Ordinary Council Meeting

26 March 2024

Late Attachments

These attachments to be retained for Council Meeting

Cliff Dredge

From: Tom Attwood <tom.attwood@dpie.nsw.gov.au>
Sent: Thursday, 21 March 2024 10:23 AM
To: Shaun Hill; Cliff Dredge
Cc: Karlene Panko; Clemencia Rodriguez Silva; Greg Mashiah; Pat Freeman; Keith Bolton; Warren Fuller; Hogan Gleeson; Andrew Potter
Subject: RE: 22425.1 - Baryulgil STP Upgrades – Major Works - Proposal

Hi Shaun,

Just confirming that this project is approved.

Cheers,

Tom Attwood
Senior Project Engineer
Aboriginal Communities Water and Sewerage Program (ACWSP)
Water
Department of Climte Change, Energy, the Environment and Water

M 0407 529 955 **E** tom.attwood@dpie.nsw.gov.au

From: Shaun Hill <shaun@ecoteam.com.au>
Sent: Friday, 15 March 2024 2:04 PM
To: cliff.dredge@clarence.nsw.gov.au
Cc: Tom Attwood <tom.attwood@dpie.nsw.gov.au>; Karlene Panko <karlene.panko@dpie.nsw.gov.au>; Clemencia Rodriguez Silva <Clemencia.RodriguezSilva@clarence.nsw.gov.au>; Greg Mashiah <greg.mashiah@clarence.nsw.gov.au>; Pat Freeman <patrick.freeman@dpie.nsw.gov.au>; Keith Bolton <keith@ecoteam.com.au>; Warren Fuller <Warren@ecoteam.com.au>; Hogan Gleeson <hogan@ecoteam.com.au>; Andrew Potter <andrew.potter@clarence.nsw.gov.au>
Subject: 22425.1 - Baryulgil STP Upgrades – Major Works - Proposal

Hello all,
Please see the attached proposal to upgrade the Baryulgil STP. Please note that deliverables under 22425.0 are attached with this proposal, including plumbing and sampling reports.

To answer Karlene's questions from earlier this week (sorry for being slow)

1. You mentioned that the effluent tests indicate treatment is adequate. Can you provide this data?
   Included in proposal.
2. You intend to install a poly chlorine shed in addition to the container, is it possible to include the chlorine dosing system in the new container?
   I have had bad experiences with chemicals inside shipping containers, my recommendations is keep them separate.
3. Will be good to see a design/layout as to what is planned.
   Tim has done up sketches to aid in the quoting, we have made minor changes since these were done so I wont supply them with the official proposal. However I can send them separate so you can visualise what we are proposing.
4. If there is potential for a new tank as well, consider this in the fencing plans.
   New tanks either at the start or end of the system can be retro fitted quite easily, yes fencing will need to be adjusted. I suggest if we are confident that a new tank would be going in we do it now, otherwise additional fencing for a potential tank would likely lead to wasted money possibly?
5. Do you intend to install risers on the access lids to prevent inflows during wet weather?
   Wet weather ingress seems to be a gravity mains issue, the STP has a reasonable diversion drain around the perimeter. Tanks sit approx. 100mm proud of the ground.

6. Will there be any interruptions to the service for the community and if so what is the management plan?
   Provided we can get the daily inflows down to sub 25kL we do not anticipate any interruptions for the community.

If you would like any additional information on the proposed scope or a greater break down of costs please let me know.

Regards,

Shaun Hill
Water Operations Manager & Licenced Asbestos Assessor

ecoteam
natural solutions for environmental challenges

www.ecoteam.com.au
mobile: 0447 272 313
office: (02) 6621 5123
address: 13 Ewing Street, Lismore NSW 2480
ABN: 82 106 758 123

Ecoteam acknowledges and respects the Aboriginal custodians of the land in which we work. We acknowledge Aboriginal history and connection to Country, spanning thousands of generations. We pay our respects to Elders past, present and emerging.

22425.1 - Baryulgil STP Upgrades – Major Works Proposal

Project Title:	22425.1 - Baryulgil STP Upgrades – Major Works
Job Number:	22425.1
Document Title:	Major Works
Date:	15/03/2024
	Quote valid for 14 days

13 Ewing Street, LISMORE
NSW 2480 Australia
Phone: (02) 6621 5123
Fax: (02) 6621 8123
Email: info@ecoteam.com.au
Web: www.ecoteam.com.au
ABN: 82 106 758 123

1 INTRODUCTION

1.1. Project Overview

The Baryulgil Sewage Treatment Plant (STP) consists of two primary digestion tanks, a rotating biological contactor (RBC) for secondary treatment and irrigation facilities. This treatment system has proven to be reliable and low maintenance over the past 15 years that Ecoteam has been providing operation and maintenance at Baryulgil Village.

In recent years, maintenance requirements have been increasing with tree root intrusion, aging electrical infrastructure and a lack of controls being of particular concern.

A Plumbing assessment of STP components has been included in **Appendix A**.

Sampling analysis of the treatment system was undertaken to confirm the treatment performance of the STP. See **Appendix B** for results.

1.2. Design issues

There are many issues hindering the Baryulgil STP which are compounded by a combination of old age and multiple 'add on' additions that have been grafted into the original design. A major over haul is required to get all systems talking to each other and bring all components up to current standards.

- Termite and ant damage to main control shed.
- No electrical controls for tank 3 pumps and tank 5 dam pumps.
- Separate power supplies and control circuits for related infrastructure.
- Non-compliant power supply from submains board.
- Severe heat stress on chlorine system.
- Aging tank and pipework infrastructure, allowing root intrusion.
- Hydraulic design issues during rain events.
- No communications system.

1.3. Hydraulic assessment

The STP is currently undersized for the daily hydraulic inflow. Sewerage inflow is estimated as 80% of potable water consumption by all buildings connected to the mains sewer and has exceeded 25kL per day on all readings since October 2023 (**Appendix C**).

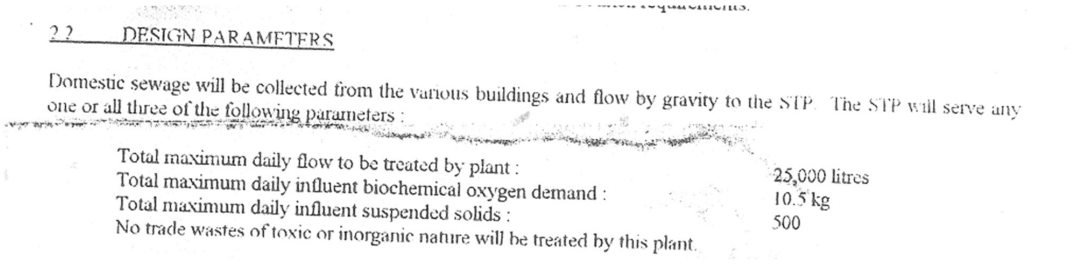
It is noted that the proposed treatment of river extracted water will create an additional wastewater stream. Ultra Filtration plants typically waste 10-15% of total processed water, therefore it is reasonable to expect an additional 3-4 kL per day of hydraulic loading when this upgrade occurs.

Through the analysis of **Table 1** it is evident that if the in house water leaks are repaired the STP has the ability to handle the average daily inflow plus the additional loading from the proposed WTP upgrade. However this will not allow for peak flows during busy times of year, funerals and flash flooding events.

Table 1. Analysis of long term water usage data to estimate sewage in flows.

Total days	Total usage (kL)	Average daily water consumption (kL)	Average daily sewage production (kL)
742	19355.798	26.086	20.869

Screen shot from original RBC proposal document. Note the total daily design flow is 25kL per day.



2.2 DESIGN PARAMETERS

Domestic sewage will be collected from the various buildings and flow by gravity to the STP. The STP will serve any one or all three of the following parameters :

Total maximum daily flow to be treated by plant : 25,000 litres
Total maximum daily influent biochemical oxygen demand : 10.5 kg
Total maximum daily influent suspended solids : 500
No trade wastes of toxic or inorganic nature will be treated by this plant.

Figure 1. Extract from works 'Baryulgil Square: Backlog Maintenance of Water Supply and Sewerage Management Infrastructure proposal'.

1.4. Previous upgrades

The STP has undergone several minor upgrades over the years since the original installation in approximately 1996.

2012

As a part of project 'Baryulgil Square: Backlog Maintenance of Water Supply and Sewerage Management Infrastructure' upgrades to the STP were undertaken. Works included can be found in **Figure 1, 2 & 3**. Works were primarily based around refurbishing the RBC.

Proposal

- Install high level alarm in primary tank.
- Replace all bearings on rotor shaft, inspect shaft on RBC.
- Inspect repair/replace rusted disc assembly on RBC.
- Clean and inspect/repair oil bath on RBC.
- Supply new rotor chain and sprockets to RBC drive gear.
- Fit new rotor drive motor and gearbox to RBC. Repair and recondition exiting as spares.
- Install high level alarm in tertiary tank.
- Repair fire damage to RBC lid.
- Remove fire damaged matting, apply new aggregate to compound grounds.

Figure 2. Extract from works 'Baryulgil Square: Backlog Maintenance of Water Supply and Sewerage Management Infrastructure proposal'.

3.3 Sewage Treatment Plant		
Repair and refit RBC	Grafton Power Products	$50,151.82
Field Assistant - 2 days	ecoteam	$654.55
Supervisor - 2 days	ecoteam	$1,745.45
Travel - 2 days	ecoteam	$510.40

Figure 3. Extract from Baryulgil Square: Backlog Maintenance of Water Supply and Sewerage Management Infrastructure showing costings associated with the proposed works.

Sewage Treatment Plant

Ecoteam engaged Grafton Power Products to conduct an assessment of the Rotating Biological Contactor which took place on 8 August 2011. During the assessment stage it was identified that the sump of the RBC was compromised and leaking in several points including into the oil sump. It was resolved to render the RBC chamber as part of the project as it was essential work, and was able to be incorporated into the budget without overextending it.

Figure 4. Extract from 'Milestone Report 4: Baryulgil Backlog Maintenance Works' detailing variation to reseal the RBC.

2013

During late 2009, Ecoteam and Thinkwater Alstonville submitted a design for a surface irrigation system which was subsequently approved by Council. Funds were approved for construction of the system in 2011.

Upgrades within the STP occurred to support the installation of the 3 new irrigation fields including –

- Central control panel – Including galvanised shed housing and electrical control panel.
- Tank 5 - Duty/standby transfer pump set, alarm and backup disinfection.
- Chlorine dosing pump and tank.
- A 40kL Colourbond Irrigation tank (tank 6).
- Duty standby irrigation pump set, including auto backwashing filters.

1.5. Recent maintenance projects

Over the past 3 years the STP has been progressively experiencing an increasing amount of minor failures and breakages. A list of works projects relating the STP below -

- 22425.0 - Baryulgil STP upgrades - Pre Planning Works. This project made allowance for a plumbing inspection and report, a one off sampling event to quantify the treatment performance of the STP.
- 20045 - Bary STP Electrical Issue Tank 5 - Emergency Works – Pump controls failed in tank 5.

- 20227 - Baryulgil STP blockage T4-T5 – Tree root ingress into the pipeline between tank 4 and tank 5.
- 20263 - Baryulgil STP Tank 6 pump and irrigation float failure – Irrigation pump wet end failure.
- 20465 - Baryulgil & Mala STP Emergency call out – Tank 5 transfer pump fault.
- 21129 - BARY - STP Pump controls Tank 3 – Failed displacement float on tank 3 and tank 5.
- 21222 - Baryulgil STP possible blockage tank 4 - Tree root ingress into the pipeline between tank 4 and tank 5.
- 21171 - Baryulgil Sump pump repair RBC – Sump sludge pump failure and replacement.
- 21304 - Baryulgil STP replace floats in tank 5 – Replace floats in tank 5.
- 21395 - Baryulgil STP Chlorine Injector Service - Oct 21 – Service of chlorine injector.
- 21470 - Baryulgil STP Tank 3 pump fail - Emergency works – Pump failure in tank 3.
- 22002 - Baryulgil STP tank 6 issues – Irrigation timer failure.
- 22154 - Baryulgil STP power supply issue - April 22 - Emergency works – Power supply failure in the submains board.
- 22375 - Baryulgil STP tank 5 duty cycle fault 10/22 - Emergency works – Duty cycle control failure and 12v power supply issues.
- 23123.1 - Baryulgil STP timer and pump issues - Emergency works - Irrigation timer failure. Fault found to be caused by ant ingress.
- 23123.2 - Baryulgil STP Timer and Pump Issues - Pump repairs and servicing – Irrigation timer replacement, servicing of 4 pumps across tank 5 and tank 6.

1.6. **Recommendations**

Ecoteam is proposing a major upgrade of the Baryulgil STP. Given the recent refurbishment of the RBC, it is thought that the majority of the upgrade will be electrical upgrades, allowing for full control over all pump and control systems.

Ecoteam also acknowledges that this proposal is primarily an Electrical upgrade, no upgrades are proposed for the hydraulic or nutrient treatment capacity are proposed. On this basis, the inflow to the STP needs to be addressed. Currently the hydraulic capacity of STP is being exceeded by the community sewerage generation. The source of the inflow has been identified as in house plumbing leaks and must be delt with outside of this proposal.

The gravity mains into the STP allows for ingress of storm water which inundates the STP during high rainfall events. This issue will not be addressed under this proposal and needs to be considered.

LORA upgrades originally proposed under this project have been removed due time constraints. The upgrade will be installed LORA ready, to allow for future retrofitting of a LORA based communications package.

1.7. Additional Works Recommendations

The wet weather dam conveyance line is in poor condition. The line has several raisers that have previously been used as irrigation points (**Figure 12**), these poly raiser have been burnt and would likely leak effluent into the adjacent waterway. The pipe is rural poly, which typically indicates that it is 50+ years old. Ecoteam have been patching multiple leaks found in this line under projects 22268.0 & 22268.1 and expect that the entire length will be failing and leeching effluent into the waterway that separates the STP and wet weather storage dam.

2 Scope of works

2.1 Scope of works – Major Works Project (22425.1)

Table 2 contains proposed scope of works for the major upgrade component.

Table 2. Scope of works for 22425.1 - Baryulgil STP upgrades – Major Upgrade.

Trade	Location	Item	Details
Plumbing	Tank 4	V notch weir	Remove and replace with outlet T baffle
Plumbing	Tank 4 + 5	Inlet pipe	Repairs to tank perforations and replacement of gravity line from 4 to 5
Plumbing	Tank 6	Investigate tank liner	Assess tank liner and why it leaks when high level
Plumbing	Tank 6	Replace tank 6	Would be quoted as a variation if the liner is not repairable
Electrical	Container	Container appearance	Ensure container presents well due to high visibility location
Electrical	Container	Container	Supply and fit out container for electrical controls, include shelving, GPOs, lighting and ventilation
Electrical	Tank 3	Pump controls	Improve controls for tank 3 pumps, including standard protections, duty cycle, run + alarm lights, manual run
Electrical	Tank 5	Pump controls	Improve controls for tank 5 pumps, including standard protections, duty cycle, lights, manual run
Electrical	Tank 6	Dam pumps	Improve controls for tank 5 dam pumps, including standard protections, duty cycle, lights, Including high level switching from irrigation field to dam
Electrical	Tank 6	Pump controls	Improve controls for tank 6 pumps, including standard protections, duty cycle, lights, manual run
Electrical	Tank lids	Tank 1	Improve and seal tank access lids
Electrical	Tank lids	Tank 2	Improve and seal tank access lids
Electrical	Tank lids	Tank 3	Improve and seal tank access lids
Electrical	Tank lids	Tank 4	Improve and seal tank access lids
Electrical	Tank lids	Tank 5	Improve and seal tank access lids
Electrical	Tank lids	Tank 6	Improve and seal tank access lids
Electrical	Chlorine enclosure	Chlorine enclosure	Purchase and install enclosure, with sun protection on western side
Electrical	Tank 6	Access platform	Supply and install access platform
Electrical	Container	Effluent filters	Manualise system - Relocate filters into shipping container, including pressure gauges, drain lines and shut off valves. Supply new filter housings and disks.
Electrical	STP	Fence	Modify and install new fencing

Electrical	STP	Power supply	Investigate, design and install suitable power supply from mains to STP
Electrical	STP	Power supply	Excavate in accordance to asbestos management procedures
Electrical	STP	Radar floats	Quote for radar on all controls
Electrical	STP	Online monitoring	Provide access to alarms and monitoring
Electrical	Container	Flow meter	Install flow meter
Ecoteam	Project management	Project management	Project management
Ecoteam	STP	Trees	Install native shrubs/trees for aesthetics and shading
Ecoteam	Asbestos supervision	Air monitoring	Set up, manage and report on air monitoring for 6 days
Ecoteam	Asbestos soil sampling	Sampling for asbestos	Sample proposed areas prior to excavations to identify area of high risk
Ecoteam	Trees	Tree planting	Ecoteam proposed to plant trees to create a visual barrier to soften the aesthetic of the STP

3 Variations

All potential variations will be raised with the client as soon as they are identified. Please note that likely variations are –

- Replacement of tank 6 due to liner issues. Liner replacement has been quote at $15,000 which is equivalent to the price of a new tank. Ecoteam endeavour to find and repair the issue with the existing issue and avoid this cost.
- Significant asbestos contamination found in sampling may increase costs. In most instances a suitable area should be available without increasing costs.

Project component	Cost (Inc GST)
Additional excavation due to rock or unforeseen items	Contractor costs + 15%
Damage to or alterations due to underground services	Contractor costs + 15%
Extreme weather events, including wet weather delays including erosion and sediment controls due	Contractor costs + 15%
Additional design work due to unforeseen circumstances, community events, community concerns, unforeseen contamination, heritage and flora/fauna ect	$152.75 per hour (Inc GST)
Additional design works/ applications requested by essential energy	Contractor costs + 15%
Replacement of tank 6 liner/ tank	Contractor costs + 15%
Liquid waste removal due to excessive inflows	Contractor costs + 15%
Additional labour and materials due to excessive inflows	Contractor costs + 15%
Works to investigate/ repair gravity mains	Contractor costs + 15%
Additional labour/ materials required to mitigate risk of asbestos contamination identified by soil sampling	Contractor costs + 15%

4 Proposal

2.1. **Costings for proposed works**

It is proposed that progress invoices will be issued through out the project along with works to date reports.

QUOTE

Clarence Valley Council - RAMP Works
Locked Bag 23
GRAFTON NSW 2460
ABN: 85 864 095 684

Date
15 Mar 2024

Expiry
29 Mar 2024

Quote Number
22425.1

Reference
22425.1 - Baryulgil STP upgrades - Major Upgrade

ABN
82 106 758 123

Ecotechnology Australia Pty. Ltd.
13 Ewing Street
LISMORE NSW 2480
AUSTRALIA

Description	Quantity	Unit Price	GST	Amount AUD
Ecoteam				
Project management	1.00	20,087.30	10%	20,087.30
WHS + QA	1.00	2,350.00	10%	2,350.00
Asbestos management	1.00	17,994.30	10%	17,994.30
Asbestos sampling	1.00	8,660.25	10%	8,660.25
TJM Plumbing				
Plumbing repairs	1.00	4,530.49	10%	4,530.49
Tank 6 repairs - Maximum estimate	1.00	6,325.00	10%	6,325.00
Tank 6 replacement - Additional	1.00	0.00		0.00
AAE Industries				
Project costs	1.00	9,970.50	10%	9,970.50
Site establishment	1.00	9,896.90	10%	9,896.90
Shipping container - Materials	1.00	16,884.30	10%	16,884.30
Shipping container - Preparation of site	1.00	10,377.60	10%	10,377.60
Consumer mains supply line	1.00	23,875.15	10%	23,875.15
Electrical control panel	1.00	26,450.00	10%	26,450.00
Sub main power	1.00	4,761.00	10%	4,761.00
Level sensors - Radar	1.00	9,973.26	10%	9,973.26
Electrical install	1.00	17,480.00	10%	17,480.00

Description	Quantity	Unit Price	GST	Amount AUD
Hydraulic install	1.00	31,967.84	10%	31,967.84
Chlorine shed	1.00	4,468.90	10%	4,468.90
Tank 6 ladder - Concrete slab	1.00	4,418.30	10%	4,418.30
Tank 6 ladder - Materials	1.00	7,038.78	10%	7,038.78
Tank lids - 10 x aluminum lids with fall grate	1.00	47,309.63	10%	47,309.63
Fence modifications - Chain wire fence to match existing	1.00	16,856.70	10%	16,856.70
Tank 6 - lid including additional bracing if required	1.00	7,521.00	10%	7,521.00
		INCLUDES GST	10%	28,108.87
		TOTAL AUD		**309,197.20**

Terms

28 days

Appendix A. **Plumbing Assessment**

1 Plumbing Report

1.1. Tanks 1 and 2 (septic tanks)

Two 20,000L non baffled concrete tanks. Structural integrity visually solid, with the option to epoxy seal perforations should they fail.

SERIES 6 RBC 3.

2.7 PRIMARY & SECONDARY SEWAGE TANKS

Provide two (2) *3.4 dia. x 3.0 metre deep precast reinforced concrete tanks* having a combined effective volume of 37,600 litres. Inlet is to be one (1) 150 mm dia. dropper, outlet of tank is to be a 150mm dia. dropper to prevent short-circuiting. Tanks to be inter-connected by two (2) 300 dia. PVC conduits to allow for sludge dispersion between tanks. All tanks to be fitted with 600mm x 1200mm long x 6mm thick aluminium checker-plate covers.

Tank 3 (Pump well into RBC)

One 10,000L concrete pump well. Structural integrity visually solid, with the option to epoxy seal perforations should they fail.

2.8 PUMPWELL (BALANCE TANK)

Provide one (1) 2.5 dia. x 2.7 metre deep precast reinforced concrete pumpwell (balance tank) having an effective volume of 9,000 litres. Effluent to be metered at a uniform rate to RBC No. 1.

RBC

Resealed in last 10 years. Gear oil and chain set up frequently results in oil inundation and contaminates being transported throughout sewage network.

Consider pulley and belt or dry chain assembly.

Sludge pump and gear motor can be serviced and replaced as needed. Drive shaft bearings are serviceable, discs appear in good condition.

2.9 ROTATING BIOLOGICAL DISC SECTION

Provide one (1) 2.1 wide x 6.3 long x 1.6 metre deep precast reinforced concrete rotating biological disc tank having an effective working volume of 7,800 litres and a minimum retention period of 6 hours. The tanks will be baffled into four (4) separate compartments. There is to be a total of 200 discs each having an effective surface area of 5.08 square metres. The discs are rotated on a SS central drive shaft which in turn is driven by a suitably sized gear motor.

Tank 4 (Clarifier tank)

V notch baffle failed, needs to be repaired or replaced. Gravity outlet to tank 5 has previously been repaired due to tree root intrusions. Recommend replacing outlet pipe work and resealing perforation into tank 4.

2.10 CLARIFIER NO. 1

Provide one (1) *3.4 x 3.0 metre deep precast reinforced concrete clarifier* having an effective volume of 18,800 litres. The tank will meet the following design conditions :

(a) maximum surface overflow rate of 1,000 litres per sq. metre per hour
(b) maximum weir overflow rate of 2,000 litres per metre per hour
(c) minimum detention time of 4 hours at average daily flow

The tanks are to be fitted with an inlet dropper, outlet baffle and 3 metre long weir box and automatic sludge removal facilities. All tanks to be fitted with 600mm x 1200mm x 6mm thick aluminium checker plate covers.

Tank 5 (Transfer tank)

Significant corrosion above operating height, inlet requires re-sealing.

Tank 6 (Irrigation tank)

One 40,000L metal tank with plastic liner. Liner appears to have slipped or spilt, tank leaks before overflow height.

2.11 CLARIFIER NO. 2 (CONTACT TANK)

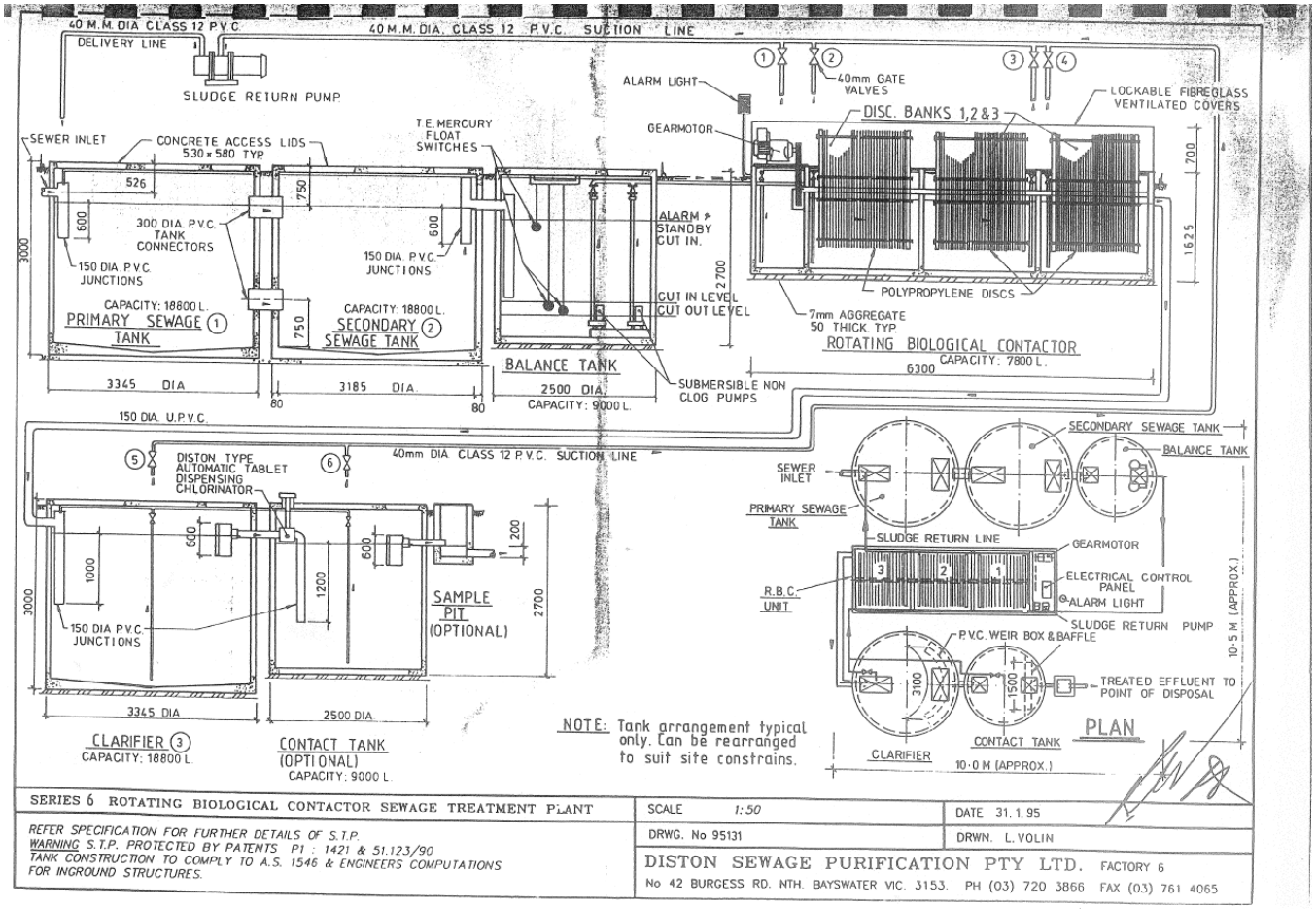
Provide one (1) 2.5 dia. x 2.7 metre deep precast reinforced concrte clarifier having an effective volume of 9,000 litres. Design conditions as for Clarifier No. 1.

Wet weather dam

Pipeline to dam in question over condition and age.

Scrape in a spill way to allow overflow into the irrigation field instead of road side gully, can be done with the pump out line job.

2 Original Design Schematic



3 Photos

Figure 1. Baryulgil Sewage Treatment Plant.

Figure 2. Corrosion on the inlet to tank 5.

Figure 3. Termite damage within the main control shed.

Figure 4. Termite damage and moisture rot damage within the main control shed.

Figure 5. Main control shed flooding during major rain event.

Figure 6. RBC flooded due to electrical issue resulting in high water levels.

Figure 7. Float tangling due to poor design and limited tank space.

Figure 8. Irriagtion pumps in irriation shed. Note corrosion to the galvanised shed.

Figure 9. Damaged raiser that has been capped off. This raiser had been burnt and hidden in long grass, testing revealed this pipe is associated with the STP to wet weather dam pipeline. Many more like this have been located and capped.

Figure 10. Wet weather dam at high level due to perlonged electrcial control issues plaging the irrigation system.

Appendix B. **Sampling Report**

Project No. 22425.0
Baryulgil Effluent Quality

Treatment Performance
of
Baryulgil Wastewater Treatment Plant

1. Background

Planning is in process to upgrade the Baryulgil Wastewater Treatment Plant (WWTP). The treatment train of the WWTP consists of

- **2 x 15 kL concrete primary digestion tanks** (Tank 1 & Tank 2) arranged in series. Primary treated effluent flows to the primary pumpwell (Tank 3) which conveys effluent to the downstream RBC.
- **Rotating Biological Contactor** (RBC) with three tanks in series. Effluent from the RBC flows to a 15 kL clarifier.
- **Clarifier** with V-notch weir (Tank 4). A sludge pump conveys settled solids from the clarifier back to the first primary treatment tank. Clarified effluent flows to the secondary pumpwell (Tank 5) which conveys effluent to the Disinfection / Irrigation Tank
- **Chlorination system.** When the secondary pumpwell activates, it also activates a chlorine injector which injects chlorine into the Disinfection / Irrigation Tank.
- **Effluent Irrigation System.** Effluent is irrigated to three irrigation zones around Baryulgil Village. The pumps are activated by a timer at 2 am to minimse the risk of human contact.

As part of the planning process, the treatment performance of the Baryulgil WWTP was investigated. This document presents the outcome of a one-off sampling programme.

2. Method

Water samples were collected from the inlet primary digestion tank (tank 1) and the irrigation tank (tank 6) by Cail Cooper on 18 October 2023. Refer to **Figure 1**. Samples were collected using a plastic sample bottle secured to an extendable sampling rod. To minimise the risk of cross-contamination, effluent was sampled first from the effluent irrigation tank (as it was most likely to have lower concentration of analytes) followed by the primary digestion tank. The sample rod was cleaned and disinfected between samples.

Effluent from the irrigation tank was collected from the tank inspection lid and the sample rod was used to collect a subsurface sample. In order to collect a representative sample from the primary digestion tank, a section of the

scum layer was first removed using a trowel and the sample was collected from the clear-water section of the tank using the sample rod and bottle. Samples were poured into the appropriate sample containers.

Samples were placed into an iced esky immediately after sampling, stored in the fridge overnight, then couriered to Chatswood Envirolab.

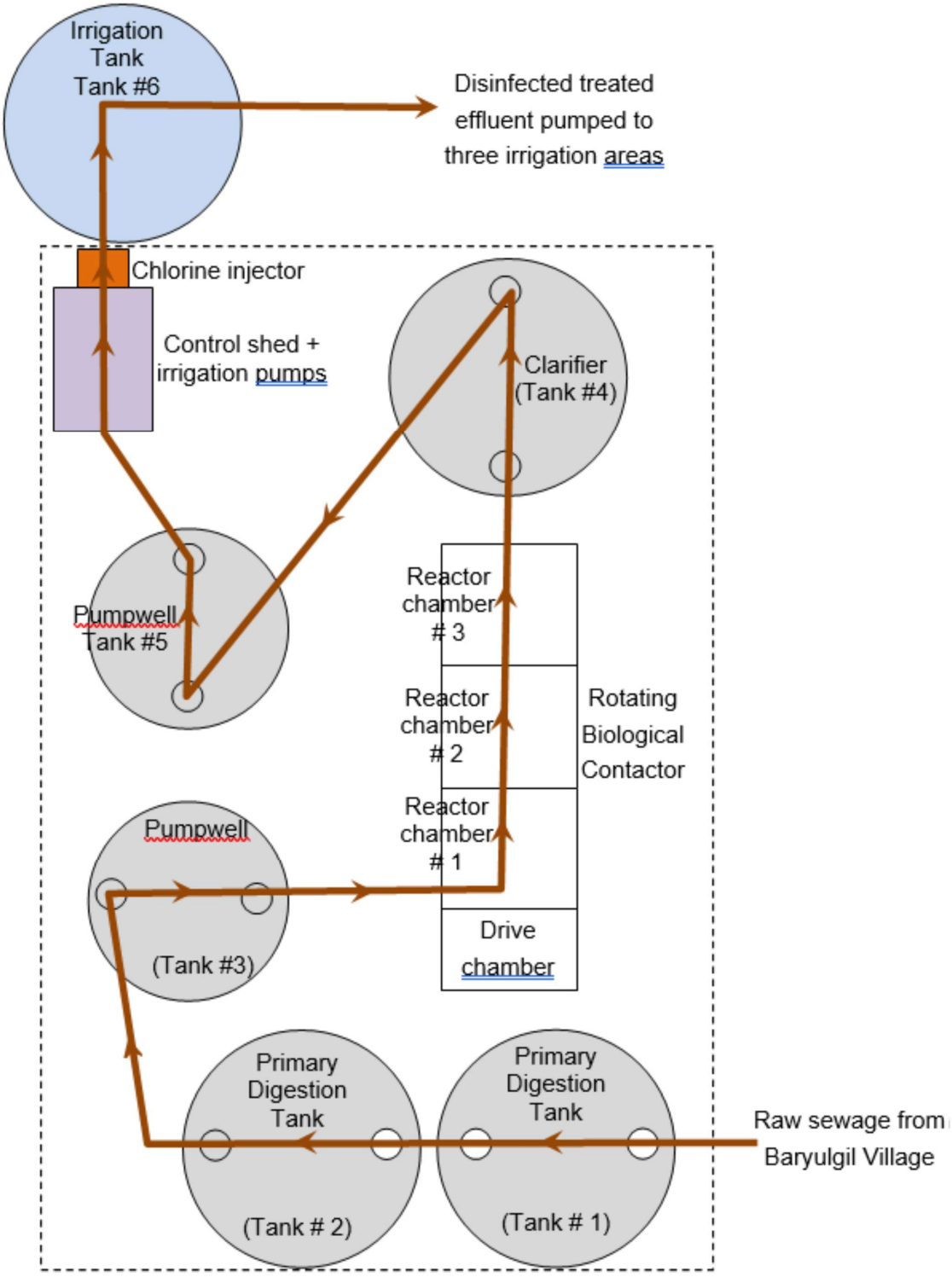


Figure 1. Layout of the Baryulgil WWTP

3. Results

3.1. NSW Secondary Treatment Standards

3.1.1. TSS and BOD

The Total Suspended Solids (TSS) and Biological Oxygen Demand (BOD). concentrations of primary tank effluent and irrigation tank effluent were 3,300 mg/L and 1,680 mg/L, respectively which is around an order of magnitude higher than a typical septic tank. Despite these high inlet concentrations, TSS and BOD concentrations in the irrigation tank were 5 mg/L and <5 mg/L, respectively.

3.1.2. Bacteria

The primary tank sample had *E. coli* concentrations of 3.5 x 10^5 mpn/100mL, however *E. coli* concentrations in the irrigation tank had dropped below the laboratory detection limit of <18 mpn/100mL, representing >99.99% reduction in *E. coli* concentrations. All of the faecal coliforms detected in the primary tank sample were E. coli.

3.1.3. Secondary treatment performance

The NSW Health Standards for Advanced Secondary Treatment with Disinfection require final effluent to comply with the following standards:

Table 3. Standard for secondary treatment performance with nutrient reduction.

Parameter	Standard
BOD (mg/L)	<10 mg/L
TSS (mg/L)	<10 mg/L
E. coli (mpn/100 mL)	<10 cfu/100 mL

The BOD and TSS concentrations in the sample from the disinfection/ irrigation tank easily conformed to the NSW Health Standards for Advanced Secondary Treatment. The Advanced Secondary Treatment with Disinfection stipulate an *E. coli* concentration of <10 cfu/100 mL which is less than the detection limit of the laboratory.

3.2. Nutrients

3.2.1. Total Nitrogen

Total Nitrogen (TN) concentrations in the primary digestion tank and irrigation tank samples were 32 mg/L and 7.0 mg/L, respectively. This represents a 78% reduction in TN concentration through the treatment train.

3.2.2. NH_4 Nitrogen

NH_4 was the predominant form of TN in the primary effluent sample. The NH_4-N concentrations in the primary digestion tank sample was 31 mg/L, however had decreased to 0.005 mg/L through the treatment train. Essentially all of the NH_4-N was removed through the treatment train. This demonstrates that the aerobic nitrification processes which convert NH4-N into oxidized forms of nitrogen including NO_3^- and NO_2^- are very effective.

3.2.3. NOx Nitrogen

Th NOx-N concentration in the primary digestion tank sample was below the detection limit of 0.005 mg/L, however the concentration had increased to 5.8 mg/L at the end of the treatment train and was the predominant form of nitrogen in the final effluent. This is normal due to the nitrification/ denitrification process that take place in biological treatment systems.

3.2.4. Organic Nitrogen

Since TKN concentrations were measured in the sample program, the organic nitrogen concentrations in the two samples were calculated. Organic N concentrations in the primary and irrigation tanks were 1 mg/L and 1.2 mg/L, representing a minor fraction of TN content in both samples. However organic N represented a higher fraction in the final effluent compared with the primary tank sample (3% compared with 17%).

3.2.5. Phosphorus

PO_4-P concentrations only were investigated in this document. However, given the low load of organic N detected in two tanks, and based on experience, it is likely that PO4-P comprised the great majority of the total P in both tanks.

PO_4-P concentrations in the primary digestion tank and irrigation tank samples were 5.9 mg/L and 0.95 mg/L, respectively. This represents a 84% reduction in PO_4-P concentrations through the treatment train.

3.2.6. Nutrient targets.

The 2010 Baryulgil Effluent Irrigation Design (Bolton and Carnavas, 2010) relied on sample results from 2010 to estimate final effluent quality and to calculate the irrigation field sizing. Of particularly note, the 2024 sample results had considerably lower TN and TP concentrations than the 2010 sample results. In addition, the 2024 removal rate through the treatment train was considerably higher than the 2010 removal rate (**Table 4**). This demonstrates that the treatment train is operating efficiently with respect to nutrients and indeed the TN and TP concentrations in the end effluent are exceptionally good compared with other village-scale mechanized treatment plants.

It is not immediately evident why the 2024 TN and TP concentrations in the final effluent are so much lower than 2010 results, however it is plausible that:

- operational procedures have improved, such as sludge return from the clarification tank and regular cleaning of the primary tanks.
- Repairs made to the RBC in 2012 – which included new discs, bearing and a refurbished chamber.
- Results rely on one-off samples rather than a regular monitoring programme.

Table 4. The design target concentrations and removal % for treated effluent.

	EIS design parameters		Results	
Parameter	**Nutrient concentrations**	**Removal target (%)**	**Nutrient concentrations**	**Actual removal (%)**
Total N	43mg/L	43%	7mg/L	84%
Total P	7.3mg/L	42%	~ 1	~86%

4. SUMMARY

The results demonstrate that the RBC has excellent treatment performance. It easily conforms to the NSW Health concentration limits for Advanced Secondary Treatment with Disinfection.

In addition, the treatment train has exceptional nutrient removal performance, and TN and TP concentrations in the 2024 sample were well below the design limits. This indicates that that effluent irrigation zones are not being overloaded with excess nutrients.

Caution should be applied when interpreting the results as they rely on one-off samples collected around 14 years apart. It is recommended that a scheduled monitoring program

which would allow minimum, median and maximum concentrations to be estimated and long-term trends to be determined.

Parameter	Primary Tank	Irrigation Tank	Removal	Guidelines
Total N (mg/L)	32	7	78%	40%
NH_4-N (mg/L)	31	0.005	99.98%	
NOx-N (mg/L)	<0.005	5.8	Increase	
Organic N (mg/L)	1	1.2	Increase	
PO_4-P (mg/L)	5.9	0.95	84%	
TSS (mg/L)	3,300	5	99.8%	<10 mg/L
BOD (mg/L)	1,680	<5	>99.7%	<10 mg/L
E. coli (mpn/100 mL)	350,000	<18	>99.995%	<10 cfu/100 mL
Faecal coliform (mpn/100 mL)	350,000	<18	>99.995%	
Free Chlorine	N/T			

NSW Health (2017) Recommended Final Uses of Effluent based on the Type of Treatment. Advisory Note 4 – January 2017.

Microbiologocal Testing			
Our Reference		335821-1	335821-2
Your Reference	UNITS	Baryulgil STP - Tank 1	Baryulgil STP - Tank 6
Date Sampled		18/10/2023	18/10/2023
Type of sample		Water	Water
Date of testing	-	21/10/2023	21/10/2023
E. coli	mpn/100mL	<18	350,000
Faecal Coliforms	mpn/100mL	<18	350,000

A3.5 On-going Final Effluent Quality Verification

A3.5.1 Final effluent from the {STS} taken in any random grab sample shall comply with the following standard:

- BOD^5 less than 30 mg/L
- TSS less than 45 mg/L
- E. coli less than 100 cfu/100 ml
- Free residual chlorine greater than 0.2 and less than 2.0 mg/L

A3.6 Permitted uses

A3.5.1 The effluent is suitable for re-use for garden purposes by way of any of the forms of irrigation as described in AS/NZS 1547:2000:

- above ground spray irrigation
- surface drip irrigation covered by mulch
- shallow sub-surface drip irrigation to a depth of 100 -150 mm below ground level
- sub-surface disposal in trenches, transpiration beds and the like
- but not for internal household reuse

Each of these forms of irrigation is subject to the approval of the local council.

ecoteam

Project No. 22425.0
Baryulgil Effluent Quality

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 335821

Client Details

Client	Ecoteam
Attention	Cail Cooper, Shaun Hill
Address	13 Ewing Street, Lismore, NSW, 2480

Sample Details

Your Reference	**22425.0 - Baryulgil STP Upgrades**
Number of Samples	2 Water
Date samples received	20/10/2023
Date completed instructions received	20/10/2023

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	27/10/2023
Date of Issue	27/10/2023

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Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Diego Bigolin, Inorganics Supervisor
Hannah Nguyen, Metals Supervisor
Nancy Zhang, Laboratory Manager, Sydney

Authorised By
Nancy Zhang, Laboratory Manager

Envirolab Reference: 335821
Revision No: R00

NATA

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Project No. 22425.0
Baryulgil Effluent Quality

Miscellaneous Inorganics			
Our Reference		335821-1	335821-2
Your Reference	UNITS	Baryulgil STP - Tank 1	Baryulgil STP - Tank 6
Date Sampled		18/10/2023	18/10/2023
Type of sample		Water	Water
Date prepared	-	20/10/2023	20/10/2023
Date analysed	-	20/10/2023	20/10/2023
Ammonia as N in water	mg/L	31	0.005
NOx as N in water	mg/L	<0.005	5.8
TKN in water	mg/L	32	1.3
Total Nitrogen in water	mg/L	32	7.0
BOD	mg/L	1,680	5
Total Suspended Solids	mg/L	3,300	<5
Phosphate as P in water	mg/L	5.9	0.95

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Project No. 22425.0
Baryulgil Effluent Quality

Client Reference: 22425.0 - Baryulgil STP Upgrades

Metals in Waters - Acid extractable			
Our Reference		335821-1	335821-2
Your Reference	UNITS	Baryulgil STP - Tank 1	Baryulgil STP - Tank 6
Date Sampled		18/10/2023	18/10/2023
Type of sample		Water	Water
Date prepared	-	23/10/2023	23/10/2023
Date analysed	-	24/10/2023	24/10/2023
Phosphorus - Total	mg/L	11	1.1

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Project No. 22425.0
Baryulgil Effluent Quality

Client Reference: 22425.0 - Baryulgil STP Upgrades

Microbiologocal Testing			
Our Reference		335821-1	335821-2
Your Reference	UNITS	Baryulgil STP - Tank 1	Baryulgil STP - Tank 6
Date Sampled		18/10/2023	18/10/2023
Type of sample		Water	Water
Date of testing	-	21/10/2023	21/10/2023
E. coli	mpn/100mL	<18	350,000
Faecal Coliforms	mpn/100mL	<18	350,000

Envirolab Reference: 335821
Revision No: R00

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Client Reference: 22425.0 - Baryulgil STP Upgrades

Method ID	Methodology Summary
Ext-008	Subcontracted to Sonic Food & Water Testing. NATA Accreditation No. 4034.
Inorg-019	Suspended Solids - determined gravimetricially by filtration of the sample. The samples are dried at 104+/-5°C.
Inorg-055	Nitrate - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-055/062/127	Total Nitrogen - Calculation sum of TKN and oxidised Nitrogen. Alternatively analysed by combustion and chemiluminescence.
Inorg-057	Ammonia - determined colourimetrically, based on APHA latest edition 4500-NH3 F. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a KCl extraction.
Inorg-060	Phosphate determined colourimetrically based on EPA365.1 and APHA latest edition 4500 P E. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-062	TKN - determined colourimetrically based on APHA latest edition 4500 Norg. Alternatively, TKN can be derived from calculation (Total N - NOx).
Inorg-091	BOD - Analysed in accordance with APHA latest edition 5210 D and in house INORG-091.
Metals-020	Determination of various metals by ICP-AES.

Client Reference: 22425.0 - Baryulgil STP Upgrades

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			20/10/2023	2	20/10/2023	20/10/2023		20/10/2023	[NT]
Date analysed	-			20/10/2023	2	20/10/2023	20/10/2023		20/10/2023	[NT]
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	2	0.005	[NT]		102	[NT]
NOx as N in water	mg/L	0.005	Inorg-055	<0.005	2	5.8	[NT]		95	[NT]
TKN in water	mg/L	0.1	Inorg-062	<0.1	2	1.3	[NT]		[NT]	[NT]
Total Nitrogen in water	mg/L	0.1	Inorg-055/062/127	<0.1	2	7.0	[NT]		96	[NT]
BOD	mg/L	5	Inorg-091	<5	2	5	[NT]		94	[NT]
Total Suspended Solids	mg/L	5	Inorg-019	<5	2	<5	<5	0	93	[NT]
Phosphate as P in water	mg/L	0.005	Inorg-060	<0.005	2	0.95	[NT]		93	[NT]

Envirolab Reference: 335821
Revision No: R00

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Client Reference: 22425.0 - Baryulgil STP Upgrades

QUALITY CONTROL: Metals in Waters - Acid extractable						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			23/10/2023	[NT]	[NT]	[NT]	[NT]	23/10/2023	[NT]
Date analysed	-			24/10/2023	[NT]	[NT]	[NT]	[NT]	24/10/2023	[NT]
Phosphorus - Total	mg/L	0.05	Metals-020	<0.05	[NT]	[NT]	[NT]	[NT]	104	[NT]

Client Reference: 22425.0 - Baryulgil STP Upgrades

Result Definitions	
NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Client Reference: 22425.0 - Baryulgil STP Upgrades

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from "2018 TLVs and BEIs", as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Client Reference: 22425.0 - Baryulgil STP Upgrades

Report Comments

Total metals: no unfiltered, preserved sample was received, therefore analysis was conducted from the unpreserved sample bottle.
Note: there is a possibility some elements may be underestimated.

Microbiology analysed by Sonic Food & Water Testing. Report No. W2324827-828
The time between collection and the commencement of testing should not exceed 24 hours. Samples tested outside this time may have their results compromised

Appendix C. Water Usage and Sewage Inflow Data

Date	Water meter (kL)	Number of Days	Usage	Average per day (kL)	Estimated sewage production (kL)
15/01/2024	19355.7980	12	435.908	36.326	29.061
3/01/2024	18919.8904	14	614.960	43.926	35.141
20/12/2023	18304.930	14	552.470	39.462	31.570
6/12/2023	17752.4600	16	614.044	38.378	30.702
20/11/2023	17138.4162	35	1164.713	33.278	26.622
16/10/2023	15973.703	14	483.069	34.505	27.604
2/10/2023	15490.634	12	368.900	30.742	24.593
20/09/2023	15121.734	12	214.087	17.841	14.272
8/09/2023	14907.647	16	342.432	21.402	17.122
23/08/2023	14565.215	16	394.989	24.687	19.749
7/08/2023	14170.2258	12	285.965	23.830	19.064
26/07/2023	13884.261	14	351.074	25.077	20.061
12/07/2023	13533.1870	14	368.395	26.314	21.051
28/06/2023	13164.7924	2	70.332	35.166	28.133
26/06/2023	13094.460	10	295.857	29.586	23.669
16/06/2023	12798.6030	14	351.890	25.135	20.108
2/06/2023	12446.7130	11	273.284	24.844	19.875
22/05/2023	12173.4288	21	470.836	22.421	17.937
1/05/2023	11702.5930	14	318.206	22.729	18.183
17/04/2023	11384.3871	10	237.277	23.728	18.982
7/04/2023	11147.1099	16	426.965	26.685	21.348
22/03/2023	10720.145	2	62.174	31.087	24.870
20/03/2023	10657.9710	12	328.098	27.341	21.873
8/03/2023	10329.8735	12	337.672	28.139	22.511
24/02/2023	9992.202	16	601.461	37.591	30.073
8/02/2023	9390.741	5	184.015	36.803	29.442
3/02/2023	9206.7264	21	718.995	34.238	27.390
13/01/2023	8487.731	25	806.690	32.268	25.814
19/12/2022	7681.0411	14	510.711	36.479	29.183
5/12/2022	7170.3300	12	392.865	32.739	26.191
23/11/2022	6777.4649	12	364.722	30.393	24.315
11/11/2022	6412.743	16	287.686	17.980	14.384
26/10/2022	6125.057	14	291.557	20.826	16.660
12/10/2022	5833.5	12	246.400	20.533	16.427
30/09/2022	05587.1	9	136.900	15.211	12.169
21/09/2022	5450.2	19	442.100	23.268	18.615
2/09/2022	05008.1	11	231.739	21.067	16.854
22/08/2022	4776.361	19	341.610	17.979	14.384

3/08/2022	4434.7515	14	287.952	20.568	16.454
20/07/2022	4146.8	26	503.300	19.358	15.486
24/06/2022	03643.5	14	277.600	19.829	15.863
10/06/2022	03365.9	16	357.255	22.328	17.863
25/05/2022	3008.6455	14	251.888	17.992	14.394
11/05/2022	2756.7574	12	122.957	10.246	8.197
29/04/2022	02633.8	16	326.660	20.416	16.333
13/04/2022	2307.14	9	152.840	16.982	13.586
4/04/2022	2154.3	19	551.900	29.047	23.238
16/03/2022	1602.4	35	546.190	15.605	12.484
9/02/2022	1056.21	7	114.810	16.401	13.121
2/02/2022	941.4	16	328.460	20.529	16.423
17/01/2022	612.94	14	612.940	43.781	35.025
3/01/2022	0				