

**Gladstone Area
Water Board**

**Drinking Water Quality
Management Plan**

ANNUAL REPORT 2012/13

Gladstone Area Water Board

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Gladstone Area Water Board

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1 INTRODUCTION

Gladstone Area Water Board's (GAWBs) Drinking Water Quality Management Plan (DWQMP), approved on 29 February 2011, addresses the requirements of section 95 (3) of the *Water Supply (Safety & Reliability) Act 2008* (WSSRA) to ensure safe drinking water for its customers.

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).

1.1 Registered Service Details

GAWB is a registered Water Service Provider (WSP) under the WSSRA, and is regulated by the Chief Executive of the DEWS. Powers under WSSRA have been delegated to the officers of the Office of the Water Supply Regulator (OWSR) and OWSR is the primary contact for communications regarding the DWQMP, including reporting requirements under the approval terms and conditions.

In addition, by virtue of 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 Energy and Water Supply. 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.

GAWBs 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 147 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



1.2 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 Regulators 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 Act;
- Summarises the results of the verification water quality monitoring program undertaken by GAWB; and
- Summarises customer satisfaction and GAWBs response to any complaints regarding drinking water quality.

To date, GAWB has not undertaken a review of its DWQMP (due in 2014) or been subject to an external audit of the plan and, hence, these criteria are not addressed in this annual report.



2 OVERVIEW OF OPERATIONS 2012/13

GAWB operates two registered 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 GAWBs potable water customer connections of its two schemes as of 2012/13.

GAWBs current drinking water connection details

Customer	Number of Metered Connections
Gladstone WTP Scheme	
Boyne Smelters Limited	2
Gladstone Regional Council	9
Queensland Alumina Limited	2
APLNG	1
QCLNG	1
Non-commercial connections	33
Yarwun WTP Scheme	
Cement Australia	2
Gladstone Regional Council	5
Jemena	1
Orica	1
Queensland Rail	2
Rio Tinto Aluminium Yarwun	3
TOTAL	62

2.1 Gladstone WTP Scheme

Drinking water supplied from the Gladstone scheme is treated at the Gladstone WTP and then distributed to GAWBs customers either directly off the mains or from the outlet of three 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 45,000), a number of industrial customers and 34 residential customers.

Treatment Process and Delivery Network

Gladstone WTP conventional water treatment process has a nominal capacity of 55ML per day at 20 hours availability, and consists of two parallel process streams which can be operated together or independently of one another. The main difference between the two plants is the sedimentation method:



- Plant 1 uses two circular up-flow clarifiers, which feed tube settlers from the centre. Clarified water is skimmed using radial launders and then channeled to dual media filters 1 to 8.
- Plant 2 uses Dissolved Air Flotation (DAF) to float solids to the surface for removal by rollers. Clarified water is skimmed from beneath the surface and channeled to dual media filters 9 to 12.

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, fluoridation occurs and the fully treated water enters the 2.25ML clear water contact tank.

Water is pumped from GWTP by the low lift and high lift pump sets. The low lift pumps deliver water directly to three GRC-owned reservoirs. The high lift pumps deliver water to GAWBs distribution network, which includes three reservoirs and three rechlorination facilities.

During 2012/13, GWTP produced approximately 9.5 gigalitres of drinking water, as can be seen in the table below. Average production was approximately half of the capacity of the plant, with maximum day close to plant capacity.

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 no revisions of 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 2012/13, the GWTP consistently produced filtered waters of 0.11 NTU (95th percentile).

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 GWTP and transmission network achieved 100% compliance against ADWG criteria. A full list of parameters and summary results can be found in Appendix A.

Measure	GWTP 2012/13 Performance	
Water production per annum	9,475 ML	
Average daily production	26.0 ML	
Maximum daily production	50.2 ML	12 Dec 2012
Minimum daily production	15.8 ML	21 July 2012



Filtered water turbidity (NTU)	0.11	95 th %tile
Water Quality Compliance ADWG	100% compliance	

Major works

During 2012/13 a new Powder Activated Carbon (PAC) plant was built and commissioned. The plant is designed to increase PAC contact time, optimising organics removal. It also provides a broader PAC dosing range than the old PAC plant.

During 2012/13, the GWTP scheme network was expanded with the construction of a new pump station and approximately 10km of pipeline to supply drinking water to industrial customers on Curtis Island. In terms of water quality, the system underwent a risk assessment following the GAWB DWQMP methodology and is operating under standard operating procedures (SOPs) which incorporate the risk assessment. The results of the risk assessment will be merged into the GAWB DWQMP on the upcoming review in 2014.

Treatment/network interruptions

During 2012/13 the GWTP and network did not have any interruptions to supply or quality of drinking water.

2.2 Yarwun WTP Scheme

Drinking water supplied from the Yarwun scheme is treated at the Yarwun WTP and then distributed to GAWBs 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 Water Treatment Plant (WTP), located on Reid Road in the Yarwun Industrial Estate, has a total current design capacity of 5 megalitres per day based on 20 hours availability.

Yarwun WTP conventional treatment is a single stream process with one clarifier and 3 mono-media filters, pH correction, chlorine disinfection and fluoridation. The plant is unattended and operates automatically, with daily operator visits to conduct general duties, monitoring and maintenance. The plant PLC and 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.

To ensure a disinfectant residual is maintained through to customer supply points GAWB uses 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 2012/13, YWTP produced approximately 1.5 gigalitres of drinking water, as can be seen in the table below. The average daily production was 4.1 ML/day with maximum day production 6.6ML.

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. There have been no revisions of the operational monitoring program since development of the DWQMP.

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 0.3 nephelometric turbidity units (NTU) during normal operation (that is, not including backwash or filter ripening). Excluding an extreme source water turbidity event associated with major inflows into Lake Awoonga, during the course of 2012/13 and under normal operation, the YWTP consistently produced filtered waters of 0.24 NTU (95th percentile). In early February 2013 the source water, Lake Awoonga, experienced exceptionally high turbidity and low alkalinity as a result of extreme rainfall associated with Ex- Tropical Cyclone Oswald. As a result, YWTP filters experienced prolonged turbidity breakthrough above the CCP alarm limits. The system was declared not-for-drinking on a precautionary basis until the process was brought under control. Further information on this event is provided in Section 3: Notifications to the Regulator.

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 results can be found in Appendix A.

Measure	YWTP 2012/13 Performance	
Water production per annum	1,510 ML	
Average daily production	4.1 ML	
Maximum daily production	6.6 ML	29 May 2013
Minimum daily production	2.1 ML	19 July 2012
Filtered water turbidity (NTU)	0.24	95th %tile
Water Quality Compliance ADWG	100% compliance	

Major works

During 2012/13, individual turbidity meters were installed on the outlet of each filter to enable monitoring of filtrate turbidity from each filter. The optimisation of these units, to provide reliable



data, is presently under trial and review. These units will be incorporated into the monitoring of the filter CCP when fully operational.

During 2012/13, the Mt Miller reservoir bypass pipes were replaced with a discreet inlet and outlet for the reservoir. This improvement ensures that water in the reservoir is 'turned over', minimising water aging issues associated with the reservoir being bypassed during periods of high industrial demand.

Treatment/network interruptions

During February 2012/13, the YWTP was unable to fully treat water to meet its internal drinking water targets on filtration turbidity, which resulted in a disruption in GAWBs ability to supply drinking water to several of its industrial customers. However, in consultation with its customers and the OWSR, GAWB was able to continue to supply critical process-grade water to these industries and continued to maintain a supply of drinking water to the GRC for reticulation to the Mt Larcom Township. Further information on this event is provided in Section 3: Notifications to the Regulator.



3 NOTIFICATIONS TO THE REGULATOR

The January 2013 flood event caused high turbidity in the Lake Awoonga source water over an extended period. Combined with a sudden drop in alkalinity and simultaneous high customer demand, turbidity breakthroughs occurred at the Yarwun WTP.

GAWB was unable to bring the coagulation and filtration processes under control in the short term and on 1 February 2013, notified the Regulator of a high turbidity event from its Yarwun WTP, with the potential to cause difficulty in the ability for GAWB to adequately treat drinking water to GAWB's internal standard of less than 0.3 NTU. The incident reference number is DWI-7-200-00006.

Treated drinking water from the Yarwun WTP is primarily used by GAWB's industrial customers to support plant processes (e.g. boiler water make-up). Drinking water is also supplied to the East End Reservoir, from which GRC reticulates water to the small township of Mt Larcom. In consultation with its customers, GAWB continued to produce water of a higher than normal turbidity (2-4NTU) from the Yarwun WTP, declaring the system not-for-drinking. The East End Reservoir was isolated from Yarwun WTP processes and a supply of drinking water for the township of Mt Larcom maintained through water trucking. Industrial customers provided their own drinking water on site.

An investigation of the issues found that the clarifier sludge blanket became unstable because of the large and sudden drop in alkalinity, resulting in a less than optimal pH buffering capacity for aluminium sulphate dosing. At the same time, demand through the plant increased causing further stress to the process. To bring the system back into control GAWB implemented temporary soda ash dosing to raise alkalinity levels, poly-electrolyte dosing to the filters to extend filter run times and restricted customer flows to allow the plant to recover.

Once the plant processes were confirmed to be stable, the network was disinfected and verified and declared drinking water standard on 22 February.

GAWB submitted a Part A and Part B Incident report detailing actions taken.



4 IMPLEMENTATION OF IMPROVEMENT ACTIONS

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 mitigate risks to drinking water quality.

The table below lists the improvement actions identified during the development of the DWQMP, target dates for completion and current status. Seventeen of the twenty-four action items have been complete. Of the outstanding actions:

- S1 - Land Management Plan is tracking to its target date;
- S2.1 - Connection of the water quality profiler has been delayed by significant damage sustained during the floods of early 2013. Likely completion date is now June 2014;
- G2.1 and G7.2 - Chemical jar testing optimisation and population of the AM system will continue to be ongoing improvement actions;
- Y2.1 – Future of recovered water at YWTP is subject to options study of the plant
- G7.1 – There was a delay in the release of water treatment chemical contracts to tender. The contracts, including the requirement to report maximum impurity concentrations, will be in place by October 2013.

Item No.	Scheme Component / Sub-component	Action(s)	Target date	Status as at 30/9/13	Comments
S1	Source Water - Land Management	Develop Land Management Plan	Jun-14	Ongoing	Land management plan under development and tracking to target date.
S2.1	Source Water - Water Abstraction	Connect water quality profiler to telemetry network to allow real time monitoring of water quality	Jun-12	Ongoing	Water profiler sustained significant damage during 2013 floods. A project plan is been developed for its repair, timing subject to insurance claim, however expected completion Jun -14
G1.1	GWTP - Pre-treatment	PAC system upgrade	Jul-11	Complete	
G2.1	GWTP - Primary solids removal	Chemical jar testing of other treatment chemicals	Ongoing	Ongoing	Use of specialised coagulants in emergency situations (high turbidity/low alkalinity) subject to ongoing jar tests and emergency preparedness



Item No.	Scheme Component / Sub-component	Action(s)	Target date	Status as at 30/9/13	Comments
		Clarifier shade-roof project	Jul-12	Complete	Project will not go ahead based on cost benefit considerations
G2.4	GWTP - Primary solids removal	Mechanical & chemical optimisation, including investigation of tachometer on DAF rollers, automated sludge removal, alternate chemical jar testing	Jul-12	Complete	Optimisation investigations complete. Changes made to mechanical mixing of coagulant and coagulant aid resulting in improved turbidity from DAF units. Automated sludge removal requires major plant upgrade: decision deferred until next major plant augmentation. To be identified as new item in 2014 review of DWQMP.
G3.1	GWTP - Filtration	Plant operating philosophy - Improve flow rate control & implement soft start on plant. Investigate VSD on pump sets	Jul-11	Complete	Flow rate control and soft starts implemented. VSDs project in 5 year capital plan with target commissioning date end 2014.
		Review filter ripening parameters	Jul-12	Complete	Filter ripening parameters incorporated into quarterly filter inspections
G6.1/Y7.1	GWTP - Distribution and delivery	Mains break/repair procedures	Jul-12	Complete	SOP developed for mains break including disinfection of equipment and returning system to service
	GWTP - Distribution and delivery	Pipeline pressure monitoring and recording via telemetry	Oct-11	Complete	Pressure monitoring implemented. Ongoing improvements will be automatic alarming for pressure/flow discrepancy
G6.6	GWTP - Distribution and delivery	Investigate control for filling GRC reservoirs from low lift system	Jul-12	Complete	Flow control ramps have reduced sudden shear through filters. VFD project will result in further reduction in plant ramp speeds. Filters performing at <0.1NTU consistently
G7.1	GWTP - Chemical procedures	Develop Chemical Acceptance and Handling SOP for all chemicals	Jul-11	Complete	All chemical batches subject to documented chemical acceptance procedure.
		Certificate of Analysis in future chemical contracts	Oct-11	Ongoing	Scopes for all chemicals have been developed. There has been an internal delay in releasing new contracts to tender, however this will be complete by Oct-13
G7.2	GWTP - General Maintenance	Sanitary work methods in site induction and contracts	Jul-11	Complete	Contractor handbook includes requirement to use sanitary methods to protect water quality. Water quality considered and incorporated in all new contracts.



Item No.	Scheme Component / Sub-component	Action(s)	Target date	Status as at 30/9/13	Comments
		AM system to flag potable water assets	Ongoing	Ongoing	Ongoing population of AM system captures requirements for drinking water assets
G7.3	GWTP - Emergency	Communication of significant risks to GRC	Dec-11	Complete	Communicated through dissemination of DWQMP .
		Development of a multi-stakeholder DWQ Emergency Action Plan	Jul-12	Complete	Ongoing scenario testing now in progress
		Pipe line pressure monitoring and recording via telemetry	Oct-11	Complete	Future continuous improvements to include alarms on pressure drops through network
Y2.1	YWTP - Recovered Water	Develop project for alternative use of recovered water	Jul-12	Ongoing	YWTP subject to new capacity study which includes recovered water system
Y3.1	YWTP - Primary solids removal	Clarifier shade-roof project	Jul-13	Complete	Project will not go ahead based on cost benefit considerations
Y4.1	YWTP - Filtration	Install turbidity meters on outlet of each filter	Jul-11	Complete	Ongoing work required to make these reliable
Y7.3	YWTP - Distribution	Discreet inlet and outlet on Mt Miller Reservoir so that water cannot bypass reservoir	Jul-12	Complete	
General	GAWB processes	Migrate DWQ risks into CURA risk management software to allow streamlined tracking of risks	Jul-12	Complete	Risk management software populated with water quality risks.



5 CUSTOMER SATISFACTION

GAWB monitors customer satisfaction on the water quality by maintaining a register of complaints. Complaints are reported to the Minister on a quarterly basis in GAWB Performance Plan Key Performance Measures. During 2012/13 GAWB did not record any complaints about water quality from its customers, including GRC, industrial customers or the small number of reticulation customers on GAWBs 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. During 2012/13 the GRC did not report any water quality complaints to GAWB.

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, as demonstrated by the cooperative response by its customers to the water quality issues at Yarwun WTP. 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 2012/13, GAWBs industrial drinking water customers did not report any water quality complaints to GAWB.



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. All 'less than' results have been analysed as having a value of zero (0), consistent with the quarterly reporting requirements of the OWSR.

Deviations from the sampling program proposed in the DWQMP include:

- Exclusion of investigative and system verification results derived during the Yarwun WTP turbidity incident;
- Field pH probe was unservicable during the week ending 15 March 2013, hence verification results for pH are not available for that week;
- *E. coli* sampling not undertaken in the week following Christmas due to closure of laboratories.

Consistency of monitoring results over the 2012/13 period with previous years demonstrates a level of surveillance consistent and appropriate with the risks to drinking water quality. Sampling for manganese from the WTP inlets and outlets at both plants has been increased to weekly. This was undertaken to remove the risk to operators from having to handle the cyanide-based reactant used for in-house manganese testing in operational monitoring.

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)	95th %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	0.0	0.0	2	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



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)	95th %tile	Limit of reporting	Laboratory name
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
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	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



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)	95th %tile	Limit of reporting	Laboratory name
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
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	0.0	0.0	2	ALS
Lake Awoonga	Source Water	Parathion	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	2	ALS
Lake Awoonga	Source Water	Parathion-methyl	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	2	ALS
Lake Awoonga	Source Water	Pirimphos-ethyl	µg/L	Q	4	0	0	0.0	0.0	0.0	0.0	2	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	30.6	119.2	75.8	94.0	0.1	Internal
Lake Awoonga	Source Water	pH	pH Unit	W	98	98	0	6.9	9.0	7.9	8.2	0.1	Internal
Lake Awoonga	Source Water	Turbidity	NTU	W	100	100	0	0.6	166.0	30.4	126.5	0.1	Internal
Lake Awoonga	Source Water	Hardness	mg/L	W	8	8	0	35	85	66	85	1	Internal
Lake Awoonga	Source Water	Total Dissolved Solids	mg/L	M	8	8	0	111	205	164	203	10	ALS
Lake Awoonga	Source Water	Arsenic	mg/L	M	4	4	0	0.000	0.002	0.002	0.002	0.001	ALS
Lake Awoonga	Source Water	Barium	mg/L	M	4	4	0	0.013	0.027	0.018	0.026	0.001	ALS
Lake Awoonga	Source Water	Cadmium	mg/L	M	8	0	0	0.0000	0.0000	0.0000	0.0000	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)	95th %tile	Limit of reporting	Laboratory name
Lake Awoonga	Source Water	Chromium	mg/L	M	4	4	0	0.000	0.004	0.001	0.004	0.001	ALS
Lake Awoonga	Source Water	Copper	mg/L	M	4	4	0	0.000	0.018	0.006	0.016	0.001	ALS
Lake Awoonga	Source Water	Lead	mg/L	M	4	4	0	0.000	0.002	0.001	0.002	0.001	ALS
Lake Awoonga	Source Water	Mercury	mg/L	M	4	0	0	0.0000	0.0000	0.0000	0.0000	0.0001	ALS
Lake Awoonga	Source Water	Nickle	mg/L	M	8	8	0	0.000	0.014	0.002	0.009	0.001	ALS
Lake Awoonga	Source Water	Selenium	mg/L	M	4	0	0	0.00	0.00	0.00	0.00	0.01	ALS
Lake Awoonga	Source Water	Zinc	mg/L	M	4	4	0	0.000	0.014	0.004	0.012	0.005	ALS
Lake Awoonga	Source Water	Cyanide	mg/L	M	7	0	0	0.000	0.000	0.000	0.000	0.004	ALS
Lake Awoonga	Source Water	Manganese	mg/L	BM	26	26	0	0.002	0.016	0.005	0.007	0.001	ALS
Lake Awoonga	Source Water	Cyanobacteria	cells/mL	W	97	97	0	0	51000	3925	16480	1	Ecoscope
Lake Awoonga	Source Water	Cylindrospermops in	µg/L	W	2	2	0	0	0	0	0	0.2	Ecoscope
Lake Awoonga	Source Water	Escherichia coli	MPN/100 mL	W	99	99	0	0	276	4	6	1	Ecoscope
Lake Awoonga	Source Water	Cryptosporidium	oocysts/L	M	3	0	0	0	0	0	0	1	ALS
Lake Awoonga	Source Water	Giardia	cysts/L	M	3	0	0	0	0	0	0	1	ALS
Lake Awoonga	Source Water	Total PAHs	µg/L	Q	4	0	0	0	0	0	0	1	ALS
Lake Awoonga	Source Water	Benzo(a)pyrene	µg/L	Q	4	0	0	0	0	0	0	0.5	ALS
GWTP	Treatment Plant	Free Chlorine	mg/L	W	51	51	0	1.0	4.1	2.0	3.1	0.1	Internal
GWTP	Treatment Plant	Dissolved Oxygen	%	W	51	51	0	79.3	122.3	92.8	101.5	0.1	Internal
GWTP	Treatment Plant	pH	pH Unit	W	50	50	0	6.8	8.1	7.4	7.9	0.1	Internal
GWTP	Treatment Plant	Turbidity	NTU	W	51	51	0	0.1	0.3	0.2	0.3	0.1	Internal



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)	95th %tile	Limit of reporting	Laboratory name
GWTP	Treatment Plant	Colour	PCU	M	12	11	0	0	7	4	7	1	ALS
GWTP	Treatment Plant	Hardness	mg/L	Q	4	4	0	37	83	65	83	1	ALS
GWTP	Treatment Plant	Total Dissolved Solids	mg/L	Q	4	4	0	117	230	167	223	10	ALS
GWTP	Treatment Plant	Aluminium	mg/L	M	12	12	0	0.02	0.11	0.04	0.09	0.01	ALS
GWTP	Treatment Plant	Arsenic	mg/L	Q	4	0	0	0.000	0.000	0.000	0.000	0.001	ALS
GWTP	Treatment Plant	Barium	mg/L	Q	4	4	0	0.012	0.013	0.013	0.013	0.001	ALS
GWTP	Treatment Plant	Cadmium	mg/L	Q	4	0	0	0.0000	0.0000	0.0000	0.0000	0.0001	ALS
GWTP	Treatment Plant	Chromium	mg/L	Q	4	0	0	0.000	0.000	0.000	0.000	0.001	ALS
GWTP	Treatment Plant	Copper	mg/L	Q	4	4	0	0.002	0.007	0.005	0.007	0.001	ALS
GWTP	Treatment Plant	Lead	mg/L	Q	4	0	0	0.000	0.000	0.000	0.000	0.001	ALS
GWTP	Treatment Plant	Mercury	mg/L	Q	4	0	0	0.0000	0.0000	0.0000	0.0000	0.0001	ALS
GWTP	Treatment Plant	Nickle	mg/L	Q	4	0	0	0.000	0.000	0.000	0.000	0.001	ALS
GWTP	Treatment Plant	Selenium	mg/L	Q	4	0	0	0.00	0.00	0.00	0.00	0.01	ALS
GWTP	Treatment Plant	Zinc	mg/L	Q	4	1	0	0.000	0.009	0.002	0.008	0.005	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	12	11	0	0.00	0.13	0.01	0.06	0.05	ALS
GWTP	Treatment Plant	Manganese	mg/L	M	26	22	0	0.000	0.002	0.000	0.002	0.001	ALS
GWTP	Treatment Plant	Trihalomethanes	µg/L	M	12	12	0	5	40	21	39	5	ALS
GWTP	Treatment Plant	Cyanobacteria	cells/mL	W	49	11	0	0	540	31	80	1	Ecoscope
GWTP	Treatment Plant	Escherichia coli	MPN/100 mL	W	51	0	0	0	0	0	0	1	Ecoscope



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)	95th %tile	Limit of reporting	Laboratory name
GWTP Distribution	Transmission	Free Chlorine	mg/L	W	305	305	0	0.3	3.7	1.4	2.2	0.1	Internal
GWTP Distribution	Transmission	Dissolved Oxygen	%	W	305	305	0	79.9	116.6	95.8	103.8	0.1	Internal
GWTP Distribution	Transmission	pH	pH Unit	W	295	295	0	6.6	8.5	7.6	8.1	0.1	Internal
GWTP Distribution	Transmission	Turbidity	NTU	W	305	305	0	0.1	1.1	0.2	0.3	0.1	Internal
GWTP Distribution	Transmission	Colour	PCU	M	72	66	0	0	8	3	7	1	ALS
GWTP Distribution	Transmission	Aluminium	mg/L	M	72	72	0	0.02	0.14	0.04	0.06	0.01	ALS
GWTP Distribution	Transmission	Arsenic	mg/L	Q	24	1	0	0.000	0.002	0.000	0.000	0.001	ALS
GWTP Distribution	Transmission	Barium	mg/L	Q	24	24	0	0.008	0.014	0.012	0.013	0.001	ALS
GWTP Distribution	Transmission	Cadmium	mg/L	Q	24	2	0	0.0000	0.0003	0.0000	0.0001	0.0001	ALS
GWTP Distribution	Transmission	Chromium	mg/L	Q	24	0	0	0.000	0.000	0.000	0.000	0.001	ALS
GWTP Distribution	Transmission	Copper	mg/L	Q	24	24	0	0.002	0.011	0.005	0.009	0.001	ALS
GWTP Distribution	Transmission	Lead	mg/L	Q	24	1	0	0.000	0.001	0.000	0.000	0.001	ALS
GWTP Distribution	Transmission	Mercury	mg/L	Q	24	0	0	0.0000	0.0000	0.0000	0.0000	0.0001	ALS
GWTP Distribution	Transmission	Nickle	mg/L	Q	24	0	0	0.000	0.000	0.000	0.000	0.001	ALS
GWTP Distribution	Transmission	Selenium	mg/L	Q	24	0	0	0.00	0.00	0.00	0.00	0.01	ALS
GWTP Distribution	Transmission	Zinc	mg/L	Q	24	12	0	0.000	0.012	0.004	0.010	0.005	ALS
GWTP Distribution	Transmission	Iron	mg/L	M	72	2	0	0.00	0.31	0.01	0.00	0.05	ALS
GWTP Distribution	Transmission	Manganese	mg/L	M	72	21	0	0.000	0.007	0.001	0.003	0.001	ALS
GWTP Distribution	Transmission	Trihalomethanes	µg/L	M	72	72	0	26	142	66	104	5	ALS
GWTP Distribution	Transmission	Escherichia coli	MPN/100 mL	W	299	0	0	0	0	0	0	1	Ecoscope



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)	95th %tile	Limit of reporting	Laboratory name
YWTP	Water Treatment	Free Chlorine	mg/L	W	48	48	0	1.1	4.6	2.5	4.0	0.1	Internal
YWTP	Water Treatment	Dissolved Oxygen	%	W	48	48	0	76.5	107.4	93.5	104.9	0.1	Internal
YWTP	Water Treatment	pH	pH Unit	W	47	47	0	6.5	8.5	7.5	8.1	0.1	Internal
YWTP	Water Treatment	Turbidity	NTU	W	48	48	0	0.1	2.3	0.4	1.0	0.1	Internal
YWTP	Water Treatment	Colour	PCU	M	10	10	0	1	6	4	6	1	ALS
YWTP	Water Treatment	Hardness	mg/L	Q	3	3	0	60	88	78	88	1	ALS
YWTP	Water Treatment	Total Dissolved Solids	mg/L	Q	3	3	0	165	226	204	226	10	ALS
YWTP	Water Treatment	Aluminium	mg/L	M	11	11	0	0.04	0.21	0.11	0.19	0.01	ALS
YWTP	Water Treatment	Arsenic	mg/L	Q	3	0	0	0.000	0.000	0.000	0.000	0.001	ALS
YWTP	Water Treatment	Barium	mg/L	Q	3	3	0	0.011	0.013	0.012	0.013	0.001	ALS
YWTP	Water Treatment	Cadmium	mg/L	Q	3	0	0	0.0000	0.0000	0.0000	0.0000	0.0001	ALS
YWTP	Water Treatment	Chromium	mg/L	Q	3	0	0	0.000	0.000	0.000	0.000	0.001	ALS
YWTP	Water Treatment	Copper	mg/L	Q	3	2	0	0.000	0.002	0.001	0.002	0.001	ALS
YWTP	Water Treatment	Lead	mg/L	Q	3	0	0	0.000	0.000	0.000	0.000	0.001	ALS
YWTP	Water Treatment	Mercury	mg/L	Q	3	0	0	0.0000	0.0000	0.0000	0.0000	0.0001	ALS
YWTP	Water Treatment	Nickle	mg/L	Q	3	0	0	0.000	0.000	0.000	0.000	0.001	ALS
YWTP	Water Treatment	Selenium	mg/L	Q	3	0	0	0.00	0.00	0.00	0.00	0.01	ALS
YWTP	Water Treatment	Zinc	mg/L	Q	3	0	0	0.000	0.000	0.000	0.000	0.005	ALS
YWTP	Water Treatment	Cyanide	mg/L	Q	3	0	0	0.000	0.000	0.000	0.000	0.004	ALS
YWTP	Water Treatment	Iron	mg/L	M	11	0	0	0.00	0.00	0.00	0.00	0.05	ALS
YWTP	Water Treatment	Manganese	mg/L	M	25	14	0	0.000	0.007	0.002	0.010	0.001	ALS
YWTP	Water Treatment	Trihalomethanes	µg/L	M	10	10	0	12	53	30	45	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)	95th %tile	Limit of reporting	Laboratory name
YWTP	Water Treatment	Cyanobacteria	cells/mL	W	47	12	0	0	860	46	174	1	Ecoscope
YWTP	Water Treatment	Escherichia coli	MPN/100 mL	W	47	0	0	0	0	0	0	1	Ecoscope
YWTP Distribution	Transmission	Free Chlorine	mg/L	W	259	259	0	0.1	4.9	1.5	2.9	0.1	Internal
YWTP Distribution	Transmission	Dissolved Oxygen	%	W	266	266	0	62.9	132.5	96.7	104.8	0.1	Internal
YWTP Distribution	Transmission	pH	pH Unit	W	260	260	24	6.4	9.2	8.0	8.8	0.1	Internal
YWTP Distribution	Transmission	Turbidity	NTU	W	259	259	0	0.1	1.1	0.2	0.5	0.1	Internal
YWTP Distribution	Transmission	Colour	PCU	M	51	49	0	0	9	3	7	1	ALS
YWTP Distribution	Transmission	Aluminium	mg/L	M	51	51	0	0.04	0.22	0.09	0.17	0.01	ALS
YWTP Distribution	Transmission	Arsenic	mg/L	Q	14	0	0	0.000	0.000	0.000	0.000	0.001	ALS
YWTP Distribution	Transmission	Barium	mg/L	Q	14	14	0	0.010	0.020	0.013	0.020	0.001	ALS
YWTP Distribution	Transmission	Cadmium	mg/L	Q	14	0	0	0.0000	0.0000	0.0000	0.0000	0.0001	ALS
YWTP Distribution	Transmission	Chromium	mg/L	Q	14	1	0	0.000	0.001	0.000	0.000	0.001	ALS
YWTP Distribution	Transmission	Copper	mg/L	Q	14	10	0	0.000	0.006	0.002	0.005	0.001	ALS
YWTP Distribution	Transmission	Lead	mg/L	Q	14	0	0	0.000	0.000	0.000	0.000	0.001	ALS
YWTP Distribution	Transmission	Mercury	mg/L	Q	14	0	0	0.0000	0.0000	0.0000	0.0000	0.0001	ALS
YWTP Distribution	Transmission	Nickle	mg/L	Q	14	1	0	0.000	0.002	0.000	0.001	0.001	ALS
YWTP Distribution	Transmission	Selenium	mg/L	Q	14	0	0	0.00	0.00	0.00	0.00	0.01	ALS
YWTP Distribution	Transmission	Zinc	mg/L	Q	14	1	0	0.000	0.008	0.001	0.003	0.005	ALS
YWTP Distribution	Transmission	Iron	mg/L	M	48	1	0	0.00	0.07	0.00	0.00	0.05	ALS
YWTP Distribution	Transmission	Manganese	mg/L	M	48	35	0	0.000	0.010	0.002	0.010	0.001	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)	95th %tile	Limit of reporting	Laboratory name
YWTP Distribution	Transmission	Trihalomethanes	µg/L	M	44	44	0	20	121	66	113	5	ALS
YWTP Distribution	Transmission	Escherichia coli	MPN/100 mL	W	264	0	0	0	0	0	0	1	Ecoscope



Table A2 - Reticulation *E. coli* verification monitoring in Gladstone WTP Distribution

Tables A2 and A3 summarise the monthly results and rolling 12 month compliance with ADWG for all *E. coli* verification monitoring undertaken in the Gladstone and Yarwun systems.

Gladstone WTP Distribution 2012/13												
Month	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Jan-13	Feb-13	Mar-13	Apr-13	May-13	Jun-13
No. Samples collected	35	28	27	35	29	22	35	20	28	35	28	28
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	25	43	26	28	28	40	35	27	28	30	35	28
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 2012/13												
Month	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Jan-13	Feb-13	Mar-13	Apr-13	May-13	Jun-13
No. Samples collected	35	25	22	31	27	21	32	7	24	28	33	26
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	15	18	17	15	36	28	33	28	26	27	35	28
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