal and vertical busbars
Main Switch	250 Amp
Busbar	Hard Drawn, High Conductivity, Round Edge Copper

Equipment Identifier	
Equipment Type	Variable Speed Drive
Model Number	FC202P1K5, Safe Stop, Coated

Data Sheet	
Description	**Detail**
Manufacturer	Danfoss
Enclosure Protection	IP20
Rated Power	1.5kW, 4.1A
Rated Voltage	AC 380...480 volts, 3 Phase
Control	V/f vector oriented flux control no f/back
Maximum Current	120% for 60s / 10 minutes, 135% for 2 s
Dimensions	268 x 90 x 205mm (HxWxD),
Frame Size	Frame A2
Losses at Rated Current	64 Watts
Cooling Air	$1m^3/hr$
Short Circuit	50kA

PART 2
RECORDS

5.0 As Constructed Drawings

5.1 As Constructed Electrical Drawings

DRAWING #	DESCRIPTION
486/5/5/0199/500	TITLE PAGE
486/5/5/0199/501	DRAWING INDEX
486/5/5/0199/502	RAW SEWAGE SCREEN SWITCHBOARD - 1
486/5/5/0199/503	RAW SEWAGE SCREEN SWITCHBOARD - 1 415/240VAC CHASSIS
486/5/5/0199/504	RAW SEWAGE SCREEN SWITCHBOARD - 1 UPS
486/5/5/0199/505	RAW SEWAGE SCREEN SWITCHBOARD - 1 24VDC
486/5/5/0199/506	RAW SEWAGE SCREEN SWITCHBOARD - 1 110VAC
486/5/5/0199/507	RAW SEWAGE SCREEN SWITCHBOARD - 2
486/5/5/0199/508	Metering
486/5/5/0199/509	
486/5/5/0199/510	SCREEN 1 - MAIN DRIVE
486/5/5/0199/511	SCREEN 1 - BRUSH MOTOR
486/5/5/0199/512	SCREEN 2 - MAIN DRIVE
486/5/5/0199/513	SCREEN 2 - BRUSH MOTOR

486/5/5/0199/514	SCREEN 3 - MAIN DRIVE
486/5/5/0199/515	SCREEN 3 - BRUSH MOTOR
486/5/5/0199/516	SCREEN 4 - MAIN DRIVE
486/5/5/0199/517	SCREEN 4 - BRUSH MOTOR
486/5/5/0199/518	SCREEN 5 - MAIN DRIVE
486/5/5/0199/519	SCREEN 5 - BRUSH MOTOR
486/5/5/0199/520	SCREEN 6 - MAIN DRIVE
486/5/5/0199/521	SCREEN 6 - BRUSH MOTOR
486/5/5/0199/522	SCREEN 7 - MAIN DRIVE
486/5/5/0199/523	SCREEN 7 - BRUSH MOTOR
486/5/5/0199/524	SCREEN 8 - MAIN DRIVE
486/5/5/0199/525	SCREEN 8 - BRUSH MOTOR
486/5/5/0199/526	DIVERTER FLAP 1
486/5/5/0199/527	DIVERTER FLAP 2
486/5/5/0199/528	WASH PRESS 1

486/5/5/0199/529	WASH PRESS 2
486/5/5/0199/530	WASH PRESS 3
486/5/5/0199/531	STORAGE BIN 1
486/5/5/0199/532	STORAGE BIN 2
486/5/5/0199/533	STORAGE BIN 3
486/5/5/0199/534	INLET PENSTOCK 1
486/5/5/0199/535	INLET PENSTOCK 2
486/5/5/0199/536	INLET PENSTOCK 3
486/5/5/0199/537	INLET PENSTOCK 4
486/5/5/0199/538	INLET PENSTOCK 5
486/5/5/0199/539	INLET PENSTOCK 6
486/5/5/0199/540	INLET PENSTOCK 7
486/5/5/0199/541	INLET PENSTOCK 8
486/5/5/0199/542	OUTLET PENSTOCK 1
486/5/5/0199/543	OUTLET PENSTOCK 2

486/5/5/0199/544	OUTLET PENSTOCK 3
486/5/5/0199/545	OUTLET PENSTOCK 4
486/5/5/0199/546	
486/5/5/0199/547	
486/5/5/0199/548	
486/5/5/0199/549	
486/5/5/0199/550	
486/5/5/0199/551	PLC 3 NETWORK DIAGRAM
486/5/5/0199/552	PLC 3 POWER DIAGRAM
486/5/5/0199/553	PLC 3 RACK 0 SLOT 5 AI
486/5/5/0199/554	PLC 3 RACK 0 SLOT 6 AI
486/5/5/0199/555	PLC 3 RACK 0 SLOT 7 AO
486/5/5/0199/556	PLC 3 RACK 0 SLOT 8 AO
486/5/5/0199/557	PLC 3 RACK 0 SLOT 9 DO
486/5/5/0199/558	PLC 3 RACK 0 SLOT 10 DO

486/5/5/0199/559	PLC 3 RACK 0 SLOT 11 DO
486/5/5/0199/560	PLC 3 RACK 0 SLOT 12 DO
486/5/5/0199/561	PLC 3 RACK 0 SLOT 13 DO
486/5/5/0199/562	PLC 3 RACK 0 SLOT 14 DO
486/5/5/0199/563	PLC 3 RACK 0 SLOT 15 SPARE
486/5/5/0199/564	PLC 3 RACK 1 SLOT 2 DI
486/5/5/0199/565	PLC 3 RACK 1 SLOT 3 DI
486/5/5/0199/566	PLC 3 RACK 1 SLOT 4 DI
486/5/5/0199/567	PLC 3 RACK 1 SLOT 5 DI
486/5/5/0199/568	PLC 3 RACK 1 SLOT 6 DI
486/5/5/0199/569	PLC 3 RACK 1 SLOT 7 DI
486/5/5/0199/570	PLC 3 RACK 1 SLOT 8 DI
486/5/5/0199/571	PLC 3 RACK 1 SLOT 9 DI
486/5/5/0199/572	PLC 3 RACK 1 SLOT 10 DI
486/5/5/0199/573	PLC 3 RACK 1 SLOT 11 DI

486/5/5/0199/574	PLC 3 RACK 1 SLOT 12 DI
486/5/5/0199/575	PLC 3 RACK 1 SLOT 13 DI
486/5/5/0199/576	PLC 3 RACK 1 SLOT 14 DI
486/5/5/0199/577	PLC 3 RACK 1 SLOT 15 DI
486/5/5/0199/578	PLC 3 RACK 2 SLOT 2 DO
486/5/5/0199/579	PLC 3 RACK 3 SLOT 3 DO
486/5/5/0199/580	PLC 3 RACK 4 SLOT 4 DO
486/5/5/0199/596	SWITCHBOARD 1 GENERAL ARRANGEMENT (WITH DOORS CLOSED)
486/5/5/0199/597	SWITCHBOARD 1 GENERAL ARRANGEMENT (WITH DOORS REMOVED)
486/5/5/0199/598	SWITCHBOARD 2 GENERAL ARRANGEMENT (WITH DOORS CLOSED)
486/5/5/0199/599	SWITCHBOARD 2 GENERAL ARRANGEMENT (WITH DOORS REMOVED)

6.0 Commissioning Report

7.0 Electrical Test Report

7.1 Switchboard Works Test Report

7.2 Electrical Test Report

8.0 List of Contract Variations and Plant Modifications

Variation No.	Variation Details
1	Wash Water Pump Station relocated location from tender design, Electrical and Control Supply from existing Wash Water Pump Station Switchboard.
2	Bin Extendable Chutes.
3	Rescheduling Costs.
4	110VAC Solenoid Supply.
5	IO Re-Allocation including naming convention change.
6	RPEQ certification for Design and As Constructed works.
7	110VAC Solenoid Supply.
8	Screen Field Selector Switch Control.
9	Bin 3 Addition.
10	Shed Existing Electrics Removal.

9.0 VSD Parameters

10.0 PLC/SCADA

PART 3
OPERATION AND MAINTENANCE

11.0 Functional Specification

12.0 6/12 Monthly Maintenance

14.1 Switchroom

- Building inspection and cleaning. Check for leaks, vermin ingress, corrosion or damage.
- Remove any unnecessary stored equipment.
- General and emergency lighting checks.
- Operational check of door switches.
- A/C Maintenance.
- Insulation, earth continuity and earth leakage testing.

14.2 Switchboard & Variable Speed Drive

- Thermoscan inspection of all power enclosures.
- Power system insulation test (1000VDC).
- Inspect and check power and control connections.
- Check enclosure cooling fan operation and thermostat control.
- Clean and remove dust.
- Functional check of all controls.
- Ensure doors are secured – IP Rating & Arc Fault Containment.

14.3 Field Local Control Stations including Cable Tray Support Systems

- Thermoscan inspection of all power enclosures.
- Power system insulation test (1000VDC).
- Inspect and check power and control connections.
- Inspect systems for corrosion or damage.
- Earth continuity test.
- Check foundation bolts for security of attachment and corrosion.

- Check compression cable glands for tightness.
- Remove and clean pressure transducers (12 monthly only).

14.4 Rotork Actuators

- Ensure there is not an excessive build-up of dust or contaminant on the actuator.

14.5 Level Transducers

- Check compression cable glands for tightness.
- Inspect and check power and control connections.
- Clean/inspect sensing face.

PART 4
APPENDICES

Appendix 1 – VSD

Appendix 2 – Telemetry & SCADA