

Gladstone Area Water Board

Drinking Water Quality Management Plan Annual Report 2021/2022

Gladstone Area Water Board
Phone: (07) 4976 3000
Fax: (07) 4972 5632

136 Goondoon Street
Gladstone Q 4680
www.gawb.qld.gov.au

Gladstone Area Water Board

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AUTHORISATION AND APPROVAL

Endorsed by:

X *Lisa Wright*
Lisa Wright (Dec 16, 2022 13:52 GMT+10)

Lisa Wright
Technical Officer - Water Quality & Environment

Approved by:

X *Scott Wikman*

Scott Wikman
General Manager - Network

1 DOCUMENT STATUS

Document Status					
Date	Revision	Description	Author	Checked	Approved
12/2022	V1	Annual drinking water quality information updated for 21/22. Issued for review and submission to DRDMW.	Scott Wikman		

2 GLOSSARY OF TERMS

Term	Description
WSSRA	Water Supply (Safety & Reliability) Act 2008
GAWB	Gladstone Area Water Board
GRC	Gladstone Regional Council
WSP	Water Service Provider
DRDMW	Department of Regional development, Manufacturing and Water
DWQMP	Drinking Water Quality Management Plan
ADWG	Australian Drinking Water Guidelines (2011). Published by the National Health and Medical Research Council of Australia
GWTP	Gladstone Water Treatment Plant
WTP	Water Treatment Plant
YWTP	Yarwun Water Treatment Plant
DAF	Dissolved Air Flotation
CCP	Critical Control Point
SCADA	Supervisory Control and Data Acquisition
PLC	Programmable Logic Controller
<i>E. coli</i>	<i>Escherichia coli</i> , a bacterium which may indicate the presence of faecal contamination and therefore potential health risk
HACCP	Hazard Analysis and Critical Control Points assessment for protecting drinking water quality
mg/L	Milligrams per litre
NTU	Nephelometric Turbidity Units
MPN/100mL	Most probable number per 100 millilitres
CFU/100mL	Colony forming units per 100 millilitres
<	Less than
>	Greater than
OBS	Observation
Minor NC	Minor Non-Conformance

3 INTRODUCTION

Gladstone Area Water Board's (GAWB's) amended Drinking Water Quality Management Plan (DWQMP), approved on 27 September 2021, addresses the requirements of section 95(3) of the *Water Supply (Safety & Reliability) Act 2008 (WSSRA)* to ensure safe drinking water for its customers. The Plan was first reviewed in 2014 and amendments approved on 28th May 2014. The Plan was then reviewed again in early 2016, without the need for an amendment. The most recent amendment of GAWB's DWQMP was received by the Department of Regional Development, Manufacturing and Water on 30 August and 15 September 2021. The resulting approval notice was issued on 27 September 2021.

Gladstone Area Water Board (GAWB) is the bulk water provider for the Gladstone region, supplying drinking water services to the Gladstone Regional Council (GRC) (for reticulation to the city of Gladstone, the towns of Calliope, Tannum Sands, Benaraby and Mt Larcom) and to major industrial facilities located around Gladstone. GAWB also supplies a small number of domestic connections directly off the GAWB trunk mains.

Safe drinking water is essential to sustaining a healthy community. GAWB provides safe drinking water at a cost reasonable to the consumer. GAWB employs a multiple barrier system to ensure safe drinking water for its customers, using risk management methods consistent with the National Health and Medical Research Council's (NHMRC) Australian Drinking Water Guidelines 2011 (ADWG).

3.1 Registered Service Details

GAWB is a registered Water Service Provider (WSP) under the WSSRA, and is regulated by the Department of Regional Development, Manufacturing and Water (DRDMW). Powers under WSSRA have been delegated to the officers of the relevant section of the department; DRDMW is the primary contact for communications regarding the DWQMP, including reporting requirements under the approval terms and conditions.

In addition, pursuant to section 1084 of the *Water Act 2000 (Water Act)*, GAWB is taken to be a Category 1 Water Authority from 1 July 2000 and is responsible to the Minister for Regional Development and Manufacturing and Minister for Water. GAWB operates as a commercialised statutory authority with the function of carrying out water activities and has a key objective to ensure its operations are as efficient as possible, with its prices being cost reflective. GAWB's WSP details are provided in Table 1.1 below.

Table 1.1: Water Service Provider information for Gladstone Area Water Board

Information Required	Details
SPID	200
Service Provider Name	Gladstone Area Water Board
Contact Details	PO Box 466 Gladstone QLD 4680 136 Goondoon St (p) 07 4976 3000 (fax) 07 4972 5632 www.gawb.qld.gov.au
Name of Schemes	Gladstone Water Treatment Plant Scheme Yarwun Water Treatment Plant Scheme

3.2 Purpose of this Report

The purpose of this report is to summarise the performance of GAWB against criteria detailed in its DWQMP. As per the Regulator’s reporting guidelines, this Report:

- Documents the actions undertaken by GAWB to implement the DWQMP.
- Summarises any non-compliances and incidents under section 102 and 102A of the WSSRA.
- Summarises the results of the verification water quality monitoring program undertaken by GAWB.
- Summarises customer satisfaction and GAWB’s response to any complaints regarding drinking water quality.
- Summarises any reviews of the DWQMP.

4 OVERVIEW OF OPERATIONS 2021/2022

GAWB operates two drinking water schemes, from which it provides bulk drinking water to the Gladstone Regional Council (GRC) for reticulation to domestic users and to various industrial customers.

The table below details GAWB’s potable water customer connections of its two schemes as of 2021/2022.

GAWB’s current drinking water connection details

Customer	Number of Metered Connections
Gladstone WTP Scheme	
Boyne Smelters Limited	2
Gladstone Regional Council	10
Queensland Alumina Limited	2
APLNG	1
GLNG	1
QCLNG	1
Non-commercial connections	34
Yarwun WTP Scheme	
Cement Australia	2
Gladstone Regional Council	6
Jemena	1
Orica	3
Aurizon	2
WICET	2
Rio Tinto Aluminium Yarwun	3
Alpha HPA	1
TOTAL	71

4.1 Gladstone Water Treatment Plant Scheme

Drinking water supplied from the Gladstone scheme is treated at the Gladstone WTP and then distributed to GAWB's customers either directly off the mains or from the outlet of seven service reservoirs. Gladstone WTP services the requirements of the Gladstone Regional Council drinking water reticulation system for the City of Gladstone and surrounding townships (a population of about 64,304 – source, Australian Bureau of Statistics, Regional population (Rebased 2020-21 data to the 2021 Census was released on 26 July 2022.) a number of industrial customers and 34 residential customers.

Treatment Process and Delivery Network

Gladstone WTP conventional water treatment process has a design capacity of 57 ML per day and consists of parallel up-flow clarification and Dissolved Air Flotation (DAF) processes which can be operated together or independently of one another.

The plant has six operating modes, allowing either or both plants to be run and the filters can be configured in such a way as to keep the process streams separate or run water from either or both plants over all filters. Direct filtration modes on the plant are disabled and can only be operated manually with direct management approval.

Once filtered, water is corrected for pH and disinfected with sodium hypochlorite in two clear water wells, after which the process streams rejoin, and the fully treated water enters the 2.25ML clear water contact tank.

During 2021/2022, GWTP produced approximately 9.2 gigalitres of drinking water, as can be seen in the table below. Average production was approximately less than half of the capacity of the plant, with maximum day approximately 68.9% of plant capacity. Water is delivered either directly to a number of GRC reservoirs, or into GAWBs distribution system, which includes a number of reservoirs and re-chlorination facilities.

Water quality

GAWB undertakes comprehensive operational and verification monitoring of water quality. The operational monitoring is concentrated around the quality of source water and the treatment process and includes daily measurements throughout the plant as well as online monitoring through the process and of re-chlorination facilities. There have been only minor changes to the operational monitoring program since development of the DWQMP.

Filter operation is a Critical Control Point (CCP) in the treatment process and the turbidity of each filter is monitored continuously using online turbidity meters. The target filtrate turbidity is less than 0.1 nephelometric turbidity units (NTU) during normal operation (not including backwash or filter ripening). During the course of 2021/22, the GWTP consistently produced filtered waters of 0.08 NTU.

Verification monitoring focuses on the finished product as it leaves the plant and is delivered to customer supply points. This includes weekly monitoring of parameters to verify effective disinfection and less-frequent monitoring of parameters which have been identified as having a lower risk in the drinking water. In terms of water quality, water delivered from the GWTP, and transmission network achieved 100% compliance against ADWG health criteria. A full list of parameters and summary results can be found in Appendix A.

Table 1.2 – GWTP 2021/22 Performance

GWTP 2021/22 Performance		
Water production per annum	9,199.607ML	
Average daily production	25.204ML	
Maximum daily production	39.288 ML	25 th Feb 2022
Minimum daily production	14.27 ML	26 th May 2022
Filtered water turbidity (NTU)	0.08	Average
Water Quality Compliance ADWG	100% compliance	

*Fluoridation has since ceased on 28th August 2016 as per Gladstone Regional Council directive.

4.2 Yarwun Water Treatment Plant Scheme

Drinking water supplied from the Yarwun scheme is treated at the Yarwun WTP which can be partially or fully supplemented with drinking water from the Gladstone scheme via an interconnection between the two systems, commissioned in early 2017. Drinking water is distributed to GAWB’s customers either directly off the mains or from the outlet of two service reservoirs. GRC reticulates the water to domestic users after the points of supply.

Treatment Process and Delivery Network

The Yarwun WTP, located on Reid Road in the Yarwun Industrial Estate, has a total current design capacity of 5 megalitres per day based on 20hrs availability.

Yarwun WTP conventional treatment is a single stream process with one clarifier and 3 mono-media filters, pH correction, and chlorine disinfection. The plant operates automatically, with daily operator visits to conduct general duties, monitoring and maintenance. The plant programmable logic controller (PLC) and Supervisory Control and Data Acquisition (SCADA) control system supervises all necessary functions and will shut the plant down automatically in the event of equipment failure or power loss. Online monitors are used throughout the system to facilitate control of the process.

Yarwun WTP services the requirements of the GRC and a number of industrial customers. Water is pumped from Yarwun WTP to the Mt Miller reservoir and then gravitates to the Boat Creek PS, supplying several industrial customers with process and drinking water. Water is then pumped to East End Reservoir, where it is re-chlorinated and supplied to the GRC for reticulation.

Since early 2017 the Gladstone and Yarwun systems have been interconnected to provide greater resilience to both YWTP and the network. There are several modes of interconnection operation, which GAWB can use to suit the needs of operation.

To ensure a disinfectant residual is maintained through to customer supply points GAWB practices supplementary disinfection at the East End Reservoir, where sodium hypochlorite is dosed to a set point in a recirculation stream from the reservoir. The chlorine residual is continuously monitored, with alarms for low and high dose relayed back to the treatment plant.

During 2021/22 YWTP produced approximately 0.89 gigalitres of drinking water, as can be seen in the table below. The average daily production was 2.4 ML/day with maximum day production 5.2ML.

Water quality

GAWB undertakes comprehensive operational and verification monitoring of water quality. The operational monitoring is concentrated around the quality of source water and the treatment process and includes daily measurements throughout the plant as well as online monitoring through the process and delivery network.

Filter operation is a Critical Control Point (CCP) in the treatment process at YWTP and the combined turbidity of the three filters is monitored continuously using an online turbidity meter. The target filtrate turbidity is less than 0.1 nephelometric turbidity units (NTU) during normal operation (that is, not including backwash or filter ripening). During the course of 2021/22 and under normal operation, the YWTP consistently produced filtered waters of 0.08NTU

Verification monitoring focuses on the finished product as it leaves the plant and is delivered to customer supply points. This includes weekly monitoring of parameters to verify effective disinfection and less-frequent monitoring of parameters which have been identified as having a lower risk in the drinking water. In terms of water quality, the YWTP and distribution network achieved 100% compliance against ADWG criteria. A full list of parameters and summary results can be found in Appendix A.

Table 1.3 – YWTP 2021/22 Performance

Measure	YWTP 2021/22 Performance	
Water production per annum	891.81 ML	
Average daily production	2.44 ML	
Maximum daily production	5.23ML	21 st June completed2022
Minimum daily production	0.00 ML	
Filtered water turbidity (NTU)	0.08	Average
Water Quality Compliance ADWG	100% compliance	

5 ACTIONS TAKEN TO IMPLEMENT THE DWQMP

During the development of its Drinking Water Quality Management Plan, GAWB identified a number of improvement actions in management of source water, in the treatment process at both of its plants and in the operations of its network, to improve the risks to drinking water quality.

The table below lists the outstanding improvement actions identified during the review of the DWQMP, target dates for completion and current status.

Item No.	Scheme Component / Sub-component	Action(s)	Target date	Status	Comments
Y3.1	Yarwun Water Treatment Plant	Raw and clearwater turbidity meter upgrades	June 2022	Complete	End of life replacement of existing turbidity sensors.
	Cybersecurity	Improvements to GAWB's Information Security Management System (GAWB IT Department)	31 June 2022	Complete	<ul style="list-style-type: none"> ▪ GAWB has implemented Multifactor Authentication for accessing Microsoft 365 and TechnologyOne ERP ▪ GAWB has implemented quarterly access checks against contractor and vendor accounts for validity ▪ Regular vulnerability assessments are completed and identified issues are rectified ▪ Completed is annual check of the cybersecurity awareness training package to confirm relevance to emerging risks ▪ GAWB completed the annual penetration testing.
	Internal Audit	Internal Management Systems Audit	20 July 2022	Complete	Assess GAWB compliance with Water Quality Monitoring and Documentation.
	Gladstone Water Treatment Plant	Filter Media and Filter Refurbishment, Filters 1 to 12	31 December 2022	In Progress	Improved filter performance and replacement of old filter media with garnet-based material.

6 IMPROVEMENT ACTIONS IDENTIFIED IN THE DWQMP

Gladstone

Process step	Hazard	Hazardous Event	Inherent Risk 2021	Preventive Measure	Residual Risk 2021	Final treatment barrier for hazard?	Required improvements	Timing	Responsibility
<p>1.1 Powder activated carbon (PAC) dosed intermittently into raw water to remove trace organics including algal toxins, T&O compounds and DOC. Dosed before Aluminium Sulphate coagulant</p>	<p>Extra-cellular (dissolved) algal toxin measured as Cylindrospermopsin</p>	<p>Contact time not sufficient, Dose Rates under/overdose Equipment Failure, for removal of free algal toxins. Contamination of chemical</p>	<p>High 7</p>	<p>Dose PAC when needed PAC contact time optimisation study complete. Daily Drop tests & Routine Inspections/Preventative Maintenance. PAC CT is about 3 minutes</p>	<p>Low 3</p>	<p>N</p>	<p>PAC screw feeder not operational and is currently dosing manually.</p>	<p>2023-25 FY *Long lead times due to COVID</p>	<p>Water Treatment Manager/Drinking Water Quality Leader</p>
<p>2.1 Plant 1 Coagulation/ Flocculation of particulate and colloidal matter with aluminium sulphate and Magna Floc LT 25 polyelectrolyte</p>	<p>Ineffective coagulant</p>	<p>pH outside range. Dose Rates under/overdose Equipment Failure where Alum can be effective. Contamination of Chemical</p>	<p>Medium 6</p>	<p>alum normally drops pH to acceptable range, but seasonally becomes borderline. Daily Drop tests & Routine Inspections/Preventative Maintenance Add Soda Ash/Suitable chemical to raise the pH.</p>	<p>Low 4</p>	<p>N</p>	<p>Conduct Jar tests regularly and the records are saved</p>	<p>Complete</p>	<p>Water Treatment Manager</p>
<p>3.3 Filter Ripening water</p>	<p>Pathogen - Cryptosporidium, Giardia</p>	<p>Filters do not ripen adequately allowing pathogen breakthrough, filters overcleaned lengthening ripening, or ripening water sent to finished water</p>	<p>High 8</p>	<p>Plant design parameters filter ripening parameters Seeding of filters with backwash water Filter maintenance & monitoring program Operators trained in filter optimisation Soft Start of Plant Optimisation. Upgrade of programming in Scada to allow Filters to settle for a set time prior to Filter coming Online</p>	<p>Medium 6</p>	<p>Y</p>	<p>Filter Media replacement, Filter optimisation of the plant</p>	<p>Annually/or as required</p>	<p>Water Treatment Manager/Drinking Water Quality Leader</p>

Process step	Hazard	Hazardous Event	Inherent Risk 2021	Preventive Measure	Residual Risk 2021	Final treatment barrier for hazard?	Required improvements	Timing	Responsibility
4.1 Sodium hypochlorite dosed into clear water well and enters contact tank	Bacteria and viruses	Incorrect dose for pathogen inactivation due to equipment failure. Concentration/Contamination of Hypo. Disabling of Scada controls	Extreme 10	Set point dosing to target concentration by analyser feedback on sample taken from 2.25ML clear water reservoir. Increase Testing Frequency. Adequate Operator Training. Documentation for receiving chemicals	Medium 5	N	Calculate minimum CT at first customer offtake given low CCP critical limit.	Annually	Water Treatment Manager/Drinking Water Quality Leader
8.1 General Maintenance	Pathogens/Chemicals	Sick workers in contact with water	Medium 5	Personal Hygiene in site induction and contracts	Low 3	N	Qld Water Directorate 'Aquacard' under consideration	Annually/As required	Drinking Water Quality Leader/Water Treatment Manager
8.1 General Maintenance	Incorrect Analyser Readings-CCP Alarms	Water not Treated to drinking water Standards (ADWG)	High 7	1.Regular Verifications 2. Scheduled PM	Low 4	Y	Maintain & upgrade as required	Ongoing Maintenance & Replacement schedule	Water Treatment & Maintenance Manager
8.1 General Maintenance	Contaminants - metals, organics, solvents	Product not suitable for use in potable water	Medium 6	Chemical register updated by Health and Safety Team and Risk & Compliance Team. Contracts include requirement for products suitable for use in potable water Work orders issued AMS system to flag potable water assets	Low 4	N	Qld Water Directorate 'Aquacard' under consideration	Annually/As Required	Water Treatment Manager/Drinking Water Quality Leader

Process step	Hazard	Hazardous Event	Inherent Risk 2021	Preventive Measure	Residual Risk 2021	Final treatment barrier for hazard?	Required improvements	Timing	Responsibility
7.2 Emergency	Pathogens/Chemicals	Cyber security breach - accidental or deliberate attack on SCADA system resulting in no disinfection, outages, negative pressure, overriding alarms, control of systems, permanent loss of system	Extreme 10	Monitoring of traffic in and out of SCADA through managed service, SCADA & corporate network segregation, firewall separation between internal & external networks Cyber security audit Cyber security training	Medium 6	N	Consider annual cybersecurity penetration testing and cybersecurity review Closing outstanding OT cybersecurity audit actions - end point security on SCADA devices and physical security on SCADA Devices OT Cybersecurity Disaster Recovery Plan Require detailed procedure for manual running of treatment	Bi-Annual	Head of Technology
4.1 Filtration of clarified water through Dual media	Pathogens, particularly Protozoa - Cryptosporidium, Giardia	Breakthrough of protozoa due to any of: a) flow rate change b) filter bed develops mudballs c) filter bed cracks/ shears d) Loss of media e) plant operated outside operating philosophy due to demand/ maintenance f) hydraulic shock	Extreme 9	Plant design parameters for flow rates and media depth Filter maintenance & monitoring program CMMS Plant ramping operating philosophy Operator competent in minimum Cert II and trained to optimise filters Reactive & preventative maintenance requires consideration of water quality, Scada Monitoring, Filter Media Replacement Program in place which reduces the impacts of having hazardous events raised.	Medium 6	Y	Filter Media replacement, SCADA monitoring of filter turbidity in absence of UV disinfection to be considered with introduction of HBT in ADWG	Action item to be reviewed annually or as required	Water Treatment Manager/Drinking water Quality Leader

Yarwun

Process step	Hazard	Hazardous Event	Inherent Risk 2021	Preventive Measure	Residual Risk 2021	Final treatment barrier for hazard?	Required improvements	Timing	Responsibility
7.4 GWTP to Yarwun WTP Interconnection	disinfection by products	Interconnection increases hydraulic residence time allowing for increased disinfection by products	Medium 6	Manned Intermittent Mode Changes on Scada to operate the Interconnection Line. Regular water Testing at customer offtake.	Medium 5	N	Investigate additional Lead Indicators. Operator Training & SOP's, additional monitoring for potential of Disinfection by products at WTP outlet	To commence from late 2022	Water Treatment Manager/Drinking water Quality Leader
7.4 GWTP to Yarwun WTP Interconnection	Low Residual Chlorine	Low usage in interconnection branch results in Lower chlorine levels and increase in pH	Medium 6	Plan to operate with continuous flow. Operator Training, SOP, Regular Testing.	Low 4	N	Investigate additional Lead Indicators. Operator Training & SOP's, additional monitoring for potential of Disinfection by products at WTP outlet	To commence from late 2022	Water Treatment Manager/Drinking water Quality Leader
2.1 Recovered Water - Backwash Water and Clarifier Waste sent to settling ponds. Supernatant returned to start of process at rate of up to 10% of flow	Pathogens	Pathogens build up in ponds and are returned in higher concentrations than raw water to head of plant	Extreme 10	Recovered water returned at up to 10% of plant flow. Pond cleaned out on regular schedule. Pre chlorine Dosing Daily Operator Duties to inspect ponds	Medium 6	N	Pre dosing of chlorine project to be commenced in absence of UV disinfection	2023-25	

7 COMPLIANCE WITH WATER QUALITY CRITERIA FOR DRINKING WATER

The results from the verification monitoring program have been compared against the levels of the water quality criteria specified by the Regulator in the *Water Quality and Reporting Guideline for a Drinking Water Service* and are summarised in Appendix A, Table A1. As can be seen, GAWB drinking water is compliant with the ADWG 2011 and meets the water quality criteria specified by the Queensland Water Supply Regulator

The reported statistics do not include results derived from quality control, blank or repeat samples, or from emergency or investigative samples undertaken in response to an elevated result.

Consistency of monitoring results over the 2021/22 period with previous years demonstrates a level of surveillance consistent and appropriate with the risks to drinking water quality. GAWB far exceeds the number of *E. coli* samples required to be taken under the Public Health Act 2005 according to population by almost threefold. The below table provides a summary of verification monitoring conducted for the 2021/2022 year. The figures in the below table consider the full distribution (Gladstone and Yarwun), including water treatment plant outlets and customer service points. The actual number of samples taken versus the sampling program reflects shutdowns and access issues, whereby sampling was not appropriate during various plant and network shutdowns or because safe access to sites was not available during sampling runs.

Table 1.4 – Water Quality Criteria and Sampling

Scheme name	Parameter	No of samples required to be collected (as per the approved DWQMP)	No of samples actually collected	Water quality criteria		No of non-compliant samples	Comments
Gladstone	Free Chlorine	480	456	Health guideline limit	<5mg/l	0	
Gladstone	Dissolved Oxygen	480	453	Aesthetic guideline limit - treated water only	>85%	11	11 Samples were found to be less than 85%
Gladstone	pH	480	450	Aesthetic guideline limit	6.5 - 8.5 pH Unit	0	
Gladstone	Turbidity	480	456	Aesthetic guideline limit	<5NTU	0	
Gladstone	Colour	148	70	Aesthetic guideline limit	<15HU	0	Colour Determination occurred only at selected sites in addition to WTP Outlet. Verification program to be reviewed accordingly.

Gladstone	Hardness	4	4	Recommended limit	<200mg/l	0	
Gladstone	Total dissolved solids	4	4	Recommended limit	<600mg/l	0	
Gladstone	Bromate	12	4	Health Guideline			Bromate analysed at GWTP Outlet only.
Gladstone	Aluminium	110	112	Aesthetic guideline limit	<0.2mg/l	0	
Gladstone	Arsenic (Total)	37	37	Health guideline limit	0.01mg/l	0	
Gladstone	Ba,Cd,Cr,Cu,Pb,Hg,Ni,Se,Zn (total)	37	36	Health and Aesthetic guideline limit	Various depending on metal	0	
Gladstone	Cyanide	37	4	Health guideline limit	<0.08mg/l	0	Cyanide analysis performed only at WTP outlets; Verification Program shall be reviewed accordingly
Gladstone	Iron	150	151	Aesthetic guideline limit	<0.3mg/l	0	
Gladstone	Manganese	150	149	Aesthetic guideline limit	<0.1mg/l	0	
Gladstone	THM's	110	109	Health guideline limit	<0.25mg/l	0	
Gladstone	Cyanobacteria	52	50	No guideline limit		0	
Gladstone	<i>E. coli</i>	480	459	Health guideline limit	0mg/l in any 100ml sample	0	
Gladstone	<i>Chlorate</i>	156	245	WHO Interim Health Guideline	0.7mg/l	0	

Yarwun	Free Chlorine	364	354	Health guideline limit	<5mg/l	0	
Yarwun	Dissolved Oxygen	364	354	Aesthetic guideline limit	>85%	1	
Yarwun	pH	364	347	Aesthetic guideline limit	6.5 - 8.5 pH Unit	0	
Yarwun	Turbidity	364	354	Aesthetic guideline limit	<5NTU	0	
Yarwun	Colour (Number reduced in amended DWQMP)	124	24	Aesthetic guideline limit	<15HU	0	Colour determination occurred only at YWTP Outlet and 1 selected site. Verification program to be

							reviewed accordingly.
Yarwun	Hardness	4	4	Recommended limit	<200mg/l	0	
Yarwun	Total dissolved solids	4	4	Recommended limit	<600mg/l	0	
Yarwun	Aluminium	84	84	Aesthetic guideline limit	<0.2mg/l	0	
Yarwun	Arsenic (Total)	28	28	Health guideline limit	0.01mg/l	0	
Yarwun	Ba,Cd,Cr,Cu,Pb,Hg,Ni,Se,Zn (total)	28	28	Health and Aesthetic guideline limit	Various depending on metal	0	
Yarwun	Bromate	8	8	Health Guideline			
Yarwun	Cyanide	28	4	Health guideline limit	<0.08mg/l	0	Cyanide Analysis performed only at GWTP Outlet. Verification program to be reviewed accordingly.
Yarwun	Iron	124	122	Aesthetic guideline limit	<0.3mg/l	0	
Yarwun	Manganese	124	123	Aesthetic guideline limit	<0.1mg/l	0	
Yarwun	THM's	84	84	Health guideline limit	<0.25mg/l	0	
Yarwun	Cyanobacteria	52	50	No guideline limit		0	
Yarwun	<i>E. coli</i>	364	348	Health guideline limit	0mg/l in any 100ml sample	0	
Yarwun	<i>Chlorate</i>	104	99	WHO Interim Health Guideline	0.7mg/l	0	

8 NOTIFICATIONS TO THE REGULATOR

During the 2021/21 FY, there were no notifications submitted to the regulator.

9 CUSTOMER SATISFACTION

During 2021/22 year, GAWB did not record any complaints about water quality from its customers, including GRC, industrial customers or the small number of reticulation customers on GAWB's network.

The Gladstone Regional Council (GRC) reticulates bulk drinking water produced by GAWB to domestic users. Consumer feedback on quality or supply of drinking water from domestic users is generally managed by the GRC, who maintain a database of customer feedback. In practice, GAWB will assist the regional council with enquiries on water quality where applicable and escalate issues internally if there is cause.

In general, industrial customers use the bulk of their treated water reservation for process water (e.g., in boilers) and to provide drinking water to their sites. GAWB maintains an open and responsive relationship with its customers. GAWB receives several enquiries each year from current or potential customers for information on the quality of water, to inform the design of processing plant. During 2021/22, GAWB's industrial drinking water customers did not report any water quality complaints to GAWB.

10 FINDINGS AND RECOMMENDATIONS OF THE DWQMP AUDITOR

GAWB arranged for Viridis Consultants to conduct a regular audit of the DWQMP on the 21st and 22nd January 2020 and 24th, 25th November 2015. The purpose of the audit was to verify the accuracy of the monitoring and performance data provided to the Regulator and compliance with the DWQMP. It also aims to assess the relevance of the DWQMP in relation to the service provided. A summary of outcomes of the audit are provided below. Minor non-conformances are highlighted in yellow, while the remainder of the recommendations are opportunities for improvement. The next audit is due to be completed by

Improvement Recommendation	Recommendation or OFI	Status
Migrate jar test template into Tech One (AMS) system to ensure all jar testing records are maintained	OFI	Complete
Develop a process to undertake periodic checks of SCADA alarms including shutdowns	Recommendation	In progress
Document the review process key steps including: triggers for a review, nature (comprehensive or minor), and essential inputs	Recommendation	Complete/ Ongoing
Improvement Actions Identified in the DWQMP		
Align the filtration CCP critical limit with the ADWG (i.e. 0.5NTU)	Recommendation	In Progress
Develop a framework to guide the decision on the selection of intake level	OFI	In progress
Ensure that all relevant procedure are easily accessible through the document management system	OFI	In progress
Include tracking of improvements identified in the DWQMP as part of the DWQ Weekly meetings spreadsheet	OFI	In progress
Consider additional hazards for completeness of risk register: PFAS Opportunistic pathogens Cybersecurity Staff and contractor skills and qualifications Yarwun WTP – pre chlorination step	OFI	In progress
Include a justification on the selection of the CCP critical limit values in the DWQMP	OFI	In progress
Periodically check all CCP limits to ensure they are consistent with the Documentation	Recommendation	In progress/ Ongoing
Investigate the Possibility of using Tablets/PDA devices for field Technicians performing water sampling and for the results to get logged directly into the Database/spread sheet	Recommendation	In Progress

11 OUTCOME OF THE REVIEW OF THE DWQMP

A review of the DWQMP was completed and submitted to the regulator in March 2022. Further request for information and clarifications were included on September 12, 2022. GAWB received a response from the regulator approving our DWQMP submission with the request for further information to be submitted by 31 May 2023.

The clarifications and inclusions have been outlined below:

(a) Revise 'Appendix E - DWQ Emergency Action Plan' to address the issues stated herein, including incident response protocol flowcharts.

- DWQ Emergency Action Plan needs to include 'incident notification to other two key stakeholders, i.e., Gladstone Regional Council (GRC) and/or the Central Queensland Public Health Unit (CQPHU);
- Make it clear who is responsible for issuing 'media statements and notices' pertaining to any water quality incident/event, which will adversely impact public health and/or safety; and
- Ensure incident flow charts are consistent with the most contemporary regulatory reporting requirements stated in this notice, including, but not limited to missed verification samples and your verification and operational monitoring programs.

(b) Revise the risk assessment in 'Appendix D GAWB Risk Assessment Register' and update it to include all existing and proposed preventive measures intended to achieve acceptable residual risks and identify the procedures used to ensure that these measures are effective in managing the identified risks.

It is noted you only provided information about chlorate in your IRN response, and the associated preventive measure was limited to 'reducing age of chlorine'. Preventive measures to achieve acceptable residual risks for chlorate would also include, but may not be limited to:

- (i) 'reducing rate of chlorate formation prior use' (e.g., storing sodium hypochlorite solutions in cool areas and out of direct sunlight, i.e., air-conditioned room or shaded, well ventilated storage areas;
 - (ii) process optimisation, e.g., chlorine dose optimisation to avoid high doses of chlorine;
- and
- (iii) developing a 'chemical acceptance & handling SOP'.

You must address all identified hazards with an unacceptable risk rating, similarly.

APPENDIX A – SUMMARY OF COMPLIANCE WITH WATER QUALITY CRITERIA

The results from the verification monitoring program have been compared against the levels of the water quality criteria specified by the Regulator in the *Water Quality and Reporting Guideline for a Drinking Water Service* and are summarised in Table A1. As can be seen, GAWB drinking water is compliant with the ADWG 2011 and meets the water quality criteria specified by the Office of the Water Supply Regulator

The reported statistics do not include results derived from quality control, blank or repeat samples, or from emergency or investigative samples undertaken in response to an elevated result. Nor does it include results from booster stations not considered to be direct customer offtakes as per recommendation by the DWQMP auditors. All 'less than' results have been analysed as having a value of zero (0), consistent with the quarterly reporting requirements of the QWSR.

Consistency of monitoring results over the 2021-22 period with previous years demonstrates a level of surveillance consistent and appropriate with the risks to drinking water quality.

Table A1: Verification monitoring results

Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	95 th %tile	Limit of reporting	Laboratory name
Lake Awoonga	Source Water	4,4'-DDD	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	4,4'-DDE	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	4,4'-DDT	µg/L	Q	4	0	0	0	0	0	0	2	ALS
Lake Awoonga	Source Water	Acenaphthene	µg/L	Q	4	0	0	0	0	0	0	1	ALS
Lake Awoonga	Source Water	Acenaphthylene	µg/L	Q	4	0	0	0	0	0	0	1	ALS
Lake Awoonga	Source Water	Aldrin	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	alpha-BHC	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	alpha-Endosulfan	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	beta-BHC	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	beta-Endosulfan	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	cis-Chlordane	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	delta-BHC	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Dieldrin	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS

Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	95 th %tile	Limit of reporting	Laboratory name
Lake Awoonga	Source Water	Endosulfan sulfate	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Endrin	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Endrin aldehyde	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Endrin ketone	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	gamma-BHC	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Heptachlor	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Heptachlor epoxide	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Hexachlorobenzene (HCB)	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Methoxychlor	µg/L	Q	4	0	0	0	0	0	0	2	ALS
Lake Awoonga	Source Water	Sum of Aldrin + Dieldrin	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Sum of DDD + DDE + DDT	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Total Chlordane (sum)	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	trans-Chlordane	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Azinphos Methyl	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Bromophos-ethyl	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Carbophenothion	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Chlorfenvinphos	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Chlorpyrifos	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Chlorpyrifos-methyl	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Demeton-S-methyl	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Diazinon	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Dichlorvos	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS

Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	95 th %tile	Limit of reporting	Laboratory name
Lake Awoonga	Source Water	Dimethoate	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Ethion	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Fenamiphos	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Fenthion	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Malathion	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Monocrotophos	µg/L	Q	4	0	0	0	0	0	0	2	ALS
Lake Awoonga	Source Water	Parathion	µg/L	Q	4	0	0	0	0	0	0	2	ALS
Lake Awoonga	Source Water	Parathion-methyl	µg/L	Q	4	0	0	0	0	0	0	2	ALS
Lake Awoonga	Source Water	Pirimphos-ethyl	µg/L	Q	4	0	0	0	0	0	0	0.5	ALS
Lake Awoonga	Source Water	Prothiofos	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	0.5	ALS
Lake Awoonga	Source Water	Dissolved Oxygen	%	W	100	100	0	38.7	95.6	66.0	88.0	0.1	Internal
Lake Awoonga	Source Water	pH	pH Unit	W	98	98	0	6.4	8.3	7.7	8.2	0.1	Internal
Lake Awoonga	Source Water	Turbidity	NTU	W	100	100	0	0.5	4.2	1.7	2.8	0.1	Internal
Lake Awoonga	Source Water	Hardness	mg/L	Q	8	8	0	74	89	80	86	1	Internal
Lake Awoonga	Source Water	Total Dissolved Solids	mg/L	Q	8	8	0	153	175	164	175	10	ALS
Lake Awoonga	Source Water	Arsenic	mg/L	Q	4	4	0	0.0009	0.0016	0.0012	0.0016	0.0002	ALS
Lake Awoonga	Source Water	Barium	mg/L	Q	4	4	0	0.0104	0.0153	0.0132	0.0151	0.0005	ALS
Lake Awoonga	Source Water	Cadmium	mg/L	Q	8	0	0	0.0000	0.0000	0.0000	0.0000	0.00005	ALS
Lake Awoonga	Source Water	Chromium	mg/L	Q	4	0	0	0.0000	0.0000	0.0000	0.0000	0.0002	ALS
Lake Awoonga	Source Water	Copper	mg/L	Q	4	4	0	0.0007	0.0012	0.0009	0.0012	0.0005	ALS
Lake Awoonga	Source Water	Lead	mg/L	Q	4	0	0	0.0000	0.0000	0.0000	0.0000	0.0001	ALS
Lake Awoonga	Source Water	Mercury	mg/L	Q	4	0	0	0.0000	0.0000	0.0000	0.0000	0.0001	ALS
Lake Awoonga	Source Water	Nickel	mg/L	Q	4	1	0	0.0000	0.0000	0.0000	0.0000	0.0005	ALS
Lake Awoonga	Source Water	Selenium	mg/L	Q	4	0	0	0.0000	0.0000	0.0000	0.0000	0.0002	ALS

Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	95 th %tile	Limit of reporting	Laboratory name
Lake Awoonga	Source Water	Zinc	mg/L	Q	4	1	0	0.000	0.001	0.000	0.001	0.001	ALS
Lake Awoonga	Source Water	Cyanide	mg/L	Q	8	0	0	0.000	0.000	0.000	0.000	0.004	ALS
Lake Awoonga	Source Water	Manganese-Dissolved	mg/L	W	97	96	0	0.0000	0.01	0.00021	0.0007	0.0005	ALS
Lake Awoonga	Source Water	Manganese-Total	mg/L	W	97	96	0	0.0000	0.0892	0.0195	0.0378	0.0005	ALS
Lake Awoonga	Source Water	Cyanobacteria	cells/mL	W	98	98	0	280	40610	4922	14048	1	Ecoscope
Lake Awoonga	Source Water	Escherichia coli	MPN/100 mL	W	99	21	0	0	365	5	2	1	Ecoscope
Lake Awoonga	Source Water	Cryptosporidium	oocysts/L	Q	4	0	0	0	0	0	0	0.1	ALS
Lake Awoonga	Source Water	Giardia	cysts/L	Q	4	0	0	0	0	0	0	0.1	ALS
Lake Awoonga	Source Water	Total PAHs	µg/L	Q	4	0	0	0	0	0	0	0.5	ALS
GWTP	Treatment Plant	Free Chlorine	mg/L	W	53	53	0	1.5	2.9	2.2	2.8	0.1	Internal
GWTP	Treatment Plant	Dissolved Oxygen	%	W	52	52	0	63.5	122.3	96.0	110.6	0.1	Internal
GWTP	Treatment Plant	pH	pH Unit	W	52	52	0	6.9	7.8	7.4	7.8	0.1	Internal
GWTP	Treatment Plant	Turbidity	NTU	W	53	53	0	0.01	0.64	0.11	0.19	0.1	Internal
GWTP	Treatment Plant	Colour	TCU	M	12	12	0	2	2	2	2	1	ALS
GWTP	Treatment Plant	Hardness	mg/L	Q	4	4	0	77	81	79	81	1	ALS
GWTP	Treatment Plant	Total Dissolved Solids	mg/L	Q	4	4	0	167	177	174	177	10	ALS
GWTP	Treatment Plant	Aluminium	mg/L	M	12	12	0	0.034	0.079	0.056	0.076	0.005	ALS
GWTP	Treatment Plant	Arsenic	mg/L	Q	4	4	0	0.0004	0.0005	0.0005	0.0005	0.0002	ALS
GWTP	Treatment Plant	Barium	mg/L	Q	4	4	0	0.0079	0.0143	0.0122	0.0142	0.0005	ALS
GWTP	Treatment Plant	Cadmium	mg/L	Q	4	0	0	0.00000	0.00000	0.00000	0.00000	0.00005	ALS
GWTP	Treatment Plant	Chromium	mg/L	Q	4	0	0	0.0000	0.0000	0.0000	0.0000	0.0002	ALS
GWTP	Treatment Plant	Copper	mg/L	Q	4	4	0	0.0012	0.0039	0.0024	0.0037	0.0005	ALS
GWTP	Treatment Plant	Lead	mg/L	Q	4	2	0	0.0000	0.0003	0.0001	0.0003	0.0001	ALS

Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	95 th %tile	Limit of reporting	Laboratory name
GWTP	Treatment Plant	Mercury	mg/L	Q	4	0	0	0.0000	0.0000	0.0000	0.0000	0.0001	ALS
GWTP	Treatment Plant	Nickel	mg/L	Q	4	0	0	0.0000	0.0000	0.0000	0.0000	0.0005	ALS
GWTP	Treatment Plant	Selenium	mg/L	Q	4	0	0	0.0000	0.0000	0.0000	0.0000	0.0002	ALS
GWTP	Treatment Plant	Zinc	mg/L	Q	4	4	0	0.003	0.005	0.004	0.005	0.001	ALS
GWTP	Treatment Plant	Cyanide	mg/L	Q	4	0	0	0.000	0.000	0.000	0.000	0.004	ALS
GWTP	Treatment Plant	Iron	mg/L	M	50	16	0	0.000	0.002	0.001	0.002	0.002	ALS
GWTP	Treatment Plant	Manganese-Dissolved	mg/L	W	51	22	0	0.0000	0.0060	0.0006	0.0019	0.0005	ALS
GWTP	Treatment Plant	Manganese-Total	mg/L	W	50	31	0	0.000	0.0297	0.0015	0.0051	0.0005	ALS
GWTP	Treatment Plant	Trihalomethanes	µg/L	M	12	12	0	6	27	15	27	5	ALS
GWTP	Treatment Plant	Cyanobacteria	cells/mL	W	51	3	0	0	30	1.8	15	1	Ecoscope
GWTP	Treatment Plant	Escherichia coli	MPN/100 mL	W	50	0	0	0	0	0	0	1	Ecoscope
GWTP	Treatment Plant	Chlorate	mg/L	W	50	50	0	0.031	0.221	0.090	0.188	0.005	ALS
GWTP Distribution	Transmission	Free Chlorine	mg/L	W	454	454	0	0.17	3.1	1.3	2.0	0.1	Internal
GWTP Distribution	Transmission	Dissolved Oxygen	%	W	452	452	0	62.1	115.0	96.3	107.2	0.1	Internal
GWTP Distribution	Transmission	pH	pH Unit	W	448	448	0	6.7	8.4	7.6	8.0	0.1	Internal
GWTP Distribution	Transmission	Turbidity	NTU	W	493	493	0	0.0	0.6	0.1	0.2	0.1	Internal
GWTP Distribution	Transmission	Colour	TCU	M	58	58	0	1	3	2	2	1.0	ALS
GWTP Distribution	Transmission	Aluminium	mg/L	M	112	112	0	0.005	0.084	0.048	0.063	0.005	ALS
GWTP Distribution	Transmission	Arsenic	mg/L	Q	37	37	0	0.0004	0.0011	0.0005	0.0006	0.0002	ALS
GWTP Distribution	Transmission	Barium	mg/L	Q	36	36	0	0.0083	0.0147	0.0128	0.0143	0.0005	ALS
GWTP Distribution	Transmission	Cadmium	mg/L	Q	36	0	0	0.0000	0.0000	0.0000	0.0000	0.0002	ALS

Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	95 th %tile	Limit of reporting	Laboratory name
GWTP Distribution	Transmission	Chromium	mg/L	Q	36	10	0	0.0000	0.0008	0.0001	0.0006	0.0002	ALS
GWTP Distribution	Transmission	Copper	mg/L	Q	36	36	0	0.0007	0.0352	0.0047	0.0070	0.0005	ALS
GWTP Distribution	Transmission	Lead	mg/L	Q	35	25	0	0.0000	0.0025	0.0003	0.0009	0.0001	ALS
GWTP Distribution	Transmission	Mercury	mg/L	Q	35	0	0	0.0000	0.0000	0.0000	0.0000	0.0001	ALS
GWTP Distribution	Transmission	Nickel	mg/L	Q	36	4	0	0.0000	0.0027	0.0002	0.0007	0.0005	ALS
GWTP Distribution	Transmission	Selenium	mg/L	Q	36	0	0	0.0000	0.0000	0.0000	0.0000	0.0002	ALS
GWTP Distribution	Transmission	Zinc	mg/L	Q	37	37	0	0.001	0.020	0.005	0.012	0.001	ALS
GWTP Distribution	Transmission	Iron	mg/L	M	112	95	0	0.000	0.144	0.009	0.027	0.002	ALS
GWTP Distribution	Transmission	Manganese	mg/L	M	111	45	0	0.000	0.008	0.0001	0.002	0.0005	ALS
GWTP Distribution	Transmission	Trihalomethanes	µg/L	M	109	109	0	31	219	101	178	5	ALS
GWTP Distribution	Transmission	Escherichia coli	MPN/100 mL	W	461	0	0	0	0	0	0	1	Ecoscope
GWTP Distribution	Transmission	Chlorate	mg/L	W	195	195	0	0.041	0.608	0.179	0.442	0.005	ALS
YWTP	Water Treatment	Free Chlorine	mg/L	W	52	52	0	1.3	2.6	2.2	2.5	0.1	Internal
YWTP	Water Treatment	Dissolved Oxygen	%	W	52	52	0	60.8	107.6	90.0	102.5	0.1	Internal
YWTP	Water Treatment	pH	pH Unit	W	51	51	0	6.9	7.9	7.4	7.8	0.1	Internal
YWTP	Water Treatment	Turbidity	NTU	W	52	52	0	0.01	0.3	0.1	0.2	0.1	Internal
YWTP	Water Treatment	Colour	PCU	M	12	12	0	2	5	2	3	1	ALS
YWTP	Water Treatment	Hardness	mg/L	Q	4	4	0	77	84	81	84	1	ALS
YWTP	Water Treatment	Total Dissolved Solids	mg/L	Q	4	4	0	165	183	175	183	10	ALS
YWTP	Water Treatment	Aluminium	mg/L	M	12	12	0	0.030	0.068	0.047	0.064	0.005	ALS
YWTP	Water Treatment	Arsenic	mg/L	Q	4	4	0	0.0003	0.0004	0.0004	0.0004	0.0002	ALS

Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	95 th %tile	Limit of reporting	Laboratory name
YWTP	Water Treatment	Barium	mg/L	Q	4	4	0	0.0092	0.0138	0.0122	0.0137	0.0005	ALS
YWTP	Water Treatment	Cadmium	mg/L	Q	4	0	0	0.0000	0.0000	0.0000	0.0000	0.0005	ALS
YWTP	Water Treatment	Chromium	mg/L	Q	4	1	0	0.0000	0.0026	0.0007	0.0022	0.0002	ALS
YWTP	Water Treatment	Copper	mg/L	Q	4	4	0	0.0010	0.0018	0.0015	0.0018	0.0005	ALS
YWTP	Water Treatment	Lead	mg/L	Q	4	1	0	0.0000	0.0002	0.0001	0.0002	0.0001	ALS
YWTP	Water Treatment	Mercury	mg/L	Q	4	0	0	0.0000	0.0000	0.0000	0.0000	0.0001	ALS
YWTP	Water Treatment	Nickel	mg/L	Q	4	0	0	0.0000	0.0000	0.0000	0.0000	0.0005	ALS
YWTP	Water Treatment	Selenium	mg/L	Q	4	0	0	0.0000	0.0000	0.0000	0.0000	0.0002	ALS
YWTP	Water Treatment	Zinc	mg/L	Q	4	4	0	0.002	0.008	0.005	0.008	0.001	ALS
YWTP	Water Treatment	Cyanide	mg/L	Q	4	0	0	0.000	0.000	0.000	0.000	0.004	ALS
YWTP	Water Treatment	Iron	mg/L	W	50	18	0	0.000	0.032	0.003	0.011	0.002	ALS
YWTP	Water Treatment	Manganese Dissolved	mg/L	W	51	32	0	0.0000	0.0070	0.0008	0.0025	0.0005	ALS
YWTP	Water Treatment	Manganese-Total	mg/L	W	49	35	0	0.000	0.0100	0.0011	0.0033	0.0005	ALS
YWTP	Water Treatment	Trihalomethanes	µg/L	M	12	11	0	0	37	25	36	5	ALS
YWTP	Water Treatment	Cyanobacteria	cells/mL	W	51	0	0	0	0	0	0	1	Ecoscope
YWTP	Water Treatment	Escherichia coli	MPN/100 mL	W	51	0	0	0	0	0	0	1	Ecoscope
YWTP	Water Treatment	Chlorate	mg/L	W	50	50	0	0.064	0.264	0.143	0.219	0.005	ALS
YWTP	Water Treatment	Bromate	mg/L	Q	4	0	0	0	0	0	0	0.005	ALS
YWTP Distribution	Transmission	Free Chlorine	mg/L	W	353	353	0	0.04	3.2	1.2	1.8	0.1	Internal
YWTP Distribution	Transmission	Dissolved Oxygen	%	W	353	353	0	65.9	111.4	97.58	107.6	0.1	Internal
YWTP Distribution	Transmission	pH	pH Unit	W	346	346	0	7.0	8.9	7.8	8.4	0.1	Internal
YWTP Distribution	Transmission	Turbidity	NTU	W	353	352	0	0.0	0.7	0.1	0.3	0.1	Internal
YWTP Distribution	Transmission	Colour	TCU	M	24	24	0	2	5	2	5	1	ALS

Scheme name	Scheme component	Parameter	Units	Frequency of sampling	Total No. samples collected	No. of samples in which parameter was detected	No. of samples exceeding water quality criteria	Min	Max	Average (Mean)	95 th %tile	Limit of reporting	Laboratory name
YWTP Distribution	Transmission	Aluminium	mg/L	M	74	74	0	0.030	0.070	0.048	0.064	0.005	ALS
YWTP Distribution	Transmission	Arsenic	mg/L	Q	24	24	0	0.0004	0.0006	0.0005	0.0005	0.0002	ALS
YWTP Distribution	Transmission	Barium	mg/L	Q	24	24	0	0.0091	0.0150	0.0127	0.0145	0.0005	ALS
YWTP Distribution	Transmission	Cadmium	mg/L	Q	24	9	0	0.00000	0.00000	0.00000	0.00000	0.00005	ALS
YWTP Distribution	Transmission	Chromium	mg/L	Q	24	7	0	0.0000	0.0024	0.0004	0.0023	0.0002	ALS
YWTP Distribution	Transmission	Copper	mg/L	Q	24	24	0	0.0006	0.0090	0.0034	0.0069	0.0005	ALS
YWTP Distribution	Transmission	Lead	mg/L	Q	24	16	0	0.0000	0.0006	0.0002	0.0004	0.0001	ALS
YWTP Distribution	Transmission	Mercury	mg/L	Q	24	0	0	0.0000	0.0000	0.0000	0.0000	0.0001	ALS
YWTP Distribution	Transmission	Nickel	mg/L	Q	24	2	0	0.0000	0.0010	0.0000	0.0005	0.0005	ALS
YWTP Distribution	Transmission	Selenium	mg/L	Q	24	0	0	0.0000	0.0000	0.0000	0.0000	0.0002	ALS
YWTP Distribution	Transmission	Zinc	mg/L	Q	24	22	0	0.000	0.006	0.003	0.006	0.001	ALS
YWTP Distribution	Transmission	Iron	mg/L	M	73	45	0	0.00	0.037	0.004	0.017	0.002	ALS
YWTP Distribution	Transmission	Manganese-Total	mg/L	M	74	28	0	0.0000	0.0203	0.0007	0.0029	0.0005	ALS
YWTP Distribution	Transmission	Trihalomethanes	µg/L	M	73	73	0	26	135	61	98	5	ALS
YWTP Distribution	Transmission	Escherichia coli	MPN/100 mL	W	346	0	0	0	0	0	0	1	Ecoscope
YWTP Distribution	Transmission	Chlorate	mg/L	W	49	49	0	0.083	0.453	0.272	0.422	0.005	ALS

Tables A2 and A3 summarise the monthly results for all *E. coli* verification monitoring undertaken in the Gladstone and Yarwun systems.

Table A2 - Reticulation *E. coli* verification monitoring in Gladstone WTP Distribution. This includes the WTP Treated water, Distribution Network.

Gladstone WTP Distribution 2021/22												
Month	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22
No. Samples collected	47	52	47	44	49	37	50	36	53	48	56	43
No samples collected in which <i>E. coli</i> was detected	0	0	0	0	0	0	0	0	0	0	0	0
No samples collected in previous 12-month period	30	38	50	44	42	44	38	31	53	48	55	47
No samples in which <i>E. coli</i> detected for previous 12-month period	0	0	0	0	0	0	0	0	0	0	0	0
% Samples that comply	100	100	100	100	100	100	100	100	100	100	100	100
Compliance with 98% annual value	100	100	100	100	100	100	100	100	100	100	100	100

Table A3 - Reticulation E. coli verification monitoring in Yarwun WTP Distribution

Yarwun WTP Distribution 2021 / 22												
Month	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22
No. Samples collected	32	40	32	32	39	26	32	32	40	32	30	32
No samples collected in which E. coli was detected	0	0	0	0	0	0	0	0	0	0	0	0
No samples collected in previous 12-month period	21	23	32	28	27	27	24	16	35	28	28	35
No samples in which E. coli detected for previous 12-month period	0	0	0	0	0	0	0	0	0	0	0	0
% Samples that comply	100	100	100	100	100	100	100	100	100	100	100	100
Compliance with 98% annual value	100	100	100	100	100	100	100	100	100	100	100	100