



# Operation & Maintenance Manuals Volume 1

## Gibson Island Belt Filter Press Replacement

### O&M Manual



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# **1 VOLUME 1**

## **1.1 Introduction**

This manual has been written in the intention to be read, understood and observed by those responsible for operation and maintenance of the newly installed dewatering plant at Gibson Island.

The complete O&M manuals (All 5 volumes) should always be kept at a place near the dewatering plant. The O&M manual provides basic know-how of the plant and contains important operational, maintenance and safety instructions. Particularities of plant use are referred to in the O&M manual.

The use of single components must be seen in the context of the overall plant operation, and the manual is therefore divided according to major areas of activity.

Plant defects and malfunctions can only be avoided through in-depth knowledge of the information contained within the O&M manuals. It is therefore extremely important for the responsible people to be familiar with all information contained within the O&M manuals.

Tenix do not take any liability for damage and malfunctions resulting from non-observance of the information contained within the O&M manuals.

## 1.2 Location Details & Map

The plant is located at Gibson Island, 188 Paringa Road, Murarrie.



### 1.3 System Overview

Queensland Urban Utilities (QUU) awarded the upgrade of Gibson Island STP Sludge Dewatering Replacement to Tenix under the Collaborative Delivery Initiative (CDI) agreement.

The Design and Construct Contract was for the replacement and upgrade of the existing sludge dewatering facility to provide the Principal, (QUU) with a reliable and economical sludge dewatering facility at Gibson Island WRP.

The design has been undertaken by Tenix Engineering and Operations Department (E&O) in accordance with QUU technical specifications, applicable standards and the contract drawings.

Gibson Island STP dewatering replacement project has consisted of the following design phases:

- 5% Basis of design report / review of QUU technical specification
- 30% design report and HAZOP work shop
- 80% design report, SID work shop and IFA "Issue for Approval" drawings
- Issue of Vendor Packages and Request for Tender documents
- 100% design report and IFC "Issue for Construction" drawings

Information was obtained through the following methods:

- Technical Specifications – Reference and adherence to the technical specifications, noting non-conformances and alternatives of the offer proposed.
- Stakeholder meetings – Conducted with key personnel involved during the tender period and throughout the approval processes.
- Tender research – Conducted by researching tender documents, offers and previous submissions made by Tenix during the tender phase.
- Vendor information – Conducted by asking specific details, functionality and explanations to the selected equipment supplier. QUU operatives and design engineers were fully consulted and informed during the design phase. Various design workshop reviews were held which included by were not limited to design start up, HAZOP, SID, 30% design phase, 80% design phase and 100% design phase workshops.

Upon completion of the above mentioned design the construction and commissioning of the new plant was also undertaken by Tenix (Infrastructure Department) again in accordance with QUU technical specification, applicable standards and the IFC design.

The key equipment renewal objectives were to provide:

- Maximum operating configuration of three duty Belt Filter Presses (BFP), 24 hrs /day, 7 day /week
- Routine operating configuration of three duty BFP, 14 hrs /day, 6 day /week

OR

- Routine operating configuration of two duty BFP, 18 hrs /day, 7 day /week

The work to be performed under the contract comprised of the provision of all materials, plant and labour for the design, construction, installation and commissioning of all mechanical, electrical, structural and civil aspects associated with the upgrade of the sludge dewatering facility including. In particular the scope included the following:

- Replacement of 3 No. belt filter presses;
- Replacement of 3 No. sludge feed pumps;
- Replacement of 3 No. wash water pumps;
- Installation of a wash water filter and bypass strainer;
- Replacement of existing polymer storage/batching tanks;
- Replacement of 3 No. Polymer dosing pumps;
- Installation, commissioning and decommissioning of a portable polymer dosing system during the construction/installation;
- Replacement of the existing overhead crane;
- Installation of sludge, water, polymer and compressed air pipework and in line equipment;
- Civil/Structural modifications to the building and concrete plinths as necessary to accommodate belt filter presses, polymer tanks, pumps;
- Refurbishment and modification to existing switchboard;
- Supply and installation of local control stations
- Modification of PLC and supply and installation of HMI into associated MCCs;

This project has been delivered by Tenix to provide the Principal, Queensland Urban Utilities (QUU), with a reliable and economical sludge dewatering facility at Gibson Island WRP, with capacity to meet future demand up to 2031 with no reduction in capacity due to equipment breakdown.

## **1.4 Description of Equipment**

### **1.4.1 Belt Filter Presses**

The BFP objectives are listed below:

- Provide multiple dewatering configurations:
  - Maximum operating configuration of three duties BFP, 24 hrs /day, 7 day /week
  - Routine operating configuration of three duties BFP, 14 hrs /day, 6 day /week
  - Routine operating configuration of two duties BFP, 18 hrs /day, 7 day /week
- Ability to handle multiple sludge feeds and solids concentrations:
  - Operating condition 1 : 31kL/hr @ 1.5% dry solids
  - Operating condition 2 : 24kL/hr @ 2.0% dry solids
- Provide solids capture rate greater than 95% and cake dry solids content greater than 12%. The polymer dose shall be less than or equal to 8 kg (dry polymer) per tonne dry solids.



Design Criteria	Final Installation
No. of belt filter presses	3 x Andritz PP-S 2000
Routine operating Configuration	Duty/duty/duty, 14 hours/day, 6 days/week
Maximum operating Configuration	Duty/duty/duty, 24 hours/day, 7 days/week
Sludge type	Thickened waste activated sludge (TWAS) / Municipal
Maximum sludge feed per belt filter press	31 m <sup>3</sup> /hr @ 1.5% dry solids 24 m <sup>3</sup> /hr @ 2.0% dry solids
Turn-down ratio required	2:1
VSS/TSS range	65% - 85% (average 77%)
Solids capture rate	>= 95%
Cake dry solids content	13% +/- 1%
Polymer dose	6-8 kg/tonne as per Andritz recommendations
Solid throughout capacity ash content pf >30%	480 kg/hr dry solids based on 1.5% solids content
Dry Solid content (%)	1.5 - 2
Belt wash water	12 m <sup>3</sup> /hr at 800 kPa (max solid size 500 ppm). The belt wash water system includes the nozzle cleaning option
Compressed air	1 m <sup>3</sup> /hr FAD at 1000 kPa
Electrical	2 x 1.1 kW
Frame	SS 316 L
No. of roller	11 (As selected and agreed when the offer was made)
Belt Material	Polyester with coated clipper seam ( endless belt with coated clip)
Dynamic flocculator material	550 L capacity , 316SS. Include vertical mixer – SS316 + Motor 1.1 kw IP56
Drainage pan	Provided
Gear box drainage	Ball valve + plug to ease maintenance operation



The three existing BFP's were removed and three (3) new BFP's were installed in the existing sludge dewatering building in Gibson Island WRP.

- Each Belt Filter Press is fed via a dedicated sludge feed pump located in the polymer dosing room.
- Each Belt Filter Press compressed air requirement is provided by the existing compressed air system located in the polymer dosing room. The existing compressed air system consists of two 2.2 kW Atlas Copco LE6 compressors, each with a free air delivery (FAD) of 13.32 Nm<sup>3</sup>/hr rated pressure of 10 bar. The air is then dried and stored in a 0.5 m<sup>3</sup> compressed air cylinder with design pressure of up to 10 bar (operated between 7-8 bar). The air is connected to the belt filter presses via a 0.5 inch pneumatic line.
- Each Belt Filter Press wash water requirement is provided by a common wash water booster pump skid located in the polymer dosing area.
- Each Belt Filter Press polymer dosing requirement is provided by a dedicated polymer dosing pump located in the polymer dosing area and dilution water shall be made available from the wash water booster pumps.
- Each dynamic flocculator is fitted with a level measurement device or high level switch.
- Each dynamic flocculator is located upstream to the BFP and fitted with a fixed speed vertical mixer. Both belts filter press drives are operated by a single VSD per BFP. Each Belt Filter Press has a pneumatic panel and electrical termination box installed on the right hand side of the sludge flow (western side of the BFP in situ)
- Each Belt Filter Press is fitted with, PTC switches for over temperature protection, belt tensioning limit switches & two lanyard safety switches.

The Andritz Belt Filter Presses (BFP), model PP-S 2000, receive thickened waste activated sludge, polymer solution and dilution water. The Sludge starts flocculating in the feed pipe and goes through a dynamic flocculator which improves the quality of the flocs. The solid/ liquid separation takes place in the different separation zones, whose functions are basically distinct. The gravity zone, wedge zone, low pressure dewatering zone and S-module press zone are described below:

- Gravity Zone of BFP: feed and uniform distribution of the sludge takes place; the solid/liquid separation is mainly caused by gravity; rows of baffles turn the sludge over and thus improve dewatering; released water is drained through the belt.
- Wedge Zone: it constitutes the first pressure stage and is formed by the converging of the upper and lower belts. The available volume is thus reduced and causes a progressive pressure increase. Uniform & homogenous transfer of the sludge cake from the gravity zone to the wedge zone is ensured by turning of the sludge over on the lower part of the BFP which is slightly longer than the upper part.

- Low pressure dewatering zone: in this zone, the pressure on the sludge cake is increased. Sludge pressed between the two belts is dewatered by evacuation of the water through the upper belt which applies pressure towards the inner part of the rollers.
- S-module press zone: in this zone, the cake is subjected to a higher pressure in order to obtain the maximum final dryness. Under a preset S tension, both belts and cake pass over several rollers whose diameter progressively decreases.

Wash-water, controlled by a solenoid valve, is used to continuously clean the belt utilising two sets of sprays. Each BFP has its own dedicated sludge feed pump, polymer feed pump. There is no interconnection for these pumps with other belt presses.

The belts are made of polyester with coated clipper seam. Each belt is driven by a drive roller equipped with a 1.1 kW motor. Each BFP comes with 2 electric motors; both motors will be driven by a common Variable Speed Drive (VSD) to ensure they both run at the same speed.

The filtrate and the washing water from the upper belt are collected in the corresponding filtrate trays mounted inside the BFP frame. The filtrate and wash-water from the lower belt are discharged directly to the concrete sump below each BFP. The pipes generally used for connections are made of PVC.

The pressed cake is removed from the filter belts by a wear resistant scraper. A lever ensures unstacking for cleaning.

The belts are cleaned with two washing spray ramps with flat jet nozzles made of brass.

The washing water shall have a pressure of 8 Bars and solid content less than 500 ppm (i.e. 100% of the particles < 500 micron grain size). Cleaning brushes to clean the nozzles are part of the scope of supply. These brushes can be operated by a hand wheel while the BFP is in operation.

The solid/liquid separation takes place in BFP. In BFP zone, the solid/liquid separation is by low pressure and the high pressure dewatering processes to achieve the required solids content of minimum 12% - 13%.

The filtrate and the wash water from the belts of BFP No.1 are collected in the BFP No.1 Dewatering equipment apron and drained to the existing Manhole No.1 (MNH-1) which is then gravity drained to the existing Manhole No.4 (MNH-4). (Refer Dwg. No. 485/5/5/0125-015)

The filtrate and the wash water from the belts of BFP No.2 are collected in the BFP No.2 Dewatering equipment apron and drained to the existing Manhole No.2 (MNH-2) which is then gravity drained to the existing Manhole No.4 (MNH-4). (Refer Dwg. No. 485/5/5/0125-016)

The filtrate and the wash water from the belts of BFP No.3 are collected in the BFP No.3 Dewatering equipment apron and drained to the existing Manhole

No.3 (MNH-3) which is then gravity drained to the existing Manhole No.4 (MNH-4). (Refer Dwg. No. 485/5/5/0125-017)

The filtrate and the wash water from Manhole No.4 (MNH-4) are drained to the existing Inlet Works Pump station. (Refer Dwg. No. 485/5/5/0125-015)

There are two Emergency Stop Lanyard switches for each BFP located on each side of the BFP; the activation of any of the BFP lanyard switches will result in shutting down of the related BFP.

Andritz advise the following performance characteristics:

- Andritz 11 rolls BFP (PPS 2000) can produce cake with dryness greater than 18 % with a TWAS feed @ 2% dry solids
- If the VSS are greater than 75%, the dryness of the cake will be reduced by 1% for every 5 points of Volatile Mass (refer to Table 7.3.1 in the next section)
- 12% cake dry solids or less will only exist as a result of process malfunction. The Polymer batching and dosing system as well the quality of the polymer in use will have to be investigated if low performances are noted during operation.

Andritz (BFP manufacturer) recommend the installation of a sludge inline mixer to assist and maintain 95% capture rate during dewatering operation with low or fluctuating dry solids concentration. The inline mixer acts like a shear valve and creates a hydraulic shock in the sludge stream to jump start the flocculation process in the sludge pipe work prior to the flocculator. Andritz recommends locating the inline mixer 10 meters upstream to the flocculator inlet.

### 1.4.2 Washwater System

The Wash water objectives are listed below:

- Ability to supply BFPs and polymer batching and dosing system requirement at all times
- Ability to filter the service water to meet downstream equipment requirement

A total of four (4) Wash Water Booster Pumps on a skid were installed in the existing dewatering building in Gibson Island STP. Each Wash Water Booster Pump has the following characteristics:

- One common suction and discharge manifold
- One common discharge manifold connected to one water filter

The Wash Water Booster Pump skid provides:

- Water to each BFP, dilution water line, polymer make up tank and service hoses
- One dilution water connection per Belt Filter Press and includes a rotameter per dilution line

Design criteria	Final Installation
Configuration	Wash water booster pump skid (3 duties + 1 stand by wash water booster pump) To be installed indoor (Polymer dosing area)
Total dynamic head	Maximum Pump head 96 m Head details : 80 m static head + 7 m head loss + 10 % margin (9 m)
Flow rate per pump	Minimum 0.74 L/s (2.66 m <sup>3</sup> /hr) Flow rate 5.8 L/s (20.88 m <sup>3</sup> /hr) Maximum 6.6 L/s (23.76 m <sup>3</sup> /hr)
Model	Grundfos
Dead head pressure	15 bar
Material	316 Stainless Steel pump Hot dipped galvanised base
Electrical	11 kW, 2900 rpm, 415/3/50, IP54, variable speed motor
Pump details	Suction 100 x 50 mm Discharge 100 x 50 mm

A Wash Water Filter was also installed in the existing dewatering building in Gibson Island STP.

- The Wash Water Filter is connected to the Wash Water Booster Pump skid discharge.

- Wash Water Filter is equipped with a by-pass y-strainer.

Design criteria	Final Installation
Configuration	1 wash water filter downstream wash water booster pump
Total duty capacity	Max flow 80 m3/hr Max pressure = 16 bar
Aperture size	300 micron / 0,3 mm
Filter details	Suction 50mm PN 16 Discharge 50 mm PN16
Model	Amiad SAF 1500 16 bar

There are 4 (four) wash water booster pumps installed on a skid in the existing polymer dosing building in Gibson Island STP. The suction of the wash water pump skid is connected to an existing service water connection (TP14 refer to Dwg. No. 486/5/5/0125-011). Each BFP is connected to a common wash water manifold and supplied with a minimum of 12 m3/hr of wash water at 8 bar to clean the belt.

The wash water common discharge manifold also supplies water to three high pressure hoses in the Sludge Dewatering building (two in the Belt Filter Presses area and one in the Polymer Dosing area) and three dilution water connections (one per polymer pump). The wash water common discharge manifold is also connected to the inlet of the polymer batching system and can supply wash water instead of potable water to the batching plant if required.

The wash water booster pumps common discharge manifold is connected to one water filter (supplied with a by-pass) to remove any particles from the system and prevent future maintenance issues and damage to the equipment in operation.

The operation of wash water booster pump station requires the pump station to be "enabled" on the SCADA system prior to system start-up.

One wash water filter is installed and ensures filtered wash water is supplied to all equipment located downstream.

The wash water filter, equipped with a bypass and a y-strainer, is located on the discharge of the wash water booster pump station. The wash water filter and by-pass y-strainer are designed to operate up to 16 bar. The wash water filter is equipped with an electric motor to control the scanning and cleaning operation inside the filter. The wash water filter cleans itself automatically without interrupting the supply of water.

The cleaning cycle is based on high pressure drop across the filter or timer. The filter backwashing operation is controlled by a standalone vendor control station. The Vendor control station is connected to Scada via physical I/Os (Hard wired – 2 Inputs / 2 Outputs). The flushing water line is fitted with a diaphragm valve to limit the pressure drop during the cleaning cycle and is connected to the closest drain point, DP03, (TP16 refer to Dwg. No. 486/5/5/0125-011).

The wash water booster pump station also provides wash water to dilute the polymer solution on the discharge of the polymer dosing pumps. A pressure reducing valve, a diaphragm valve and a rotameter are provided to manually adjust the dilution water flow on site during BFP operation. Each dilution water line is fitted with a manual ball valve and a solenoid valve. There is an option on SCADA to enable or disable the dilution water lines (solenoid) on start-up of the system. Typically, the "disable" option is selected, as the existing BFP has been found to operate better without the addition of dilution water on start-up of the system. Each BFP has its own dedicated dilution water supply pipe work.

### 1.4.3 Sludge Feed System

The sludge feed pumps objectives are listed below:

- One sludge feed pump shall be dedicated to each BFP and the operation configuration of each sludge feed pump shall match the configuration of each BFPs.
- Ability to supply 120% of BFPs sludge feed to each BFPs
- Ability to meet the BFP turndown requirement (2:1)

A total of three (3) Sludge Feed Pumps are installed in the existing polymer dosing room in Gibson Island STP. Each Sludge Feed Pump and feed line have the following:

- One common suction manifold and a dedicated feed to a single Belt Filter Press
- One electromagnetic flow meter
- One pressure transmitter
- One variable speed drive
- One pressure relief valve
- One non return valve
- One sludge static mixer
- Two polymer injection locations

Design Criteria	Final Installation
No. of pumps	3 No. Mono Pumps
Operating configuration	No interconnection between the pumps
Flow per pump	Min operation =15.5 m <sup>3</sup> /hr Duty operation =31 m <sup>3</sup> /hr Max operation =37.2 m <sup>3</sup> /hr (120% of maximum sludge feed)
Total dynamic head	184.3 (Absolute pressure)
Sludge density	1070 kg/m <sup>3</sup>
Dynamic viscosity	500 cP



Model	MONO PUMP EZY STRIP MONO BLOC – Z18AC81RMB
Connection details	Suction DN125 BS EN 1092 –N16 Discharge: DN125 BS EN 1092 –N16
Electrical	7.5 kW, 415/3/50hz Variable speed motor

The sludge feed pumps are helical rotor type and located inside the polymer dosing area. They pump TWAS from the sludge balancing tank to each BFP. Each BFP has its own dedicated sludge feed pump, with no interconnections provided, and supplies 31.0m<sup>3</sup>/hr per BFP. The pumps are designed for maximum capacity of 120% of max BFP capacity (37.2 m<sup>3</sup>/hr).

Each sludge feed pump is skid mounted and fitted with a pressure relief valve to limit any pressure build up in the pump to limit spillage and pump damage. The pressure relief valve is fitted with a lever indicator connected to SCADA. The discharge of the pressure relief valve is connected to the suction of the pump to automatically stop the pump in the case of a high pressure event.

A flow meter is installed on the discharge of each sludge feed line to monitor the flow and control the speed of the pump. In the case of a low flow event, the pump will be stopped and a fault raised on SCADA.

Each Sludge feed pump has a dedicated wall mounted VSD located in the switch room and wall mounted Local Control Station located next to the pump

#### 1.4.4 Poly Batching & Dosing System

The polymer batching and dosing system objectives are listed below:

- Ability to dilute dry cationic polymer (SNF FO 4700 / BASF Zetag 8185)
- Have a dry storage volume of 4000 kg
- Ability to batch solution concentration between 0.2% - 0.4% water/volume (w/v) with multiple water sources (primary = potable, secondary = wash water)
- Polymer solution ageing time shall be 30 minutes as a minimum for all specified BFP operating conditions
- One dosing pump shall be dedicated to each BFP and the operation configuration of each polymer dosing pump shall match the configuration of each BFPs.
- Ability to supply continuously 120% of BFPs polymer demand at maximum solids load, maximum polymer dose and minimum batching concentration.

A total of one (1) polymer system shall be installed in the existing polymer dosing room in Gibson Island STP

The polymer storage and batching system is composed of:

- A dry bulk polymer hopper of 5m<sup>3</sup>.
- One dry bulk polymer silo
- One polymer feed system
- One batching and ageing tank
- One dosing tank
- One polymer dosing pump system
- One mixer in the batching and ageing tank

The final installed polymer dosing system consists of three (3) polymer dosing pumps (one pump shall be dedicated to each Belt Filter Press).

Each polymer dosing pump is fitted with:

- A flow meter
- A static mixer
- A pressure regulating valve
- Flushing connections on the suction and discharge sides

- A variable speed drive motor

Design Criteria	Final Installation
Polymer	Type Dry cationic polymer (e.g. SNF FO 4700 or BASF Zetag 8185)
Dry storage volume	5 m <sup>3</sup> x 0.75 = 3750 kg Polymer Bulk Specific gravity = 0.75
Batching concentration	0.20% -0.40% w/w
Batching water type	Primary: Potable water Secondary: wash water (to be used for batching if potable water is temporarily unavailable.) Wash water = service water boosted by wash water pumps.
Batching system continuous supply capacity	120% of BFPs polymer demand at maximum solids load, maximum polymer dose and minimum batching concentration.
Ageing time	30 – 60 minutes
No. of dosing pumps	3 No. Mono progressive cavity pumps
Dosing pump electrical	1.5 kW, 239 rpm, 1440/3/50, IP56, variable speed motor
Dosing pump size	1700 l/hr at 6 bar at 50Hz Suction DN32 BS EN 1092 –N16 Discharge:DN32 BS EN 1092 –N16
Operating configuration	1 x dosing pump dedicated to each BFP. Operating configuration of dosing pumps to match configuration of BFPs
Flow rate per dosing pump	Duty flow : 80 - 1200 L/hr Max flow : 1700 L/hr Pump turndown ratio of 10:1.
Dilution water type	Wash water ( from the wash water booster pump)
Diluted polymer concentration	0.05 -0.1 % w/w

Maximum dilution water per dosing pump discharge	3.78 m <sup>3</sup> /hr
Polymer Batching and Ageing System	Tomal, Volume = 4.2 m <sup>3</sup> , Diameter 2000 mm.
Polymer Dosing System	Volume = 4.2 m <sup>3</sup> , Diameter 2000 mm. Mono Pumps
Polymer Batching & Transfer pipe work	SS 316
Polymer transfer piping	U-PVC at skid connected to Flanged Stainless Steel – Schedule 40
Water & transfer	SS 316
Maximum Viscosity	2000 cps (pipe located between the dissolver cone and the ageing and batching tank ONLY)

The new Polymer Storage and Batching system includes a dry polymer storage silo, a dry polymer powder hopper equipped with a screw (powder) feeder, a dissolver cone, a polymer batching and ageing tank, a polymer dosing tank shown in Dwg. No. 486/5/5/0125-020.

The new polymer storage system is designed to store dry polymer powder and the new polymer batching system is designed to batch the polymer in a continuous process.

The dry polymer is delivered to the centre of the wetting cone through screw conveyors via a heated transition piece. A low volume of wash water is introduced at the top of the wetting cone to wash the sides. The main water flow through the ejector creates significant suction and provides the initial mixing energy required ensuring that all of the polymer grains are fully coated and that the polymer activation process is started. The resulting water/polymer mix is delivered via a non-return valve to the preparation (top) tank where it is gently stirred by a low speed, large diameter stirrer for the required maturing time.

The ejector ensures rapid activation of the dry polymer and limits the formation of “jelly fish” at the top of the batching and ageing tank.

The minimum preset maturing time is 30 mins, the maximum is 60 mins. Once polymer solution is mature, the dump valve, located on the side of the polymer batching tank, opens and the batch of polymer solution is transferred by gravity to the Polymer Dosing Tank.

The polymer batching operation is fully automated and controlled by Prominent (vendor) control panel. The vendor control panel controls the bulk polymer storage silo, screw feeder, dissolver cone, water inlet, polymer batching levels, dump valve and polymer dosing tanks levels.

The local control panel provides local control to operate electrical equipment in local mode and remote control to SCADA in remote manual. The vendor control panel is fitted with a Siemens S2-700 PLC and is communicating with the GE Fanuc PLC 6 (GE Rx3i) via Profibus.

A common feed pipe connects the polymer dosing tank to three polymer dosing pumps. Each BFP has its own dedicated poly dosing pump and feed pipe. No pipe work interconnections are provided between each of the BFP polymer feed pumps. Refer to Dwg. No.486/5/5/0125-021

The Polymer dosing equipment comprises of three identical, VSD controlled helical rotor dosing pumps, pipe-works, instrumentation, valves, fittings and connections mounted on skids (duty 1, duty 2 and duty 3, no standby).

Each pump has a dedicated VSD starter and a Local Control Station (LCS), the VSD starter is wall mounted in the switch room and the LCS is wall mounted next to the pump.

The diluted polymer is pumped to the polymer injection points located in the sludge line. Wash water can be added to the diluted polymer solution and mixed through an inline mixer prior to the first injection point. Two polymer liquid injections are available on the sludge line; the first injection point is located 10 metres upstream to the flocculator inlet and consists of a circular ring with four injection points located on the suction of the sludge inline mixer. The second injection point is located on the flocculator inlet and consists of one single tapping point.

Sludge pipe lengths between each BFP inlet and their respective sludge feed pump discharge varies due to configuration of the belt filter press area. As a result, all sludge inline mixers are installed at equal distance from the discharge of the sludge feed pumps in the polymer dosing area. Provisions have been made on the sludge piping to relocate the sludge inline mixer 10 meters upstream to the flocculator inlet if the commissioning results are not satisfactorily in order to fully comply with the manufacturer recommendations.

### 1.4.5 Overhead Crane

The Overhead crane objectives are listed below:

- Ease maintenance operation around the belt filter press area
- Reduce manual lifting operation around the belt filter presses
- Enhance safety and improve crane access and manoeuvrability

A new overhead crane was installed in the existing dewatering building in Gibson Island STP in lieu of the existing crane

- Overhead crane is rated to 500 kg
- Overhead crane hoist is motorised and fitted with a control panel (cable)
- Overhead crane trolleys are motorised in longitudinal and cross directions

Design Criteria	Final Installation
Civil structures	80 years
Mechanical and electrical plant/equipment	20 years
Control & instrumentation systems	10 years
Computer systems	5 years
Analytical and process instruments	10 years

The overhead crane is designed by Demag and installed to maintain and access each BFP during routine operations. The down shop crane rails are supported of the rafters by a proprietary system (Demag KBK System). The crane has a rated capacity of 500 kg SWL complete with electric hoist, down and cross shop electric drives. The overhead crane is controlled by a push button pendant hard wired to the hoist.

The single girder KBK-II crane beam operates on 20.5 m long KBK-II runway track spaced by 5.5 m centres span. Three electric friction drive units allow the complete crane to be motorised in all travel direction (N-S-E-W) together with hoisting.

The travel speed is between 7 and 27 meters per minutes (m/min).

The crane is used to remove the smaller rollers located in the BFP S-module press zone and to refurbish bearings and others ancillary items. The heaviest BFP roller is 1000 kgs (larger diameter) and shall not be removed with the 500kg Demag crane on site. If maintenance is required on the heaviest roller, the entire BFP shall be put on temporary rollers, removed from site and transported to a suitable facility where maintenance operations and repairs can be undertaken.

It is recommended to remove the entire BFP from site and to perform all maintenance operations at the same time in a suitable workshop. The BFP room is not a suitable work environment for extended period of time due to potential presence of pathogens in aerosols from the BFPs operating nearby.

The crane shall only be used in case of emergency, to perform quick repairs and to assist operators with heavy equipment.



## 1.5 Description of Process

The Sludge Dewatering system removes solids from the existing Bioreactors at a rate that ensures that the Bioreactors operate within the desired range of Mixed Liquor Suspended Solids (MLSS) and sludge age.

Waste Activated Sludge is drawn off the bottom of the two existing Picket Fence Thickener Tanks and pumped via the existing TWAS pumps to the existing Sludge Balance Tank located next to the dewatering building, in the South – West corner of Gibson Island STP. Scum from the surface of the existing Bioreactors is also harvested and pumped via the Scum Pumps to the existing Sludge Balance Tank.

The Sludge Balancing Tank is equipped with four multitrode level sensors (LowLow, Low, High, and HighHigh). The Sludge Balancing Tank is automatically refilled by the TWAS pumps (one per Picket Fence Thickener) located next to the main Gibson Island WRP office building when the level is low.

All supply pumps stop if the high level is reached in the Sludge Balancing Tank. The Sludge Balancing Tank is 2.44 m diameter and has a total volume of 8.416 m<sup>3</sup> (TWL 6.25 – tank floor RL 4.45). The Sludge Balancing Tank useful volume is 2.805 m<sup>3</sup> during normal operation (TWL 5.65 – tank floor RL 4.45).

The sludge flows by gravity to the sludge feed pumps and is then pumped to the BFP. Diluted polymer is injected to the sludge stream to flocculate solids before the mechanical dewatering process takes place through the BFPs.

Dry polymer is stored on site, in a silo, then transferred and mixed with water in a batching tank. The diluted polymer solution strength can be selected between 0.2 to 0.4% (0.1 % = 1 kg/kL water) and the ageing time can be selected between 30 to 60 mins. 30 minutes maturing time is the minimum acceptable time required by QUU to produce an effective polymer solution.

The coagulated sludge pours on to the top of the belts, and is captured by the top belt. The sludge is then dewatered by squeezing it between the two belts, and increasing the pressure as it passes around each roller. Finally, the dewatered “cake” is scraped off the belt and it falls on to the sludge collection conveyor.

See QUU PID drawings 486/5/5/0125-004 up to 486/5/5/0125-022

The process flow diagram (Dwg. No. 486/5/5/0125-004) indicates the flow connections between all equipment involved in the dewatering process in Gibson Island STP.

The Total Solids (TS) contents of sludge are used in the design of wastewater treatment facilities. Total Suspended Solids (TSS), including the volatile fraction (VSS), are commonly monitored to evaluate the degree of pollution in wastewaters and serve as a key process control parameter for wastewater treatment operation.

- VSS is reported as a percentage of TSS, rather than as mg/l in this report

- Sludge solids are reported in percentage solids as dry weight (1 % dry solids is approximately 10,000 mg/L).

The process design is based on a solid capture rate of 95 % and a Volatile Suspended Solids (VSS) concentration between 65% and 85 % of Total Suspended Solids (TSS), the average has been established by QUU and is equal to 77% of TSS.

Mass / flow balances represent two dewatering operating conditions listed in the table 7.2

Operating conditions	Sludge flow	% Dry Solids	Refer to Drawing No.
1	31 kL/hr	1.5	486/5/5/0125-007
2	24 kL/hr	2	486/5/5/0125-008

## 1.6 Functional Specification

The final as constructed functional specification has been issued to QUU as a standalone document. This document forms part of the O&M Manual Volume 5.

## 1.7 Design.

The final as constructed design report has been issued to QUU as a standalone document. This document forms part of the O&M Manual Volume 5.