Torres Strait Island Regional Council

Saibai Sewage Treatment Plant

Part 1: Condition Assessment

Part 2: Upgrade Options Study Report

Part 3: Environmental Evaluation

Revision B

November 2017

GANDEN Project No. 0615

GANDEN
ENGINEERS AND PROJECT MANAGERS

PLANNING ▶ DESIGN ▶ PROCUREMENT ▶ CONSTRUCTION ▶ COMMISSIONING ▶ O&M ▶ ASSET MANAGEMENT

Executive Summary

Torres Strait Island Regional Council (TSIRC) have been experiencing operational issues with the Saibai Island Sewage Treatment Plant (STP) resulting in in numerous breaches of the Environmental License conditions. The Department of Environment and Heritage Protection (DEHP) issued a "Notice to conduct or commission an environmental evaluation" to TSIRC on the 5th of June 2017 following several environmental non-compliances with the Environmental Authority (EA) EPPR00713013 for ERA 16-A(b)(ii).

The non-compliances noted are summarised as: -

1. Exceedances of effluent water quality parameters (numerous between November 2016 and January 2017);
2. Overflow of effluent from final effluent tank causing release of effluent into the coastal waters; and
3. Release of poorly treated effluent from the Saibai Island STP with the potential to cause environmental harm;

TSIRC has engaged GANDEN Engineers and Project Managers to undertake a condition assessment, environmental evaluation and options analysis for the upgrade of the Saibai Sewage Treatment Plant.

The Saibai STP was inspected by Aaron Bull (GANDEN) and Nick Steer (GANDEN) on the 1st August 2017. Tom Day (TSIRC) and Toni Veronese (TSIRC) were also present at the inspection. Previously, GANDENs Trevor Nel undertook a condition assessment of the water and wastewater infrastructure on the Saibai Island for the Department of Infrastructure, Local Government and Planning (DILGP) in 2016, which included a high-level overview of the STP. The previous Condition Assessment Report (Saibai Water and Wastewater Condition Assessment Revision A – December 2016) was used as a basis for this report.

The Saibai Sewage Treatment Plant (STP) is subject to a highly corrosive environment due to the tropical climate and proximity to the ocean. Evidence of severe corrosion and ultraviolet (UV) radiation was observed throughout the plant resulting in assets prematurely degrading. Some of the premature corrosion issues were caused by dissimilar metals being used without appropriate material isolation.

The overall condition of the treatment plant is poor and the treatment process has failed resulting in numerous breaches to the Environmental Authority discharge conditions. The failure of the treatment process is largely due to the failure of major equipment items (pumps, blowers, mixers and instrumentation). This is due to a combination of inappropriate specification of equipment and materials, coupled with the apparent lack of maintenance to the assets.

Rectification/Refurbishment Works Required

If TSIRC wish to refurbish the existing STP, the following works will be required (not limited to): -

1. Replace/repair the DN200 MDPE outfall pipeline extending the required 400m out to ensure the effluent release point provides suitable clearance from the foreshore;
2. Repair or replace the stainless-steel inlet screen and support structure. Fabricate out of suitable corrosion resistance materials and isolate dissimilar metals;
3. Installation of shade/roof over screen;
4. Refurbish the screenings collection trailer and sump;
5. De-sludge all tanks to remove solids accumulated to ensure proper flow paths are maintained;
6. Inspect fiberglass tanks and undertake integrity tests to determine actual residual life and refurbish if possible. Alternatively, replace all fiberglass tanks if 20-year life cannot be guaranteed;
7. Replace aeration blowers;
8. Replace WAS/RAS pumps (may be able to seek alternative recycling and wasting via gravity, therefore actuated valves);

9. Replace Aerobic Return Pump;
10. Replace supernatant pumps;
11. Replace Clarifier Lift Pump Station including tank, pumps and instrumentation;
12. Refurbish/clean and maintain the Clarifier and address corrosion issues;
13. Replace Flowmeters & actuated valves;
14. Replace pipework and pipe supports;
15. Replace corroded pump skids;
16. Replace all mixers;
17. Replace mixer support frames;
18. Repair/modify to walkways/platforms to conform to Australian Standards and rectify stability issues;
19. Replace structural bolts etc. that have perished on the platforms/walkways;
20. Replace all site run electrical cabling, cable trays, power outlets etc.;
21. Repair the site fence and front gate;
22. Replace the Final Effluent Pump Station, pumps and instrumentation;
23. Replace the Clarifier Sprinkler Pump and fittings;
24. Replace eyewash/safety shower with self-contained unit with tank;
25. Install purpose built Sodium Hypochlorite storage shed and dosing system conform the relevant Australian Standards;
26. Rectify operational issues with Potable and Service water supply to prevent contamination;
27. Replace all ABS and PVC pipework;
28. Replacement or refurbishment of the existing switchboard, RTUs etc. to suit modified plant;
29. Process design review and modifications ensuring required treatment is achieved. This would include the production of as constructed P&IDs, updated functional description and operating philosophy, O&M manuals etc.
30. Installation of SCADA systems;
31. Recommissioning of refurbished plant;
32. Operator training including daily checklists; and
33. Supply of spare pumps, instrumentation and the like.

The works outlined are the minimum work required to get the STP functioning, however, there is no guarantee that the tanks etc. will provide a long-term solution. Assets to be reused will need to undergo further condition assessment and possible refurbishment works to prolong their service life. Portions of the fiberglass tanks will be examined and tested to further understand their condition.

Recommendations

TSIRC have advised that the cost of providing infrastructure throughout the Torres Strait Islands can be anywhere between three and eight times higher than mainland costs due to the excessive costs of transporting equipment along with providing transport and accommodation for specialist labour on the island.

Due to the high costs of labour and equipment on the island, the whole-life-cost to refurbish the existing treatment plant may be higher than the whole-life-cost to replace the treatment plant with a purpose-built treatment plant designed specifically for the island.

It is recommended that the STP is replaced with a fit-for-purpose STP that is designed to be simple to operate and maintain, requires minimal operator input and can be remotely monitored and controlled via SCADA.

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Revision	Date	Description	Author	Reviewed	Approved
Rev A	October 2017	Issued for Client Review	A. Bull	N. Steer	D. Nutt
Rev B	November 2017	Issued for Approval	A. Bull	N. Steer	D. Nutt

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Contents

Glossary of Terms

Abbreviations	
DEHP	Department of Environment and Heritage Protection
DWQMP	Drinking Water Quality Management Plan
EV	Environmental Values
OH&S	Occupational Health and Safety
TSIRC	Torres Strait Island Regional Council
STP	Sewage Treatment Plant
WQO	Water Quality Objectives

1. Introduction

Torres Strait Island Regional Council (TSIRC) have been experiencing operational issues with the Saibai Island Sewage Treatment Plant (STP) resulting in in numerous breaches of the Environmental License conditions. The Department of Environment and Heritage Protection (DEHP) issued a "Notice to conduct or commission an environmental evaluation" to TSIRC on the 5th June 2017 following several environmental non-compliances with the Environmental Authority (EA) EPPR00713013 for ERA 16-A(b)(ii).

The non-compliances noted are summarised as: -

1. Exceedances of effluent water quality parameters (numerous between November 2016 and January 2017);
2. Overflow of effluent from final effluent tank causing release of effluent into the coastal waters; and
3. Release of poorly treated effluent from the Saibai Island STP with the potential to cause environmental harm;

GANDEN Engineers and Project Managers have been engaged by TSIRC to undertake an Environmental Evaluation, Condition Assessment and Options Investigation of the Saibai STP.

The Saibai STP was inspected by Aaron Bull (GANDEN) and Nick Steer (GANDEN) on the 1st August 2017. Tom Day (TSIRC) and Toni Veronese (TSIRC) were also present at the inspection. Previously, GANDENs Trevor Nel undertook a condition assessment of the water and wastewater infrastructure on the Saibai Island for the Department of Infrastructure, Local Government and Planning (DILGP) in 2016 which included a high-level overview of the STP. The previous Condition Assessment Report (Saibai Water and Wastewater Condition Assessment Revision A – December 2016) was used as a basis for this report.

Since the last Condition Assessment (2016), the STP has shown signs of further deterioration including electrical and mechanical failure.

1.1 Location

The Saibai Island STP is located on the western edge of the community. The effluent outfall is via a marine pipeline which discharges to the north of the STP.

Figure 1 - Saibai STP Locality Plan

1.2 Reference Documentation

The following reference documentation has been used for preparation of this report.

Table 1 – Reference Documentation

Description	Author	Year of Issue
O&M Manual Saibai New (draft)	Enviroflow	2008
Saibai Island STP O&M Manual	Enviroflow	2002
0370 – Saibai Water and Wastewater Condition Assessment Rev A	GANDEN	2016
Saibai Island Record Drawings (Original Plant)	Enviroflow	2001
Saibai Island Record Drawings (Upgraded Plant)	Enviroflow	2008
Upgrade of Boigu and Saibai Wastewater Treatment Plants – Design Report	GHD	2006
Saibai Island Drinking Water Management Plan	TSIRC	2016
MIP4 Regional Infrastructure Asset Replacement Report (Group C) – Revision 2	Aurecon	2010
MIP4 Group C RAIRP Final Report – Revision 2	Aurecon	2013

1.3 Influent Flows

Based on the Drinking Water Quality Management Plan (DWQMP), the current population of the Saibai Island is 480 people, projected to increase to 559 people by 2026. Based on preliminary investigations undertaken by TSIRC (limited data), the influent flows in dry weather conditions vary between 140 and 170kL/day.

1.4 Existing Treatment Plant Layout

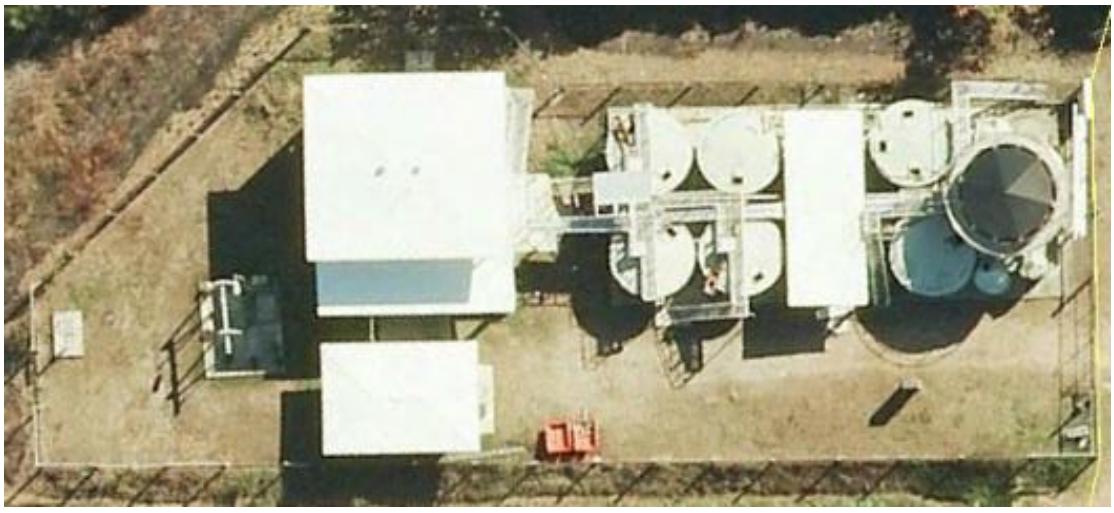

Figure 2 – Aerial view of the existing STP

2. Condition Assessment

2.1 STP Process Performance

During the site visit, the following operational, maintenance and safety issues were observed: -

1. STP in Bypass Mode – It was observed that the treatment plant was being bypassed and all flows were directed to the ocean outfall, this had only recently been bypassed, as wastewater was overflowing from screenings trailer and sump pump was active;
2. The static screen was overflowing due to buildup of slime/grit/screenings. Leaks were observed on the back and underside of the screen due to corrosion of welds and connections;
3. Screenings collection trailer was damaged (wheels fallen off);
4. A number of process pumps, blowers and instrumentation were not operational;
5. A section of the STP inlet works had severely deteriorated. Flanges were rusted and leaking and flowmeter did not appear to be functional; and
6. Clarifier was being bypassed due to the failure of the Clarifier Lift Pump Station.

2.2 Admin Building

The existing admin building was in good condition and had recently been upgraded in 2012. The following issues were identified: -

1. The outdoor air-conditioning units and associated supports and frames have corroded and will likely need to be replaced; and
2. Algal growth on the walls and roof.

Figure 3 – Admin Building over Drying Beds

Figure 4 – Corroded Air-conditioning units & algal growth on roof

2.3 Screen & Screenings Handling

The Static Screen was installed in 2008, the condition of the static screen appeared to have deteriorated significantly since the last assessment (2016). The following issues were identified: -

1. Severe buildup of slime, grit, rags and other putrescible due to lack of maintenance e.g. sprays, cleaning etc. leading to regular overflow of the screen;
2. A section of the STP influent pipeline is in poor condition with severe corrosion on flanges, bolts etc. resulting in leaks and release of raw sewage onto the ground;
3. Leaks were observed on the back and underside of the screening unit due to corrosion around welds and connections;
4. Flowmeter was not in operation and bypass valve actuator was covered in slime/algae preventing the position indication from being read (access to control valves is poor);
5. Screenings collection trailer was damaged (wheels fallen off); and
6. Sump grate was missing.

Figure 5 - Static Screen and Screenings Collection Trailer

Figure 6 – Inlet Works Area

Figure 7 – Inlet Works Area

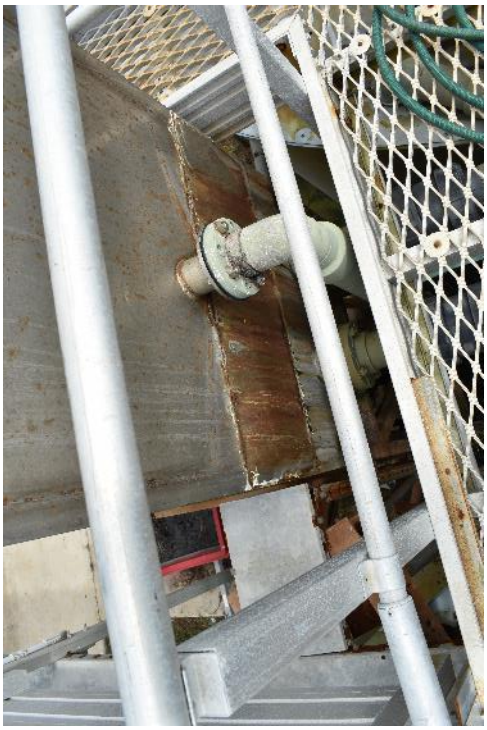

Figure 8 – Inlet Works Area

2.4 Drying Beds

The drying beds and associated pipework and valves were upgraded in 2012 and are in good serviceable condition. Some minor cracking was observed on external the blockwork and some vegetation growth can be seen in the drying beds.

Figure 9 - Drying beds

2.5 Supernatant Pump Station

The supernatant pump station well was in good structural condition and some vegetation growth can be seen surrounding the pump station. The submersible supernatant pump was not operating during the site inspection and the level in the well was quite high, possibly indicating that the pump was not operational.

Figure 10 - Supernatant Pump Station

2.6 Sewage Pump Station 1 (SPS 1)

Sewage Pump Station 1 (SPS 1) is located at the southern end of the treatment plant and delivers flows into the STP based on the level in the wet well. The SPS Manhole and Wet wells were installed in 2001 and remained in a serviceable condition with some corrosion evident around the invert of the inlet in the receiving manhole. All other components (lids, pumps, instrumentation, electrical, RTU etc.) were upgraded in 2016 and are in good condition.

Figure 11 - SPS 1 Screening Manhole (Corrosion near invert)

Figure 12 - Sewage Pump Station 1

2.7 Service Water Systems

All assets in the service water system appeared to be in serviceable condition, however, some operational issues were identified during the site visit, including the installation and operation of the service water systems. There are currently two service water tanks and booster pump systems located on the treatment plant site which are: -

1. Treatment plant service water system comprising of: -
    a. A storage tank;
    b. A Booster pump;
    c. A number of hose reels at various locations around the plant, and
    d. A safety shower and eyewash located at the storage shed.

Figure 13 - STP Service Water Tank (Booster set is located under the clarifier)

Figure 14 - STP Service Water Booster Pump (Located underneath the clarifier)

2. Sewage Pump Station 1 Service water system comprising of: -
    a. A Storage tank;
    b. A Booster Pump, and
    c. A Hose-reel.

Figure 15 - SPS 1 Service Water System

2.7.1 Operational Issues

As stated above, there are two service water systems on-site, which are connected in series. The current configuration of the service water is as follows: -

1. Flow from the reticulation network through an RPZ into the Service Water storage tank at the front of the plant (Figure 13);
2. Booster pump set draws from the Service Water Storage tank and the supplies service water network (hose reels, safety shower and eyewash) based on loss of pressure in the network;
3. SPS Service Water tank (Figure 15) fills via a connection taken off the service water network; and
4. SPS booster pump supplies the hose reel adjacent (Figure 15).

The following operational and OH&S issues have been identified: -

1. Service water storage tank sits adjacent to clarifier and has an open manhole with a high chance of contamination,
2. Emergency eyewash/safety shower is connected to the service water reticulation network. This is not compliant with AS 4775. The safety shower and eyewash shall be plumbed from the potable (drinking water) network;
3. Emergency eyewash/safety shower is remote to the sodium hypochlorite dosing system;
4. The booster pump located underneath the clarifier is switched on and off manually, therefore the service water tank at the pump station and, all hosereels, safety shower and eyewash is not operational.
5. A mixture of different coloured hosereels were available onsite which is not in conformance with AS2700; and
6. Service water booster pump was located underneath the clarifier, the suction and discharge pipework present a trip hazard and access to the pump is poor.

2.8 Treatment Process

The sewage treatment process consists of a series of hydraulically linked fiberglass tanks providing biological nutrient removal by mixing, aerating and recycling wastewater followed by a clarifier for solids removal and disinfection comprising of a sodium hypochlorite dosing and a chlorine contact tank for disinfection prior to discharge into via the ocean outfall.

The process is not being maintained and operated as per the design which has led to the DEHP issuing a non-conformance notice for exceedances in the effluent license conditions.

A number of issues were identified in relation to the biological treatment process including: -

1. Aeration blowers were not operational;
2. Clarifier lift pumps weren't operational resulting bypassing of the clarifier directly to the chlorine contact tank via an overflow pipe;
3. RAS/WAS and aerobic return pumps were not operational; and
4. STP was being bypassed during the site visit (reason for bypassing was unconfirmed at the time of the visit);

2.8.1 Fiberglass Tanks

The six fiberglass tanks are installed at the STP (Pre-Anoxic, Anoxic 1, Anoxic 2, Aeration 1, Aeration 2 and Chlorine Contact Tank) appear to be in a serviceable condition, the following issues have been identified: -

1. Some UV degradation was evident on all fiberglass tanks;
2. A number of patches exist at modified penetrations; and
3. Some tank roofs have collapsed in places.

The fiberglass tanks were installed in 2001 as part of the original STP design. The typical design life for fiberglass tanks is 25 years.

Figure 16 – Anoxic 1 Tank, corroded cable cable trays, fasteners etc.

2.8.2 RAS, WAS and Aerobic Return Pump Station

The RAS, WAS and Aerobic Return Pump Station was not operational during the site visit and, there was only a single pump installed (believed to be the RAS). The pump station is located central to the plant and access was poor. The

support frame is corroded and will require replacing in the future. It is noted that the WAS pipeline has become blocked as sludge has dried in the pipeline, this will need to be pigged, rodded or replaced to clear the blockage.

Figure 17 - RAS, WAS & Aerobic Return Pump Station

2.8.3 Anoxic Mixers

Only one of the anoxic mixers was in service during the site visit (there are 3 anoxic tanks), however, TSIRC confirmed all mixers are operational (power supply to the mixers may have been interrupted during the time of the visit). The mixers support frames are severely corroded and are not in a serviceable condition.

Figure 18 - Corroded mixer supports (typical)

Figure 19 – Corroded Mixer Supports (typical)

Figure 20 – Corroded Anoxic Tank Mixer (typical)

2.8.4 Aeration Blowers

The blowers were not operational during the site visit, these are being replaced with Jet Aerators under a current minor STP improvements project. As the blowers have not been operational in some time, the submerged diffusers within the tanks will be filled with sludge and TSIRC advised that the diffusers have not been routinely replaced and would be approaching the end of their service life.

Figure 21 - Aeration blowers (straight ahead) and old blowers (right) had not been removed from site

2.8.5 Clarifier Lift Pump Station

The Clarifier Lift Tank is situated at the back end of the treatment process underneath the Clarifier. This pump station was installed as part of the 2008 upgrade of the plant. Duty/Standby pumps transfer treated water to the Clarifier based on the level in the lift tank. During the site visit, it was evident that this pump station had not been operational for some time as the Clarifier was not being used (Figure 24). Flows were overflowing from the Clarifier Lift Tank into the Chlorine Contact Tank prior to being pumped out to the outfall. The following issues were identified: -

1. Staining can be seen around pipework penetrations indicating leaking;
2. The submersible Clarifier lift pumps were not operational therefore clarifier was being bypassed;
3. The old redundant dry mounted clarifier lift pumps and associated pipework was retained in situ and a flexible hose connection used to connect the new lift pumps into the discharge pipework (Figure 23); and
4. Access to the submersible pumps is poor, a ladder would be required to remove the pumps from the tank if required.

Figure 22 – Clarifier Lift Tank

Figure 23 - Clarifier Lift Pump Station (note: hose connection connecting into existing discharge, old lift pumps retained in situ, see bottom right of photo)

2.8.6 Clarifier

The Stainless-Steel clarifier was installed as part of the 2008 upgrade of the STP. It was evident that the clarifier had not been utilised for some time due to the failure of the Clarifier Lift Pump Station. The overall condition of the clarifier is good, issues identified include: -

1. There is evidence of surface corrosion in some places, particularly around the welds, bolts and washers. This corrosion appeared to be superficial and doesn't compromise the structural integrity of the Clarifier;
2. Walkways were wobbly in places, corrosion of fasteners was evident;

3. Supports for shade sale are corroding due to the lack of dissimilar metal isolation. Aluminum supports have been connected to the stainless-steel clarifier; and
4. Deflection plate for the clarifier sprinkler had fallen off.

Figure 24 – Clarifier with low level water level and stagnant water

Figure 25 - Corrosion of shade structure supports at connection to Clarifier

2.8.7 Clarifier Sprinkler Pump

The Clarifier Sprinkler Pump was not operational during the site visit. The following operational and OH&S issues were witnessed: -

1. Clarifier sprinkler pump was not operational;
2. Sprinkler deflection plate had fallen off; and
3. Clarifier sprinkler pump draws un-clarified effluent from the clarifier, midway up the Clarifier. This is an OH&S risk as the water being used is not clarified therefore solids are being discharged by the way of a sprinkler. The water has not been disinfected and has the potential to cause harm to operators through exposure to, or ingestion of the spray mist.

Figure 26 - Clarifier Sprinkler Pump

2.8.8 Chlorine Contact Tank

Clarified effluent flows from the Clarifier into the Chlorine Contact Tank. Sodium Hypochlorite is dosed into the transfer line at an operator-selected flow rate. As the Clarifier was not operational at the time of the site visit, the Clarifier Lift Tank was overflowing into the Chlorine Contact Tank. The tank had a significant amount of surface scum which gives an indication to the effluent quality discharging into the ocean.

A number of patches have been installed around penetrations on the Chlorine Contact Tank. The integrity of the patch work is unknown, some leaks were evident around patches.

Figure 27 - Chorine Contact Tank Penetrations

2.8.9 Final Effluent Pump Station

The final effluent pump station receives disinfected effluent from the Chlorine Contract Tank and pumps it to the ocean outfall. The pump station was operational at the time of the inspection; however, flows were minimal due to the plant being bypassed.

Some leaks were observed on the Final effluent tank, particularly on the incoming line into the tank. See image below.

Figure 28 – Connection into Final Effluent Tank

2.9 Sodium Hypochlorite Dosing

The Sodium Hypochlorite Dosing system does not comply with AS 3780-2008 – The Storage and Handling of Corrosive Substances. A number of OH&S issues have been identified including: -

1. Access to the Sodium Hypochlorite dosing system is poor, operators are required to manually handle the 200L drums;
2. The dosing pump is not properly supported and the support frame has been broken. A steel pole has been placed to support the protection cover;
3. The safety shower is located on the other side of the plant and not within the required distance, and the path from the chlorine dosing system to the safety shower is heavily obstructed; and
4. There is no dedicated bunding or storage for the dosing system.

Figure 29 - Sodium Hypochlorite Dosing System

Figure 30 - Sodium Hypochlorite Dosing System

Figure 31- Sodium Hypochlorite dosing point

2.10 Outfall Pipeline

The existing DN200 MDPE outfall pipeline was constructed in 2001 is designed to discharges into the ocean approximately 400m North of the STP. During the site visit, TSIRC advised the pipeline was cut several years ago due to a blockage in the pipeline, but are unsure of the exact location due to conflicting information between previous reports. The actual cause of the blockage is unknown; however, it is thought to be from one of the following: -

- Crustacean buildup within the pipeline;

- Buildup of silt in the pipeline;
- Damage caused by recreational use in the area i.e. boats, anchors etc; and
- Poor design or execution of the pipeline.

From investigations and the as-constructed drawing of the pipeline (dated 2001), the outfall pipeline has been trenched from chainage 0 to chainage 260 where it breaches (Note: this is from 2001, as this is located around the low tide level, it is likely the surface has changed). Ganden assumes that the pipeline was blocked and has been cutoff between chainage 250 and 400.

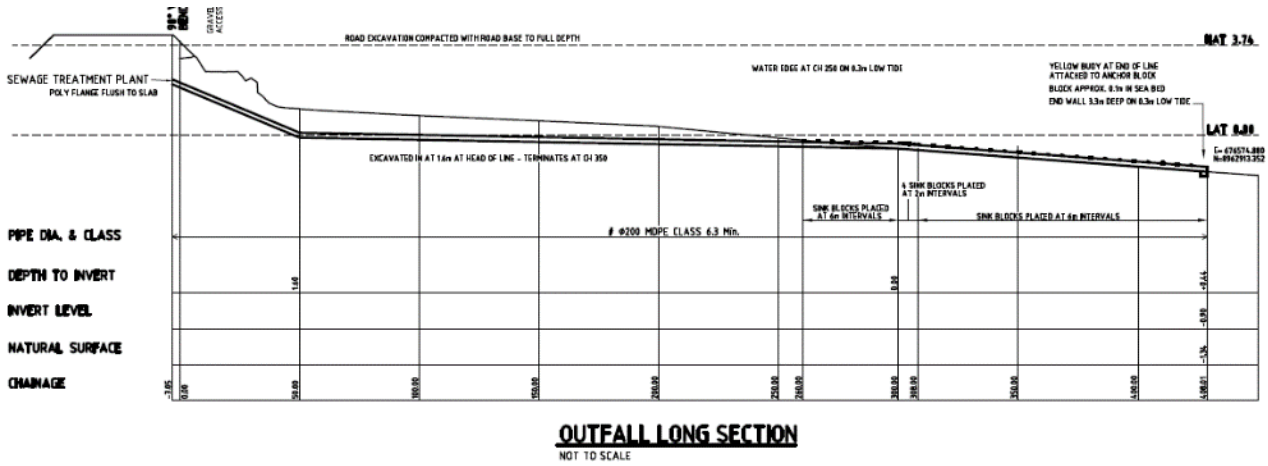

Figure 32 - Outfall Pipeline Long Section (From drawing 90014-15 dated 16/08/2001)

As the pipeline has been cut, it has been flagged as a breach of the STP environmental license. TSIRC are required to replace the cut section or replace the entire outfall pipeline. The condition of the existing pipeline is unknown.

2.11 ABS/PVC Pipework

The ABS/PVC pipework was in serviceable condition; however, the following issues were identified: -

1. Some UV degradation on the pipework is evident;
2. Some interconnecting pipework between tanks was poorly supported, increasing stress on connections and leading to leaks on the fiberglass tanks;
3. Existing galvanised pipe supports have suffered corrosion; and
4. Pipework is run along the ground and at head height throughout the treatment plant causing OH&S issues such as potential head clashes and trip hazards.
5. Low quality tank connections causing leaks (i.e. uniseals have been used for majority of connections and can be unreliable);

2.12 Walkways and Platforms

The platforms and walkways were in a serviceable condition with some corrosion of fixings which will need to be rectified. Some of the stairs, ladders, walkways and platforms were unstable and do not comply with AS1657-2013 – Fixed Platforms, Walkways, Stairways and Ladders.

The following issues were identified: -

1. Some of the platforms/walkways were unstable due to lack of supports and bracing;

2. Some of the stairs, ladders, walkways and platforms were unstable and do not comply with AS1657-2013 – Fixed Platforms, Walkways, Stairways and Ladders.
3. Structural bolts had corroded (potentially a partial cause of the stability issues); and

Figure 33 – Clarifier (missing handrailing)

Figure 34 - Corroded Structural Bolts on Platforms

2.13 Electrical & Instrumentation

The overall condition of the electrical assets at the STP is poor (excluding MCC). All site run cables, power points and instrumentation are in poor condition and are approaching the end of their service life.

The following issues were identified: -

1. All cable trays have suffered from severe corrosion and were falling to pieces. Pieces of the corroded cable trays were witnessed breaking off when the above platforms vibrated. This is and OH&S risk and at any stage under windy conditions (which are common on the island), the corroded cable trays could potentially pierce live electrical cables.
2. Two flowmeters were installed onsite, one on the influent (at the inlet works) and one on the RAS pipeline. Neither flowmeter was operational at the time of the site visit, however, TSIRC have advised that the influent flowmeter is now operational.
    a. RAS flowmeter – Evidence of surface corrosion and was not operational;
3. Float switches were in poor condition and not operational; and
4. Power points, cables and other electrical fittings were in poor condition.

Figure 35 - Severely Corroded Cable Trays

Figure 36 - Corroded Cable Trays

Figure 37 - Influent Flowmeter

2.13.1 MCC

Although the control room was locked and access was not possible. TSIRC advised that the switchboard was recently upgraded in 2012, is of a good quality and is in good serviceable condition.

2.14 STP Concrete Slab

A visual inspection of the concrete slab was undertaken and the slab appeared to be in serviceable condition with minimal damage or corrosion. Excavation adjacent to the slab at one location revealed that is 150mm thick.

Figure 38 - STP Concrete Slab

3. Asset Age and Condition

The following table summarises the asset age, condition and estimated residual life of assets associated with the STP.

Table 2 - STP Asset Age, Condition and Residual Life

Description	Year Installed/Upgraded	Asset Age (Year)	Typical Asset Life (Years)	Condition/Comments	Estimated Residual Life
Static Screen	2008	9	25	Average condition. Leaks present due to corrosion around welds and nozzles.	16[1]
Fibreglass Tanks (Biological Treatment Tanks inc. CCT)	2001	16	25	Average condition, UV degradation, A number of patches exist at modified penetrations.	9[1]
Clarifier Lift & Final Effluent Tanks (Polyethylene)	2008	9	15	Serviceable condition, leaks around penetrations.	7[1]
RAS Pump[2]	-	-	20	A single RAS pump was onsite but not operational.	0
WAS Pump[2]	-	-	20	No WAS pump was installed. WAS pipework is blocked.	0
Aerobic Return Pump[2]	-	-	20	No Aerobic Return Pump was onsite	0

Description	Year Installed/Upgraded	Asset Age (Year)	Typical Asset Life (Years)	Condition/Comments	Estimated Residual Life
Clarifier Lift Pumps	2008	9	2	Clarifier Lift Pumps were not operational	0
Final Effluent Pumps[2]	-	-	2	Final Effluent Pumps were operational.	5
Aeration Blowers	2008	9	2	Blowers were not operational	0
Influent Flow Meter[2]	-	-	10	Flanged on connecting pipework corroded. Operational	10
RAS Flow Meter	2008	9	15	Not operational	0
Supernatant Return Pump	2008	9	2	Not operational	0
Clarifier	2008	9	50	Serviceable condition, some surface corrosion around welds and connections	41
Chlorine Dosing Pump[2]	-	-	2	Serviceable condition, to be relocated, poor access and does not comply with AS.	1
Service Water Booster Pump[2]	2012	5	2.5	Poor access, to be relocated.	1
Service Water (Break of Head Tank)	2012	5	15	Tank to be relocated, contamination of potable	10

Description	Year Installed/Upgraded	Asset Age (Year)	Typical Asset Life (Years)	Condition/Comments	Estimated Residual Life
				water.	
ABS/PVC Pipework	2001	16	20	UV degradation in serviceable condition. Pipe supports corroded.	4
Electrical & Instrumentation	2008	9	15	Cable trays and cabling in poor condition and some power sources no longer operational	0
Pump Skids	2008	9	15	Severely Corroded	0
Anoxic Tank Mixers	2008	9	10	Mixers corrosion, only one mixer operational at time of site visit.	1
Mixer Support Frames	2008	9	20	Mixer support frames severely corroded. Some support columns had broken.	0
Safety Shower / Eyewash	2012	5	10	Safety shower and eyewash was too far from hypo dosing. Eyewash was not operational, no water pressure.	5
Electrical (MCC)	2012	5	15	MCC was in good condition.	10
Drying Beds	2012	5	50	Good condition.	45

Description	Year Installed/Upgraded	Asset Age (Year)	Typical Asset Life (Years)	Condition/Comments	Estimated Residual Life
Control Building – Structural	2012	5	40	Generally good condition, some cracked blockwork	35
Control Building – Roof	2012	5	20	Good condtion, some surface corrosion	15
Workshop/Storage Building – Structural	2012	5	70	Good Condition	65
Workshop/Storage Building Roof	2012	5	20	Good Condition	15
Roof Structure in Middle of STP	2012	5	20	Good condition, some surface corrosion.	15

[1] Asset requires refurbishment to achieve the residual design life; [2] Item has been replaced recently and year of replacement is unknown, a residual life of 5 years assigned due to corrosive environment;

4. Rectification/Refurbishment Works

The Saibai STP has experienced operational issues since the original plant was constructed (2001). The majority of assets at the STP have significant degradation and are in poor condition approaching the end of their useful asset life.

As the effluent quality criteria does not meet the requirements of the Environmental Authority (EA), process changes may be required in addition to refurbishment to meet the EA effluent limits.

If TSIRC wish to refurbish the existing STP, the following works will be required (not limited to): -

1. Replace/repair the DN200 MDPE outfall pipeline extending the required 400m out to ensure the effluent release point provides suitable clearance from the foreshore;
2. Repair or replace the stainless-steel inlet screen and support structure. Fabricate out of suitable corrosion resistance materials and isolate dissimilar metals;
3. Installation of shade/roof over screen;
4. Refurbish the screenings collection trailer and sump;
5. De-sludge all tanks to remove solids accumulated to ensure proper flow paths are maintained;
6. Inspect fiberglass tanks and undertake integrity tests to determine actual residual life and refurbish if possible. Alternatively, replace all fiberglass tanks if 20-year life cannot be guaranteed;
7. Replace aeration blowers;
8. Replace WAS/RAS pumps (may be able to seek alternative recycling and wasting via gravity, therefore actuated valves);
9. Replace Aerobic Return Pump;
10. Replace supernatant pumps;
11. Replace Clarifier Lift Pump Station including tank, pumps and instrumentation;
12. Refurbish/clean and maintain the Clarifier and address corrosion issues;
13. Replace Flowmeters & actuated valves;
14. Replace pipework and pipe supports;
15. Replace corroded pump skids;
16. Replace all mixers;
17. Replace mixer support frames;
18. Repair/modify to walkways/platforms to conform to Australian Standards and rectify stability issues;
19. Replace structural bolts etc. that have perished on the platforms/walkways;
20. Replace all site run electrical cabling, cable trays, power outlets etc.;
21. Repair the site fence and front gate;
22. Replace the Final Effluent Pump Station, pumps and instrumentation;
23. Replace the Clarifier Sprinkler Pump and fittings;
24. Replace eyewash/safety shower with self-contained unit with tank;
25. Install purpose built Sodium Hypochlorite storage shed and dosing system conform the relevant Australian Standards;

26. Rectify operational issues with Potable and Service water supply to prevent contamination;
27. Replace all ABS and PVC pipework;
28. Replacement or refurbishment of the existing switchboard, RTUs etc. to suit modified plant;
29. Process design review and modifications ensuring required treatment is achieved. This would include the production of as constructed P&IDs, updated functional description and operating philosophy, O&M manuals etc.
30. Installation of SCADA systems;
31. Recommissioning of refurbished plant;
32. Operator training including daily checklists; and
33. Supply of spare pumps, instrumentation and the like.

The works outlined are the minimum work required to get the STP functioning, however, there is no guarantee that the tanks etc. will provide a long-term solution. Assets to be reused will need to undergo further condition assessment and possible refurbishment works to prolong their service life.

5. Recommendations

Due to the poor condition of the STP, the residual life of major assets and the cost to completely refurbish and replace equipment, it is recommended that the STP is replaced with a new 'simple to operate' plant designed specifically for remote communities, with limited operational input.

TSIRC have advised that the cost of providing infrastructure throughout the Torres Strait Islands can be anywhere between three and eight times higher than mainland costs due to the excessive costs of transporting equipment along with providing transport and accommodation for specialist labour on the islands.

It is recommended that an Options Analysis for the upgrade of the plant is undertaken to compare whole-of-life costs of each option, the analysis should include the following options: -

1. Refurbish the existing treatment plant and associated outfall pipeline; and
2. Construct new STP and associated outfall pipeline.

The upgraded plant should be, as a minimum: -

1. Simple to operate and maintain with minimal operator input and maintenance required;
2. Able to have critical process parameters monitored/controlled remotely via SCADA; and
3. Be made from suitably selected materials that can withstand the highly corrosive climate.