Drinking Water Quality Management Plan
Annual Report 2020-2021

Revision 01 | December 2021

seqwater
WATER FOR LIFE

SOURCE STORE SUPPLY

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1 Executive summary

The Queensland Bulk Water Supply Authority trading as Seqwater (SPID 507) is responsible for South East Queensland's bulk water supply system. This includes catchments, storages, water treatment plants and bulk distribution infrastructure along with several small reticulation systems supplying recreation parks.

Seqwater's Drinking Water Quality Management Plan Report (**report**) outlines the activities for the management of water quality risk and issues. The report covers the period from 1 July 2020 to 30 June 2021 (**reporting period**), during which Seqwater complied with the approval conditions of its Drinking Water Quality Management Plan (**DWQMP**).

Seqwater's operational and verification monitoring programs have occurred in accordance with the criteria documented in the approved DWQMP. Operational monitoring includes online monitoring with process instrumentation and operator testing designed to assess the performance of preventive measures and requirements for corrective actions.

Verification monitoring involves a sampling and analytical testing program. Sampling and some on-site analysis are undertaken by Seqwater, with the majority of analytical testing undertaken by an external NATA-accredited laboratory. Verification monitoring during the reporting period included 29,906 tests of treated water at individual water treatment plants, and 48,156 supply system drinking water tests.

Seqwater also completed catchment and source water risk characterisation and monitoring activities, including catchment surveys and the deployment of passive samplers to detect micro-pollutants. These activities help identify changes to the source water risk profile and support Seqwater operations by enabling informed decisions about daily operations, water security and supply planning.

Water treatment and supply system verification testing against the water quality criteria in the DWQMP detected no individual health-related exceedances. Seqwater was measured as compliant during the 2020-21 reporting period for all of its water treatment operations and supply system zones for microbiological and health compliance as per *Public Health Regulation 2018*.

There was a single individual aesthetic exceedance detected within the routine verification monitoring program within the reporting period. Maroon Dam water treatment plant (**WTP**) had an elevated total iron result that was found to be due to the poor internal asset condition of a pressure vessel, which was quickly repaired. There was no significant impact to Maroon Dam's relatively small recreation park system.

Consistently low numbers of exceedances across a large and complex system during the last few years, including 2020-21, reflects the achievements made through the continuous improvement of Seqwater's drinking water assets and drinking water quality management system.

A single reportable event occurred at Image Flat WTP where low reservoir levels had the potential to affect primary disinfection. This was reported to the Water Supply Regulator (**WSR or the Regulator**) within the required timeframes. The event involved the rapid draw down of the on-site reservoir which affected the required contact time for disinfection at the WTP. Further investigation found the additional contact time achieved in the water supply mains ensured this did not impact on the safety of the water supplied to consumers. Seqwater's management of the event was compliant with its DWQMP.

Other drinking water quality management system improvement activities completed during the reporting period include eight risk assessment reviews, 27 HACCP team meetings, 21 internal audits of treatment plants and supply system sites, and an external third-party audit to maintain ISO 22000 certification. A regular audit and a review of the DWQMP were not required to be undertaken during the reporting period.

These reviews and audits are part of a schedule that encompasses all of Seqwater's treatment plants and supply system sites and the findings were used to improve the Drinking Water Quality management system.

Long-term improvement initiatives identified through these assessments and reviews have been captured in a consolidated Drinking Water Quality Improvement Plan.

An amended DWQMP, following the regular review completed in June 2020, was submitted to the Regulator for approval in August 2020. The Regulator approved the DWQMP on 15 March 2021.

2 Introduction

This is the 2020-21 DWQMP report for Seqwater, a registered service provider with identification (**SPID**) number SP507. Seqwater possesses raw water storage, bulk treatment and transport assets from Noosa to the Gold Coast region and across to the Somerset region. Seqwater has responsibility for managing 32 operational WTPs, a desalination plant, 25 dams and 47 weirs. Not all of this infrastructure is related to the supply of drinking water, as some of the dams and weirs are used for irrigation schemes. Seqwater has nine WTPs and a desalination plant connected to the Supply System, 19 WTPs (including the offline Banksia Beach WTP) directly connected to SEQ Water Service Providers and five recreational WTPs operated solely for Seqwater's recreational sites and supporting assets. Only those WTPs and Supply System components operated for the supply of drinking water are included in the Seqwater DWQMP and this report.

Seqwater is operating under an approved DWQMP to ensure consistent supply of safe, high quality drinking water in order to protect public health. This is achieved through proactive identification and minimisation of public health-related risks associated with drinking water.

This DWQMP report includes:

- the activities undertaken over the financial year in operating our drinking water service
- drinking water quality summary
- summary of our performance implementing our approved DWQMP.

This report is submitted to the WSR to fulfil our regulatory requirement under the *Water Supply (Safety and Reliability) Act 2008* (Qld) (**the Act**). This report is made publicly available to our customers and the South East Queensland community through our website, or for inspection upon request at Seqwater's Head Office during office hours on business days.

2.1 Purpose

This DWQMP report has been prepared in accordance with section 142 of the Act (refer to Table 1). The purpose of this DWQMP report is to provide the Regulator with information on the overall performance of the DWQMP for the reporting period 1 July 2020 to 30 June 2021. This report also provides an accountability mechanism to our customers and communities.

Table 1 Regulated Conditions and Implemented Compliance

DWQMP Report Condition	Seqwater Compliance
Section 142 Drinking water quality management plan reports This section applies for each financial year after a financial year in which a relevant service provider's drinking water quality management plan has been approved. The provider must, unless the provider has a reasonable excuse— • prepare a report (a drinking water quality management plan report) for the financial year complying with this section and, if section 142C(2) applies to the provider, that subsection; and • give the regulator a copy of the report within 120 business days after the financial year ends.	The current report is required to be submitted to the Regulator within 120 business days after the 2020-21 financial year ends. As outlined in the Information Notice, submission for this report is due by 17 December 2021. This report has been prepared in accordance with the approval conditions of the DWQMP and the Drinking Water Quality Management Plan Report Guidance Notes. Section 142C(2) is not applicable.

DWQMP Report Condition	Seqwater Compliance
Section 142(3) The report must state or include all of the following—	This report provides an update on the implementation of the DWQMP in accordance with the approval conditions and the above regulatory guidance.
a. the information required under the latest reporting requirement given to the provider;	
b. the actions the provider took to implement the plan;	Refer to Section 3 of this report.
c. the outcome of any review of the plan in the financial year and how the provider has addressed matters raised in the review;	Refer to Section 7 of this report. A regular review of the DWQMP was not required to be completed in the reporting period.
d. if a drinking water quality management plan audit report has been prepared for the financial year— a summary of its findings and any recommendations;	Refer to Section 6 of this report. A regular audit of the DWQMP was not required to be completed during the reporting period.
e. details of any information the provider gave the regulator under sections 102 and 102A in the financial year;	Refer to Section 5 of this report for details of incident/event reporting during the reporting period.
f. details of the provider's compliance with water quality criteria for drinking water;	Refer to Sections 3 and 5 of this report. Enclosure 1 provides the 2020-21 Water Quality Data report. This report also includes aesthetic criteria.
g. if the provider supplies drinking water to customers— details of any complaints to the provider about the provider's drinking water service.	Seqwater does not supply drinking water directly to customers (as defined under the Act). Customer complaints are managed by Water Service Providers (**WSPs**), with the exception of the small recreation park systems operated by Seqwater where there have been no recorded complaints. Accordingly, complaints are not detailed in this report.

2.2 Plan overview

Seqwater must comply with the DWQMP approved by the Regulator and developed under the Act. The DWQMP forms part of the corporate drinking water quality management system Seqwater has implemented to cover the drinking water assets and activities captured by the Act. The Seqwater water quality management system has been developed to be consistent with the *Drinking Water Quality Management Plan Guideline* (2018) issued under the Act as well as the Framework for the Management of Drinking Water Quality within the *Australian Drinking Water Guidelines* (**ADWG**, 2011). Accordingly, Seqwater adopts the multi-barrier approach for drinking water quality management.

Seqwater currently has responsibilities across all these barriers, which include:

- Catchments
- Storages and dams
- Water treatment
- Disinfection
- Supply systems
- Distribution systems in recreation areas.

The DWQMP covers the drinking water quality management activities of Seqwater for all drinking water treatment plants and the bulk water supply systems managed by Seqwater. Accordingly, the plan applies to barriers from selective abstraction of the raw water to the management of bulk water supply assets and small distribution networks in Seqwater's recreation areas.

The final barriers in the reticulated distribution system are predominantly managed by downstream WSPs who provide distribution and connections with consumers in all systems except for Seqwater's recreation areas.

3 Implementation of the DWQMP

A revised and updated version of Seqwater's DWQMP was submitted to the Regulator during the reporting period on 11 August 2020 following a review of the DWQMP in the previous reporting period for the financial year (2019-20). Seqwater received approval from the Regulator under Information Notice dated 15 March 2021 (**Information Notice**) for the revised and updated DWQMP. Seqwater's compliance with the conditions in the Information Notice for its approved DWQMP is detailed in Section 3.1 of this report.

Amendments to the DWQMP were made in accordance with section 99A of the Act. The DWQMP amendments included various minor changes to the DWQMP and associated site-based HACCP plans and procedures identified in the DWQMP review. Additionally, the currency of the DWQMP and site-based HACCP plans (sub-plans) have been reviewed through the ongoing continuous improvement activities detailed in Section 7 of this report.

The risk assessment reviews completed during the reporting period are detailed in Section 3.2 of this report. Changes to the DWQMP and site-based HACCP plans are detailed in Enclosure 4.

Seqwater maintains an operational monitoring program which supports the multiple-barrier approach to effectively manage drinking water quality as described in Section 3.3. This includes monitoring of key operational parameters by online instrumentation that feed into Supervisory Control And Data Acquisition (**SCADA**) systems as well as the operational monitoring performed by Water Treatment Plant operators and Internal Process Laboratories. The Operator and Process Laboratory monitoring is used to verify the operation of the plant and the accuracy of online instrumentation. There have been no significant revisions to the operational monitoring program during the reporting period.

Seqwater's verification monitoring program covers a wide range of parameters determined using a risk-based approach. These are detailed in the DWQMP. The results of Seqwater's verification monitoring during the reporting period are described in Section 3.4 of this report and a detailed data report in the format prescribed by the Regulator is provided in Enclosure 1. Verification monitoring, including sampling and analysis, was undertaken by an external NATA accredited laboratory and Seqwater on-site field testing. The results are recorded in the Seqwater's Laboratory Information Management System (**LIMS**). Seqwater reviews the verification monitoring program on a quarterly basis. All raw water, treated water and supply system monitoring was maintained during the reporting period.

Seqwater has continued to improve its drinking water quality management system. Actions in the risk management improvement program, known as the Drinking Water Quality Improvement Plan (**DWQIP**) were implemented during the 2020-21 reporting period as described in Section 4 of this report. The DWQIP changes during 2020-21 are provided in Enclosure 3 to this report.

3.1 Approval conditions

As outlined above, the Regulator provided conditional approval of Seqwater's amended DWQMP prior to the commencement of the 2020-21 reporting period on 29 April 2020. During the reporting period, on 15 March 2021, under an Information Notice given pursuant to section 99(1)(b) of Act Seqwater's amended DWQMP was formally approved by the Regulator. The approval conditions for both notices, and Seqwater's compliance with them, are detailed in Table 2 below.

Table 2 Conditional Approval and Compliance

Condition	Compliance
No. 1. Water Quality Criteria	
Water quality criteria for drinking water including: • The standards for drinking water quality prescribed in a regulation under the *Public Health Act 2005* (Qld) (**Public Health Act**). • The criteria in any guideline, if any, made by the Regulator about the quality of drinking water. • The criteria for drinking water made in a condition applicable to the DWQMP. For the purpose of (iii), the following applies: All parameters that have health guideline values in the ADWG are deemed to be water quality criteria that apply to this DWQMP. Parameters with only aesthetic guideline values are not considered to be water quality criteria and are not required to be reported. Seqwater is required to implement the verification monitoring program as detailed in the approved DWQMP and report any non-compliance with the water quality criteria for the parameters monitored. Additionally, Seqwater must report any non-compliance with a health guideline value through monitoring or other activity that is not part of this program.	Compliant. There were no non-compliances with relevant criteria including health guideline values in the ADWG and standards in the *Public Health Act* as identified through the verification monitoring program. Seqwater has fully implemented its verification monitoring program. Seqwater is not aware of any non-compliance with the health guideline values in the ADWG that could have been identified through other monitoring including research activities.
No. 2. Additional Reporting requirements; (a) events and (b) where a parameter has no water quality criteria	
Additional reporting requirements include: • An event including anything that has happened to Seqwater's service which has escalated beyond its ability to control, and Seqwater believes, or is concerned, that public health may be impacted as a result. • Where a parameter has no water quality criteria which Seqwater believes cannot be managed under its DWQMP and Seqwater believes, or is concerned, that public health may be impacted. These reporting requirements must be made immediately to the Regulator and in the prescribed form within 24 hours.	Compliant. Seqwater has actively reported all events relating to its treatment operations which could have had the potential to impact on public health. Incident reporting has included events where there was an increased risk profile. Reporting requirements are compliant.

Condition	Compliance
No. 3. Research projects and additional reporting requirements	
If Seqwater becomes involved in any water quality research activities and becomes aware of a detection that must be reported as: • Non-compliance with water quality criteria • An event • A parameter with no water quality criteria These reporting requirements must be made immediately to the Regulator and in the prescribed form within 24 hours, unless Seqwater has obtained formal acknowledgement of the research activity of by the Regulator.	Seqwater is not aware of any non-compliance with the health guideline values in the ADWG, events that could impact on public health, or detections of parameters without water quality criteria that is identifiable from water quality research activities.
No. 4. Financial outlays	
The State accepts no liability for any financial outlay incurred by you in complying with the drinking water quality management plan and the conditions in this approval	No applicable claims/actions.

3.2 Risk assessment

Seqwater's water treatment operations and supply system were assessed and eight risk assessment reviews completed during the reporting period. There are 34 water treatment schemes listed in Section 5.1 of the Information Notice for the approved DWQMP including the Gold Coast Desalination Plant and the Supply System.

The findings from the recent risk assessment reviews are consistent with those reported in the previous 2019-20 DWQMP report (i.e. the main risks identified did not significantly change, and in most cases, pathogens are the predominant limiting hazard). From these recent reviews, significant risks and improvements were identified to reduce the risk to acceptable levels. Multiple sites have identified opportunities for:

- increased source water and raw water quality information collation to aid in decision-making to optimise source selection of raw water to the WTP
- process assessment and optimisation of coagulant dosing and mixing to optimise flocculation and settling performance
- improved system monitoring and control around filter performance and supernatant management to optimise filter performance and reduce filter breakthrough probability
- improved asset integrity protective measures against animal and stormwater ingress
- improved disinfection, secondary disinfection and network monitoring of disinfectant residuals.

In some cases, the residual (mitigated) risks have been further reduced by capital upgrades to assets as a part of the regular asset management process. Improvements identified through incident management processes include protection from lightning strikes and power interruptions on control systems. Improvements identified through the risk assessment review process include SCADA upgrades, process instrumentation, and interlocks between these instruments and plant operation. These improvements have reduced the risk of non-compliant water leaving WTPs.

The remaining operational WTPs yet to have SCADA upgrades have been included in the forward program schedule. Seqwater is continuing to monitor its progress in these areas through its capital works and renewals programs and the implementation of its Monitoring and Control System Asset Class Plan.

Seqwater also reviewed and improved upon the established Pre-requisite Programs (**PRPs**) and operational Pre-requisite Programs (**oPRPs**) (Enclosure 4). This approach is consistent with the requirements of AS NZS/ISO22000:2018 Food Safety Management Systems standard to which Seqwater has maintained its certification (See Section 6.2 for more details).

3.3 Operational monitoring

3.3.1 Water Treatment Plant operational monitoring

Operational monitoring in water treatment includes real-time monitoring through process instrumentation, operator grab sample tests and observations, and analytical laboratory testing by Seqwater's process laboratories. Operational monitoring programs for each WTP are designed to assess the performance of preventive measures identified for particular hazardous events and to prompt requirements for corrective actions.

Following the recommendations in the ADWG with regards to the reliance on operational monitoring, the site-specific Hazard Analysis and Critical Control Point (**HACCP**) plans generally specify online monitoring as the Critical Limit monitoring. All potential exceedances are first verified to rule out instrumentation measurement errors, and upon verification are reported to the Drinking Water Quality team within a specified timeframe.

The main preventive measures are well established across all WTPs, with Critical Control Points (**CCP**) monitored by online instrumentation clearly identified in the process flow diagrams in each site-based HACCP Plan. Where possible, multiple levels of alarms for each online instrument through the SCADA system provide early warning of process control issues and early intervention by Operations staff. Additionally, some alarm set points are interlocked to shut down the WTP before Critical Limits are exceeded.

The HACCP Plan Wall Chart procedures document the Action Limits, Critical Limits and key corrective actions, including clear instructions for Operations staff and their supervisors on when the process is to be rated down or shut down, as well as reporting requirements. Across Seqwater's treatment operations, the operational monitoring system has worked successfully throughout the year with many improvements implemented.

Internal auditing (Section 6) reviews the effectiveness of operational monitoring, online water quality instruments, alarm set points and the compliance with the CCP procedures. The main preventive measures typical of most WTPs are listed below with an update of the status of the preventive measure and operational monitoring.

Table 3 Preventive Barriers in Water Treatment

Preventive Measure	Related Hazardous Events	Operational Monitoring	Status
Coagulation	Raw water exceeds treatment capability Coagulant dosing failures Low alkalinity Poor pH control Poor or excessive mixing Incorrect dose rates Inadequate coagulation aids	Dose water pH Chemical dosing alarms Observation checks of flocculation and sedimentation	Instrumentation for dosed water pH, including alarms, is established at all sites using aluminium sulfate (**alum**) as the coagulant and where pH regulation of the dosed water is in place. Additionally, the instrumentation and SCADA upgrade provides settled water turbidity analysers and alarms across all of Seqwater's sites that have a clarification or Dissolved Air Flotation process. Operator grab sample monitoring has been compliant with the WTPs HACCP plan which documents operational monitoring.
Filtration	Raw water exceeds treatment capability Coagulation failure Solids carryover Poor backwashing Filtration break-through	Online turbidity for each cell/filter outlet SCADA tools such as head loss, runtime / production For membrane filtration sites - Pressure Decay Test.	Instrumentation is in place for monitoring individual filters for filtered water turbidity at all relevant sites. All sites have alarms that automatically dial-out to the on-call operator's mobile phone. Most sites have interlocks in place to stop operation or activate filter backwash. There is a program of control system upgrades to implement this functionality across all sites where it is achievable. Online instrumentation and operator grab sample monitoring has been compliant with the WTPs HACCP plan which documents operational monitoring.
Disinfection (by Ultraviolet irradiation **(UV)**)	High flows – low contact time Low flows – not enough turbulence to distribute the dose Low UVT – unable to adequately penetrate microorganisms	Online UV intensity and flows UV Dose Ultraviolet Transmittance (**UVT**)	UV disinfection is typically implemented at sites that require pathogen treatment beyond what is achievable by 'conventional treatment.' These sites include Kilcoy, Capalaba, Beaudesert, and Kalbar WTPs. It is also implemented at smaller sites, such as Dayboro, Kenilworth and Linville WTPs where it forms an efficient primary pathogen treatment process. UV disinfection has worked effectively at these sites without significant issues/excursions.

Preventive Measure	Related Hazardous Events	Operational Monitoring	Status
Disinfection (by chlorination)	Chlorine dosing failures Incorrect dose rates Poor pH control High flows – low contact time Low reservoir levels Contamination to reservoir Filter break-through causing shielding	Online free chlorine after dosing and after contact time Online pH and turbidity after contact time Reservoir levels and flows Chemical dosing alarms	All sites have online instrumentation monitoring free chlorine, pH and flow in the dosed filtered water and treated water and alarms dial-out to the on-call operator's mobile phone. At most sites, interlocks are also implemented that stop the WTP process. There is a program of control system upgrades to implement this functionality across all sites where it is achievable. Online instrumentation and operator grab sample monitoring has been compliant with the WTPs HACCP plan which documents operational monitoring.
Fluoridation	Overdosing fluoridation chemical	Online fluoride monitoring pre and post on-site reservoir Operator fluoride monitoring – concentration by lab testing Operator monitoring – daily calculated fluoride dose using product weights and flow meter data. Chemical dosing alarms	The fluoride dosing monitoring arrangements are fully established and documented. Operator testing and checks of the online monitoring system are performed at least daily. Queensland Health periodically audit fluoridation of the water supply at all Seqwater sites with fluoridation systems.
Reticulation (recreation sites)	Ingress or infiltration Corrosion and deterioration of assets	Observation Chlorine residual monitoring Demand monitoring (plant operation hours and reservoir levels) Vermin proofing inspections on reservoirs.	Reticulation systems are monitored by operational staff to ensure there is no ingress from vermin or through loss of positive pressure. System leaks are identified by these inspections and the draw on the plant's capacity. Scheduled maintenance inspections and condition assessments are also conducted. Chlorine testing on recreation park taps is undertaken and backed up by verification monitoring at the same sample sites.

3.3.2 Supply System operational monitoring

In the DWQMP, operational monitoring includes the planned sequence of measurements and observations to assess and confirm the performance of preventive measures identified for particular hazardous events. Measurements of operational parameters indicate the effectiveness of processes. As part of the ADWG Framework, AS NZS/ISO22000 Food Safety Management Systems standard and HACCP standards, these operational measures have been identified and summarised within the supply system DWQMP as CCPs and operational Pre-requisite Programs.

The preventive measures are well established within Seqwater, with CCPs monitored by online instrumentation throughout the supply system. Supply system staff can react to the exceedances when notified through the SCADA system. Alarming is programmed into the SCADA system at three different incident levels, each defining the severity of the exceedance. Each incident level has a documented contingency and escalation procedure for staff to follow.

Internal auditing and compliance spot checks monitor the operational Pre-requisite Programs. The principal preventive measures are listed in Table 4. The most common limiting hazard identified is pathogens. Unacceptable risks requiring further treatment are listed in the improvement plan (Section 4) of this report.

Table 4 Preventive Measures in the Supply System

Preventive Measure	Related Hazardous Events	Operational Monitoring	Status
Water quality considerations as part of the Monthly Operating Supply Schedule (**MOSS**) & routine meetings with WSPs (Regional Operational Managers Meeting). Includes drought operating modes.	Non-compliant water supplied to the Supply System by Bulk Water Suppliers Deterioration of water quality in service reservoirs due to variable water ages	This is issued monthly to the Drinking Water Quality team for review and to provide feedback on any foreseen issues arising from different source waters.	This formalised process continues as the MOSS at Seqwater. Water quality issues are raised if there are concerns of any localised issues and the MOSS amended accordingly. E.g. Mt Crosby Geosmin and 2-methyl isoborneol (**MIB**) issues.

Preventive Measure	Related Hazardous Events	Operational Monitoring	Status
Maintain disinfection residual	Non-drinking water or organic matter entering service reservoir or pipeline Contamination to reservoirs by access by third party Contamination to reservoir by vermin entry	Chlorine, pH and temperature parameters are measured online at all Key Interface Points which is representative to each water zone. These signals are transferred and alarmed at the 24/7 operations centre. Operations centre escalation and corrective action procedures are audited routinely. Training is delivered for new operations centre staff.	Established SCADA systems and critical limit alarm levels notify the operations centre of low chlorine residual. Escalation procedures covering different severities of alarms are well established and are followed by operations centre staff. Corrective actions are documented in a procedure and are followed by operations centre staff and supply system operations management. A documented procedure on maintaining chlorine residual is used by operational staff. In addition to the above, as part of the Regional Disinfection Optimisation Program, Seqwater, in conjunction with three of its WSPs (Urban Utilities, Unitywater and Logan City Council) undertook a three-month increased chloramine dosing trial. The aim was to increase secondary disinfection residuals in the WSPs network over summer, when traditionally chloramine decay is elevated and residuals at the customers tap is reduced. This is an interim measure until pH correction is implemented to increase chloramine stability. More information can be found in Enclosure 4.
Service Reservoir Inspection Program	Ingress of non-drinking water to reservoirs	Service reservoir inspections are carried out monthly using a checklist and photo evidence process. These records are audited routinely to identify any deficiencies. These inspections are	This process and water quality focused culture is well established within the business. Any issues identified are raised and corrected through the work order system and for larger improvements via the

Preventive Measure	Related Hazardous Events	Operational Monitoring	Status
	Vermin entry to reservoir Corrosion and deterioration of assets	supplemented by annual external inspections using Unmanned Aerial Vehicles (**UAV**), and three-yearly internal inspections using submersible Remote Operated Vehicles (**ROV**) combined with specialist software to inspect and track deterioration.	renewals process within the capital improvement program.
Mains Hygiene Procedure	Stagnation of reservoirs and pipelines Commissioning new assets and pipelines Maintenance and operational changes to the supply system	This procedure provides the formal process to prevent contamination of pipelines and reservoirs during maintenance activities. It also covers disinfection of assets before returning to service. On-site compliance checks are routinely carried out to identify any deficiencies.	This process and water quality focused culture is now well established within the business. Training is delivered during the induction of new field staff.
Locked and alarmed hatches on reservoirs	Contamination to reservoirs by access of third party	All reservoirs' hatches are locked, and alarm systems notify the 24/7 operations centre of any unauthorised access to reservoirs. Closed Circuit TV cameras are also in place at some reservoir sites. Security guards routinely patrol the reservoir sites.	The alarming of reservoirs is tested routinely with operations centre staff well versed in the procedures if a security breach occurs. Access to these reservoirs is managed by works access and permit to work procedures.
Maintaining Positive Pressure	Ingress of non-potable water or organic matter to pipelines	Pressure and flow are monitored online at locations throughout the supply system. These are alarmed and notify the 24/7 operations centre of any low-pressure situations.	The operations centre staff are well versed in the procedures to follow in the case that low pressure occurs within the supply system. Planned and unplanned pipeline isolations are managed by the Disinfection of Water Mains Procedure.

Preventive Measure	Related Hazardous Events	Operational Monitoring	Status
Optimisation of re-chlorination through automated control systems Maintain or treat to lower DOC/Bromide Levels	Formation of disinfection by-products	All chemical dosing facilities are comprehensively equipped with system redundancies including dual online instruments, Uninterruptable Power Supply, multiple chemical dosing pumps, back-up telemetries with multi-barrier alarming to the 24/7 operations centre.	Control systems are well established and have proven historical track records. The operations centre has comprehensive documentation to assist in the control of these systems and are well versed in the procedures to operate these stations efficiently and effectively.
Pigging or super-chlorination of pipelines	High flow or changes in flow rate or direction in pipelines	Turbidity and conductivity parameters are measured online at all Key Interface Points.	Routine cleaning programs for reservoirs are in place. However, there is no routine scheduled pigging program for the existing pipelines. Biofilm testing has proven biofilms are in low volume and pathogens have not been detected in the samples measured. High flows and direction changes are managed by the control systems and operating manuals by the operations centre.

3.4 Verification monitoring

The results of Seqwater's verification monitoring during the 2020-21 reporting period are summarised below. The detailed data report at Enclosure 1 is in the format prescribed by the Regulator. This program includes:

- the Scheme component (e.g. reticulation, source water)
- parameter
- unit of measure
- total number of samples collected (number of analyses)
- number of samples that did not meet the water quality criteria
- minimum concentration or count
- maximum concentration or count
- average (arithmetic mean) concentration or count.

For all parameters tested more than once a year, the frequency of sampling has been distributed evenly throughout the year (weekly, monthly, quarterly, or six-monthly).

3.4.1 Analysis of Micro-pollutants using Passive Samplers

The sampling and analysis of micro-pollutants using a passive sampler methodology began in July 2014 for catchment sites where the sampling devices could be deployed. The micro-pollutants analysed included pesticides, pharmaceuticals and personal care products.

The passive sampler reports for sampling conducted during the 2020-21 reporting period are provided at Enclosure 2a and 2b. There were no exceedances of the ADWG values observed during the 2020-21 reporting period for these chemicals using passive sampling methodologies. Some parameters have been detected at trace levels, but this has generally been two orders of magnitude below the guideline values.

3.4.2 Compliance with DWQMP and Key Performance Indicators

Drinking water quality compliance is measured across supply zones using the methods recommended by the ADWG and the *Public Health Regulation 2018* (**PHR**). A supply zone is defined as a WTP and if relevant, the connected downstream components of the supply system. For corporate Key Performance Indicator (**KPI**) reporting, the water quality results from routine monitoring in each supply zone are assessed over a 12-month period against the water quality criteria, with the final report being issued in June each year. The methods are briefly described below:

3.4.2.1 Microbiological compliance

A supply zone is compliant if at least 98% of routinely monitored samples do not exceed the water quality criteria, namely *E. coli* (as per Schedule 52 of the PHR).

3.4.2.2 Health related compliance

For parameters sampled eight or more times during the year, the 95th percentile result of each health-related parameter is used for assessment against the water quality criteria, being the health guideline values in the ADWG as per Schedule 52 of the PHR. For parameters sampled less than eight times per year, the maximum result is used for assessment against the water quality criteria. If the 95th percentile (or maximum if sampled less than eight times) value is greater than the water quality criteria, then the whole zone is deemed non-compliant.

3.4.2.3 Aesthetic compliance

The average of each parameter is assessed against the water quality criteria (aesthetic guideline values from the ADWG) only if there are impacts to downstream users. If any value is greater than the water quality criteria, then the whole zone is deemed non-compliant.

Seqwater was measured to be compliant during the 2020-21 reporting period for all of its water treatment operations and supply system zones for microbiological, health and aesthetic compliance.

3.4.3 Water Treatment Plant verification monitoring

Verification monitoring occurred in accordance with the Seqwater Water Quality Verification Monitoring Plan. This was undertaken by the National Association of Testing Authorities (**NATA)** accredited (ISO 17025) contracted Laboratory Service Provider at Seqwater's raw water, treated water and recreation park distribution system sample points, covering more than 70 different parameters at various frequencies. The verification program provides the necessary information to validate that the preventive approach to water quality management is effective.

A summary table of verification monitoring of the treated or supply system (bulk) water for the Reporting Period is provided in Table 5. The statistics from the verification monitoring results for all parameters for raw water and treated water at each operational site is provided within Enclosure 1. Please note recreational plants will include reticulated monitoring in WTP test count.

Table 5: WTP Verification Monitoring Summary

Name of scheme component	Number of Analyses Performed	Number of Individual ADWG Health Exceedances	Number of Individual ADWG Aesthetic Exceedances
Amity Point WTP	668	0	0
Beaudesert WTP	788	0	0
Banksia Beach WTP	0	0	0
Boonah-Kalbar WTP	817	0	0
Canungra WTP	815	0	0
Capalaba WTP	772	0	0
Dayboro WTP	696	0	0
Dunwich WTP	680	0	0
Esk WTP	774	0	0
Ewen Maddock WTP	788	0	0
Hinze Dam WTP	1084	0	0
Image Flat WTP	1647	0	0
Jimna WTP	767	0	0
Kenilworth WTP	623	0	0
Kilcoy WTP	788	0	0
Kirkleagh WTP	1122	0	0
Kooralbyn WTP	794	0	0
Landers Shute WTP	788	0	0

Name of scheme component	Number of Analyses Performed	Number of Individual ADWG Health Exceedances	Number of Individual ADWG Aesthetic Exceedances
Linville WTP	1434	0	0
Lowood WTP	780	0	0
Maroon Dam WTP	1082	0	1
Molendinar WTP	771	0	0
Moogerah Dam WTP	1053	0	0
Mt Crosby East Bank and West Bank WTPs	1657	0	0
Mudgeeraba WTP	773	0	0
Noosa WTP	1419	0	0
North Pine WTP	959	0	0
North Stradbroke Island WTP	730	0	0
Point Lookout WTP	668	0	0
Rathdowney WTP	771	0	0
Somerset Dam WTP	858	0	0
Tugun Desalination Plant	1049	0	0
Wivenhoe Dam WTP	1491	0	0
Total	29906	0	1

3.4.4 Analysis of the Water Treatment Plant verification monitoring data

Through an assessment of the water quality data from the verification program, it was found WTPs were compliant against the ADWG health guideline values for drinking water, with no health exceedances recorded during the reporting period. This exemplifies the continued improvement Seqwater has shown in driving excellence in our drinking water quality.

Overall, the count of ADWG health-related exceedances over the past few years has remained at a relatively constant low and no exceedances occurred in 2018-19 and 2020-21, which is a considerable achievement given the number of diverse schemes and systems. The count of aesthetic exceedances has on average been generally decreasing (Figure 1). The continued improvement in reducing exceedances across all WTPs is evident in the simple linear trend of total exceedances.

The single aesthetic guideline exceedance due to routine verification monitoring included one elevated iron result.

Maroon Dam WTP Iron: Routine verification testing returned an iron concentration of 1.5 mg/L, above the ADWG aesthetic guideline value of 0.3 mg/L. The result was found to be due to the poor internal condition of a pressure vessel. Repairs to the pressure vessel rectified the issue and there were no significant impacts to Maroon Dam's relatively small system which includes recreation park taps and amenities, two school camps and Seqwater's site office.

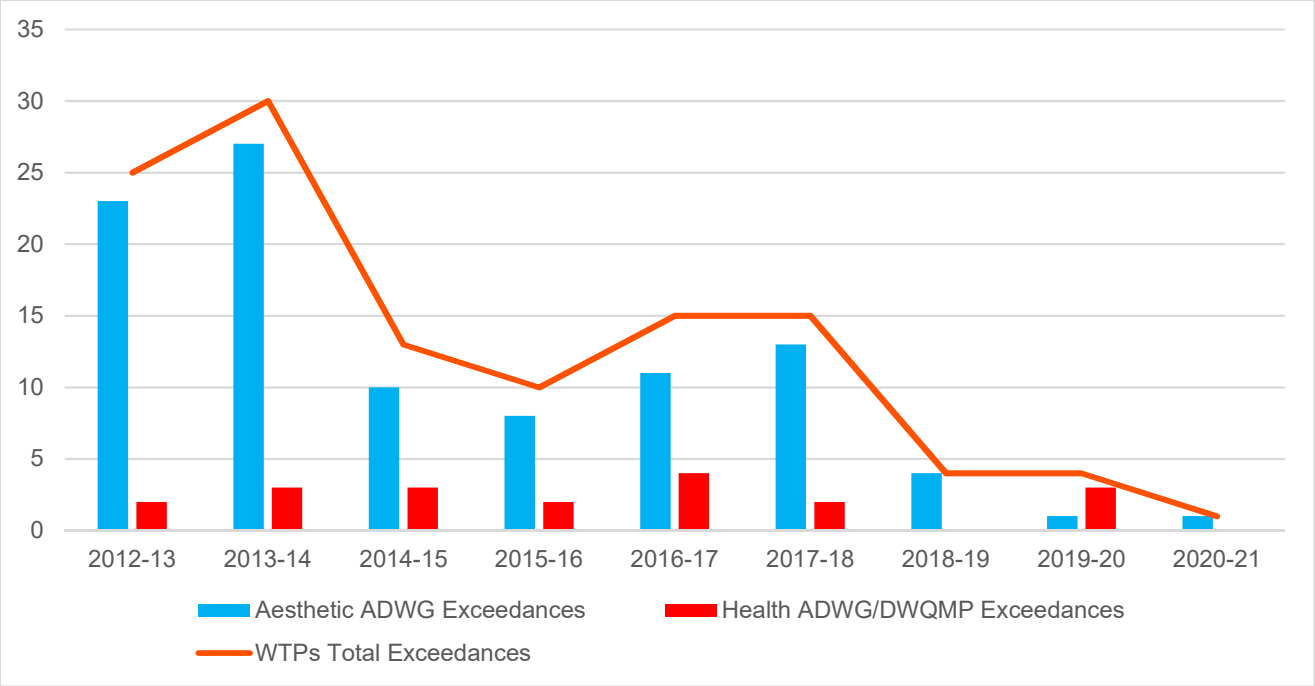

Figure 1 WTP exceedances over different reporting periods

Seqwater continues to seek and implement improvements for its treatment processes and preventive measures. With regards to continually improving water quality (for example, in accordance with Element 12 of the Framework for Management of Drinking Water Quality), these exceedances are considered in risk assessments and subsequent risk assessment reviews. Where a mitigated risk has been determined to be inadequate, even for aesthetic parameters, an improvement action is recorded in the DWQIP. Subsequent development ensures those improvement actions are addressed appropriately. This currently includes treatment plant upgrades, improved instrumentation, and early intervention by operations and engineering staff through changes in process control and improvements in sampling practices and the third-party NATA laboratory performance.

3.4.5 Supply System verification monitoring

Verification monitoring occurred in accordance with the Supply System Water Quality Monitoring Plan. Sampling and on-site field tests were undertaken by Seqwater's field services team and laboratory testing was undertaken by a contracted NATA-accredited laboratory service provider. This covered more than 30 different parameters with weekly and monthly routines scheduled in eight different zones. The verification program provides the necessary information to validate the preventative approach to water quality management is working effectively.

The Supply System has been assessed as compliant for all eight zones for microbiological, health and aesthetic compliance during the reporting period, as shown in Table 6.

Table 6 Supply system verification monitoring summary.

Name of scheme component	Number of Analyses Performed	Number of Individual ADWG Health Exceedances	Number of Individual ADWG Aesthetic Exceedances
Brisbane	16384	0	0
Eastern Pipeline Interconnector (EPI)	2070	0	0
Gold Coast	1371	0	0
Logan	3122	0	0
Network Integration Pipeline (NIP)	2113	0	0
Northern Pipeline Interconnector (NPI)	8722	0	0
Redland	5041	0	0
Southern Regional Pipeline (SRP)	9333	0	0
Total	48156	0	0

3.4.6 Analysis of the Supply System verification monitoring data

There were no ADWG health or aesthetic guideline exceedances for the Supply System during the reporting period consistent with the very low numbers of exceedances for each category in the previous two years. The chart below shows an initial reduction and maintenance of low numbers of exceedances since the 2013-14 reporting period (Figure 2). Although the initial drop may be attributed to the reduction in monitoring when a risk-based approach was adopted, the overall trend supports the continued successful operation of the Supply System to provide safe and high-quality drinking water.

The minimal number of exceedances across the Supply System in recent years is supported by good operating practice and improved source water conditions.

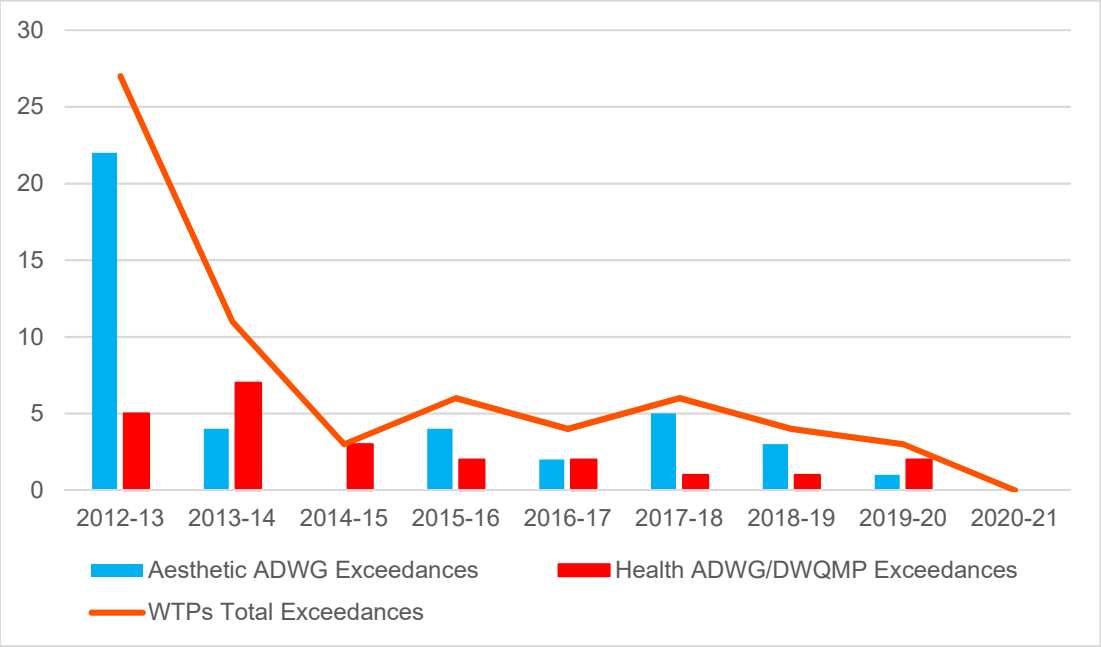

Figure 2 Supply System exceedances over different reporting periods

4 Improvement plan

Improvements continue in accordance with the DWQIP. The progress made during the reporting period to reduce health-related risks and improve the reliable provision of safe drinking water is tabled in Enclosure 3 of this report. Any improvements which are yet to be implemented are reassessed and prioritised through the internal audit and risk assessment review schedule. Asset related improvements are assessed via the capital program prioritisation process. The changes to the DWQMP identified in risk assessment reviews, HACCP team meetings and the investigation of incidents, reflect the significant amount of progress Seqwater has made in improving its drinking water quality management system. The details of these changes are provided in the register of changes to DWQMP, HACCP plans and procedures at Enclosure 4. A summary of significant water quality improvement deliverables in the reporting period are listed below.

Whole of Business:

- Review of management system against ISO 22000:2018 in preparation for certification audit
- Implementation of process assessments and process audits
- Improvement opportunities for online analyser maintenance
- Implementation of consistent reservoir inspection program
- Improvements to pest management program
- Improved and renegotiated water quality parameters under our Bulk Water Supply Agreements (**BWSA**) with our WSPs – amended BWSAs expected to be signed off by all WSPs in the next reporting period.

Northern Region:

- Image Flat WTP SCADA communication improvements including dial-out alarming to the on-call operator
- Noosa WTP filter media replacement
- Landers Shute WTP Reservoir 1 roof replacement including vermin proofing and ventilation improvements.

Central Region:

- East Bank WTP Stage 2 Filter upgrade including media replacement and increased dual media filter depth
- Esk WTP filters refurbished including media replacement and installation of an option for filtering to waste when required
- New powdered activated carbon dosing system implemented at the Somerset Township WTP enabling treatment of taste and odour when elevated levels occur.

Southern Region:

- Beaudesert WTP granular activated carbon filter media replacement and the installation of additional reservoirs to provide resilience during severe source water events and for flow balancing for future connection to the water grid
- Improved understanding of ground water quality risks on Minjerribah (North Stradbroke Island) – Ground water infiltration zone report to inform water quality risk, potential ground water protection zones and development assessment
- Dunwich WTP implementation of a supernatant return and sludge removal system to eliminate the environmental discharge of backwash water from the iron filtration process
- Point Lookout WTP re-establishment of Bore 1 due to the poor asset condition of the existing bore.

5 Drinking water quality incidents

The following section summarises information given to the Regulator detailing:

- Non-compliances with the water quality criteria for drinking water, and the corrective and preventive actions undertaken in response
- Prescribed incidents reported during the year including corrective and preventive actions
- Comments on the effectiveness of any preventive/control measures.

A summary of incidents at Seqwater's treatment operations and Supply System reportable to the Regulator are shown in the Table 7. Seqwater had a single incident that was considered a 'reportable event'. Reporting to the Water Supply Regulator was completed within the required timeframes.

Table 7 A summary of incidents at Seqwater's treatment operations and Supply System

Incident Number	Name of scheme component	Date Reported	Description of the Event/Incident	Improvements
DWI-507-20-08726	Image Flat WTP	08/12/2020	Event: The rapid draw down of the on-site reservoir whilst the WTP was offline resulted in low reservoir levels that affected the required contact time for disinfection at the WTP. Further investigation during the management of the incident found the additional contact time achieved in the water supply mains ensured the safety of the water supplied to consumers was not impacted SCADA and the alarm dialler failed to send out alarms to the on-call operator due to a communication fault with the telecommunications service provider. The operator was notified by the Supply System control room and reinstated the WTP to restore reservoir levels.	SCADA alarming communication improvements were made including replacement of the alarm dialler with a 4G Telstra line and backup line.

6 Audit of the Plans

6.1 Regular audits

Seqwater must audit its DWQMP at the intervals stated in an Information Notice provided under section 99 of the Act. The Information Notice for the approval of Seqwater's amended DWQMP dated 15 March 2021 specifies the next regular audit of the DWQMP is to be completed by 1 March 2025. Further regular audits are required to be completed every five years from that date. Accordingly, there was no regular audit of the DWQMP during the 2020-21 reporting period.

6.2 Audits – water treatment and Supply System operations

6.2.1 Internal audits – HACCP and Integrated Management System audits

Internal audits have been conducted throughout the year in accordance with Seqwater's HACCP and Integrated Management System audit schedules. The scope of the internal audits includes the relevant site's HACCP plan, wall chart procedure (incorporating the CCPs), operational monitoring plan, and operator and maintenance records. It includes verification of the HACCP flow diagram and process flow schematic by the HACCP Team Leader and available operational staff from the HACCP team. Internal audits have been conducted at 21 WTP and Supply System sites in the reporting period. Seqwater's remaining operational sites are scheduled as part of an ongoing audit cycle.

All major and minor non-conformances and opportunities for improvement are delivered through engagement with operations staff and the use of Seqwater's electronic document and record management systems.

6.2.2 External audits – AS NZS/ISO 22000 Re-certification audits

Seqwater has integrated the AS NZS/ISO22000:2018 Food Safety Management Systems standard into the DWQMP. Many of the requirements of the standard are consistent with, or similar to, the elements in the DWQMP, which is based on the ADWG Framework. This standard promotes greater commitment from all parts of the business during DWQMP implementation and ensures the DWQMP becomes part of the Integrated Management System (**IMS**).

During the reporting period, Seqwater prepared for re-certification against AS NZS/ISO 22000:2018 and successfully completed a re-certification audit conducted by its contracted third-party independent auditor. The scope of accreditation continues to include Seqwater's DWQMP and its major operational sites including Mt Crosby East Bank and West Bank, Capalaba, North Stradbroke Island, Molendinar, Mudgeeraba, Landers Shute, North Pine, Noosa, Image Flat, Kalbar and Lowood WTPs, and the supply system (i.e. control room and all operational sites).

6.2.3 External audits – Regulated Fluoridation Systems audits

Seqwater accommodates regulated fluoride audits every two years. Every plant with fluoride dosing is checked for compliance with the current *Fluoride Code of Practice* by the Regulator. Auditing was planned for the reporting period however audits were restricted to the Metro South Public Health Units (**PHU**) area which included Capalaba, North Stradbroke Island, Dunwich, Amity Point, Point Lookout, Beaudesert and Kooralbyn WTPs due to COVID-19 and demands on the PHU that undertake these audits. The formal reporting of the audits found only minor opportunities for improvement concerning the timely removal of contained waste and the storage of safety equipment at two sites. The remaining WTPs are expected to be completed by the relevant Public Health Units as COVID-19 commitments ease and PHU staff availability to conduct the audits improves..

7 Regular review of the plan

Pursuant to section 10.1 of the Information Notice for the approval of Seqwater's DWQMP, Seqwater is required to complete the next review of its DWQMP before 1 July 2023. Accordingly, no regular review of the plan was conducted during the reporting period.

8 Glossary

Term	Definition
ADWG	Australian Drinking Water Guidelines 2011, National Health and Medical Research Council, Commonwealth Government of Australia, Canberra
Alum	Aluminium Sulfate
BWSA	Bulk Water Supply Agreement
CCP	Critical Control Point
DWQ	Drinking Water Quality
DWQIP	Drinking Water Quality Improvement Plan
DWQMP	Drinking Water Quality Management Plan
EPI	Eastern Pipeline Inter-connector
HACCP	Hazard Analysis Critical Control Point. A food safety management system based on a set of guiding principles, known as HACCP Principles or Codex Alimentarius.
IMS	Integrated Management System – the combination of the certified ISO9001, ISO14001, ISO 22000 and ISO4500 systems implemented by Seqwater
ISO 22000	ISO 22000:2018 Food Safety Management Systems. International standard for food safety.
KPI	Key Performance Indicator
LIMS	Laboratory Information Management System
MIB	2-methyl isoborneol
MOSS	Monthly Operating Supply Schedule
NATA	National Association of Testing Authorities
NPI	Northern Pipeline Inter-connector
OPRP	Operational Pre-requisite program
PHR	*Public Health Regulation 2018* (Qld)
PHU	Public Health Unit
PRP	Pre-requisite program – terminology from ISO22000:2018 (section 8.2) that refers to programs that facilitate the prevention and/or reduction of contaminants (including food safety hazards) in the products, product processing and work environment.
Regular audit	Means an audit conducted in accordance with section 99(2)(c) of the Act.
Regular review	Means a review conducted in accordance with section 99(2)(b) of the Act.
REX	Seqwater's Document and Records Management System
Seqwater	Queensland Bulk Water Supply Authority

SCADA	Supervisory Communication and Data Acquisitioning (SCADA) system. Human to Process software interface.
SPID	Service Provide Identification – issued by water supply regulation
Supply System	Previously named the Bulk Distribution Network and formerly operated by LinkWater.
The Act	*Water Supply (Safety and Reliability) Act 2008* (Qld)
The Regulator	The chief executive of the department is the regulator under the Act. (i.e. Water Supply Regulation – Department of Regional Development, Manufacturing and Water)
UAV	Unmanned Aerial Vehicle
UV	Ultraviolet
UVT	Ultraviolet Transmission
WSPs	Water Service Providers (Urban Utilities, Unitywater, Logan City Council, Redland City Council and Gold Coast City Council)
WSR	Water Supply Regulation – Department of Regional Development, Manufacturing and Water
WTP	Water Treatment Plant

9 Enclosures

Enclosure	Name
1	Verification monitoring 2018-2020 Water Quality data report (REX ID: D21/178980)
2a	Catchment and Drinking Water Quality Micropollutant Monitoring Program - QAEHS Passive Sampling Winter 2020 Report (REX ID: D21/36960)
2b	Catchment and Drinking Water Quality Micropollutant Monitoring Program - QAEHS Passive Sampling Summer 2021 Report (REX ID: D21/102975)
3	Drinking Water Quality Improvement Plan (DWQIP) (REX ID: D21/178937)
4	Register of changes to DWQMP, HACCP plans and procedures - 2020-2121 (REX ID: D21/178938)