Drinking Water Management System

Annual Report 2021/22

Goldenfields Water County Council

Date: October 2022

Version: 3.4

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Document Control

Date	Change made	Person
August 2020	Updated Annual Report to include relevant 2019/20 data and information	Chris Breen/Geoff Veneris
October 2019	Updated Annual Report Data	Chris Breen/Geoff Veneris
October 2020	Updated Annual report with relevant data	Chris Breen/Geoff Veneris
September 2021	Updated Annual report with relevant data for 2020/21 reporting period	Chris Breen/Geoff Veneris
October 2022	Updated Annual report with relevant data for 2021/22 reporting period	Chris Breen/Geoff Veneris

Guidance

This report is designed to address the reporting (Element 10), evaluation (Element 11) and review and continual improvement (Element 12) requirements of Goldenfields Water County Council Drinking Water Management System (DWMS).

The NSW Guidelines for Drinking Water Management Systems (2013) recommends review of the following areas:

- Performance of critical control points
- Water quality review (raw, treated and distribution water quality including verification monitoring in the NSW Health Drinking Water Database)
- Levels of Service (including consumer complaints)
- Incident and emergencies (including follow up)
- Drinking Water Management System implementation
- Continuous improvement plan implementation

Review of system performance should be against ADWG, levels of service, NSW Water Supply and Sewerage Performance Monitoring Reports and other regulatory requirements (Element 1).

Shortcomings should be captured in the Improvement Plan (Element 12).

Executive Summary

Critical Control Points

The following tables provide the total number of CCP exceedances registered throughout the 2021/22 financial year with the corresponding CCP number.

Jugiong	CCP1	CCP2	CCP3	CCP4	CCP5	CCP6
Number of CCP exceedances	0	0	0	7	0	0

Oura	CCP1	CCP2	CCP3	CCP4	CCP5	CCP6
Number of CCP exceedances	1	30	0	0	0	0

Mt Daylight	CCP1	CCP2	CCP3	CCP4	CCP5	CCP6
Number of CCP exceedances	3	0	0	0	0	0

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CCP Number	Monitoring Parameter	Target Criterion	Adjustment Limit	Critical Limit
1 - Jugiong	Turbidity (Continuous online) Raw Water	Dependant on raw Water Quality		20% above set point for > 20minutes
2 - Jugiong	Turbidity (Continuous online) Filter Outlet	≤ 0.2 NTU	≥ 0.5 NTU	≥ 1.0 NTU
3 - Jugiong	Free Chlorine residual (Continuous online & alarmed) Finished Water	1.8mg/L	≤ 1.2mg/L or ≥ 2.0mg/L	**Summer**: ≤ 0.8mg/L for > 30min or ≥ 5.0mg/L **Winter**: ≤ 0.5mg/L for > 30min or ≥ 5.0mg/L
4 - Jugiong	Fluoride (Daily) Finished Water	1.0mg/L	< 0.95mg/L or > 1.05mg/L	< 0.9mg/L for > 72hrs or > 1.5mg/L
5 - Jugiong	System Integrity (monthly) Reservoir inspection	Secure, no evidence of break in or vermin	Visual identification of breach or vermin access to reservoir	Visual identification of vermin or containment in reservoir
6 - Jugiong	Free chlorine residual (continuous online & alarmed) Prunevale and Cootamundra	0.8mg/L	≤ 0.5mg/L or ≥ 2.0mg/L	≤ 0.2mg/L or ≥ 5.0mg/L

1 - Oura	Free Chlorine residual (Daily) Treated Water	0.5mg/L	≤ 0.3mg/L or ≥ 1.0mg/L	≤ 0.2mg/L or ≥ 5.0mg/L
2 – Oura	Fluoride (Daily) Treated Water	1.0mg/L	< 0.9mg/L or > 1.2mg/L	< 0.9mg/L for > 72hrs or ≥ 1.5mg/L
3 – Oura	System Integrity (monthly) Reservoir inspection	Secure, no evidence of break in or vermin	Visual identification of breach or vermin access to reservoir	Visual identification of vermin or containment in reservoir
4 - Oura	Chlorine Residual (weekly) Wyalong and Thanowring Rd	0.5mg/L	≤ 0.35mg/L	≤ 0.25mg/L
1 – Mt Arthur	Free Chlorine residual (3 x weekly) Tank 4 Outlet	0.8mg/L	≤ 0.5mg/L or ≥ 2.0mg/L	≤ 0.3mg/L or ≥ 5.0mg/L
2 – Mt Arthur	System Integrity (monthly) Reservoir inspection	Secure, no evidence of break in or vermin	Visual identification of breach or vermin access to reservoir	Visual identification of vermin or containment in reservoir
1 – Mt Daylight	Free Chlorine Residual (continuous Online) Naradhan Reservoir	0.8mg/L	≤ 0.5mg/L or ≥ 2.0mg/L	≤ 0.3mg/L or ≥ 5.0mg/L
2 – Mt Daylight	System Integrity (monthly) Reservoir Inspection	Secure, no evidence of break in or vermin	Visual identification of breach or vermin access to reservoir	Visual identification of vermin or containment in reservoir

Water Quality

Verification monitoring has been undertaken over the entire GWCC scheme during the reporting period. All data is compliant with the Australian Drinking Water Guidelines and limits set by public Health (NSW Health).

Operational monitoring has also been conducted over the entire scheme with some non-compliances reported. These non-compliances have been summarised in Table 14. The non-compliances have been mainly for low residual chlorines in the furthest extremities in each of the water source systems. The 2021/2022 reporting year was the lowest demand period on record for our water supply schemes which has exacerbated existing chlorine decay problems documented around the extremities of our systems. Water age has increased significantly in our rural localities and has a direct effect on maintaining our chlorine residuals across the schemes.

Continuous Improvement Plan

GWCC review and update their Action and Implementation Plan as per Appendix B of this report. A summary of items that have been addressed or ongoing are detailed in the below table.

	Completed or closed	In progress	Not Started	Implemented/Ongoing	Items added
Number of actions	68	2	0	9	0

*Note that the 3 items that haven't been counted above have been rolled into other action item. Full Continuous Improvement Plan can be seen in Appendix B.

DWMS Reviews

The 2017/18 DWMS was the first to be undertaken by GWCC. The 2017/18 report was conducted using only the data available at the time. The dataset used was limited to only a few months' worth of information.

This DWMS report is our fourth annual review and has utilised the entire 2021/22 data for both the Jugiong, Oura and Mt Daylight water supply systems. This data was made available from the implementation of WaterOutlook and ClearSCADA. Data is also utilised from NSW Health's Drinking Water Database.

In addition to the general progression of the DWMS, GWCC engaged its internal Auditor (National Audits Group) in 2019 to review the DWMS and provide recommendations for improvement.

A key finding was that more transparency of data reported and adopted by the Board should occur. A full list of audit findings can be found in Appendix D.

Review	Scope	Findings	Actions taken
26/09/2019	*Internal Audit*	*Listed in Appendix D*	*Responses noted in Appendix D below and added to continuous improvement plan for GWCC to action*

Reservoir Inspections

A total of 126 reservoirs, 8 surge tanks and 2 Break Pressure tanks are visually inspected weekly via a 'drive by'. A more comprehensive inspection conducted on the above is conducted on a quarterly basis. The findings of the inspections are summarised in the section headed Reservoir Inspections (page 54). A more comprehensive reservoir inspection report has been downloaded from the ASAM website, this is the database that Aqualift provide when undertaking GWCC reservoir cleaning and maintenance, the report for reservoirs inspected during the 2021/22 FY is available in Appendix C of this report. Additional internal inspection reports are completed and submitted to the Engineering division for corrective action on prioritisation of issued works.

Report Purpose

The purpose of the report is to inform and keep up to date New South Wales Department of Health (NSW Health) of Goldenfields Water County Councils (GWCC) implementation and ongoing assessment of its Drinking Water Management System. It also demonstrates that GWCC is compliant with requirement s25 Public Health Act 2010 to develop a Quality Assurance Program (QAP) in line with the framework for Drinking Water Quality Management in the Australian Drinking Water Guidelines.

Scheme Summary

GWCC provides the essential water requirements of approximately 40,000 people spread over an area in excess of 22,000 sq. km, between the Lachlan & Murrumbidgee Rivers in the Southwest of NSW.

GWCC's water supply system consists of five separate water schemes, Jugiong, Oura, Mt Arthur, Mt Daylight and Hylands Bridge. GWCC carries out water supply functions within the Local Government areas of Bland, Coolamon, Cootamundra-Gundagai Regional Council, Junee, Temora, Hilltops Council previously (Harden, Young), parts of Narrandera and Wagga Wagga.

Harden and Young Councils, now Hilltops Council are retailers who purchase bulk water from GWCC and supply the water to retail customers in their respective local government areas. Cootamundra-Gundagai Regional Council receives bulk supply from GWCC and retails water to customers in the township of Cootamundra, with GWCC supplying water to retail customers in the Cootamundra Shire outside the urban centre. GWCC also supplies small quantities of bulk water to Riverina Water County Council to service their northern supply areas.

At the end of the 2021/22 reporting period there were 11719 water connections across the entire drinking water scheme. This is an increase of 74 new connections across the Goldenfields County Council Drinking Water scheme. It should be noted that the bulk connections are identified as single connection only.

A number of projects were also undertaken that encompassed the entirety of all Drinking Water schemes; these projects and current costings are summarised below:

- Microwave Link Sites for Scada $64,1147.96
- New Scada Communication Towers $369.97
- New Scada Communications $232,633.72

Jugiong Scheme

The Jugiong drinking water supply system is one of the largest water supply systems managed by Goldenfields Water. Most of the water produced in the Jugiong system supplies the bulk water Councils of Cootamundra Gundagai and Hilltops. Water is also delivered to a small number of retail customers in rural properties and the villages of Stockinbingal, Wallendbeen and Springdale. Approximately 18,000 people are supplied water from the Jugiong system.

Source Water

Goldenfields Water is licenced to extract water from the Murrumbidgee River via two submersible pumps operated in a duty / stand-by configuration. The submersible pumps are fixed speed; pump 1 operates at 185 L/s and pump 2 operates at 300 L/s.

The Jugiong source has been categorised as having a "Low" risk regarding Cryptosporidium. NSW Public Health's preliminary outcome assessment for Cryptosporidium for the Jugiong scheme was reported to GWCC on 27th November 2019. A listed action for the Jugiong Scheme was

> *'Maintaining the operation and monitoring (ideally continuously) of individual filters to consistently reduce turbidity to <0.2 NTU'*

Goldenfields can confirm that individual turbidity meters have now been installed during the 2021/22 financial year. Commissioning is still being undertaken further liaison with NSW Health and DPE regarding alarm set points and time delays is still required.

Water Treatment Process

The Jugiong Water Treatment Plant (WTP) is located on Waterworks Road in the township of Jugiong. The plant is a conventional WTP with a nominal capacity of 40 ML/day. It should be noted that the current pump arrangements at the plant can only produce around 23.8ML a day. Recent stress testing of the plant indicates that the plant is only capable of achieving an estimated 29ML of process whilst still maintain compliance with all CCP's for a 22 hour run time.

The treatment process at Jugiong WTP comprises of the following process steps:

- Water from the Murrumbidgee River is pumped via 120 m rising main to Jugiong WTP (capacity 23.8 ML/day) by two pumps in a duty/standby configuration
- Water passes through a flow meter, where a flow of greater than 101 L/s starts the chlorine and soda ash pre-dosing systems for oxidisation of metals and pH adjustment, respectively. The chlorine pre-dose is optional, and is switched on or off by the operator, depending on water quality conditions
- The pre-dosed water enters the rapid mix tank which consists of baffles and two mixers in series. Polymer and aluminium sulphate are dosed into the rapid mix tank to aid flocculation
- Water then flows into the two flocculation tanks which has three mixers in series operating at declining speeds to allow for floc formation
- Flocculated water then enters the two clarifiers and sludge is removed by a travelling sludge rake. Sludge is sent to the duty sludge lagoon
- Clarified water enters the filter block, where it is dosed with chlorine and subsequently distributed across six gravity sand filters
- Filtered water enters a common channel. When flow in the filtered water channel is above 101 L/s, post-dosing of soda ash and chlorine are activated for pH adjustment and increased disinfection capacity, respectively. Water is also dosed with fluoride in the filtered water channel
- Flow from the filtered water channel enters the 3 ML clear water tank through a mid-level inlet and bottom outlet configuration

- Water from the clear water tank proceeds to clear water pumping station 1 (CWPS1), which has two 680 kW pumps and a smaller 400 kW pump that operate in a duty/standby/standby mode. CWPS1 distributes water to Jugiong drinking water supply system
- Treated water is distributed through 14 reservoirs and by 8 pumping stations. There are 138 km of trunk mains and 182 km of reticulation mains in the Jugiong system

The Jugiong drinking Water scheme has 675 connections. The system also supplies GWCCs bulk customers, Hilltops and Coota-Gundagai. Jugiong GWCC retail Connections are broken down as follows:

- 20mm = 512
- 25mm = 155
- 32mm = 2
- 40mm = 2
- 50mm = 1

Included in this data are 3 stand pipe connections: 1 x 32mm, 1 x 40mm and 1 x 50mm.

For the Hilltops connections that are supplied via bulk service, the following breakdown of connections were available:

Supplied Connections	20mm	25mm	32mm	40mm	50mm	65mm	80mm	100mm	150mm	Sub total
	6058	347	30	38	48	2	5	9	0	6537

Cootamundra bulk services were inclusive of the following breakdown:

Supplied Connections	20mm	25mm	32mm	40mm	50mm	65mm	80mm	100mm	150mm	Sub total
	2899	82	33	30	32	0	2	4	0	3082

Upgrades to the System/System Improvements

GWCC staff have undertaken works to upgrade several assets within the Jugiong Drinking water scheme a summary of those works are provided below:

• Wombat BT Renewal	$6,297.11
• Jugiong Raw Water Pump #4 382(Large) Overhaul	$16,317.81
• Jugiong WPS 2 Motor 3 Overhaul	$27,900
• Jugiong WTP - Valve & Pneumatic Upgrade	$115,019.68
• Jugiong WPS 2 High Voltage Motor 1 Overhaul	$2,196.14
• Rosehill Pump 1 Overhaul Pump and Motor	$28,560.51
• Jugiong CWPS1 Pump No 2 Overhaul Pump	$53,294.53
• Jugiong Old Plant Demolition	$55,332.88
• Jugiong High Voltage	$165,9776.76
• Pump Station Valve Renewals - Jugiong	$24,875.06
• Rosehill Pump Station - Jugiong	$94,013.55
• Bulk Customer Water Quality Panels - Harden Offtake	$98,430

- Jugiong CWPS2 Pump No 2 $1,876.92
- Jugiong Compressor $1,313.66
- Stockinbingal and Springdale PRV Replacement & Decommissioning of Bauroola PRV $3,085.50
- Jugiong SAP $8,513.36
- Jugiong PLC Upgrade (included connection of 6 new individual filter turbidity meters) $1,190,022.58
- PRV Replacement - Jugiong $31,969.61
- Rosehill Pipeline Replacement $2,362,398.54
- New Non Residential Backflow - Jugiong $18,341.61

A total of $5,799,535.81 has been spent on the Jugiong scheme for the 2021/22 Financial year.

Oura Scheme

The Oura drinking water supply system is one of the largest water supply systems managed by Goldenfields Water. The majority of water is delivered to retail customers; however, a small amount is supplied to Riverina Water in bulk to customers along the Goldenfields Water pipeline. Approximately 15,000 people are supplied water from the Oura system. The Oura drinking water supply system can be connected to Goldenfields Water's non-drinking water supply at Hylands Bridge.

Source Water

Water is sourced from the Oura Borefield, which is located at Gumly Gumly Island to the north of Murrumbidgee River. Goldenfields Water is licensed to draw from four groundwater bores: Bore 2, Bore 3, Bore 4 and Bore 6. Bores are located in bore huts.

Water in the Murrumbidgee Inland Alluvial Aquifer is recharged by the Murrumbidgee River and is managed by the Natural Resource Access Regulator in NSW. There are two alluvial formations in this region: the Lachlan formation is a confined aquifer system that is overlain by the semi-confined to unconfined Cowra formation (NSW Dept. of Water and Energy, 2007).

According to the DPI Water (NSW Office of Water, 2011), groundwater in the Oura system is fresh, with total dissolved solids (TDS) ranging from zero to 500 mg/L and is suitable for domestic stock, some irrigation purposes and municipal use. NSW Public Health has issued preliminary advice regarding the risk of the Gumly Gumly source which has been deemed "protected". The Oura source has been categorised as having a "Low" risk regarding Cryptosporidium. NSW Public Health's preliminary outcome assessment for Cryptosporidium for the Oura scheme was reported to GWCC on 27th November 2019.

Water Treatment Process

Water for the Oura drinking water supply system undergoes aeration, disinfection and fluoridation prior to distribution.

The treatment process for Oura drinking water supply system comprises of the following process steps:

- Groundwater is pumped from the Oura Borefield by line shaft bore pumps in each bore. The bores are operated in sequential mode where increased water demand will increase

the number of bores online. The order of bore start up is operator adjustable, with the current order of preference set as: Bore No. 4, 6 and 3. Bore 2 was placed into service in November 2020, however, less than desirable water quality was achieved and it was decided to remove the bore from production until such time as it can be cleaned and flushed properly. The bore was removed from service and cleaned by an external contractor in early 2021 with a substantial amount of sand removed. It has since been placed back into service and is currently only used as a secondary pump. It is unable to be utilised as the lead pump due to high iron, manganese which strips our chlorine. Similar issues have been noticed in bore 4, 6 and 3 with the recent wet weather period and high recharge rate of the aquifers.

- The groundwater is dosed with chlorine prior to entering a tray aerator. The aerator serves to oxidate dissolved iron and manganese from the raw water.
- After aeration, water is transferred to the Oura Contact Tank (2.2 ML), where chlorine contact time is achieved before being pumped by Oura pumping station to Marrar Pinnacle (Marrar Pinnacle 1.6 ML, 1 reservoir) or the Junee BT Reservoir (Junee 17 ML, 3 reservoirs).
- The Oura pumping station consists of two 605 kW pumps and a smaller 400 kW pump that operator on a duty/duty/standby configuration
- Fluoride is dosed on the outlet of the Oura pumping station

The Oura drinking water supply system is one of the largest distribution systems managed by Goldenfields Water.

Treated water is distributed through 35 reservoirs and by 19 pumping stations. There are 201 km of trunk mains and 1,055 km of reticulation mains in the Oura system. There are two chlorine booster pumping stations located at Thanowring Road and Reefton pumping stations to ensure adequate free chlorine residual is maintained throughout the system.

Connections

The Oura drinking water scheme has 8933 connections, this scheme also supplies bulk water to Riverina Water County Council. The Oura connections are broken down as follows:

- 20mm = 7912 connections
- 25mm = 805 connections
- 32mm = 76 connections
- 40mm = 56 connections
- 50mm = 54 connections
- 80mm = 4 connections
- 100mm = 5 connections

Included in this data are 19 standpipe connections: 8 x 32mm, 5 x 40mm, 4 x 50mm and 4 x 80mm.

Upgrade to the System/System Improvements

GWCC staff have undertaken works to upgrade several assets within the Oura Drinking water scheme a summary of those works are provided below:

• Talbingo Pump 1	$60.95
• Urban Meter & Taggle Replacement Program	$164,970
• Mirrool Town Mains Extension and Meter Relocation	$16,430.89
• Dustin Rose Estate - Developer Paid Mains	$64,897.36
• Oura WTP PRV to customer	$11,543.18
• Accommodation Village - Boundary Road - West Wyalong	$18,729.96
• Oura New Connections from Riv Water (50% Contribution)	$8,457.45
• Strathmore Lane Coursing Park (Via Junee)	$189,196.51
• Methul Via Coolamon 63mm Mains Replacement	$26,668.88
• Mirrool - Newell Highway Mains Replacement	$50,740.55
• Oura Bore 4 - Emergency Bore Reline, Pump Works and Pump Upgrade	$194,368.5
• Pine St - West Wyalong - Renewal	$88,695.97
• Oura Reservoir & Aerator	$130,686.84
• Ungarie - Main Relocation Humbug Creek	$4,894.96
• Oura Pump 1 Overhaul Pump and Motor	$16,150.08
• Junee Mains St, Cox St Intersection	$16,279.14
• Ariah Park Pump Station Design	$60,827.35
• Junee 50mm Gal Replacement	$18,598.41
• Junee and Weethalle Trunk Designs	$5,811.4
• Oura Bore 4 Renewal	$184,642.01
• Pump Station Valve Renewals - Oura	$5,014.03
• Oura Pump 2 Rebuild	$2,737.39
• Oura Bore 3 Elec SB Renewal	$121,144.09
• Wyalong Reliability Project Pre Work	$557,477.81
• Oura Bore 6 Renewal	$7,611.23
• Mandamah Stage 2 - 4	$301,051.91
• Temora WPS SB Upgrade	$93,910.18
• Oura HV Elec Upgrade	$4,533,152.05
• Oura Strategic Plan	$893.72
• PRV Replacement - Oura	$79,887.17
• Thanowring Road Temora Pipeline Upgrade	$959,631.59
• New Non Residential Backflow - Oura	$10,437.78
• Coolamon North High Level Recoating	$470,564.16

A total of $8,416,163.50 has been spent on the Oura scheme for the 2021/22 financial year.

Mt Arthur Scheme

The Mt Arthur drinking water supply system supplies approximately 2,300 people. The Mt Arthur System can be supplemented by the Oura drinking Water supply system through Coolamon and Ganmain, however this is not common practice.

Water for the Mt Arthur drinking water supply system is drawn from the Lachlan Fold Belt fractured rock aquifer system, near the Murrumbidgee River at Matong. According to the DPI Water (NSW Office of Water, 2011), groundwater in this region is of moderate quality with

TDS between 500 to 1500mg/L and is suitable for domestic stock and some irrigation purposes.

Source Water

Water is sourced from Mt Arthur Borefield, which is located near the Murrumbidgee River at Matong. GWCC is licenced to draw 762ML per annum from two groundwater bores. These bores are located in Bore Huts on the corner of Old Narrandera Rd and Matong rd.

The Mt Arthur source has been categorised as having a "Low" risk regarding Cryptosporidium. NSW Public Health's preliminary outcome assessment for Cryptosporidium for the Mt Arthur scheme was reported to GWCC on 27th November 2019.

Water Treatment Process

The Water treatment of the Mt Arthur drinking water supply system comprises of the following steps:

- Groundwater is pumped to the surface by two 94kW bore pumps in a duty/standby configuration
- Water is injected with Chlorine prior to entering the four Ganmain Low Level Reservoirs where Iron and Manganese are settled out.
- The water is then distributed to retail customers in Coolamon, Ganmain, Matong and Grong Grong

The Mt Arthur Drinking Water Supply system distributes water to the areas of Ganmain, Coolamon, Grong Grong and Matong. Treated Water is distributed through 9 reservoirs and by 6 pumping stations. There are 76km of trunk mains and 67km of reticulation mains in the Mt Arthur system.

Connections

The Mount Arthur drinking water scheme has 1556 connections, the Mount Arthur connections are broken down as follows:

- 20mm = 1458 connections
- 25mm = 57 connections
- 32mm = 33 connections
- 40mm = 5 connections

Included in this data are 4 standpipe connections: 1 x 32mm, 1 x 40mm and 1 x 50mm

Upgrades to the System/System Improvements

GWCC staff have undertaken works to upgrade several assets within the Mt Arthur Drinking water scheme a summary of those works are provided below:

• Lonsdale Pump Overhaul Pump and Motor Replacement	$50,597.50
• Coolamon Industrial Subdivision	$48,388.57
• PRV Replacement - Mt Arthur	$291.20
• New Non Residential Backflow - Mt Arthur	$43.26

A total of $99,320.53 has been spent on the Mt Arthur scheme for the 2021/22 financial year

Mt Arthur Water Scheme – Periodic inspection

The Mt Arthur Drinking Water Scheme was inspected by the Department of Planning, Industry and Environment (DPIEs) Senior Inspector Pat Freeman. This inspection was in accordance with statutory requirements of the Local Government Act 1993. At the time of inspection (15th June 2021) the system was reported as 'performing satisfactorily" and was being "well managed". The onsite water quality results taken at time of inspection are as per the table below.

Table 1. Water quality results from Mt Arthur inspection by DPIE

Reticulation	pH	Colour NTU	Turbidity NTU	Free Chlorine mg/L	Total Chlorine mg/L
Coolamon	7.2	3.9	0.31	0.58	0.6
Ganmain	7.59	1.5	0.16	0.39	0.5
Matong	8.38	3.2	0.28	0.36	0.36
Grong Grong	7.72	3.1	0.2	0.22	0.34

These results indicate that the treatment process was being managed well and the quality of the water complies with ADWG. (For parameters tested).

Mt Daylight System

The Mt Daylight drinking water is a water supply system that supplies approximately 125 people in the villages and surrounds of Naradhan, Weethalle and Tallimba.

The Mt Daylight drinking water supply system draws its ground water from the lower Lachlan alluvium, located in the Lachlan River Catchment. The aquifers surrounding Lake Ballyrogan (Lake Brewster) from which the Mt Daylight system draws its water. This is hydraulically connected to surface waters. Meaning, that ground water quality in the daylight system is connected to surface water quality, although it is expected that the ground water turbidity would be much better due to filtration through subsurface flows. Both DPI Water (NSW Office of Water 2011) and Natural Resources Commission (2006) report that the groundwater in the Mt daylight scheme is relatively fresh with low salinity, making it suitable for municipal use.

Source Water

Water is sourced from the Daylight Borefield which consists of two bores located in the Carathool Shire local government area, between Lake Brewster and the Lachlan River. The bores are jointly owned and operated by Carathool Shire Council and GWCC. GWCC owns 71% of the assets in value and Carathool owns 29%. Carathool is responsible for the maintenance, repair, and replacement of all bores. Additionally, Carathool is the water entitlement licence holder without having GWCC listed as an entitled party. GWCC is the only provider of municipal potable water supply from this scheme.

The Mt Daylight source has been categorised as having a "Low" risk regarding Cryptosporidium. NSW Public Health's preliminary outcome assessment for Cryptosporidium for the Mt Daylight scheme was reported to GWCC on 27th November 2019.

Water Treatment Process

The treatment of the water in the Mt Daylight System comprises of the following:

- Groundwater is pumped to the surface by two 30kW pumps in a duty/standby configuration to the daylight reservoirs
- Water is injected with Chlorine at the inlet to the Mt daylight reservoirs
- Water is distributed to retail customers in Naradhan, Weethalle and Tallimba.

Treated Water is distributed through 7 reservoirs and by 5 pumping stations. There are 308km of trunk mains and 8 km of reticulation mains in the Mt Daylight system.

Connections

The Mount Daylight Drinking water supply has 264 connections, these connections are broken down as follows:

- 20mm = 137 connections
- 25mm = 123 connections
- 32mm = 1 connection
- 40mm = 1 connection
- 50mm = 1 Connection

Included in this data are 2 standpipe connections: 1 x 32mm and 1 x 50mm.

Upgrades to the System/System Improvements

GWCC staff have undertaken works to upgrade several assets within the Mt Daylight Drinking water scheme a summary of those works are provided below:

• Talleeban Rd Weethalle Mains Replacement	$87,979.47
• North Weethalle WPS Electrical and Pump Upgrade	$21,953.27
• Weethalle WPS Electrical and Pump Upgrade	$24,898.73
• PRV Replacement - Daylight	$962.15

A total of $135,793.62 has been spent on the Mt daylight scheme for the 2021/22 financial year.

Rural Backflow Prevention Program

GWCC rural Backflow prevention Program sees a Reduced Pressure Zone Device (RPZD) installed on rural water connections to prevent the cross contamination of water supply.

An RPZD is a device that stops the reverse flow of contaminated water in rural areas from entering our rural water supply system.

All rural connections have been classified as high risk of cross contamination due to the use of hazardous chemicals and livestock on rural properties. Cross contamination caused by

these factors can travel back into rural customers' water mains which can potentially harm health or cause death. Due to the risk, the installation of a testable RPZD is required to ensure compliance in accordance with the Australian Standard (AS3500 Part 1: Plumbing and Drainage Section 4).

GWCC adopted the Backflow Prevention policy (PP06) in August 2016 and works began in May 2017 to install backflow devices on all rural properties. To date a total of 1347 RPZD have been installed within the GWCC area. GWCC have installed 119 RPZDs for Hilltops Council during the 2021/22 FY making it a total of 1466 installations. There are currently approximately 120 installations outstanding, or no certificate has been found and/or completed for their install.

DWMS Document Control

The Drinking Water Management System for GWCC was issued to NSW Health and DPI Water in March 2017 and adopted and approved by Council in early 2018. Only minor modifications have been undertaken to the DWMS with nothing relevant to report to the NSW Health for updating.

Document	Version	Updates	Submitted to NSW Health and date submitted?
Drinking Water Management System	2.0	Continuous Improvement Plan Appendix B	Yes, March 2017
Drinking Water Management System		Continuous Improvement Plan Appendix B	Yes, October 2019
Drinking Water Management System		Reservoir Inspection Report	Yes, October 2020
Drinking Water Management System		Continuous Improvement Plan Appendix B	Yes, October 2020
Drinking Water Management System		Continuous Improvement Plan Appendix B, Reservoir Inspection Report	Yes, September 2021
Drinking Water Management System		Continuous Improvement Plan Appendix B, Reservoir Inspection Report	Yes, November 2022

Critical Control Points

No Changes have been made to the CCP's during the 2021/22 reporting period.

Table 2. Summary of critical control points.

CCP Number	Monitoring Parameter	Target Criterion	Adjustment Limit	Critical Limit
1 - Jugiong	Turbidity (Continuous online) Raw Water	Dependant on raw Water Quality		20% above set point for > 20minutes
2 - Jugiong	Turbidity (Continuous online) Filter Outlet	≤ 0.2 NTU	≥ 0.5 NTU	≥ 1.0 NTU
3 - Jugiong	Free Chlorine residual (Continuous online & alarmed) Finished Water	1.8mg/L	≤ 1.2mg/L or ≥ 2.0mg/L	**Summer**: ≤ 0.8mg/L for > 30min or ≥ 5.0mg/L **Winter**: ≤ 0.5mg/L for > 30min or ≥ 5.0mg/L
4 - Jugiong	Fluoride (Daily) Finished Water	1.0mg/L	< 0.95mg/L or > 1.05mg/L	< 0.9mg/L for > 72hrs or > 1.5mg/L
5 - Jugiong	System Integrity (monthly) Reservoir inspection	Secure, no evidence of break in or vermin	Visual identification of breach or vermin access to reservoir	Visual identification of vermin or containment in reservoir
6 - Jugiong	Free chlorine residual (continuous online & alarmed) Prunevale and Cootamundra	0.8mg/L	≤ 0.5mg/L or ≥ 2.0mg/L	≤ 0.2mg/L or ≥ 5.0mg/L
1 - Oura	Free Chlorine residual (Daily) Treated Water	0.5mg/L	≤ 0.3mg/L or ≥ 1.0mg/L	≤ 0.2mg/L or ≥ 5.0mg/L
2 – Oura	Fluoride (Daily) Treated Water	1.0mg/L	< 0.9mg/L or > 1.2mg/L	< 0.9mg/L for > 72hrs or ≥ 1.5mg/L
3 – Oura	System Integrity (monthly) Reservoir inspection	Secure, no evidence of break in or vermin	Visual identification of breach or vermin access to reservoir	Visual identification of vermin or containment in reservoir
4 - Oura	Chlorine Residual (weekly) Wyalong and Thanowring Rd	0.5mg/L	≤ 0.35mg/L	≤ 0.25mg/L
1 – Mt Arthur	Free Chlorine residual (3 x weekly) Tank 4 Outlet	0.8mg/L	≤ 0.5mg/L or ≥ 2.0mg/L	≤ 0.3mg/L or ≥ 5.0mg/L
2 – Mt Arthur	System Integrity (monthly) Reservoir inspection	Secure, no evidence of break in or vermin	Visual identification of breach or vermin access to reservoir	Visual identification of vermin or containment in reservoir
1 – Mt Daylight	Free Chlorine Residual (continuous Online) Naradhan Reservoir	0.8mg/L	≤ 0.5mg/L or ≥ 2.0mg/L	≤ 0.3mg/L or ≥ 5.0mg/L

2 – Mt Daylight	System Integrity (monthly) Reservoir Inspection	Secure, no evidence of break in or vermin	Visual identification of breach or vermin access to reservoir	Visual identification of vermin or containment in reservoir	

Critical Limit Exceedance

A breakdown of what each CCP represents can be seen in Table 1 above. Summary of Critical Control points. Note that OCP1 relates to pH which is an operational control point with associated critical limits (<7 and >8) and is not a critical control point. However, exceedances related to this operational control point have been included in Table 3 Critical Limit Exceedances.

Table 3. Critical limit exceedances - Jugiong

Date	CCP1	CCP 2	CCP 3	CCP 4	CCP 5	CCP 6	OCP 1	Water Quality Issue	Reason	Immediate Correction	Preventive Action
10/7/2021				0.85					Fluoride blockage in Hopper	Clear Blockage	Replace Heater
19/7/2021				0.62					Fluoride Flow Solution Fault	-3 degree day, warm up	Replace Heater
11/9/2021			0.02						Plant shut down and instrument fault	Recalibrate/clean instrument and start plant	
27/9/2021				0.85							
2/12/2021				0.76					Ball Float filled with water	Replace Ball Float	
1/5/2022				0.84					Float failure		
2/5/2022				0.05							
8/6/2022							8.1				
24/6/2022				0.46							

Table 4. Critical limit exceedances - Oura

Date	CCP 1	CCP2	CCP3	CCP4	Water Quality Issue	Reason	Immediate Correction	Preventative Action
5/7/2021		0.24						
19/7/2021		0.28				Fluoride Dosing Pump fault	Changed to pump 2	
20/7/2021		0.25				Fluoride Tank Solution Fault		
6/8/2021		0.26				Fluoride plant did not run due to a cable coming loose	Reconnect cable	Have cable hard wired
26/9/2021		0.29				Fluoride fault pump stopped working	Change to second standby pump	
27/9/2021		0.33				Fluoride solution tank low level fault	Electrician to fix	Have a spare pump on shelf in case of breakdown
28/9/2021		0.3				Continued from past couple days low fluoride level	Mechanical indicates that its an electrical fault	Electrician to fix/replace

30/9/2021		0.4				Electrical fault	Waiting electricians	
2/10/2021		0.44				Fluoride not dosing	Waiting on electricians	
3/10/2021		0.41				Fluoride Not dosing	Waiting on electricians	
4/10/2021		0.24				Fluoride not dosing	Waiting on electricians	
5/10/2021		0.29				Fluoride not dosing		
6/10/2021		0.39				Fluoride not dosing		
7/10/2021		0.37				Fluoride not dosing		
8/10/2021		0.36				Fluoride not dosing		
9/10/2021		0.34				Fluoride not dosing		
10/10/2021		0.24				Fluoride not dosing		
11/10/2021		0.24				Fluoride not dosing		
12/10/2021		0.28				Fluoride not dosing		
13/10/2021		0.28				Fluoride not dosing		
14/10/2021		0.3				Fluoride not dosing		
15/10/2021		0.28				Fluoride not dosing		
16/10/2021		0.27				Fluoride not dosing		
17/10/2021		0.27				Fluoride not dosing		
18/10/2021		0.24				Fluoride not dosing		
19/10/2021		0.23				Fluoride not dosing		
20/10/2021		0.24				Fluoride not dosing		
7/10/2021		0.37				Fluoride Feeder fault	Electricians to investigate	
7/3/2022		0.26				Feeder faulted	Fitters inspected need electricians	
21/4/2022		0.82				Fluoride feeder fault		

Table 5. Critical Limit Exceedances for Mt Daylight

Date	CCP1	CCP2	Water Quality Issue	Reason	Immediate Correction	Preventative Action
31/5/2022	0.27			Chlorine regulator miss calibrated		
1/6/2022	0.14			Chlorine regulator miss calibrated		
2/6/2022	0.14			Chlorine regulator miss calibrated	Recalibrate and increase dose rate	Add SCADA Alarms

Critical Control Point Graphs

Figure 1. Jugiong water treatment plant - free chlorine.

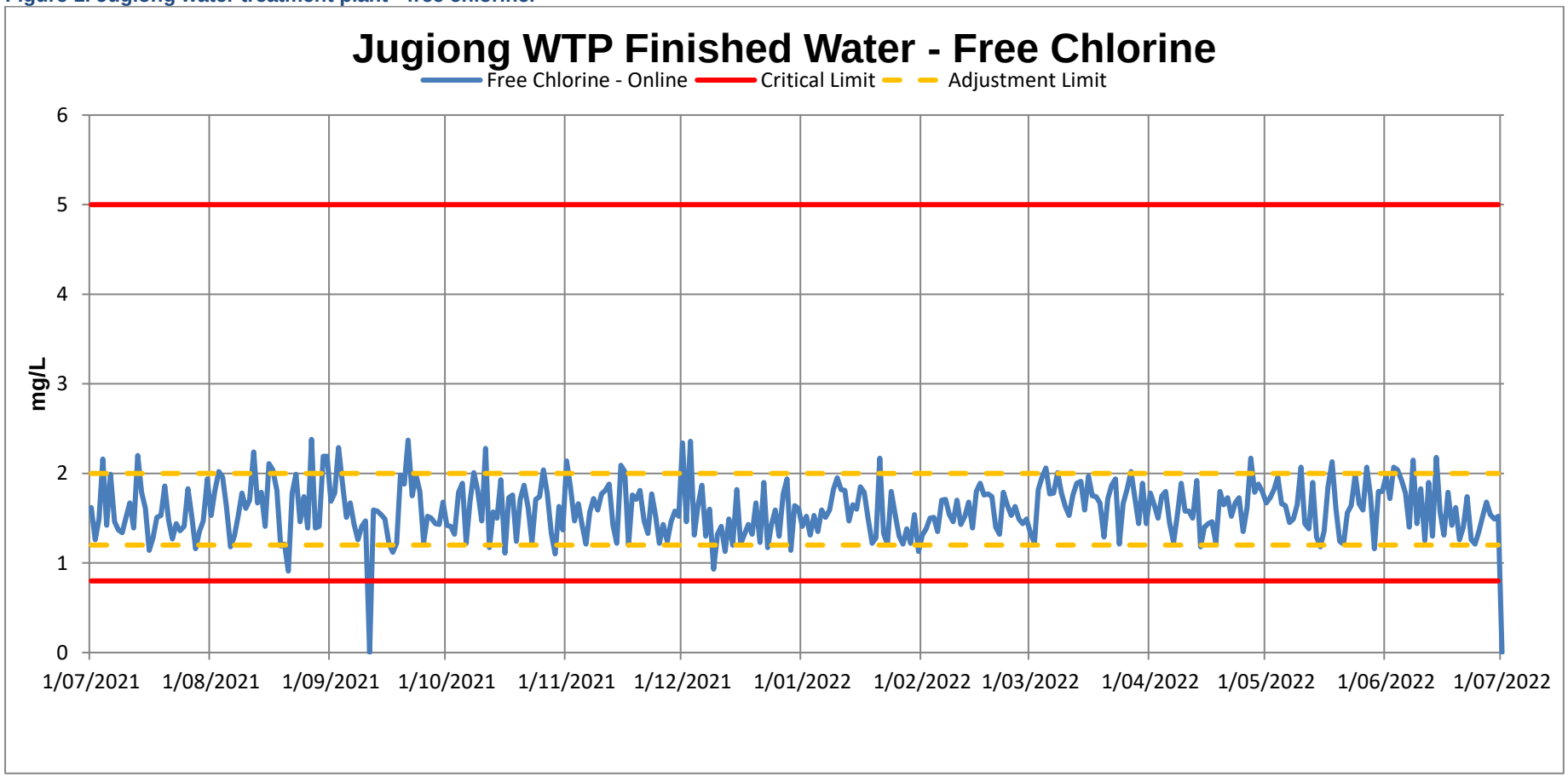


Figure 1 above is a representation of Free Chlorine in the water leaving the Jugiong Water Treatment Plant. The red lines are our Critical Control Points (CCP) for the concentration of chlorine in the water and the orange lines are our Operational control points. As is indicated above, GWCC is consistently within the CCP throughout the year with the exception of 1 exceedance. This exceedance is explained in Table 3 above as failed instrumentation.

Figure 2. Jugiong water treatment plant - finished fluoride.

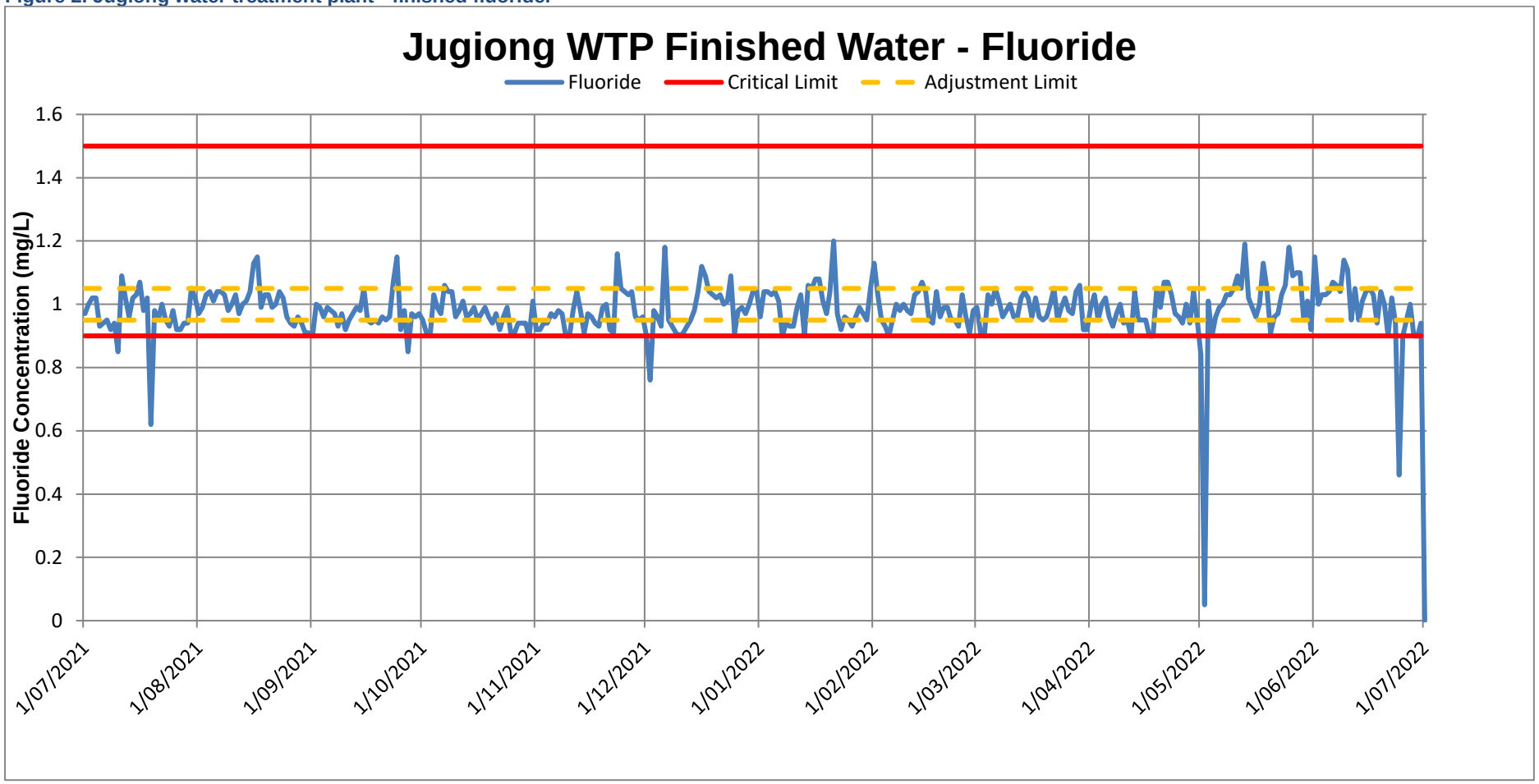


Figure 2 is a representation of the Finished Water Fluoride in the water leaving the Jugiong Water Treatment Plant. The red lines are our Critical Control Points (CCP) limits for the concentration of Fluoride in the water and the orange lines are our Operational control points. As is indicated above, GWCC is generally within the CCP throughout the year with the exception of 7 exceedances as indicated above. These exceedances are explained in Table 3 above, Critical Limit exceedances. Fluoride dosing equipment has been recently audited by Atom Consulting in 2020 with an estimated price for replacement of equipment to be $190,000.

Figure 3. Oura water treatment plant - finished water free chlorine.

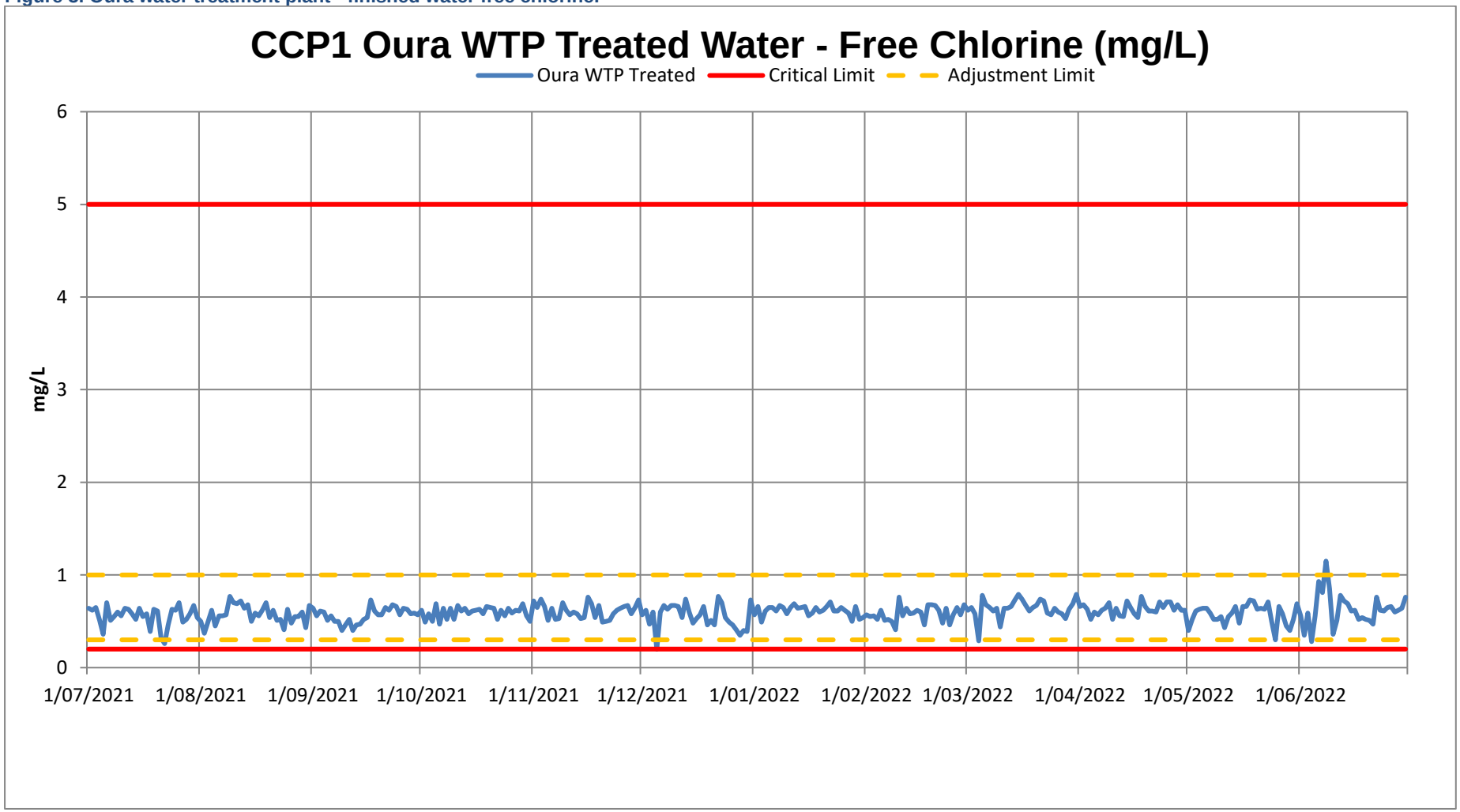


Figure 3 above is a representation of Free Chlorine in the water leaving the Oura Water Treatment Plant which employs a logarithmic scale on vertical axis. The red lines are our Critical Control Points (CCP) for the concentration of chlorine in the water and the orange lines are our Operational control points. As is indicated above, GWCC is consistently within the CCP throughout the year with no exceedances.

Figure 4. Oura water treatment plant - treated water fluoride.

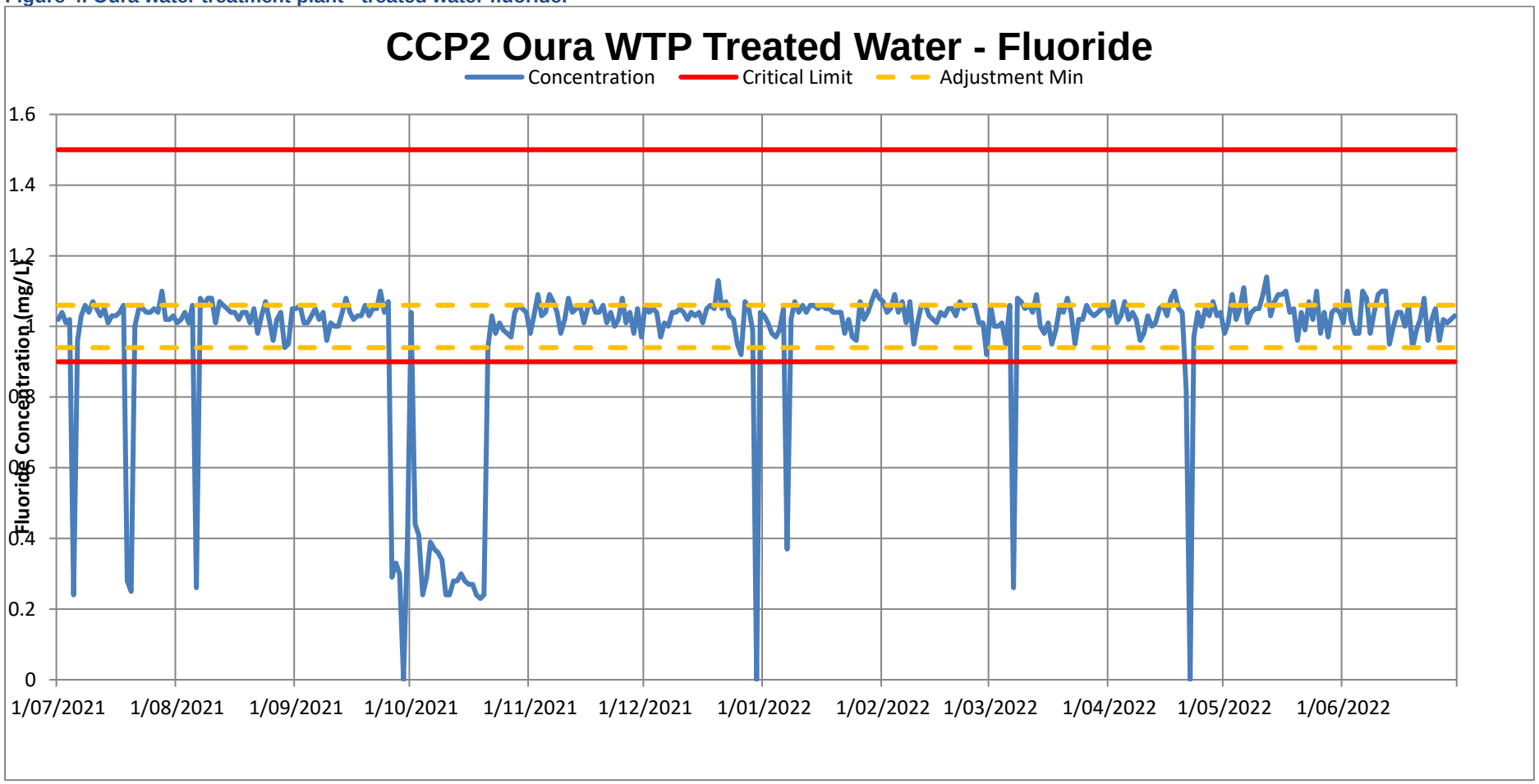


Figure 4 above is a representation of the Finished Water Fluoride in the water leaving the Oura Water Treatment Plant. The red lines are our Critical Control Points (CCP) limits for the concentration of Fluoride in the water and the orange lines are our Operational control points. As is indicated above, there has been multiple exceedances throughout the reporting period, these exceedances have been explained in table 4 above. New Fluoride assets are recommended by GWCC and will be considered for replacement in 2024 in conjunction with the development of a new pump station and dosing facility.

Figure 5: Mt Daylight finished water Free Chlorine

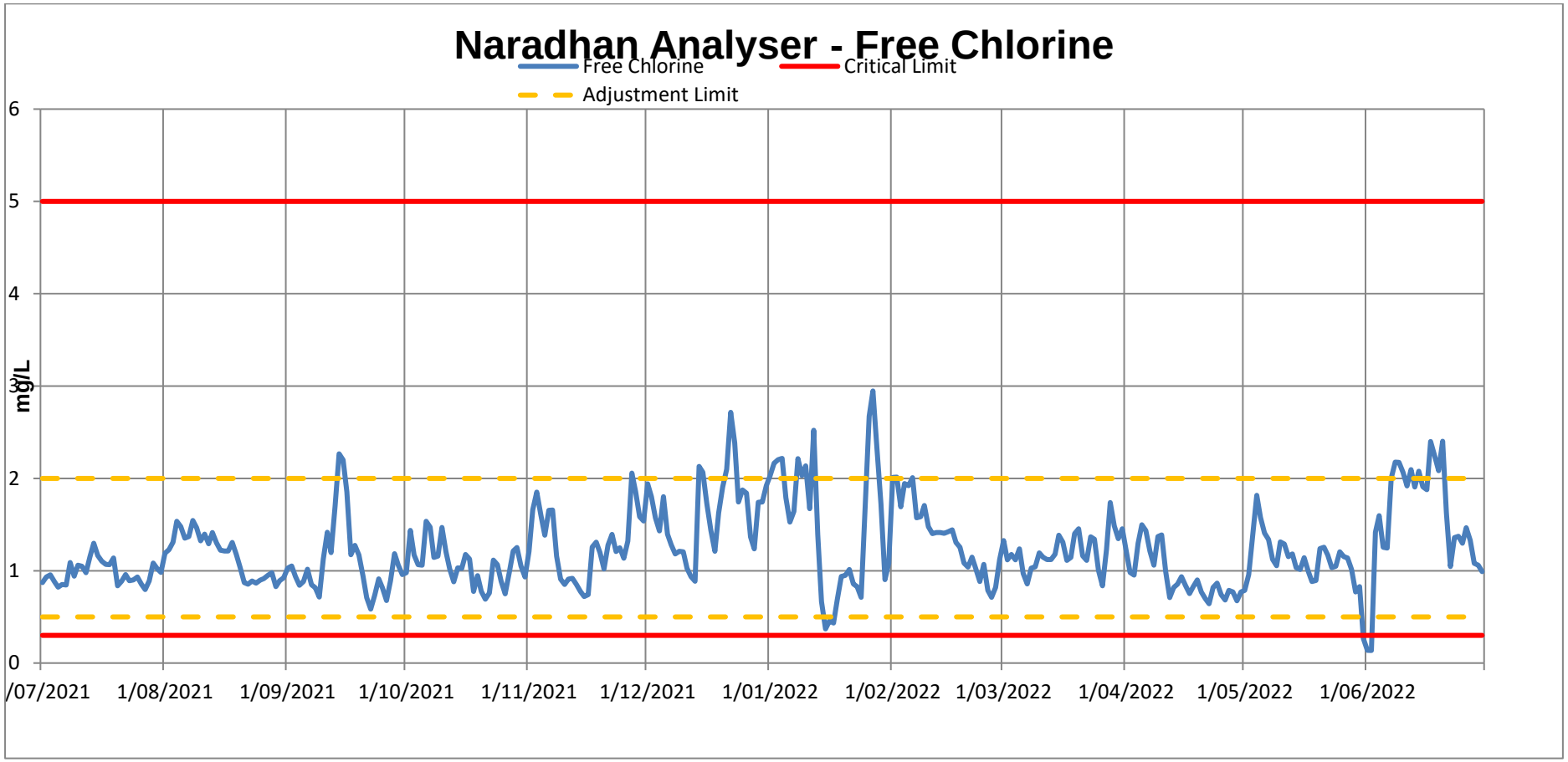


Figure 5 above is representative of the finished water Free Chlorine for the Mt Daylight system. The red lines are our CCPs and the orange lines are the operational limits. It has been a very consistent throughout the year, however, there were three exceedances reported due to failed calibrations.

These exceedances have been explained in table 5 above.

Fluoride Critical Limit exceedance

See Table 3. Critical limit exceedances - Jugiong and Table 4. Critical limit exceedances - Oura.

Table 6. Fluoride critical limit exceedances – Summary all results in (mg/L)

Date	Scheme	Recorded Concentration (mg/L)	Amount Exceeded By (mg/L)
10/7/2021	Jugiong	0.85	0.1
19/7/2021	Jugiong	0.62	0.33
27/9/2021	Jugiong	0.85	0.1
2/12/2021	Jugiong	0.76	0.19
1/5/2022	Jugiong	0.84	0.11
2/5/2022	Jugiong	0.05	0.9
24/6/2022	Jugiong	0.46	0.51
5/7/2021	Oura	0.24	0.71
19/7/2021	Oura	0.26	0.69
20/7/2021	Oura	0.25	0.7
6/8/2021	Oura	0.26	0.69
26/9/2021	Oura	0.29	0.66
27/9/2021	Oura	0.33	0.62
28/9/2022	Oura	0.3	0.65
30/9/2021	Oura	0.4	0.55
2/10/2021	Oura	0.44	0.51
3/10/2021	Oura	0.41	0.54
4/10/2021	Oura	0.24	0.71
5/10/2021	Oura	0.29	0.66
6/10/2021	Oura	0.39	0.56
7/10/2021	Oura	0.37	0.58
8/10/2021	Oura	0.36	0.59
9/10/2021	Oura	0.34	0.61
10/10/2021	Oura	0.24	0.71
11/10/2021	Oura	0.24	0.71
12/10/2021	Oura	0.28	0.67
13/10/2021	Oura	0.28	0.67
14/10/2021	Oura	0.3	0.65
15/10/2021	Oura	0.28	0.67
16/10/2021	Oura	0.27	0.68
17/10/2021	Oura	0.27	0.68
18/10/2021	Oura	0.24	0.71
19/10/2021	Oura	0.23	0.72
20/10/2021	Oura	0.24	0.71
7/1/2022	Oura	0.37	0.58
7/3/2022	Oura	0.26	0.69
21/4/2022	Oura	0.82	0.13

Water Quality

Throughout the reporting period GWCC have undertaken numerous water samples for both operational and verification monitoring. These samples are tested at the GWCC laboratory or an external NATA accredited laboratory for operational monitoring or NSW Health's FASS lab for

verification or compliance purposes. GWCC also conducted a number of onsite tests for operational purposes which are presented below.

Water samples are tested for Physical, Chemical and Microbial properties in the water.

Throughout the reporting period GWCC have conducted a total of 1296 microbial water samples to be either tested by NSW Health or tested 'in-house' by GWCC Water Quality staff.

The drinking water is also tested throughout the period for chemical elements which may be present in the water, a total of 186 water samples were carried out during the reporting period, and all were tested by NSW Health's FASS laboratory. From the 186 total samples collected and tested, 116 were treated water samples taken in the distribution system and 70 were raw or bore water samples.

GWCC also undertake pesticide sampling of the drinking water across the entire scheme. These samples are tested by a NATA accredited laboratory for the 2021/22 FY a total of 14 samples were tested for the presence of pesticides. All sample results were compliant with parameters set in the ADWGs.

It is also a requirement for GWCC to test for Radiological characteristics in the ground water supplies every 2 years, for the 2021/22 FY 4 Radiological samples were taken and tested by Australian Nuclear science and Technology Organisation (ANSTO). Results and locations can be seen in table 11.

Another initiative undertaken by GWCC is the monitoring of chlorine within the distribution system networks across the entire drinking water scheme. These tests are conducted routinely by the distribution staff and a total of 3165 chlorine test were conducted onsite throughout the year. These tests include both Total and Free chlorine. A running spreadsheet of results was previously updated by office staff once data was received by the distribution staff and is now located in GWCC new database Content Manager (doc 18/1344). Water outlook has since been rolled out to the distribution staff to upload the results of the chlorine tests. Since this implementation of WO to staff there has been 7375 chlorine test results uploaded into the database. See table 8 below, 'GWCC entire distribution system chlorine management'.

Data Collection

GWCC have conducted numerous monitoring samples throughout the distribution system as well as a number of verification samples that are tested by independent Forensic Analytical Science Services (FASS) laboratories. Below is a summary of Micro samples taken and tested throughout GWCC distribution system as well as tests conducted onsite and at GWCC Water Treatment plants.

Table 7. Micro sampling summary

Microorganisms Summary					
Tests conducted	**Tested by Pathology**	**Non-compliant samples**	**Tested In House**	**Non-compliant samples**	**(Total)**
Jugiong	78	0	208	3	286
Oura	270	0	481	0	751
Mt Arthur	64	0	91	0	155
Mt Daylight	26	0	78	0	104
Total	438	0	858	3	1296

New South Wales Health – Micro Monitoring

New South Wales Health Drinking Water Monitoring Program outlines the number and allocation of samples within a Drinking Water System. These numbers are based on population served and the complexity of the system. Currently GWCC have 438 water samples tested by FASS for E.coli and Faecal Coliforms across the entire drinking water scheme. These numbers can be further broken down into water supply systems:

- Jugiong Drinking Water Scheme 78 samples annually for E.coli and Faecal Coliforms
- Oura Drinking Water Scheme 270 samples annually for E.coli and Faecal Coliforms
- Mount Arthur Drinking Water Scheme 64 samples annually for E.coli and Faecal Coliforms
- Mount Daylight Drinking Water Scheme 26 samples annually for E.coli and Faecal Coliforms

Comprehensive Chemical Sample Summary

Table 8. Comprehensive chemical sample results - summary

	Tested by FASS (Verification and Operational)	Non-compliant samples	Samples with an indicator not compliant with ADWG e.g. Iron or Manganese or pH	Reason/Notes:
Comprehensive chemical Samples Treated Water	67	See Table 14	6	See list below Some samples are Non-Compliant for more than 1 parameter
Comprehensive Chemical for Raw and/or Bore Data	69			

GWCC conduct both Verification and Operational monitoring of potential chemicals in the drinking water over all of the drinking water scheme. Raw water or untreated water samples are taken from all duty bores from Mt Arthur, Mt Daylight and Oura on a monthly basis. Treated water samples are also taken in the distribution system of all of these schemes. As can be seen from table 6 above GWCC has conducted 67 comprehensive chemical samples for our treated water and 69 samples for our raw and/or bore water. A breakdown of how many samples were taken and tested by the FASS lab for each drinking water scheme is presented below:

- **Oura** – 17 raw water samples were taken from the duty bores each month and 35 Treated water samples taken from the distribution system.
- **Jugiong** – 24 raw water samples taken from the Murrumbidgee River and 12 Treated water samples were taken from the distribution system.
- **Mt Daylight** – 16 Raw water samples were taken from the bores and 2 Treated water samples taken from the distribution system.
- **Mt Arthur** - Raw water samples were taken from the duty bore each month, a total of 12 samples for the reporting period and 7 Treated water samples taken from the distribution system.

Table 9. Breakdown of number of samples with parameters exceeding ADWG values – Treated Water only.

Site	Indicator Non-Compliant							
	Selenium	Iron	Manganese	Colour	Turbidity	pH	Fluoride	Lead
Distribution – Oura Scheme			1			2	19	1
Distribution – Jugiong Scheme			1					
Distribution – Mt Arthur Scheme		1				1	7*	

Note: Only shows treated water samples taken from the distribution systems. **Non Fluoridated system*

Source water (Ground Water) monitoring has also been increased during the reporting period. All 'on duty' bores are sampled every month and samples sent to FASS for testing. A total of 45 samples were taken during the reporting period from a combination of Oura Bores, Mt Arthur Bores and Mt Daylight bores.

Chlorine Distribution Summary

Table 10. GWCC entire distribution system chlorine management

Chlorine Distribution System Monitoring	in Situ tests for Chlorine from spreadsheet and Water Outlook for (2020/21)	in Situ test results for Chlorine - since implementation of Water Outlook
Entire Scheme	3165	4210

Every week GWCC distribution staff conduct Chlorine Analysis of the water distribution system at GWCC. Above is a summary of how many samples are tested for Free, Total Chlorine as well as Temperature and soon Turbidity and pH throughout the entire distribution system.

Radiological Sampling

NSW Health Drinking Water Monitoring Program indicates that Ground water supplies are to be tested every 2 years for Radiological characteristics. Table 11 below shows the results of these tests. All samples are within ADWG guidelines. Note: these samples are from 2018/19 and are GWCCs most recent results, Radiological testing will be undertaken in November 2020.

Table 11. Results of radiological sampling

Sample description	Client ID	Ansto ID	Gross Alpha (Bq/L)	Gross Beta (Bq/L)
Oura Bore 2	Bore 2	C0887	0.03 ± 0.01	0.03 ± 0.01
Oura Bore 6	Bore 6	C0888	0.034 ± 0.015	0.03 ± 0.01
Mt Arthur Bore 1	Bore 1	C0889	<0.03	<0.03
Jugiong River	River	C0890	0.09 ± 0.01	0.08 ± 0.01

Water Treatment Plants

GWCC have two main Water Treatment Plants (WTPs) located at Jugiong and Oura. A number of operational water sample results are taken and used on daily basis to help with the operation of the plants and to determine correct amounts of chlorine and fluoride that need to be injected into the water to make it suitable for consumption. Below is a list of the tests conducted and where within the treatment process they are taken.

Along with the operational monitoring conducted at the WTPs, verification monitoring is also undertaken, specifically for Fluoride. A fluoride sample is taken from both WTPs every month and sent to FASS for testing. Results can be seen in the Fluoride Compliance Summary report in appendix C.

Table 12. Jugiong water treatment plant in-house testing

Raw Water	Dosed Water	Settled Water	Finished Water
Fluoride	pH	Turbidity	Turbidity - online
Turbidity - online		Colour	Turbidity - Offline
Turbidity - Offline		pH	Colour
Colour			pH
pH			Alkalinity
Alkalinity			Hardness
Hardness			Temperature
Temperature			Free Chlorine
			Total Chlorine
			Fluoride

Table 13. Oura water treatment plant in-house testing

Raw Water	Treated Water	Oura Collection tank
Temperature	Free Chlorine	Turbidity
Fluoride	Total Chlorine	
pH	Temperature	
	Fluoride	
	pH	

Non-Compliant Data

Operational monitoring indicates there have been some incidences of high pH and low residual chlorine in the extremities of the Jugiong, Oura, Mt Daylight and Mt Arthur drinking water schemes. Results are indicated in Table 14 below.

Table 14. Summary of non-compliant water quality data from operational monitoring

Date	Location	Parameter	Exceedance	Correction	Preventive action	Notes
Jugiong Scheme						
2/8, 10/8, 16/8, 23/8, 19/10, 16/11, 6/12, 7/12, 12/1, 20/1, 9/2, 8/2, 8/3, 27/4, 10/5,	**Young Storage Outlet**	Free Chlorine	0.2, 0.07, 0.09, 0.17, 0.02, 0.15, 0.02, 0.07, 0.02, 0.02, 0.02, 0.07, 0.18, 0.02, 0.12, 0.07,	Upstream Dosing	More monitoring	
10/5, 7/12	**Young Storage Outlet**	Turbidity (NTU)	1.13, 1.7			
12/1, 8/3,	**Young Storage Inlet**	Free Chlorine	0.08, 0.02			
7/12, 12/1,	**Young Storage Inlet**	Turbidity (NTU)	1.08, 1.36			
27/4	**Young Storage Outlet**	pH	9.22	Recalibrate analyser		
16/9, 9/2, 29/3,	**Young Terminal Inlet**	Free Cl	0.02, 0.03, 0.16			
16/8, 16/9	**Young Terminal Inlet**	Turbidity (NTU)	1.72, 1.34			
7/12	**Black Range**	Turbidity(NTU)	1.56			
19/10, 12/1, 8/2, 8/3	**Harden Town offtake**	Free Cl	0.06, 0.02, 0.02, 0.02	Manually Dose harden Town res	Extra Monitoring Upstream	
19/10, 8/2	**Cowangs reservoir Inlet**	Free Cl	0.11, 0.02, (mg/L)	Manual Dose	Monitor Cl coming out of plant, run sample water longer	
7/12	**Cowangs reservoir Inlet**	Turbidity (NTU)	1.12			

Date	Location	Parameter	Exceedance	Correction	Preventive action	Notes
12/1, 20/1, 9/2, 8/2, 16/2, 8/3, 22/3, 29/3, 27/4, 10/5,	**Cowangs reservoir Outlet**	Free Cl	0.02, 0.05, 0.09, 0.02, 0.02, 0.02, 0.1, 0.13, 0.05, 0.18			
18/8, 15/9, 13/10, 7/12, 8/12, 12/1, 30/3, 2/5, 10/5	**New Horizon Gundagai Rd**	Free Cl	0.11, 0.1, 0.02, 0.02, 0.16, 0.02, 0.02, 0.02, 0.05	Manual Dose upstream	Monitor Cl in distribution	
12/1, 2/5	**New Horizon Gundagai Rd**	Colifroms	11, 22			
10/8, 6/9, 20/9, 27/9, 13/10, 7/12, 12/1, 1/3,	**Stockinbingal Bowling Club**	Free Cl	0.14, 0.12, 0.15, 0.13, 0.09, 0.03, 0.02, 0.02 (mg/L)	Manual Dose	Monitor Cl in Distribution System	
7/12	**Stockinbingal Bowling Club**	Turbidity (NTU)	1.07			
6/12, 7/12, 12/1, 20/1, 9/2, 1/3, 22/3, 29/3, 9/5, 10/5	**Bauloora Res**	Free Cl	0.16, 0.03, 0.02, 0.02, 0.08, 0.02, 0.02, 0.02, 0.02, 0.02(mg/L)	Manual Dose	Monitor Cl in Distribution system	
7/12	**Bauloora Res**	Turbidity (NTU)	1.07			
10/8, 16/8, 23/8, 6/9, 15/9, 20/9, 12/10, 25/10, 3/11, 23/11, 6/1, 20/1, 1/3, 2/3, 22/3, 29/3, 27/4, 2/5,	**Dirnaseer reservoir**	Free Cl	0.08, 0.03, 0.08, 0.16, 0.02, 0.02, 0.05, 0.02, 0.02, 0.17, 0.15, 0.05, 0.02, 0.02, 0.02, 0.11, 0.02, 0.19, (mg/L)	Manual Dose	Monitor Cl in Distribution system	
1/3	**Dirnaseer reservoir**	Temperature	25.4			
18/8, 13/10, 7/12, 12/1, 1/3, 30/3, 2/5	**Town offtake Springdale**	Free Cl	0.02, 0.02, 0.02, 0.02, 0.02, 0.02, 0.02, (mg/L)	Manual dose	Monitor cl in Distribution system	Near the end of the line for the Jugiong system

Date	Location	Parameter	Exceedance	Correction	Preventive action	Notes
7/12, 1/3, 2/5	**Town offtake Springdale**	pH	8.65, 8.72, 8.58			
18/8	**Town offtake Springdale**	Turbidity (NTU)	1.27			
15/9, 7/12, 2/5	**Wallendbeen School**	Free Cl	0.17, 0.06, 0.11 mg/L	Manual Dose Upstream	Monitor Cl in distribution	
7/12, 23/6	**Wallendbeen School**	Turbidity (NTU)	1.08, 1.06			
2/5	**Wallendbeen School**	pH	8.58			
20/9, 20/1	**Rosehill Pump Station**	Free Cl	0.14, 0.02 (mg/L)	Manual Dose	Monitor Cl in distribution	
13/9, 25/10, 6/12, 6/1, 20/1, 16/1, 1/3, 11/3, 29/3, 27/4, 9/5,	**Wallendbeen res**	Free Cl	0.1, 0.02, 0.02, 0.09, 0.14, 0.02, 0.04, 0.02, 0.07, 0.02, 0.1			
10/8, 16/8, 23/8, 27/9, 3/11, 6/1, 11/3, 22/3, 9/5, 26/5, 16/6,	**Brawlin Res**	Free Cl	0.04, 0.11, 0.03, 0.02, 0.02, 0.02, 0.03, 0.02, 0.07, 0.02, 0.07			
12/10, 25/10, 3/11, 6/12, 20/1, 1/3, 11/3, 22/3, 29/3, 26/5,	**Frampton Res**	Free Cl	0.07, 0.02, 0.15, 0.08, 0.05, 0.02, 0.04, 0.09, 0.02, 0.02			
16/8, 11/3, 22/3	**Stockinbingal Res**	Free Cl	0.02, 0.05, 0.02			
28/5	**Temora East**	Free Cl	0.18			
Oura Scheme						
12/1, 23/2, 22/3	**Tara Pump Station Discharge**	Temperature	26.1, 28.7, 27			

Date	Location	Parameter	Exceedance	Correction	Preventive action	Notes
1/12, 12/1, 22/3, 20/4, 18/5	**Tara Pump Station Discharge**	pH	8.57, 8.52, 8.53, 8.62, 8.97			
23/2,	**Ariah Park Res**	Temperature	26.3			
23/2	**Ariah Park Res**	Turbidity (NTU)	1.17			
22/10, 22/3, 20/4, 18/5	**Ariah Park Res**	pH	8.62, 8.53, 8.53, 8.56			
12/1	**Wellmans St, Ariah Park**	Temperature	27.7			
11/8, 12/1	**Wellmans St, Ariah Park**	pH	8.73, 8.73			
12/1, 23/2	**Beckom Hotel**	Temperature	25.6, 25.9			
11/8, 22/10, 2/2, 22/3, 20/4, 18/5	**Beckom Hotel**	pH	8.73, 8.68, 8.56, 8.69, 8.71, 8.71			
22/10, 1/12, 12/1, 20/4, 18/5	**Ardlethan**	pH	8.79, 8.63, 8.69, 8.75, 8.88		Mains Flushing/ Cleaning, pH correction	
12/1, 23/2	**Ardlethan**	Temperature	26.2, 25.9			
26/11, 11/2, 14/3,	**Barellan Res**	Free Cl	0.16, 0.11, 0.19			
12/1, 24/1, 31/1, 23/2, 7/3, 11/3	**Barellan Res**	Temperature	26.4, 26, 27, 27.4, 26.5, 26.2			
3/11, 1/12, 22/3, 20,4	**Barellan Res**	pH	8.61, 8.57, 8.61, 8.69			
21/3	**Temora BT inlet**	Temperature	25.8			
18/1, 14/6	**Temora BT inlet**	Turbidity (NTU)	1.26, 13.9			
4/6, 5/6	**Temora town res outlet**	Free Cl	0.11, 0.12			
18/1, 7/2, 21/3	**Temora town res outlet**	Temperature	26.4, 26, 26.1			
14/6,	**Temora High School**	Free Cl	0.17			
18/1, 7/2	**Temora High School**	Temperature	26, 26.4			

Date	Location	Parameter	Exceedance	Correction	Preventive action	Notes
6/4, 14/6	**Beattie St Temora**	Free Cl	0.09, 0.09			
18/1, 7/2, 6/4	**Beattie St Temora**	Temperature	28.2, 28.5, 25.1			
6/4	**Beattie St Temora**	pH	8.69			
22/9	**Beattie St Temora**	Turbidity (NTU)	1.18			
22/9, 14/6	**Temora West School**	Free Cl	0.19, 0.12			
18/1, 7/2	**Temora West School**	Temperature	28.5, 27			
25/8, 22/9, 18/1	**Temora West School**	pH	8.72, 8.6, 8.55			
8/12, 18/1, 7/2, 6/4	**Temora Caravan Park**	Temperature	26.1, 29.4, 28, 26.4			
27/8, 22/10	**Temora Caravan Park**	Turbidity (NTU)	1.02, 19.8			
6/4	**Temora Caravan Park**	pH	8.56			
21/3	**Cartwrights Hill reservoir**	Temperature	26.3			
17/9	**Marrar**	Free Cl	0.09			
22/10	**Marrar**	Turbidity (NTU)	3.38			
18/1	**Marrar**	Temperature	25.6			
19/1	**Junee Balance tank inlet**	Turbidity (NTU)	1.75			
23/8, 18/11, 19/1, 2/6	**Junee Balance tank outlet**	Turbidity (NTU)	1.28, 1.18, 1.75, 1.22			
23/8, 23/9, 23/9, 2/6	**Junee Public School**	Turbidity (NTU)	1.86, 2.1, 3.05,1.15	Flushing	NO DES	
19/1,	**Junee High School**	Free Cl	0.02			
19/1	**Junee High School**	Temperature	25.8			
23/8, 19/1	**Junee High School**	Turbidity (NTU)	1.4, 1.97			
23/8, 18/11, 2/6	**Prince St Junee**	Turbidity (NTU)	1.5, 1.5, 1.05		NO DES	
23/9	**Marinna**	Free Cl	0.04			
23/9, 19/10, 18/11, 29/6	**Illabo Hotel**	Free Cl	0.0.12, 0.12, 0.02, 0.04 (mg/L)	Manual Dose	Monitor Distribution	

Date	Location	Parameter	Exceedance	Correction	Preventive action	Notes
19/1, 8/3	**Illabo Hotel**	Temperature	25.7, 26			
23/9, 19/10, 8/3, 29/6	**Illabo Hotel**	pH	8.6, 8.51, 8.58, 8.67			
23/9, 7/12	**Eurongilly Res**	Free Cl	0.04, 0.16			
23/8, 23/9, 19/10, 18/11, 7/12, 9/2, 29/6	**Wantabadgery Hall**	Free Cl	0.19, 0.1, 0.19, 0.15, 0.1, 0.16, 0.18	Manual Dose	Monitor Distribution	
29/6	**Wantabadgery Hall**	Turbidty (NTU)	1.78			
29/6	**Wantabadgery Hall**	pH	8.58			
18/5	**Ariah Park Central School**	Free Cl	0.17			
18/5	**Ariah Park Central School**	Turbidity (NTU)	1.1			
18/5	**Ariah Park Central School**	pH	9.07			
18/5	**Palace Hotel Ardlethan**	pH	9.05			
22/9	**Marrar Public School**	Free Cl	0.03			
1/12, 2/2, 23/2	**Ariah Park Golf Club**	Temperature	25.3, 26, 27.8			
8/10, 23/2	**Ariah Park Golf Club**	Turbidity (NTU)	2.4, 1.2			
9/9, 3/11, 1/12, 20/4	**Ariah Park Golf Club**	pH	8.79, 8.57, 8.72, 9.05			
2/2, 23/2, 22/3	**Ardlethan (Bygoo St)**	Temperature	27, 28.6, 28			
12/1	**Barmedman Town reservoir**	Temperature	25.3			
4/1, 12/1, 25/1, 24/1, 31/1, 4/2, 15/2, 21/2, 9/3, 17/3	**Barmedman Park**	Temperature	25.1, 26.2, 25.5, 26, 28.1, 26, 25.1, 26.3, 25.6, 25.4			Hot Summer

Date	Location	Parameter	Exceedance	Correction	Preventive action	Notes
26/11,	**Barellan Low Level**	Free Cl	0.16			
7/3	**Barellan Club**	Temperature	25.9			
9/9, 3/11, 1/12, 20/4	**Ariah Park Golf Club**	pH	8.79, 8.57, 8.72, 9.05		Flushing, pH correction	
1/12, 2/2, 23/2	**Ariah Park Golf Club**	Temperature	25.3, 26, 27.8			
8/10, 23/2	**Ariah Park Golf Club**	Turbidity	2.4, 1.2			
5/8, 22/10, 26/10, 23/11, 24/1, 15/2, 14/3, 10/5, 7/6	**Wyalong Pump Station Meter**	pH	8.59, 8.8, 8.61, 8.63, 8.57, 8.53, 8.59, 8.95, 8.9		Mains Flushing/ Cleaning, pH correction	
24/1, 15/2	**Wyalong Pump Station Meter**	Temperature	26, 27			
5/8, 26/10, 23/11, 24/1, 15/2, 10/5, 7/6	**Wyalong School, George Bland Ave**	pH	8.63, 8.56, 8.6, 8.55, 8.51, 8.95, 9.11		Mains Flushing, pH correction	
24/1, 15/2	**Wyalong School, George Bland Ave**	Temperature	26, 26			
5/8, 2/9, 26/10, 23/11, 13/12, 24/1, 15/2, 14/3, 10/5, 7/6	**Perseverance St west Wyalong**	pH	8.77, 8.6, 8.6, 8.53, 8.67, 8.8, 8.53, 8.65, 9.09, 9.09		Mains Flushing, pH correction	
24/1, 15/2, 14/3	**Perseverance St west Wyalong**	Temperature	30.3, 26, 27			
5/8, 2/9, 26/10, 23/11, 24/1, 15/2, 14/3, 10/5	**West Wyalong Public School**	pH	8.67, 8.6, 8.79, 8.74, 8.67, 8.54, 8.65, 8.9,		Mains Flushing/ Cleaning, pH correction	Near end of the line of Oura
24/1, 15/2, 14/3	**West Wyalong Public School**	Temperature	27, 29.5, 27			
5/8, 2/9, 26/10, 23/11, 24/1, 15/2,	**West Wyalong Terminal Storage**	pH	8.7, 8.7, 8.71, 8.6, 8.77, 8.63, 8.64, 8.95, 8.87		Mains Flushing, pH correction	Near end of line of Oura

Date	Location	Parameter	Exceedance	Correction	Preventive action	Notes
14/3, 10/5, 7/6						
15/2, 15/2, 18/2, 21/2, 5/3, 9/3, 14/3	**West Wyalong Terminal Storage**	Temperature	26.6, 27, 26.4, 25.9, 26.2, 25.7, 26			
5/8, 2/9, 26/10, 23/11, 13/12, 24/1, 15/2, 14/3, 10/5,	**Calleen reservoir Outlet**	pH	8.91, 8.7, 8.91, 8.92, 8.87, 8.83, 8.97, 8.88, 9.12,		Mains Flushing/ Cleaning, pH correction	Near end of line of the Oura system
15/2	**Calleen reservoir Outlet**	Temperature	26.6			
5/8, 2/9, 26/10, 23/11, 13/12, 24/1, 15/2, 14/3, 10/5,	**Ungarie town res**	pH	9.01, 8.95, 8.91, 9.12, 9.05, 9.09, 9.18, 9.22, 9.35		Mains Flushing/ Cleaning, pH correction	Ungarie is the end of a long distribution system
5/1, 10/1, 17/1, 25/1, 24/1, 11/2, 15/2, 18/2, 21/2, 25/3	**Ungarie town res**	Temperature	25.9, 25.4, 25.5, 25.4, 26.5, 25.3, 27.6, 25.1, 25.5, 25.3			
14/12, 23/12, 5/1, 7/1, 10/1, 17/1, 25/1, 31/1, 3/2, 9/2, 11/2, 16/2, 18/2, 21/2, 1/3, 5/3, 7/3, 14/3, 21/3, 25/3, 29/3, 1/4, 4/4	**Bing Waller Park, Ungarie**	Temperature	27.2, 28.9, 30.1, 30.8, 30.3, 31.8, 26.2, 31, 26.8, 26.4, 27.8, 32.3, 31.3, 28.5, 31.1, 29.6, 28.2, 25.8, 28.5, 27.8, 25.8, 26.5, 25.1			
5/8, 26/10, 23/11, 13/12, 24/1, 15/2, 14/3	**Ungarie central School**	pH	8.97, 8.91, 8.97, 8.99, 9, 9.05, 9		Mains Flushing/ Cleaning, pH correction	End of a long system

Date	Location	Parameter	Exceedance	Correction	Preventive action	Notes
13/12, 24/1, 15/2, 14/3	**Ungarie central School**	Temperature	28.5, 31, 27, 28			
25/8, 3/9, 18/10, 12/11, 16/11, 8/12, 10/1, 18/1, 25/1, 14/3, 6/4, 8/4, 14/4, 2/5, 16/5, 25/5, 28/5, 29/5, 4/6, 5/6, 6/6,	**Temora East res**	Free Cl	0.12, 0.06, 0.14, 0.08, 0.11, 0.02, 0.13, 0.02, 0.07, 0.06, 0.02, 0.05, 0.12, 0.19, 0.14, 0.14, 0.18, 0.13, 0.18, 0.17, 0.15,			Water can be from either Oura or Jugiong or both (end of Jugiong scheme)
8/7, 29/7, 27/8, 24/9, 22/10, 10/3, 7/4, 11/5	**Temora East res**	pH	8.7, 8.7, 8.66, 8.84, 8.79, 8.7, 8.55, 8.68			
Mt Arthur Scheme						
21/12, 13/1, 3/2, 24/3, 24/3,	**Matong School**	Free Cl	0.11, 0.14, 0.02, 0.15, 0.07, 0.08	Manual Dose	Monitor	
16/7, 9/10, 5/11, 24/3, 24/3	**Matong School**	pH	9.2, 9.25, 8.79, 9, 9.19			
17/12, 13/1, 3/2, 23/2	**Matong School**	Temperature	28.1, 29, 25.1, 25.9			
22/4,	**Ganmain High Level**	Free Cl	0.11			
17/12, 14/1, 13/1	**Ganmain High Level**	Temperature	26.1, 28, 27.5			
17/12, 13/1, 3/2,	**Hay display Industry Centre Ganmain**	Temperature	29.3, 29.4, 27.3			

Date	Location	Parameter	Exceedance	Correction	Preventive action	Notes
9/10, 5/11, 3/2, 23/2, 24/3, 28/6	**Coolamon (Allawah Lodge)**	Free Cl	0.08, 0.02, 0.09, 0.02, 0.12, 0.14	Manual Dose	Monitor	
17/12, 13/1	**Coolamon (Allawah Lodge)**	Temperature	26.5, 29			
9/10, 5/11, 3/2, 23/2, 28/6	**Coolamon Central School**	Free Cl	0.08, 0.02, 0.09, 0.02, 0.12, 0.14			
9/10	**Coolamon Central School**	pH	8.68			
17/12, 20/12, 13/1, 3/2	**Coolamon Central School**	Temperature	28.8, 25.7, 27.2, 25.1			
5/11, 16/3,	**High Level North Coolamon**	Free Cl				
17/12, 14/1, 13/1, 22/1, 28/1	**High Level North Coolamon**	Temperature	26.2, 25.8, 27.2, 25.8, 25.4			
13/1	**“Tolmie” Wagga rd Coolamon**	Temperature	27.5			
17/12	**Ganmain Pre School**	Temperature	26.2			
17/2	**Ganmain Public School**	Temperature	29.2			
6/7 – 28/6 (whole of reporting period)	**Grong Grong Park**	Free Cl	0.02 – 0.42 all samples with exception of 2 were all under 0.2 mg/L			
17/12, 15/1, 13/1, 3/2, 4/2, 23/2	**Grong Grong Park**	Temperature	29.2, 31.5, 31.5, 26.9, 28, 26.9			
22/4, 7/5, 27/5, 28/6,	**Matong Low Level**	Free Cl	0.19, 0.17, 0.18, 0.04			
14/12, 14/1	**Matong Low Level**	Temperature	26.5, 27.5			
9/2,	**Matong Public Toilets**	0.05				
6/7, 12/8, 29/9, 3/11, 25/11, 11/12,	**Grong Grong (town res)**	Free Cl	0.03, 0.1, 0.02, 0.02, 0.02, 0.02, 0.02, 0.02,	Manual Dose	Monitor	

Date	Location	Parameter	Exceedance	Correction	Preventive action	Notes
21/12, 4/1, 14/1, 11/5, 31/5, 18/6, 28/6			0.02, 0.02, 0.02, 0.03			
25/11, 21/12, 14/1	**Grong Grong (town res)**	Temperature	25.3, 26.3, 29.2			
16/3, 2/2, 1/3, 16/3	**Coolamon South res**	Free Cl	0.17, 0.18, 0.13, 0.13,			
14/1, 28/1	**Coolamon South res**	Temperature	25.9, 25.8			
9/2,	**Matong High res**	Free Cl	0.15			
14/1, 15/1	**Matong High res**	temperature	28, 26.8			
Mt Daylight Scheme						
24/11, 26/11, 3/12, 7/12, 18/12, 21/12, 22/12, 24/12, 29/12, 4/1, 12/1, 20/1, 21/1, 15/2, 19/2, 22/2, 23/2, 1/3, 5/3, 9/3, 12/3, 15/3,	**Hannan Res**	Temperature	25.1, 26.5, 25.8, 25.2, 26.4, 26.2, 25.6, 26, 26.3, 26.1, 27.8, 26.3, 27.7, 26.5, 27.5, 28.7, 25.6, 27, 26.6, 26.9, 26.8, 25.4			
24/11, 26/11, 3/12, 18/12, 21/12, 24/12, 29/12, 4/1, 9/1, 12/1, 20/1, 21/1, 27/1, 12/2, 15/2, 19/2, 22/2, 23/2, 1/3, 9/3, 12/3	**Naradhan res Outlet**	Temperature	25.1, 27, 25.3, 25.3, 26.3, 25.5, 25.8, 25.9, 25.1, 26.6, 26.7, 27.8, 28.1, 25.9, 25.7,25.7, 27.1, 26.7, 26			
8/7, 7/10, 7/12, 17/3, 26/3, 1/6,	**North Weethalle Res**	Free Cl	0.17, 0.16, 0.18, 0.17, 0.13,	Manual Dose	Monitor	

Date	Location	Parameter	Exceedance	Correction	Preventive action	Notes
25/11, 21/12, 24/12, 29/12, 4/1, 12/1, 18/1, 20/1, 21/1, 27/1, 15/2, 22/2, 23/2, 1/3, 5/3, 9/3, 12/3	**North Weethalle Res**	Temperature	25.3, 25.5, 25.5, 25.8, 25.5, 26.2, 26.9, 27.2, 26.7, 29.2, 26.1, 27.7, 25.4, 26.5, 25.9, 26, 26.1			
8/7, 7/10, 29/10, 29/10, 2/11, 9/11, 24/11, 3/12, 7/12, 22/12, 24/12, 12/1, 21/1, 23/2, 12/3, 26/3, 8/4, 13/4, 21/5, 24/5, 1/6, 28/6	**Russell trading Weethalle**	Free Cl	0.11, 0.1, 0.12, 0.19, 0.18, 0.16, 0.1, 0.1, 0.07, 0.1, 0.15, 0.15, 0.1, 0.14, 0.18, 0.13, 0.18, 0.11, 0.12, 0.15, 0.1, 0.15	Manual Dose	Monitor	
16/11, 24/11, 25/11, 3/12, 7/12, 11/12, 18/12, 21/12, 22/12, 24/12, 29/12, 4/1, 9/1, 12/1, 21/1, 27/1, 12/2, 15/2, 19/2, 22/2, 23/2, 1/3, 5/3, 9/3, 12/3, 15/3, 17/3, 22/3,	**Russell trading Weethalle**	Temperature	25.8, 27.7, 28.3, 27.8, 28.1, 25.3, 26.8, 27.8, 27, 27.6, 29.1, 28.8, 27.8, 28.8, 30.7, 31.1, 26.9, 28.3, 29.2, 30.6, 26.1, 28.5, 26, 28.8, 28.8, 26.5, 25.6, 25.8			
3/12, 26/3, 21/5, 1/6,	**Nariah Res**	Free Cl	0.15, 0.05, 0.1, 0.05	Manual Dose	Monitor	
16/1, 21/1, 27/1, 22/2, 1/3, 9/3	**Nariah Res**	Temperature	26, 25.8, 27.7, 26.1, 26.5, 25.2			

Date	Location	Parameter	Exceedance	Correction	Preventive action	Notes
7/10, 29/10, 2/11, 24/11, 7/12, 11/12, 4/1, 12/1, 12/3, 15/6	**Tallimba Park**	Free Cl	0.18, 0.18, 0.15, 0.17, 0.15, 0.12, 0.15, 0.1, 0.1	Manual Dose	Monitor	
16/11, 24/11, 25/11, 3/12, 7/12, 11/12, 18/12, 21/12, 24/12, 9/1, 12/1, 20/1, 27/1, 12/2, 15/2, 19/2, 22/2, 23/2, 1/3, 8/3	**Tallimba Park**	Temperature	25.2, 25.2, 25.4, 25.3, 25.7, 25.3, 25.7, 25.9, 26, 26.1, 27.5, 27.2, 30.3, 27.5, 26, 27.5, 28.8, 25.9, 26.9, 26			
17/3	**Tallimba School**	Free Cl	0.09			
22/12, 21/1	**Tallimba School**	Temperature	27.2, 26.5			
2/9	**Tallimba Inn**	Free Cl	0.18			
21/9, 16/11, 7/12, 4/1, 20/1, 9/3, 26/3, 21/5,	**Nobbies Res**	Free Cl	0.09, 0.18, 0.05, 0.1, 0.19, 0.19, 0.05, 0.1			
3/12, 18/12, 29/12, 4/1, 12/1, 20/1, 27/1, 27/1, 12/2, 22/2, 22/2, 1/3, 5/3, 9/3, 15/3,	**Nobbies Res**	Temperature	25.3, 25.1, 25.9, 25.4, 26.3, 26.6, 25.8, 29.4, 25.9, 27.8, 27.8, 28, 25.9, 25.8, 25.7	Manual Dose	Monitor	
24/9, 7/10, 7/12, 12/3, 21/5, 1/6,	**Weethalle Res**	Free Cl	0.1, 0.19, 0.18, 0.15, 0.15, 0.09	Manual Dose	Monitor	
3/12, 18/12, 21/12, 24/12, 29/12, 4/1, 12/1, 20/1, 27/1, 12/2,	**Naradhan Steel res**	Temperature	25.6, 25.4, 26.2, 25.5, 25.3, 26, 26.6, 26.7, 28.1, 25.9, 25.7, 26.2, 27.1, 26.7, 25.3, 26.7, 26			

Date	Location	Parameter	Exceedance	Correction	Preventive action	Notes
15/2, 19/5, 22/2, 1/3, 5/3, 9/3, 12/3						
16/11, 24/11, 3/12, 18/12, 21/12, 24/12, 29/12, 9/1, 20/1, 27/1, 15/2, 19/2, 22/2, 1/3, 5/3, 9/3, 12/3, 15/3, 6/4, 8/4	**Naradhan Park**	Temperature	25.1, 26.2, 28.9, 27.5, 28.2, 26.8, 26.6, 26.3, 30.1, 26.9, 27.2, 30.1, 27.5, 26.9, 27.2, 30.1, 27.5, 26.9, 27.2, 26.2, 27.3, 25.6, 25.3			
3/12, 18/12, 21/12, 24/12, 29/12, 20/1, 22/2, 1/3, 9/3, 12/3, 15/3	**Naradhan Pump Station**	Temperature	25.1, 25.6, 25.2, 26, 25.5, 26.2, 26.1, 25.7, 25.9, 26.1, 25.4			

Water Quality Discussion

Throughout the reporting period GWCC have conducted a total of 1296 microbial water samples to be either tested by NSW Health or tested 'in-house' by GWCC Water Quality staff.

The water is also tested throughout the reporting period for chemicals which may be present in the water, a total of 186 water samples were collected and tested for chemicals during the reporting period all were tested by NSW Health FASS Lab, Not all samples were compliant and within Australian Drinking Water Guideline limits (AWDG). See table 12 for a summary of the non-compliant parameters and from what scheme the sample were undertaken.

Another initiative undertaken by GWCC in the monitoring of chlorine within the distribution system across the entire scheme. These tests are conducted routinely by the distribution staff and a total of 3165 chlorine test were conducted onsite. These tests include both Total and Free chlorine.

*Results are now entered into WaterOutlook and no longer manually entered into the chlorine history spreadsheet.

A review of the water quality monitoring was conducted by Atom consulting in 2018 and the recommendations were adopted and implemented by GWCC.

Additional works with Atom Consulting regarding the facilitation of service level agreements with our Bulk Councils has been undertaken and we have Draft water quality parameters identified for final agreement. A Draft SLA has been developed by a legal advisor with amendments required. It is intended that the Draft document will be presented to both CGRC and Hilltops Councils by December 2022.

The 2021/22 reporting year has seen unprecedented low demand periods. This has significantly impacted our water age across the extremities of our schemes and has resulted in lower, than normal chlorine residuals and an increase in discoloured water complaints, due to precipitated iron and manganese and chlorine decay.

Customer Complaints

Table 15. Customer complaints registered in the 2020/21 reporting period.

Month	Total Complaints	Discoloured Water	Burst Main	Taste/Odour Related	No Supply/Low Pressure	Leaking Meter	Messy or unsafe jobsite	Unable to Isolate meter	Other
Jul-21	8	5			1	1			1
Aug-21	42	42							
Sep-21	29	27			1	1			
Oct-21	30	27			1				2
Nov-21	14	8	2		3				1
Dec-21	43	40			2	1			
Jan-22	39	37					1		1
Feb-22	36	32			4				
Mar-22	19	16	1		1	1			
Apr-22	10	10							
May-22	33	21	2	2	2	4	1		1
Jun-22	36	33	1		1	1			

There was a total of 339 complaints made during the reporting period 2021/22. The majority of complaints that were made pertained to dirty or discoloured water totalling 298 this is an increase of 129 compared to 169 complaints recorded in 2020/21. These complaints allowed staff to determine that certain areas in the Coolamon and Junee areas required attention and from this GWCC has had reservoirs cleaned and dead ends flushed on numerous occasions. GWCC also conducted a study into the Coolamon and related townships to better handle the issue causing customer complaints. It has also allowed GWCC to eliminate the dirty water by eliminating dead ends in certain areas.

In previous years (2019) GWCC has procured the services of No-Des, a contractor that has the ability to clear water mains with no loss of water to the environment. These contractors cleaned approximately 65 km of water mains in the Coolamon and related townships. Whilst undertaking this flushing/cleaning turbidity's throughout the town were recorded as high as 171 NTU, with an average of approximately 25 NTU. Comparing against historical records of the number of complaints, this method has drastically reduced the number of customer complaints received from these areas.

Further to the implementation of automated flushing system on the notorious dead end Kingdom Drive in February 2019, GWCC has received no complaints from customers serviced on this pipeline. As such, the flushing system installed is assisting with handling of customer complaints. The study into discoloured water events found iron and manganese to be the primary cause of complaints in the Coolamon Township whereby investigating into the economic feasibility of installing a treatment plant will next be explored.

Water Quality Incidents

Table 16. Summary of incidents and emergencies, recommendations and preventative actions

Details of Incident/Emergency	Investigation Recommendations	Preventive Action Undertaken
No Water Quality Incidents have been reported for the report period 2021/22	*0*	*NA*

Staff Development and Training

Incident and Emergency Response Training

GWCC have implemented and completed Incident and Emergency response training. This training has been undertaken by relevant staff and stakeholders. GWCC Management have issued a request to NSW Health for funding for scenario training. If funded and facilitated by health GWCC will seek to undertake the training as soon as possible. NOTE: currently internal training is undertaken by Water Quality staff at the Jugiong Water Treatment plant for emergency response management as part of the Pollution Incident Response Management Plan requirements (PIRMP).

Table 17 below indicates all of the training that GWCC staff have undertaken during the reporting period of 2020/21.

Table 17. Full list of staff training for the 2020/21 reporting period.

Name	Course	Completion date	Expiry date	Training Provider
Adam Ryall	Liquefied Chlorine Gas - Level 1	25/06/2021		IXOM
Blake Hingerty	Liquefied Chlorine Gas - Level 1	25/06/2021		IXOM
Dean Wiggins	Liquefied Chlorine Gas - Level 1	25/06/2021		IXOM
Dilrosh Jayawardene	Liquefied Chlorine Gas - Level 1	25/06/2021		IXOM
Jack Fuller	Liquefied Chlorine Gas - Level 1	25/06/2021		IXOM
James Butler	Liquefied Chlorine Gas - Level 1	25/06/2021		IXOM
Jeremy Coleman	Liquefied Chlorine Gas - Level 1	25/06/2021		IXOM
Liam Moston	Liquefied Chlorine Gas - Level 1	25/06/2021		IXOM
Liam Welch	Liquefied Chlorine Gas - Level 1	25/06/2021		IXOM
Matthew Bett	Liquefied Chlorine Gas - Level 1	25/06/2021		IXOM
Ray McCarthy	Liquefied Chlorine Gas - Level 1	25/06/2021		IXOM
Shane Baldry	Liquefied Chlorine Gas - Level 1	25/06/2021		IXOM
Brad Moye	Traffic Controller	21/07/2021	21/07/2023	SafeWork NSW
Brad Moye	Implement Traffic Control Plans	21/07/2021	21/07/2023	SafeWork NSW

Brad Moye	Prepare a work zone	21/07/2021	21/07/2023	SafeWork NSW
Chris Fealy	Liquefied Chlorine Gas - Level 2	16/08/2021	16/08/2024	IXOM
Liam Welch	Liquefied Chlorine Gas - Level 2	16/08/2021	16/08/2024	IXOM
Robin Davis	Liquefied Chlorine Gas - Level 2	16/08/2021	16/08/2024	IXOM
Aaron Burnett	Remove Non Friable Asbestos	16/09/2021		TAFE NSW
Daniel Flack	Remove Non Friable Asbestos	16/09/2021		TAFE NSW
David Chandler	Remove Non Friable Asbestos	16/09/2021		TAFE NSW
Dean Wiggins	Remove Non Friable Asbestos	16/09/2021		TAFE NSW
Jeremy Coleman	Remove Non Friable Asbestos	16/09/2021		TAFE NSW
Justin Kerry	Remove Non Friable Asbestos	16/09/2021		TAFE NSW
Liam Moston	Remove Non Friable Asbestos	16/09/2021		TAFE NSW
Liam Welch	Remove Non Friable Asbestos	16/09/2021		TAFE NSW
Mark New	Remove Non Friable Asbestos	16/09/2021		TAFE NSW
Matthew Cooper	Remove Non Friable Asbestos	16/09/2021		TAFE NSW
Raymond McCarthy	Remove Non Friable Asbestos	16/09/2021		TAFE NSW
Sean Tiernan	Remove Non Friable Asbestos	16/09/2021		TAFE NSW
Geoff Veneris	Creating High Performance Habits	9/11/2021		LG Professionals
Ali Wood	Creating High Performance Habits	9/11/2021		LG Professionals
Annie Coleman	Creating High Performance Habits	9/11/2021		LG Professionals
Nicol Kelly	Creating High Performance Habits	9/11/2021		LG Professionals
Gerard Carr	Creating High Performance Habits	9/11/2021		LG Professionals
Rahul Patil	Creating High Performance Habits	9/11/2021		LG Professionals
Shane Baldry	Creating High Performance Habits	9/11/2021		LG Professionals
Tony Corby	Creating High Performance Habits	9/11/2021		LG Professionals
Tony Goodyer	Creating High Performance Habits	9/11/2021		LG Professionals
Sean Tiernan	Creating High Performance Habits	9/11/2021		LG Professionals
Ian Basham	Creating High Performance Habits	9/11/2021		LG Professionals
Aaron Drenovski	Creating High Performance Habits	9/11/2021		LG Professionals

Ray Graham	Creating High Performance Habits	9/11/2021		LG Professionals
Sammy Jung	Creating High Performance Habits	9/11/2021		LG Professionals
Ian Basham	CPR	10/11/2021	10/11/2022	JB Hunter
Aaron Burnett	CPR	10/11/2021	10/11/2022	JB Hunter
James Butler	CPR	10/11/2021	10/11/2022	JB Hunter
James Butler	CPR	10/11/2021	10/11/2022	JB Hunter
Annie Coleman	CPR	10/11/2021	10/11/2022	JB Hunter
Jeremy Coleman	CPR	10/11/2021	10/11/2022	JB Hunter
Matthew Cooper	CPR	10/11/2021	10/11/2022	JB Hunter
Andrew Derrick	CPR	10/11/2021	10/11/2022	JB Hunter
Mick Diggins	CPR	10/11/2021	10/11/2022	JB Hunter
Rob Drummond	CPR	10/11/2021	10/11/2022	JB Hunter
Daniel Flack	CPR	10/11/2021	10/11/2022	JB Hunter
Chris Fealy	CPR	10/11/2021	10/11/2022	JB Hunter
Brendon Ford	CPR	10/11/2021	10/11/2022	JB Hunter
Shane Hartshorn	CPR	10/11/2021	10/11/2022	JB Hunter
Michael Lewis	CPR	10/11/2021	10/11/2022	JB Hunter
Jeremy Coleman	LVR	10/11/2021	10/11/2022	JB Hunter
Ian Basham	Work Safely Near Powerlines	10/11/2021	10/11/2022	JB Hunter
Aaron Burnett	Work Safely Near Powerlines	10/11/2021	10/11/2022	JB Hunter
James Butler	Work Safely Near Powerlines	10/11/2021	10/11/2022	JB Hunter
David Chandler	Work Safely Near Powerlines	10/11/2021	10/11/2022	JB Hunter
Jeremy Coleman	Work Safely Near Powerlines	10/11/2021	10/11/2022	JB Hunter
Matthew Cooper	Work Safely Near Powerlines	10/11/2021	10/11/2022	JB Hunter
Andrew Derrick	Work Safely Near Powerlines	10/11/2021	10/11/2022	JB Hunter
Mick Diggins	Work Safely Near Powerlines	10/11/2021	10/11/2022	JB Hunter
Rob Drummond	Work Safely Near Powerlines	10/11/2021	10/11/2022	JB Hunter
Daniel Flack	Work Safely Near Powerlines	10/11/2021	10/11/2022	JB Hunter
Chris Fealy	Work Safely Near Powerlines	10/11/2021	10/11/2022	JB Hunter
Shane Hartshorn	Work Safely Near Powerlines	10/11/2021	10/11/2022	JB Hunter
Michael Lewis	Work Safely Near Powerlines	10/11/2021	10/11/2022	JB Hunter
Shane Bladry	CPR	11/11/2021	11/11/2022	JB Hunter
Shane Barrett	CPR	11/11/2021	11/11/2022	JB Hunter
Dilrosh Jayawardene	CPR	11/11/2021	11/11/2022	JB Hunter

Ray McCarthy	CPR	11/11/2021	11/11/2022	JB Hunter
Liam Moston	CPR	11/11/2021	11/11/2022	JB Hunter
Rod Ryan	CPR	11/11/2021	11/11/2022	JB Hunter
Les Scott	CPR	11/11/2021	11/11/2022	JB Hunter
Chris Scott	CPR	11/11/2021	11/11/2022	JB Hunter
Barry Shepherd	CPR	11/11/2021	11/11/2022	JB Hunter
Sean Tiernan	CPR	11/11/2021	11/11/2022	JB Hunter
Liam Welch	CPR	11/11/2021	11/11/2022	JB Hunter
Dean Wiggins	CPR	11/11/2021	11/11/2022	JB Hunter
Shane Baldry	LVR	11/11/2021	11/11/2022	JB Hunter
Dilrosh Jayawardene	LVR	11/11/2021	11/11/2022	JB Hunter
Ray McCarthy	LVR	11/11/2021	11/11/2022	JB Hunter
Liam Moston	LVR	11/11/2021	11/11/2022	JB Hunter
Rod Ryan	LVR	11/11/2021	11/11/2022	JB Hunter
Les Scott	LVR	11/11/2021	11/11/2022	JB Hunter
Dean Wiggins	LVR	11/11/2021	11/11/2022	JB Hunter
Shane Bladry	Work Safely Near Powerlines	11/11/2021	11/11/2022	JB Hunter
Shane Barrett	Work Safely Near Powerlines	11/11/2021	11/11/2022	JB Hunter
Dilrosh Jayawardene	Work Safely Near Powerlines	11/11/2021	11/11/2022	JB Hunter
Ray McCarthy	Work Safely Near Powerlines	11/11/2021	11/11/2022	JB Hunter
Liam Moston	Work Safely Near Powerlines	11/11/2021	11/11/2022	JB Hunter
Rod Ryan	Work Safely Near Powerlines	11/11/2021	11/11/2022	JB Hunter
Les Scott	Work Safely Near Powerlines	11/11/2021	11/11/2022	JB Hunter
Chris Scott	Work Safely Near Powerlines	11/11/2021	11/11/2022	JB Hunter
Barry Shepherd	Work Safely Near Powerlines	11/11/2021	11/11/2022	JB Hunter
Sean Tiernan	Work Safely Near Powerlines	11/11/2021	11/11/2022	JB Hunter
Liam Welch	Work Safely Near Powerlines	11/11/2021	11/11/2022	JB Hunter
Dean Wiggins	Work Safely Near Powerlines	11/11/2021	11/11/2022	JB Hunter
Blake Hingerty	CPR	12/11/2021	12/11/2022	JB Hunter
Blake Hingerty	LVR	12/11/2021	12/11/2022	JB Hunter
Blake Hingerty	Work Safely Near Powerlines	12/11/2021	12/11/2022	JB Hunter
Mike Read	Aeronautical Radio Operator Certificate	17/11/2021		Global Drone Solutions
Chris Breen	CPR	30/11/2021	30/11/2022	JB Hunter
Robin Davis	CPR	30/11/2021	30/11/2022	JB Hunter
Nicol Kelly	CPR	30/11/2021	30/11/2022	JB Hunter

Justin Kerry	CPR	30/11/2021	30/11/2022	JB Hunter
Justin Kerry	Work Safely Near Powerlines	30/11/2021	30/11/2022	JB Hunter
Christine Roberts	Emergency Procedures For Temora	2/12/2021		Goldenfields Water
Libby Kite	Emergency Procedures For Temora	2/12/2021		Goldenfields Water
Ray Graham	Emergency Procedures For Temora	2/12/2021		Goldenfields Water
Michael Annetts	CPR	3/12/2021	3/12/2022	JB Hunter
Michael Annetts	Work Safely Near Powerlines	3/12/2021	3/12/2022	JB Hunter
Kylie Crouch	Provide First Aid	15/12/2021	15/12/2024	TAFE NSW
Jeremy Coleman	Provide First Aid	15/12/2021	15/12/2024	TAFE NSW
Tony Corby	Provide First Aid	15/12/2021	15/12/2024	TAFE NSW
Michele Curran	Provide First Aid	15/12/2021	15/12/2024	TAFE NSW
Libby Kite	Provide First Aid	15/12/2021	15/12/2024	TAFE NSW
Les Scott	Provide First Aid	15/12/2021	15/12/2024	TAFE NSW
Andrew Haley	Provide First Aid	15/12/2021	15/12/2024	TAFE NSW
Dean Wiggins	Provide First Aid	15/12/2021	15/12/2024	TAFE NSW
David Chandler	Provide First Aid	15/12/2021	15/12/2024	TAFE NSW
Mitchell Farlow	Provide First Aid	15/12/2021	15/12/2024	TAFE NSW
Kate Lowe	Provide First Aid	15/12/2021	15/12/2024	TAFE NSW
Nigel Marion	Remote Pilot Licence	21/03/2022		Global Drone Solutions
Nigel Marion	Aeronautical Radio Operator Certificate	21/03/2022		Global Drone Solutions
Sonya Kovacevic	Working at Heights	30/03/2022	30/03/2024	Just Careers Training
Mitchell Farlow	Working at Heights	30/03/2022	30/03/2024	Just Careers Training
Sonya Kovacevic	Confined Spaces	31/03/2022	31/03/2024	Just Careers Training
Michell Farlow	Confined Spaces	31/03/2022	31/03/2024	Just Careers Training
Chris Fealy	Working at Heights	12/04/2022	12/04/2024	Raise Training
Jack Fuller	Working at Heights	12/04/2022	12/04/2024	Raise Training
Shane Hartshorn	Working at Heights	12/04/2022	12/04/2024	Raise Training
Bailey Lowes	Working at Heights	12/04/2022	12/04/2024	Raise Training
Liam Moston	Working at Heights	12/04/2022	12/04/2024	Raise Training
Liam Pattison	Working at Heights	12/04/2022	12/04/2024	Raise Training
Michael Read	Working at Heights	12/04/2022	12/04/2024	Raise Training
Shane Baldry	Working at Heights	13/04/2022	13/04/2024	Raise Training
James Butler	Working at Heights	13/04/2022	13/04/2024	Raise Training
Matthew Cooper	Working at Heights	13/04/2022	13/04/2024	Raise Training
Blake Hingerty	Working at Heights	13/04/2022	13/04/2024	Raise Training
Stephen Ledgard	Working at Heights	13/04/2022	13/04/2024	Raise Training
Bradley Moye	Working at Heights	13/04/2022	13/04/2024	Raise Training
Adam Ryall	Working at Heights	13/04/2022	13/04/2024	Raise Training
Rod Ryan	Working at Heights	13/04/2022	13/04/2024	Raise Training

Shane Barrett	Working at Heights	14/04/2022	14/04/2024	Raise Training
David Chandler	Working at Heights	14/04/2022	14/04/2024	Raise Training
Andrew Derrick	Working at Heights	14/04/2022	14/04/2024	Raise Training
Daniel Flack	Working at Heights	14/04/2022	14/04/2024	Raise Training
Dilrosh Jayawardene	Working at Heights	14/04/2022	14/04/2024	Raise Training
Nigel Marion	Working at Heights	14/04/2022	14/04/2024	Raise Training
Ray McCarthy	Working at Heights	14/04/2022	14/04/2024	Raise Training
Liam Welch	Working at Heights	14/04/2022	14/04/2024	Raise Training
Chris Fealy	AQF3	31/05/2022	31/05/2027	ChemCert
Chris Scott	AQF3	31/05/2022	31/05/2027	ChemCert
David Chandler	AQF3	31/05/2022	31/05/2027	ChemCert
Stephen Ledgard	AQF3	31/05/2022	31/05/2027	ChemCert
Barry Shepherd	AQF3	31/05/2022	31/05/2027	ChemCert
Rob Davis	AQF3	31/05/2022	31/05/2027	ChemCert
Matthew Cooper	AQF3	31/05/2022	31/05/2027	ChemCert
Chris Breen	Safety Trailer Familiarisation Session	16/06/2022		Mick Humphries Training Group
Dilrosh Jayawardene	Safety Trailer Familiarisation Session	16/06/2022		Mick Humphries Training Group
Dean Wiggins	Safety Trailer Familiarisation Session	16/06/2022		Mick Humphries Training Group
Jack Fuller	Safety Trailer Familiarisation Session	16/06/2022		Mick Humphries Training Group
Rod Ryan	Safety Trailer Familiarisation Session	16/06/2022		Mick Humphries Training Group
Blake Hingerty	Safety Trailer Familiarisation Session	16/06/2022		Mick Humphries Training Group
Tony Corby	Safety Trailer Familiarisation Session	16/06/2022		Mick Humphries Training Group
Mitch Farlow	Safety Trailer Familiarisation Session	16/06/2022		Mick Humphries Training Group
Ian Basham	Safety Trailer Familiarisation Session	16/06/2022		Mick Humphries Training Group
Chris Fealy	Safety Trailer Familiarisation Session	16/06/2022		Mick Humphries Training Group
Ray McCarthy	Safety Trailer Familiarisation Session	16/06/2022		Mick Humphries Training Group
Jeremy Coleman	Safety Trailer Familiarisation Session	16/06/2022		Mick Humphries Training Group
James Butler	Safety Trailer Familiarisation Session	21/06/2022		Mick Humphries Training Group
Les Scott	Safety Trailer Familiarisation Session	21/06/2022		Mick Humphries Training Group
Bailey Lowes	Safety Trailer Familiarisation Session	21/06/2022		Mick Humphries Training Group
Mike Read	Safety Trailer Familiarisation Session	21/06/2022		Mick Humphries Training Group
Sonya Kovacevic	Safety Trailer Familiarisation Session	21/06/2022		Mick Humphries Training Group
Andrew Derrick	Safety Trailer Familiarisation Session	21/06/2022		Mick Humphries Training Group

Liam Welch	Safety Trailer Familiarisation Session	21/06/2022		Mick Humphries Training Group
David Chandler	Safety Trailer Familiarisation Session	21/06/2022		Mick Humphries Training Group
Mick Diggins	Safety Trailer Familiarisation Session	21/06/2022		Mick Humphries Training Group
Brad Moye	Safety Trailer Familiarisation Session	21/06/2022		Mick Humphries Training Group
Barry Shepherd	Safety Trailer Familiarisation Session	21/06/2022		Mick Humphries Training Group
Isaac Reardon	Safety Trailer Familiarisation Session	21/06/2022		Mick Humphries Training Group
Robin Davis	Safety Trailer Familiarisation Session	29/06/2022		Mick Humphries Training Group
Stehpen Ledgard	Safety Trailer Familiarisation Session	29/06/2022		Mick Humphries Training Group
Rod Brummond	Safety Trailer Familiarisation Session	29/06/2022		Mick Humphries Training Group
Liam Pattison	Safety Trailer Familiarisation Session	29/06/2022		Mick Humphries Training Group
Sean Tiernan	Safety Trailer Familiarisation Session	29/06/2022		Mick Humphries Training Group
Shane Hartshorn	Safety Trailer Familiarisation Session	29/06/2022		Mick Humphries Training Group
Matthew Cooper	Safety Trailer Familiarisation Session	29/06/2022		Mick Humphries Training Group
Chris Scott	Safety Trailer Familiarisation Session	29/06/2022		Mick Humphries Training Group
Shane Baldry	Safety Trailer Familiarisation Session	29/06/2022		Mick Humphries Training Group
Mark Carroll	Safety Trailer Familiarisation Session	29/06/2022		Mick Humphries Training Group

Continuous Improvement Plan

Table 18 below is a summary of all items in the Continuous Improvement plan that have been completed or actioned during the 2021/22 reporting period.

Table 18. Continuous improvement plan activities that have progressed, been completed, or been added during the period 2021/22

Action no.	Item	Progress	Date for completion	Who is responsible
16	*GWCC to consider and investigate and install the most suitable Back Flow prevention device on the connection between Oura and Hylands Bridge (e.g.RPZD, Break tank with air gap)*	*A stop valve and non return valve has been put in place to reduce any risk of backflow - Complete*	*November 22*	*Manager Engineering*
29	*GWCC to consider installing online chlorine residual analyser at outlet of settling tanks to ensure*	*magflow and analysers installed however not connected to clearscada system – Mt Arthur SCADA/Telemetry network to commence upgrade in 2022/23 financial year. Connection of*	*July 2023*	*Manager Engineering*

Action no.	Item	Progress	Date for completion	Who is responsible
	30 minutes contact time (Mt Arthur system)	*water quality instrumentation to be completed after this. In progress*		
76	*Bulk Service Level Agreements (SLA)*	*Draft SLA completed and currently under review. Change in staff at Bulk councils has made it difficult to resolve outstanding items for agreement – In progress*	*July 23*	*Manager Production and Services*

Review of DWMS Implementation

Adoption of the Drinking water Management System occurred in February 2018 and the implementation has been reviewed annually. In addition to our regular annual reviews, GWCC engaged their Internal Auditor, National Audits Group to undertake a review of Councils DWMS and its associated governance and reporting requirements. Results of this Audit are provided in Appendix D below.

Table 19. Summary of internal reviews

Date	Reviewer	Scope	Findings	Actions
3/10/2019	*Geoff Veneris and Chris Breen*	*Drinking Water Policy*	*Fully Compliant – Council reviewed and endorsed the water policy on 23/08/19.*	*No Action required*
FY 2019/20	*Geoff Veneris and Chris Breen*	*Verification Monitoring*	*Council has undertaken all required verification monitoring*	*Continual compliance with NSW Health*
FY 2020/21	*Geoff Veneris and Chris Breen*	*Operational Monitoring*	*GWCC has conducted extensive Operational Monitoring of all Water Source schemes (see Water Quality Section for breakdown of monitoring)*	*Continued Monitoring of all water source scheme Review of current sampling runs are needed*
FY 2021/22	*Geoff Veneris and Chris Breen*	*Operational Monitoring*	*GWCC has conducted extensive Operational Monitoring of all Water Source schemes (see Water Quality Section for breakdown of monitoring)*	*Continued Monitoring of all water source scheme Review of current sampling runs are needed*

Table 20. Summary of external reviews.

Date	Reviewer	Scope	Findings	Actions
June 2019	*National Audits Group*	*To review the effectiveness of Council's water quality systems and monitoring procedures and to assess compliance with the ADWG*	*Table 39*	*Complete*

Reservoir inspections

GWCC conducted regular reservoir inspections throughout the reporting period. They have a schedule for weekly 'drive by' inspections, as well as a more detailed inspection regime that is carried out on a quarterly basis. Any issues found with the weekly or quarterly inspections are entered into a spreadsheet/database (CM9 doc number, 20/4023) and the appropriate section is notified of the works that will need to be carried out.

Reservoir inspections are given a priority ranking between 1 and 5, a ranking of 1 being the worst and needing immediate attention, a ranking of 5 being not so important. (At this point an electronic database has not been kept for all inspections). GWCC is currently working to implement the reservoir inspections in WaterOutlook so that all information can be gathered electronically and acted on accordingly.

Reservoir Inspections were also conducted by Aqualift (Councils contracted divers for cleaning and inspection) during the reporting period. A full report of their findings is located in Appendix. C, below is a summary of their report.

Table 21. Summary of reservoir inspections and outcomes

Date	Reservoirs inspected	Findings	Corrective actions
8/11/2021	Bethungra No 1	-There is no effective platform area present to work or rescue off if required - There are no guard rails around the edge of the roof	-Platform and guardrails need to be installed
		- The galvanised post base is corroded and the post is also deteriorated on the water line area.	-An Aquapost is an easy solution to fix the problem
8/11/2021	Bethungra No 2	-There is no effective platform area present to work or rescue off if required - There are no guard rails around the edge of the roof	-Platform and guardrails need to be installed
		- The galvanised post base is corroded and the post is also deteriorated on the water line area.	-An Aquapost is an easy solution to fix the problem

6/11/2021	Black Range	-There is calcification on the walls and significant spalling internally, so the external areas must also be suspect -The entry hatch cover is not sealed around the edges and where the ladder stiles extend through - The platform is not sealed around the entry hatch area - The hatch covers are not sealed around the edges - The level indicator is non functional and should be removed. The roof pulley is creating an entry point for contamination events - There is severe concrete spalling on the upper wall area at 5 oclock. The horizontal reinforcing steel is exposed and heavily corroded. - The overflow riser is corroded - The internal ladder is heavily corroded and is not safe to use if the tank is empty. It should be replaced with a Nextep vertical FRP system 11600mm long - The entry hatch and rescue hatch covers are not sealed around the edges. - There is severe concrete spalling on the upper wall area at 5 oclock. The horizontal reinforcing steel is exposed and heavily corroded. This issue should be addressed ASAP before further structural damage develops. -The internal ladder is heavily corroded and is not safe to use if the tank is empty	-All areas need to be inspected and sealed - It should be replaced with a Nextep vertical FRP system 11600mm long.
8/11/2021	Dirnaseer No 1	- There is no effective platform area present to work or rescue off if required - There are no guard rails around the edge of the roof - One turbine vent is missing, but the opening is closed off	-Platform and guardrails need to be installed

8/11/2021	Dirnaseer No 2	- There is no effective platform area present to work or rescue off if required - There are no guard rails around the edge of the roof - The concrete mound around the post base is breaking up	- Platform and guardrails need to be installed
7/11/2021	Frampton No 1	- There are significant cracks present, particularly around the base areas, where weepage may be occurring - The entry hatch cover is lightweight and could be bent upwards when locked, It is also unsealed around the edges - There is no effective platform area present to work or rescue off if required - There is no ventilation system in place, but the roof edge ridge caps are allowing air flow to occur - The external cracks will be mirrored internally - The post base has corroded through and is only sitting on the floor area - The roof framing has significant corrosion present	-replace with heavier cover -Install platform and guard rails -Investigate ventilation -investigate replacement with new roof -will need to be replaced soon, before the roof fails
7/11/2021	Frampton No2	- There are significant cracks present, particularly around the base areas, where weepage may be occurring - The entry hatch cover is lightweight and could be bent upwards when locked, It is also unsealed around the edges - There is no effective platform area present to work or rescue off if required - There is no ventilation system in place, but the roof edge ridge caps are allowing air flow to occur - The external cracks will be mirrored internally - The post base has corroded through and is only sitting on the floor area - The framing has surface corrosion and is lightweight	-replace with heavier cover -Install platform and guard rails -Investigate ventilation -investigate replacement with new roof
9/11/2021	Illabo No 1	- There are a few minor weeps around the external wall base area - The roof framing has significant corrosion present on the main	-will need to be replaced soon, before the roof fails

		rafters and the wall connection areas, which are uncoated	
9/11/2021	Illabo No 2	- There are a few minor weeps around the external wall base area - The roof framing has significant corrosion present on the main rafters and the wall connection areas, which are uncoated	-will need to be replaced soon, before the roof fails
21/3/2022	Jugiong BT	- The galvanised coating is deteriorated - The existing ladders, platform and upper cage section need to be replaced	-replace with an FRP vertical ladder system when the tank is re-coated
21/3/2022	Jugiong CWT	- The galvanised ladder and platform have corrosion present.	It should be replaced with a Nextep FRP vertical ladder 9300mm long
7/11/2021	Mannings Rd No 1	- The concrete walls have cracks present, but nothing is evident internally. One turbine roof vent appears to have frozen	-replace turbine vent
7/1/2021	Mannings Rd No2	- There is no safe working area on the roof	-investigate platform installation
9/11/2021	Marrar Pinnacle No 1	- The entry hatch is small for a safe diver entry or rescue situation. -An improved guard rail system is also required to upgrade personnel safety around the platform area. - The two main roof beams are un-coated and have heavy surface corrosion present - The galvanised ladder has surface corrosion present.	- It should be enlarged when the platform is upgraded -Upgrade rail system - This should not present a structural issue in the short term (5 years), but they should be monitored for future deterioration - It needs to be replaced with a Nextep FRP ladder 4300mm long.
20/3/2022	Wantabadgery No 1	- The small entry hatch is neither secure against unauthorised access or sealed against contamination ingress. -There are some significant weeping horizontal cracks in the walls which are mirrored internally. The cracks are too numerous to repair - The centre roof support post is heavily corroded	-an internal liner may be a good medium term solution to extend the life of the tank -should be replaced with an Aquapost. The corroded base plate is 400mm square.
20/3/2022	Wantabadgery No 2	- The small entry hatch is neither secure against unauthorised access or sealed against contamination ingress.	

		- The centre roof support post is heavily corroded	-should be replaced with an Aquapost. The corroded base plate is 400mm square.
12/7/2021	West Wyalong Terminal 112	- The external areas appear to be OK - There have been a significant number of patch repairs carried out across the floor, some better than others. There is no obvious corrosion present and CP has been upgraded to a more effective impressed system.	
11/7/2021	Young Terminal 115	- Padlocks are required on both the entry hatch and roof hatch to secure them from unauthorised access. - The upper section of the asbestos cement overflow riser is delaminating	-Place padlocks at both points

Appendix A – Water quality data

Water Quality Graphs

Jugiong Water Treatment Plan

Jugiong Water Treatment Plant data has been represented in the following graphs and commentary. The following data has been taken from the new Water outlook Database that GWCC is currently building with an external party, Safegroup.

Data relevant to Critical Control and operational control is reported as follows:

Chlorine is the main Critical Control Point of the Jugiong WTP used to eliminate chlorine sensitive pathogens, Disinfection.

- The chlorine target leaving the WTP is 1.8mg/L with amber alerts sent if chlorine drops below 1.2mg/L or goes over 2mg/L.
- The alert becomes critical with DWMS protocols implemented when chlorine levels drop below 0.8mg/L in summer and 0.5mg/L in winter. Figure 5 below represents the Finished water chlorine at the Jugiong WTP, both Free and Total. As can be seen GWCC has only exceeded its lower critical limit (<0.5mg/L, winter, <0.8mg/L summer) or its upper critical limit (>5.0mg/L) for Free Chlorine 4 times throughout the reporting period.
- A free/residual chlorine of 0.91mg/L was the lowest recorded result on the 21/8/2021. The highest total cl recorded was on the 15/11/2021 with a value of 2.82mg/L.
- The average Free Chlorine for the reporting year was 1.6mg/L and average Total chlorine reading was 2.0mg/L.

Figure 5. Jugiong chlorine levels for the 2021/22 reporting period

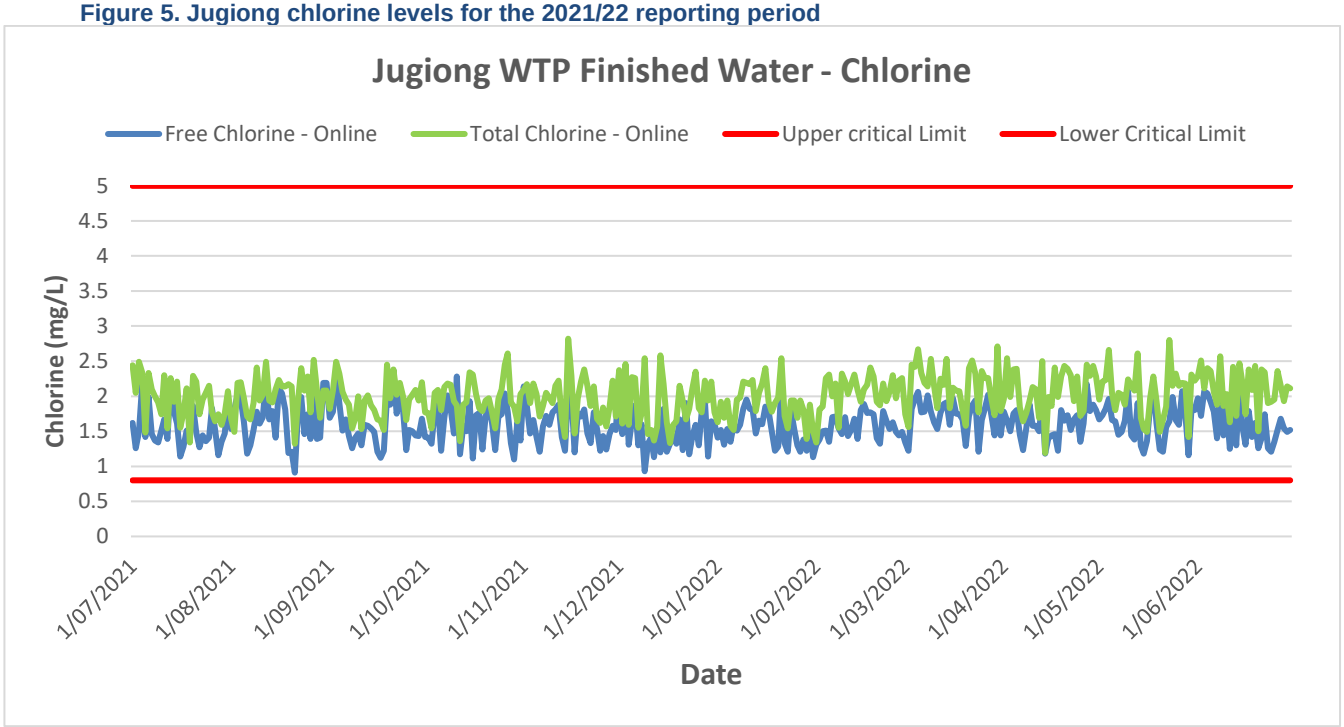


Figure 5 represents the finished water fluoride (Blue line) and Raw Water Fluoride (Green Line) for the Jugiong water treatment plant. Fluoride levels both Raw and Finished has remained consistent throughout the reporting period with a minimum value of 0.15 mg/L (Raw Water concentration) and a maximum value of 1.15 mg/L (Finished water Concentration). The Finished water Fluoride at the Jugiong Water Treatment Plant has exceeded its minimum value of 0.95mg/L on several occasions throughout the reporting period. These exceedances were due to equipment failure or breakdown.

Figure 6. Jugiong fluoride levels for the 2021/22 reporting period

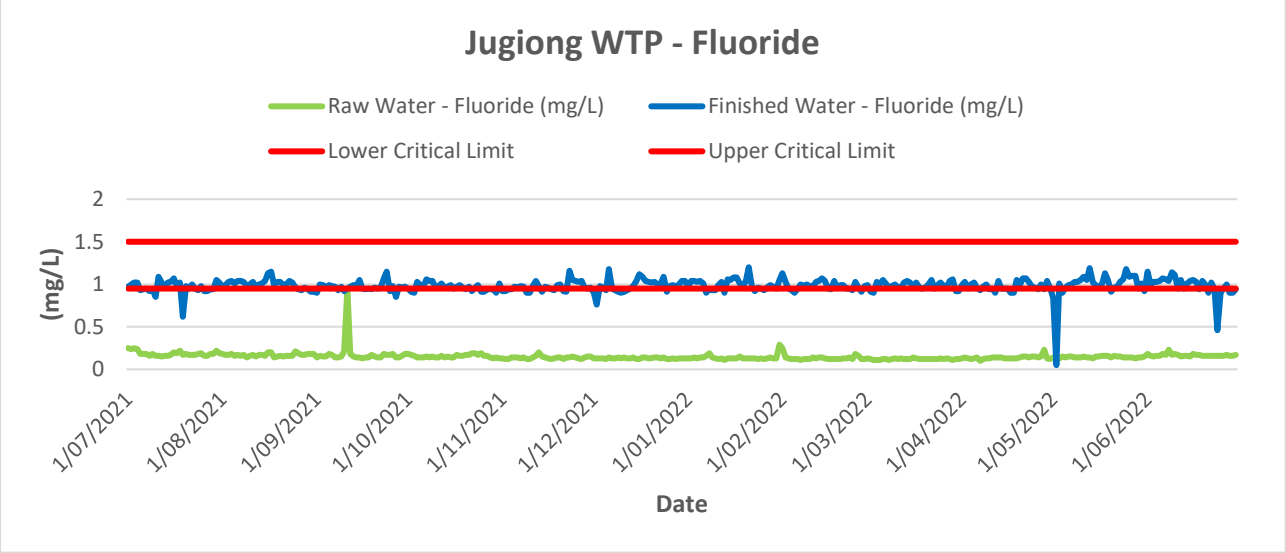


Figure 7. Jugiong raw water turbidity for the 2021/22 reporting period

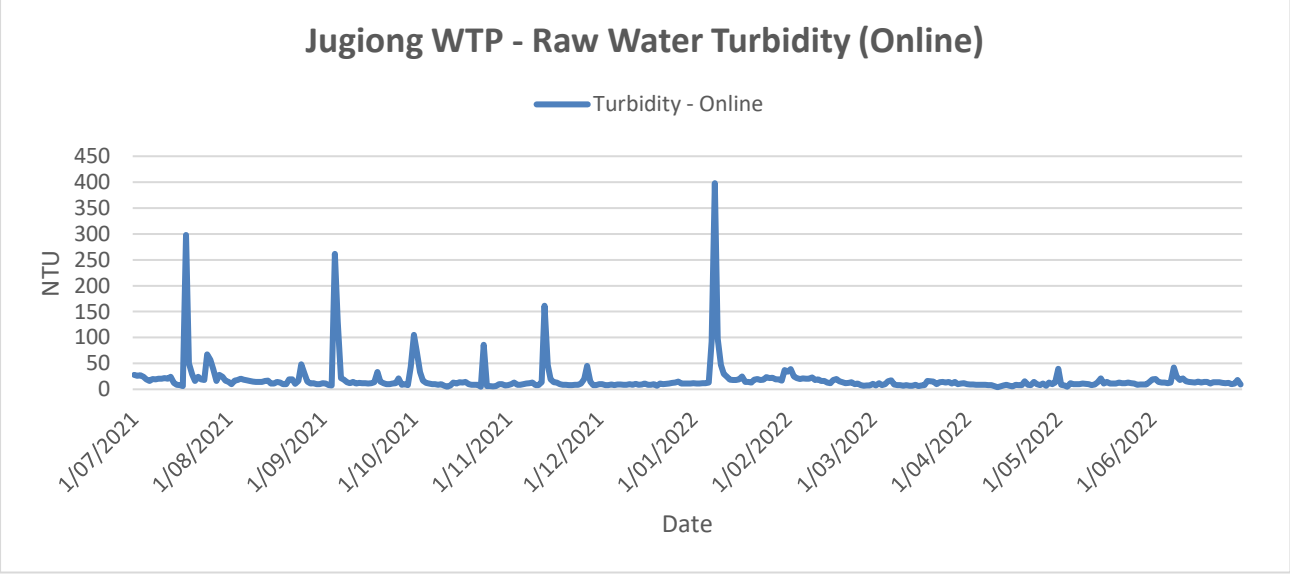


Figure 8. Jugiong finished water turbidity for the 2021/22 reporting period

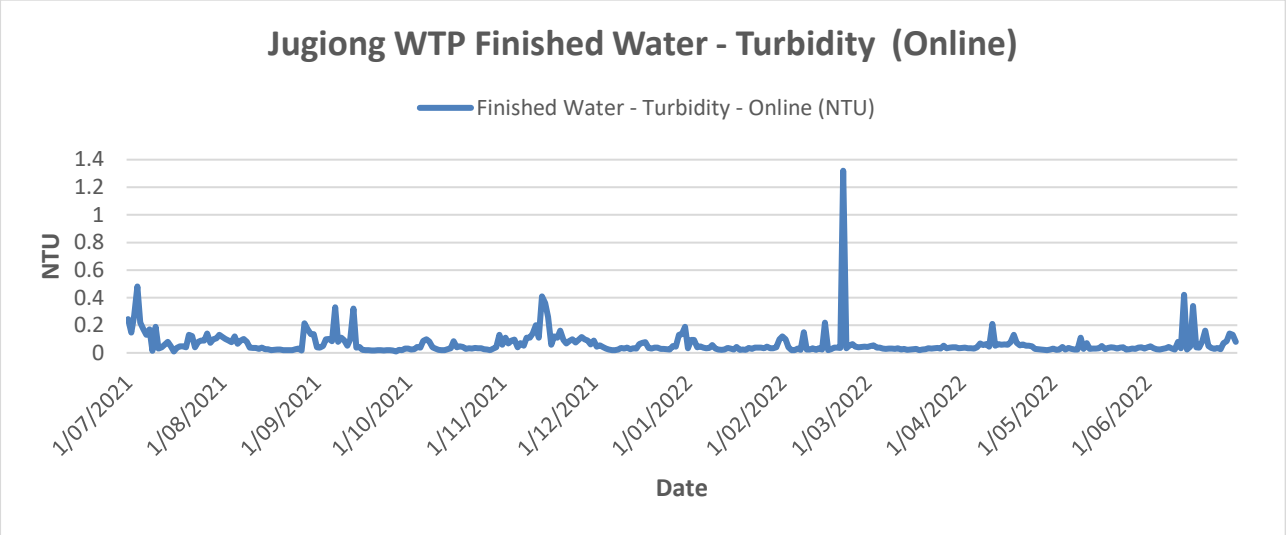
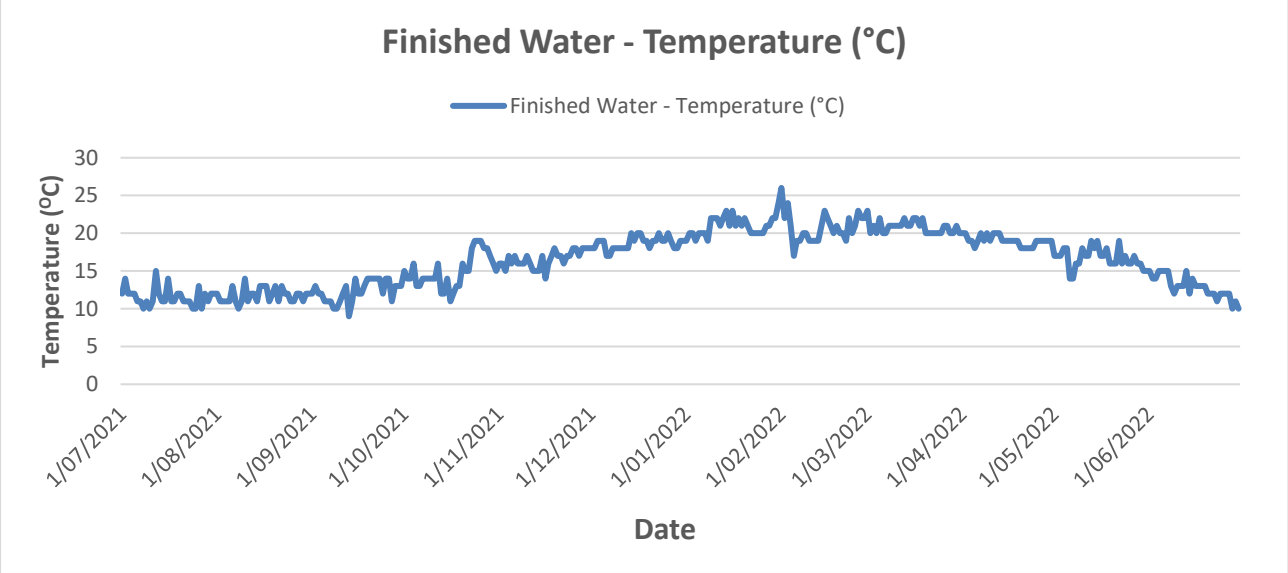


Figure 9. Jugiong finished water temperature for the 2021/22 reporting period



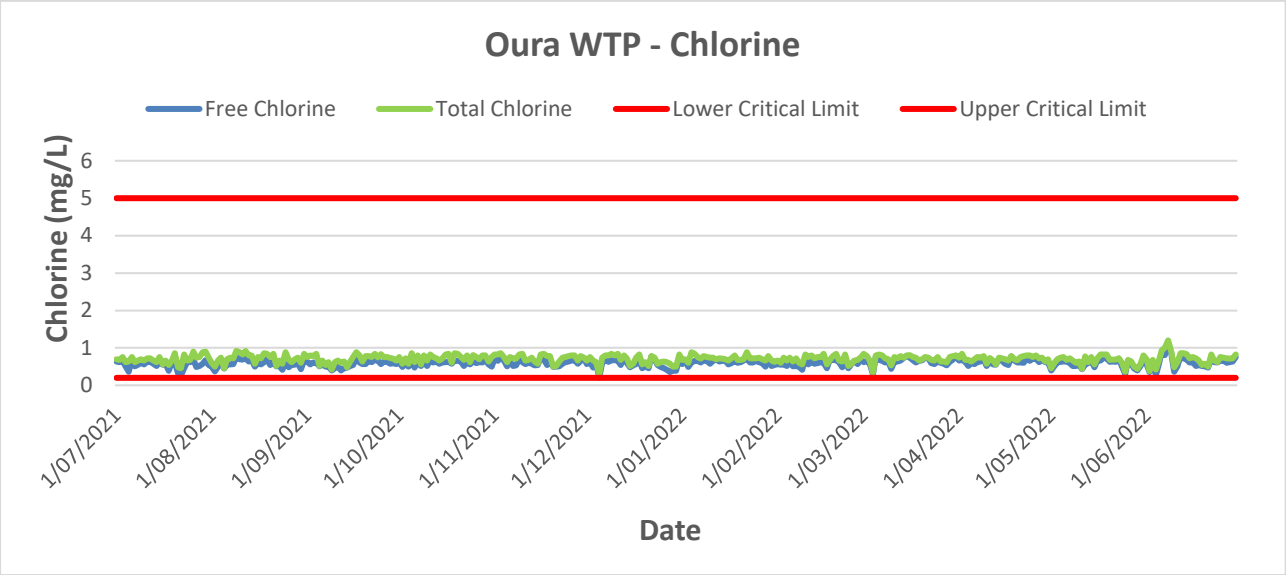
Oura Treatment Plant

Since the implementation of Water Outlook at the Oura WTP some valuable data has been produced. This data is represented in the following graphs produced for the WTP's CCP's.

Chlorine is used at the Oura WTP for disinfection of the ground water extracted from bores in Gumly Borefield. It is used to eliminate chlorine sensitive pathogens, disinfection. The chlorine target for GWCC coming out of the Oura WTP is 0.5 mg/L. An amber alert is issued through WaterOutlook when chlorine level drop below 0.3 mg/L and when they rise above 1.0 mg/L. A critical alarm is issued when chlorine levels drop below 0.2 mg/L and rise above 5mg/L.

Fluoride is also added to the water at the Oura WTP. There is natural Fluoride detected in the water, therefore more is added to meet the NSW Health target range of 0.95mg/L to 1.05mg/L. this information is represented in the graphs below.

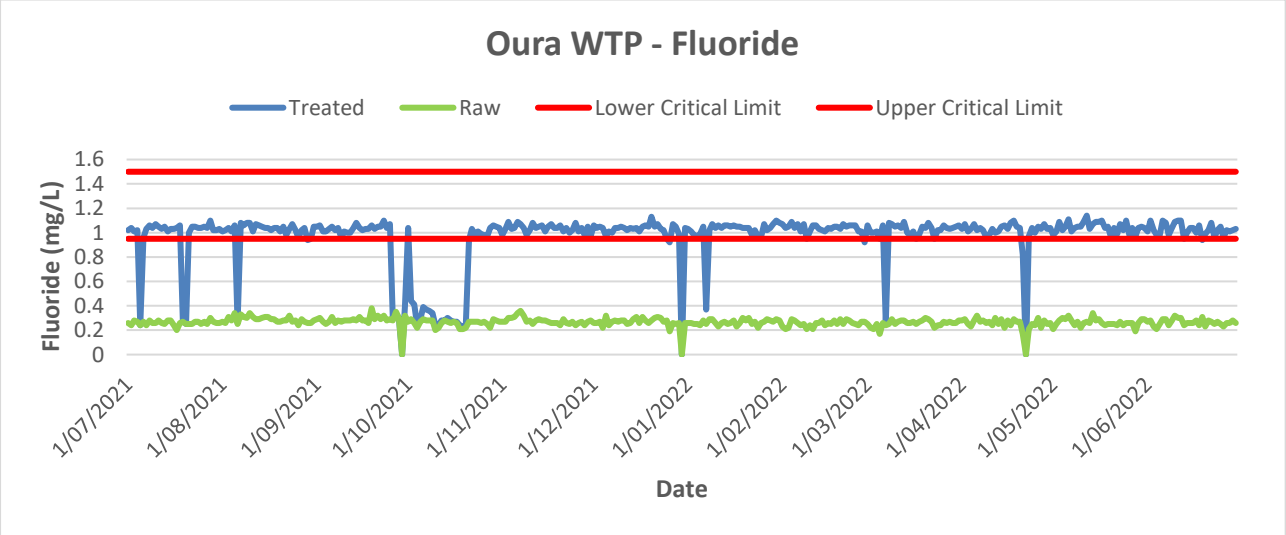
Figure 10. Oura chlorine levels for the 2021/22 reporting period



As can be seen in Figure 10, which uses a logarithmic scale on the vertical axis, the injection of chlorine into the Oura bore water has been extremely consistent throughout the reporting period. Averaging approx. 0.59mg/L (FCl) and 0.71mg/L (TCl) for the 12 months this is slightly higher than our target of 0.5mg/L but well within our CCP range of 0.2mg/L and 5mg/L. Overall a very good result for the Oura WTP operations.

There were no exceedances for chlorine dosing in the 2021/22 financial year.

Figure 11. Oura fluoride levels for the 2021/22 reporting period



As can be seen in Figure 11, the raw fluoride content from the Oura Bores is very consistent remaining mostly between 0.2mg/L and 0.4mg/L for the reporting period 2021/22. Raw water fluoride averaged 0.17mg/L for the 2021/22 period.

The treated water fluoride was fairly inconsistent over the reporting period recording several exceedances. **All exceedances may be attributed to equipment failure.**

Figure 12. Oura collection tank turbidity levels for the 2021/22 reporting period

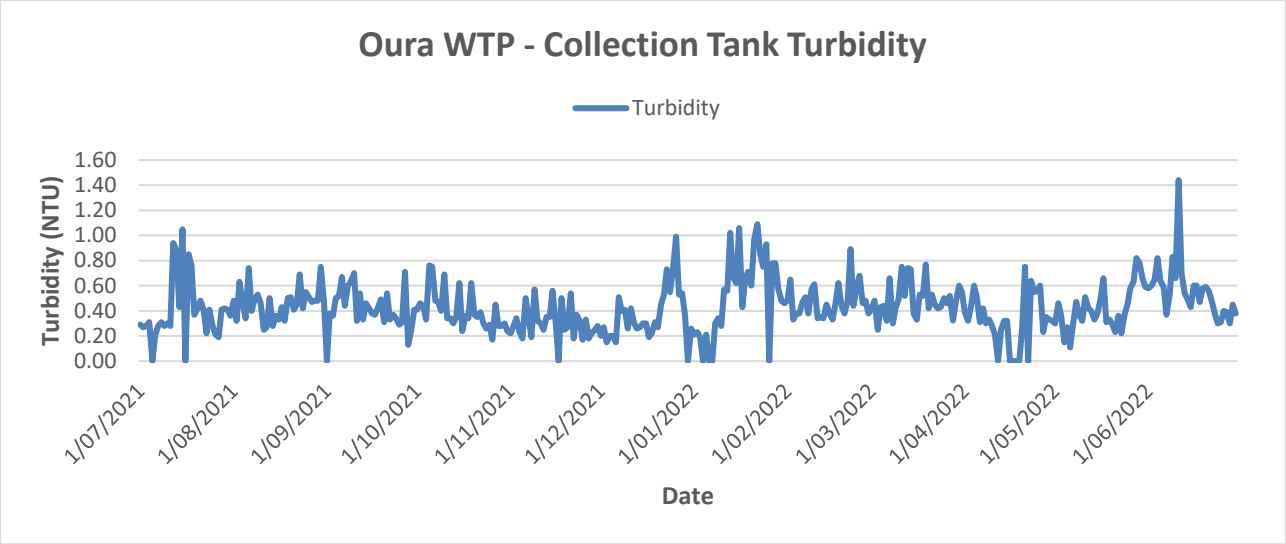


Figure 12 shows the turbidity at the Oura collection tank. Australian Drinking Water Guidelines (ADWG) indicates that turbidity should be <5 NTU (Nephelometric Turbidity Units). As can be seen, there have been no exceedances of this limit for the 2021/22 reporting period.

Figure 13. Oura treated water temperature for the 2021/22 reporting period

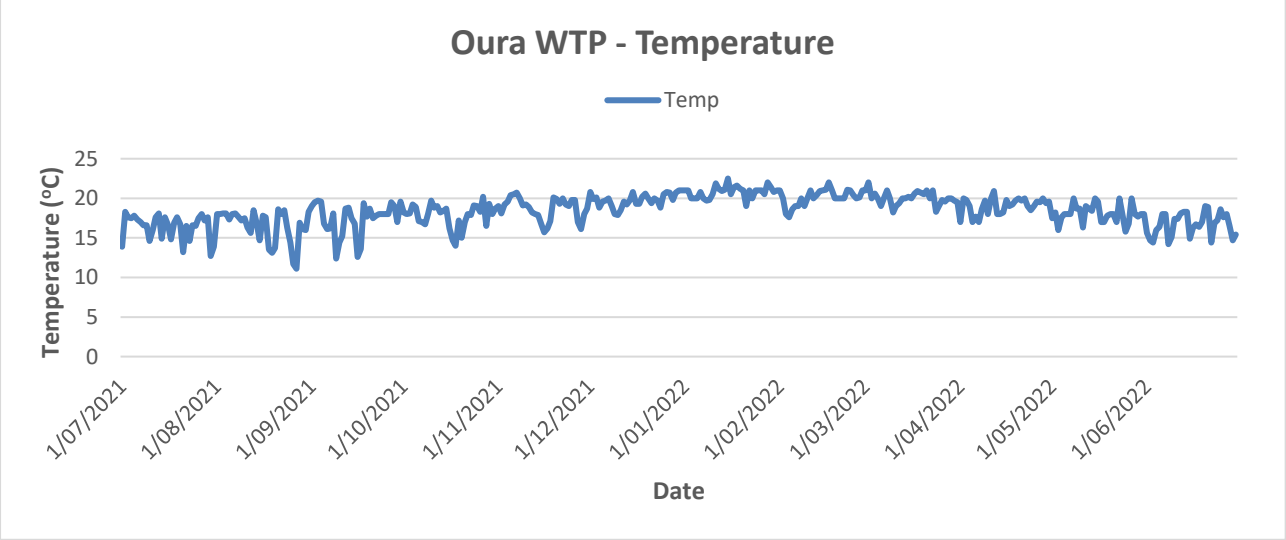


Figure 13 shows the relationship between the temperatures of the treated water with time over the reporting period. As you would surmise, it follows a seasonal trend in that the treated water is warmer in summer and colder in winter.

Water Quality Data Summary

Include a summary of available water quality data over the reporting period here:

- *Raw water*
- *Treated water*
- *Reticulation*
- *Verification*

This data has been generated using the monitoring template spreadsheet, located in the NSW Drinking Water database

Table 22. Raw water measured parameters pertaining to water quality in the 2021/22 reporting period - Jugiong

Parameter	Minimum	Average	Maximum	Lower Critical Limit	Upper Critical Limit	No. Samples
Fluoride	0.1	0.148	0.29			365
Turbidity - Online	4.09	18.51	398			365
Turbidity Offline	5	20.46	572			365
Colour	5	105.8	510			365
pH	6.24	7.58	7.99			365
Temperature	9	16.6	26			365

Table 23. Raw water measured parameters pertaining to water quality in the 2021/22 reporting period - Oura

Parameter	Minimum	Average	Maximum	Lower Critical Limit	Upper Critical Limit	No. Samples
Fluoride	0.17	0.27	0.38			365
pH	6.23	6.98	7.88			365
Temperature	11.1	18.44	22.5			365
Turbidity	0.11	0.34	1.04			365

Table 24. Treated water measured parameters pertaining to water quality in the 2020/21 reporting period - Jugiong

Parameter	Minimum	Average	Maximum	Lower Critical Limit	Upper Critical Limit	No. Samples
Turbidity Online	0.01	0.065	1.32			365
Turbidity – Offline	0.038	0.19	0.57		1	365
Colour	0	3.4	27			365
pH	7.08	7.45	8.1	7	8	365
Temperature	9	16.4	26			365
Alkalinity	40	71.5	160			365
Hardness	0	62.8	170			365
Free Chlorine – Online	0.91	1.6	2.38	0.8	5	366
Total chlorine – Online	1.19	2	2.82			365

Fluoride	0.05	0.98	1.2	0.9	1.5	365

Table 25. Treated water measured parameters pertaining to water quality in the 2021/22 reporting period - Oura

Parameter	Minimum	Average	Maximum	Lower critical limit	Upper critical limit	No. samples
Fluoride	0.23	0.97	1.14	0.9	1.5	365
pH	6.2	7.44	7.84			365
Free Chlorine	0.2	0.59	1.15	0.2	5	365
Total Chlorine	0.3	0.71	1.2			365
Temperature	11.1	18.44	22.5			365

Reticulation Water Quality Reporting

Table 26. Water quality parameters in Jugiong reticulation - Chemistry

Characteristic	Guideline Value	Min	Mean	Max	Sample Count	% meeting guideline values
Aluminium	0.2000	0.02	0.0250	0.03	2	100.00
Antimony	0.0030	0.00005	0.0001	0.00005	2	100.00
Arsenic	0.0100	0.0005	0.0005	0.0005	2	100.00
Barium	2.0000	0.0178	0.0210	0.0241	2	100.00
Boron	4.0000	0.0081	0.0081	0.0081	2	100.00
Cadmium	0.0020	0.00005	0.0001	0.00005	2	100.00
Calcium	10000.0000	11.7	14.4000	17.1	2	100.00
Chloride	250.0000	21	26.5000	32	2	100.00
Chromium	0.0500	0.0005	0.0005	0.0005	2	100.00
Copper	2.0000	0.003	0.0030	0.003	2	100.00
Fluoride	1.5000	0.87	0.9750	1.08	2	100.00
Fluoride (WU result)	1.5000	1.07	1.0700	1.07	1	100.00
Fluoride Ratio	0.8 - 1.2	0.99	0.9900	0.99	1	100.00
Iodine	0.5000	0.01	0.0100	0.01	2	100.00
Iron	0.3000	0.005	0.0050	0.005	2	100.00
Lead	0.0100	0.0001	0.0001	0.0001	2	100.00
Magnesium	10000.0000	6.94	8.2450	9.55	2	100.00
Manganese	0.5000	0.0155	0.0239	0.0322	2	100.00
Mercury	0.0010	0.0004	0.0004	0.0004	2	100.00
Molybdenum	0.0500	0.0002	0.0002	0.0002	2	100.00
Nickel	0.0200	0.0005	0.0006	0.0006	2	100.00
Nitrate	50.0000	1	1.0000	1	2	100.00
Nitrite	3.0000	0.05	0.0500	0.05	2	100.00
pH	6.5 - 8.5	7.7	7.7500	7.8	2	100.00
Selenium	0.0100	0.0035	0.0035	0.0035	2	100.00
Silver	0.1000	0.0001	0.0001	0.0001	2	100.00
Sodium	180.0000	30	34.5000	39	2	100.00
Sulfate	500.0000	45	45.0000	45	2	100.00
Total Dissolved Solids (TDS)	10000.0000	139	153.5000	168	2	100.00
Total Hardness as CaCO3	10000.0000	57.8	69.9000	82	2	100.00
True Colour	15.0000	2	6.5000	11	2	100.00
Turbidity	5.0000	0.05	0.0750	0.1	2	100.00
Uranium	0.0170	0.0001	0.0001	0.0001	2	100.00
Zinc	3.0000	0.01	0.0100	0.01	2	100.00

Table 27. Water quality parameters in Oura reticulation - Chemistry

Characteristic	Guideline Value	Min	Mean	Max	Sample Count	% meeting guideline values
Aluminium	0.2000	0.005	0.0050	0.005	12	100.00
Antimony	0.0030	0.00005	0.0001	0.00005	12	100.00
Arsenic	0.0100	0.001	0.0010	0.001	12	100.00
Barium	2.0000	0.0121	0.0187	0.0243	12	100.00
Boron	4.0000	0.0061	0.0163	0.0194	12	100.00
Cadmium	0.0020	0.00005	0.0001	0.00005	12	100.00
Calcium	10000.0000	11.5	15.3917	19	12	100.00
Chloride	250.0000	17	39.5000	62	12	100.00
Chromium	0.0500	0.0005	0.0006	0.001	12	100.00
Copper	2.0000	0.003	0.0198	0.114	12	100.00
Fluoride	1.5000	0.26	0.9592	1.15	12	100.00
Fluoride (WU result)	1.5000	0.29	0.9775	1.11	12	100.00
Fluoride Ratio	0.8 - 1.2	0.93	1.0300	1.13	12	100.00
Iodine	0.5000	0.03	0.0325	0.05	12	100.00
Iron	0.3000	0.02	0.0500	0.12	12	100.00
Lead	0.0100	0.0001	0.0005	0.0017	12	100.00
Magnesium	10000.0000	9.26	11.8942	14.68	12	100.00
Manganese	0.5000	0.0066	0.0395	0.0751	12	100.00
Mercury	0.0010	0.0004	0.0004	0.0004	12	100.00
Molybdenum	0.0500	0.00005	0.0001	0.0002	12	100.00
Nickel	0.0200	0.0002	0.0003	0.001	12	100.00
Nitrate	50.0000	0.5	1.1250	2	12	100.00
Nitrite	3.0000	0.05	0.0500	0.05	12	100.00
pH	6.5 - 8.5	7.6	7.7250	7.9	12	100.00
Selenium	0.0100	0.0035	0.0035	0.0035	12	100.00
Silver	0.1000	0.0001	0.0001	0.0001	12	100.00
Sodium	180.0000	19	30.0000	41	12	100.00
Sulfate	500.0000	4	10.2500	16	12	100.00
Total Dissolved Solids (TDS)	10000.0000	105	151.0833	207	12	100.00
Total Hardness as CaCO3	10000.0000	67.8	87.4167	107.9	12	100.00
True Colour	15.0000	0.5	0.6250	1	12	100.00
Turbidity	5.0000	0.05	0.5833	1.2	12	100.00
Uranium	0.0170	0.0003	0.0004	0.0005	12	100.00
Zinc	3.0000	0.01	0.0367	0.16	12	100.00

Table 28. Water quality parameters in Mt Arthur reticulation - Chemistry

Characteristic	Guideline Value	Min	Mean	Max	Sample Count	% meeting guideline values
Aluminium	0.2000	0.005	0.0050	0.005	2	100.00
Antimony	0.0030	0.00005	0.0001	0.00005	2	100.00
Arsenic	0.0100	0.0005	0.0008	0.001	2	100.00
Barium	2.0000	0.0099	0.0124	0.0148	2	100.00
Boron	4.0000	0.0398	0.0431	0.0464	2	100.00
Cadmium	0.0020	0.00005	0.0001	0.00005	2	100.00
Calcium	10000.0000	11.2	11.9000	12.6	2	100.00
Chloride	250.0000	42	51.0000	60	2	100.00
Chromium	0.0500	0.0005	0.0005	0.0005	2	100.00
Copper	2.0000	0.011	0.0285	0.046	2	100.00
Fluoride	1.5000	0.4	0.5100	0.62	2	100.00
Iodine	0.5000	0.03	0.0400	0.05	2	100.00
Iron	0.3000	0.05	0.1800	0.31	2	50.00
Lead	0.0100	0.0001	0.0002	0.0003	2	100.00
Magnesium	10000.0000	7.27	8.0700	8.87	2	100.00
Manganese	0.5000	0.0061	0.0216	0.037	2	100.00
Mercury	0.0010	0.0004	0.0004	0.0004	2	100.00
Molybdenum	0.0500	0.0002	0.0003	0.0004	2	100.00
Nickel	0.0200	0.0002	0.0002	0.0002	2	100.00
Nitrate	50.0000	0.5	0.5000	0.5	2	100.00
Nitrite	3.0000	0.05	0.0500	0.05	2	100.00
pH	6.5 - 8.5	7.6	7.6000	7.6	2	100.00
Selenium	0.0100	0.0035	0.0035	0.0035	2	100.00
Silver	0.1000	0.0001	0.0001	0.0001	2	100.00
Sodium	180.0000	40	44.0000	48	2	100.00
Sulfate	500.0000	8	9.0000	10	2	100.00
Total Dissolved Solids (TDS)	10000.0000	151	170.5000	190	2	100.00
Total Hardness as CaCO3	10000.0000	57.9	62.9500	68	2	100.00
True Colour	15.0000	0.5	0.7500	1	2	100.00
Turbidity	5.0000	0.1	0.7000	1.3	2	100.00
Uranium	0.0170	0.00005	0.0001	0.00005	2	100.00
Zinc	3.0000	0.01	0.0100	0.01	2	100.00

Table 29. Water quality parameters in the Mt Daylight reticulation- Chemistry

Characteristic	Guideline Value	Min	Mean	Max	Sample Count	% meeting guideline values
Aluminium	0.2000	0.005	0.0050	0.005	2	100.00
Antimony	0.0030	0.00005	0.0001	0.0001	2	100.00
Arsenic	0.0100	0.002	0.0025	0.003	2	100.00
Barium	2.0000	0.078	0.0784	0.0787	2	100.00
Boron	4.0000	0.0386	0.0392	0.0397	2	100.00
Cadmium	0.0020	0.00005	0.0001	0.00005	2	100.00
Calcium	10000.0000	24.5	25.1000	25.7	2	100.00
Chloride	250.0000	103	104.0000	105	2	100.00
Chromium	0.0500	0.0005	0.0005	0.0005	2	100.00
Copper	2.0000	0.009	0.0095	0.01	2	100.00
Fluoride	1.5000	0.56	0.5700	0.58	2	100.00
Iodine	0.5000	0.14	0.1450	0.15	2	100.00
Iron	0.3000	0.005	0.0075	0.01	2	100.00
Lead	0.0100	0.0003	0.0004	0.0004	2	100.00
Magnesium	10000.0000	19.06	20.1450	21.23	2	100.00
Manganese	0.5000	0.0009	0.0010	0.001	2	100.00
Mercury	0.0010	0.0004	0.0004	0.0004	2	100.00
Molybdenum	0.0500	0.0024	0.0025	0.0026	2	100.00
Nickel	0.0200	0.0005	0.0006	0.0006	2	100.00
Nitrate	50.0000	0.5	0.5000	0.5	2	100.00
Nitrite	3.0000	0.05	0.0500	0.05	2	100.00
pH	6.5 - 8.5	7.5	7.6500	7.8	2	100.00
Selenium	0.0100	0.0035	0.0035	0.0035	2	100.00
Silver	0.1000	0.0001	0.0001	0.0001	2	100.00
Sodium	180.0000	82	83.5000	85	2	100.00
Sulfate	500.0000	39	40.5000	42	2	100.00
Total Dissolved Solids (TDS)	10000.0000	328	344.5000	361	2	100.00
Total Hardness as CaCO3	10000.0000	142.7	145.6500	148.6	2	100.00
True Colour	15.0000	0.5	0.5000	0.5	2	100.00
Turbidity	5.0000	0.3	0.9000	1.5	2	100.00
Uranium	0.0170	0.0032	0.0035	0.0037	2	100.00
Zinc	3.0000	0.02	0.0750	0.13	2	100.00

Table 30. Microbiological results - Jugiong

Characteristic	Guideline Value	Units	Mean	Median	Standard Deviation	Min	Max	Sample Count	Exception Count	95th Percentile	5th Percentile	% meeting guideline values
E. coli	0.0000	mpn/100 mL	0.0759	0.0000	0.5006	0	4	79	2	0	0	97.47
Free Chlorine	0.2 - 5	mg/L	0.3396	0.1750	0.4689	0.02	2.21	78	42	1.62	0.02	46.15
pH	6.5 - 8.5		8.0315	8.0250	0.3823	7.25	8.92	72	7	8.65	7.35	90.28
Temperature	30.0000	C	17.6577	18.1500	4.6525	9.6	25.4	78	0	24	10.2	100.00
Total Chlorine	5.0000	mg/L	0.5701	0.4200	0.5363	0.05	2.28	78	0	1.8	0.05	100.00
Total Coliforms	0.0000	mpn/100 mL	3.1519	0.0000	22.7861	0	201	79	4	9	0	94.94
Turbidity	5.0000	NTU	0.5531	0.4650	0.3746	0.12	2.34	78	0	1.25	0.23	100.00

Table 31. Microbiological results - Oura

Characteristic	Guideline Value	Units	Mean	Median	Standard Deviation	Min	Max	Sample Count	Exception Count	95th Percentile	5th Percentile	% meeting guideline values
E. coli	0.0000	mpn/100 mL	0.0000	0.0000	0.0000	0	0	278	0	0	0	100.00
Free Chlorine	0.2 - 5	mg/L	0.4908	0.4450	0.2642	0.02	1.39	278	25	1.03	0.12	91.01
pH	6.5 - 8.5		8.4020	8.4100	0.3976	7.2	9.41	252	106	9.05	7.72	57.94
Temperature	30.0000	C	18.9383	18.5000	5.6721	7.7	33	277	3	28	10.7	98.92
Total Chlorine	5.0000	mg/L	0.6417	0.6000	0.3143	0.04	3	278	0	1.2	0.24	100.00
Total Coliforms	0.0000	mpn/100 mL	0.0180	0.0000	0.1579	0	2	278	4	0	0	98.56
Turbidity	5.0000	NTU	0.5816	0.4800	0.4363	0.07	3.7	278	0	1.31	0.18	100.00

Table 32. Microbiological results – Mt Arthur

Characteristic	Guideline Value	Units	Mean	Median	Standard Deviation	Min	Max	Sample Count	Exception Count	95th Percentile	5th Percentile	% meeting guideline values
E. coli	0.0000	mpn/100 mL	0.0000	0.0000	0.0000	0	0	49	0	0	0	100.00
Free Chlorine	0.2 - 5	mg/L	0.4337	0.4400	0.2727	0.02	1.08	49	11	0.82	0.02	77.55
pH	6.5 - 8.5		7.9909	7.8700	0.4956	7.34	9.57	44	3	9.33	7.47	93.18
Temperature	30.0000	C	18.5286	17.5000	5.1262	11.3	29	49	0	28.2	12.2	100.00
Total Chlorine	5.0000	mg/L	0.5598	0.6000	0.2821	0.04	1.25	49	0	0.9	0.07	100.00
Total Coliforms	0.0000	mpn/100 mL	0.3878	0.0000	2.3168	0	16	49	2	0	0	95.92
Turbidity	5.0000	NTU	0.5871	0.4800	0.3661	0.19	2.4	49	0	1.06	0.24	100.00

Table 33. Microbiological results – Mt Daylight - Micros

Characteristic	Guideline Value	Units	Mean	Median	Standard Deviation	Min	Max	Sample Count	Exception Count	95th Percentile	5th Percentile	% meeting guideline values
E. coli	0.0000	mpn/100 mL	0.0000	0.0000	0.0000	0	0	31	0	0	0	100.00
Free Chlorine	0.2 - 5	mg/L	0.2987	0.2700	0.2031	0.02	0.75	31	12	0.7	0.02	61.29
pH	6.5 - 8.5		7.6374	7.6000	0.2597	7.08	8.12	31	0	8.05	7.26	100.00
Temperature	30.0000	C	20.7194	22.2000	5.2721	12.2	29.3	31	0	27.3	12.2	100.00
Total Chlorine	5.0000	mg/L	0.4681	0.4600	0.2021	0.12	0.92	31	0	0.76	0.12	100.00
Total Coliforms	0.0000	mpn/100 mL	0.0000	0.0000	0.0000	0	0	31	0	0	0	100.00
Turbidity	5.0000	NTU	0.5539	0.4200	0.4854	0.08	2.8	31	0	1.22	0.15	100.00

Verification Monitoring – Jugiong

Table 34. Summary of NSW Health's drinking water monitoring program data for the Jugiong scheme

Analysis Type	Characteristic	Guideline Value	Min	Mean	Max	Sample Count	% meeting guideline values
Chemistry	Aluminium	0.2000	0.02	0.0250	0.03	2	100.00
	Antimony	0.0030	0.00005	0.0001	0.00005	2	100.00
	Arsenic	0.0100	0.0005	0.0005	0.0005	2	100.00
	Barium	2.0000	0.0178	0.0210	0.0241	2	100.00
	Boron	4.0000	0.0081	0.0081	0.0081	2	100.00
	Cadmium	0.0020	0.00005	0.0001	0.00005	2	100.00
	Calcium	10000.0000	11.7	14.4000	17.1	2	100.00
	Chloride	250.0000	21	26.5000	32	2	100.00
	Chromium	0.0500	0.0005	0.0005	0.0005	2	100.00
	Copper	2.0000	0.003	0.0030	0.003	2	100.00
	Fluoride	1.5000	0.87	0.9750	1.08	2	100.00
	Fluoride (WU result)	1.5000	1.07	1.0700	1.07	1	100.00
	Fluoride Ratio	0.8 - 1.2	0.99	0.9900	0.99	1	100.00
	Iodine	0.5000	0.01	0.0100	0.01	2	100.00
	Iron	0.3000	0.005	0.0050	0.005	2	100.00
	Lead	0.0100	0.0001	0.0001	0.0001	2	100.00
	Magnesium	10000.0000	6.94	8.2450	9.55	2	100.00
	Manganese	0.5000	0.0155	0.0239	0.0322	2	100.00
	Mercury	0.0010	0.0004	0.0004	0.0004	2	100.00
	Molybdenum	0.0500	0.0002	0.0002	0.0002	2	100.00
	Nickel	0.0200	0.0005	0.0006	0.0006	2	100.00
	Nitrate	50.0000	1	1.0000	1	2	100.00
	Nitrite	3.0000	0.05	0.0500	0.05	2	100.00
	pH	6.5 - 8.5	7.7	7.7500	7.8	2	100.00
	Selenium	0.0100	0.0035	0.0035	0.0035	2	100.00
	Silver	0.1000	0.0001	0.0001	0.0001	2	100.00
	Sodium	180.0000	30	34.5000	39	2	100.00
	Sulfate	500.0000	45	45.0000	45	2	100.00
	Total Dissolved Solids (TDS)	10000.0000	139	153.5000	168	2	100.00
	Total Hardness as CaCO3	10000.0000	57.8	69.9000	82	2	100.00
	True Colour	15.0000	2	6.5000	11	2	100.00
	Turbidity	5.0000	0.05	0.0750	0.1	2	100.00
	Uranium	0.0170	0.0001	0.0001	0.0001	2	100.00
	Zinc	3.0000	0.01	0.0100	0.01	2	100.00

Fluoride Barcode	Fluoride	1.5000	0.79	0.9108	1.03	12	100.00
	Fluoride (WU result)	1.5000	0.86	0.9767	1.07	12	100.00
	Fluoride Ratio	0.8 - 1.2	0.92	1.0742	1.15	12	100.00
Microbiology	E. coli	0.0000	0	0.0759	4	79	97.47
	Free Chlorine	0.2 - 5	0.02	0.3396	2.21	78	46.15
	pH	6.5 - 8.5	7.25	8.0315	8.92	72	90.28
	Temperature	30.0000	9.6	17.6577	25.4	78	100.00
	Total Chlorine	5.0000	0.05	0.5701	2.28	78	100.00
	Total Coliforms	0.0000	0	3.1519	201	79	94.94
	Turbidity	5.0000	0.12	0.5531	2.34	78	100.00

Table 35. Summary of NSW Health's drinking water monitoring program data for the Oura scheme.

Analysis Type	Characteristic	Guideline Value	Min	Mean	Max	Sample Count	% meeting guideline values
Chemistry	Aluminium	0.2000	0.005	0.0050	0.005	12	100.00
	Antimony	0.0030	0.00005	0.0001	0.00005	12	100.00
	Arsenic	0.0100	0.001	0.0010	0.001	12	100.00
	Barium	2.0000	0.0121	0.0187	0.0243	12	100.00
	Boron	4.0000	0.0061	0.0163	0.0194	12	100.00
	Cadmium	0.0020	0.00005	0.0001	0.00005	12	100.00
	Calcium	10000.0000	11.5	15.3917	19	12	100.00
	Chloride	250.0000	17	39.5000	62	12	100.00
	Chromium	0.0500	0.0005	0.0006	0.001	12	100.00
	Copper	2.0000	0.003	0.0198	0.114	12	100.00
	Fluoride	1.5000	0.26	0.9592	1.15	12	100.00
	Fluoride (WU result)	1.5000	0.29	0.9775	1.11	12	100.00
	Fluoride Ratio	0.8 - 1.2	0.93	1.0300	1.13	12	100.00
	Iodine	0.5000	0.03	0.0325	0.05	12	100.00
	Iron	0.3000	0.02	0.0500	0.12	12	100.00
	Lead	0.0100	0.0001	0.0005	0.0017	12	100.00
	Magnesium	10000.0000	9.26	11.8942	14.68	12	100.00
	Manganese	0.5000	0.0066	0.0395	0.0751	12	100.00
	Mercury	0.0010	0.0004	0.0004	0.0004	12	100.00
	Molybdenum	0.0500	0.00005	0.0001	0.0002	12	100.00
	Nickel	0.0200	0.0002	0.0003	0.001	12	100.00
	Nitrate	50.0000	0.5	1.1250	2	12	100.00
	Nitrite	3.0000	0.05	0.0500	0.05	12	100.00
	pH	6.5 - 8.5	7.6	7.7250	7.9	12	100.00
	Selenium	0.0100	0.0035	0.0035	0.0035	12	100.00
	Silver	0.1000	0.0001	0.0001	0.0001	12	100.00

	Sodium	180.0000	19	30.0000	41	12	100.00
	Sulfate	500.0000	4	10.2500	16	12	100.00
	Total Dissolved Solids (TDS)	10000.0000	105	151.0833	207	12	100.00
	Total Hardness as CaCO3	10000.0000	67.8	87.4167	107.9	12	100.00
	True Colour	15.0000	0.5	0.6250	1	12	100.00
	Turbidity	5.0000	0.05	0.5833	1.2	12	100.00
	Uranium	0.0170	0.0003	0.0004	0.0005	12	100.00
	Zinc	3.0000	0.01	0.0367	0.16	12	100.00
Microbiology	E. coli	0.0000	0	0.0000	0	278	100.00
	Free Chlorine	0.2 - 5	0.02	0.4908	1.39	278	91.01
	pH	6.5 - 8.5	7.2	8.4020	9.41	252	57.94
	Temperature	30.0000	7.7	18.9383	33	277	98.92
	Total Chlorine	5.0000	0.04	0.6417	3	278	100.00
	Total Coliforms	0.0000	0	0.0180	2	278	98.56
	Turbidity	5.0000	0.07	0.5816	3.7	278	100.00

Table 36. Summary of NSW Health's drinking water monitoring program data for the Mt Arthur scheme

Analysis Type	Characteristic	Guideline Value	Min	Mean	Max	Sample Count	% meeting guideline values
Chemistry							
	Aluminium	0.2000	0.005	0.0072	0.03	18	100.00
	Antimony	0.0030	0.00005	0.0001	0.0001	18	100.00
	Arsenic	0.0100	0.0005	0.0011	0.003	18	100.00
	Barium	2.0000	0.0099	0.0249	0.0787	18	100.00
	Boron	4.0000	0.0061	0.0209	0.0464	18	100.00
	Cadmium	0.0020	0.00005	0.0001	0.00005	18	100.00
	Calcium	10000.0000	11.2	15.9722	25.7	18	100.00
	Chloride	250.0000	17	46.5000	105	18	100.00
	Chromium	0.0500	0.0005	0.0006	0.001	18	100.00
	Copper	2.0000	0.003	0.0178	0.114	18	100.00
	Fluoride	1.5000	0.26	0.8678	1.15	18	100.00
	Fluoride (WU result)	1.5000	0.29	0.9846	1.11	13	100.00
	Fluoride Ratio	0.8 - 1.2	0.93	1.0269	1.13	13	100.00
	Iodine	0.5000	0.01	0.0433	0.15	18	100.00
	Iron	0.3000	0.005	0.0547	0.31	18	94.44
	Lead	0.0100	0.0001	0.0004	0.0017	18	100.00
	Magnesium	10000.0000	6.94	11.9806	21.23	18	100.00

	Manganese	0.5000	0.0009	0.0315	0.0751	18	100.00
	Mercury	0.0010	0.0004	0.0004	0.0004	18	100.00
	Molybdenum	0.0500	0.00005	0.0004	0.0026	18	100.00
	Nickel	0.0200	0.0002	0.0004	0.001	18	100.00
	Nitrate	50.0000	0.5	0.9722	2	18	100.00
	Nitrite	3.0000	0.05	0.0500	0.05	18	100.00
	pH	6.5 - 8.5	7.5	7.7056	7.9	18	100.00
	Selenium	0.0100	0.0035	0.0035	0.0035	18	100.00
	Silver	0.1000	0.0001	0.0001	0.0001	18	100.00
	Sodium	180.0000	19	38.0000	85	18	100.00
	Sulfate	500.0000	4	17.3333	45	18	100.00
	Total Dissolved Solids (TDS)	10000.0000	105	175.0000	361	18	100.00
	Total Hardness as CaCO3	10000.0000	57.8	89.2222	148.6	18	100.00
	True Colour	15.0000	0.5	1.2778	11	18	100.00
	Turbidity	5.0000	0.05	0.5750	1.5	18	100.00
	Uranium	0.0170	0.00005	0.0007	0.0037	18	100.00
	Zinc	3.0000	0.01	0.0350	0.16	18	100.00
Fluoride Barcode							
	Fluoride	1.5000	0.79	0.9108	1.03	12	100.00
	Fluoride (WU result)	1.5000	0.86	0.9767	1.07	12	100.00
	Fluoride Ratio	0.8 - 1.2	0.92	1.0742	1.15	12	100.00
Microbiology							
	E. coli	0.0000	0	0.0137	4	437	99.54
	Free Chlorine	0.2 - 5	0.02	0.4437	2.21	436	79.36
	pH	6.5 - 8.5	7.08	8.2304	9.57	399	70.93
	Temperature	30.0000	7.7	18.7894	33	435	99.31
	Total Chlorine	5.0000	0.04	0.6073	3	436	100.00
	Total Coliforms	0.0000	0	0.6247	201	437	97.71
	Turbidity	5.0000	0.07	0.5752	3.7	436	100.00
Operational Monitoring							
	Fluoride (weekly WU)	0.9 - 1.5	0.8	0.9781	1.11	171	94.74

Table 37. Summary of NSW Health's drinking water monitoring program data for the Mt Daylight scheme

Analysis type	Characteristic	Guideline Value	Min	Mean	Max	Sample Count	% meeting guideline values
Chemistry	Aluminium	0.2000	0.005	0.0050	0.005	2	100.00
	Antimony	0.0030	0.00005	0.0001	0.0001	2	100.00
	Arsenic	0.0100	0.002	0.0025	0.003	2	100.00
	Barium	2.0000	0.078	0.0784	0.0787	2	100.00
	Boron	4.0000	0.0386	0.0392	0.0397	2	100.00
	Cadmium	0.0020	0.00005	0.0001	0.00005	2	100.00
	Calcium	10000.0000	24.5	25.1000	25.7	2	100.00
	Chloride	250.0000	103	104.0000	105	2	100.00
	Chromium	0.0500	0.0005	0.0005	0.0005	2	100.00
	Copper	2.0000	0.009	0.0095	0.01	2	100.00
	Fluoride	1.5000	0.56	0.5700	0.58	2	100.00
	Iodine	0.5000	0.14	0.1450	0.15	2	100.00
	Iron	0.3000	0.005	0.0075	0.01	2	100.00
	Lead	0.0100	0.0003	0.0004	0.0004	2	100.00
	Magnesium	10000.0000	19.06	20.1450	21.23	2	100.00
	Manganese	0.5000	0.0009	0.0010	0.001	2	100.00
	Mercury	0.0010	0.0004	0.0004	0.0004	2	100.00
	Molybdenum	0.0500	0.0024	0.0025	0.0026	2	100.00
	Nickel	0.0200	0.0005	0.0006	0.0006	2	100.00
	Nitrate	50.0000	0.5	0.5000	0.5	2	100.00
	Nitrite	3.0000	0.05	0.0500	0.05	2	100.00
	pH	6.5 - 8.5	7.5	7.6500	7.8	2	100.00
	Selenium	0.0100	0.0035	0.0035	0.0035	2	100.00
	Silver	0.1000	0.0001	0.0001	0.0001	2	100.00
	Sodium	180.0000	82	83.5000	85	2	100.00
	Sulfate	500.0000	39	40.5000	42	2	100.00
	Total Dissolved Solids (TDS)	10000.0000	328	344.5000	361	2	100.00
	Total Hardness as CaCO3	10000.0000	142.7	145.6500	148.6	2	100.00
	True Colour	15.0000	0.5	0.5000	0.5	2	100.00
	Turbidity	5.0000	0.3	0.9000	1.5	2	100.00
	Uranium	0.0170	0.0032	0.0035	0.0037	2	100.00
	Zinc	3.0000	0.02	0.0750	0.13	2	100.00
Microbiology	E. coli	0.0000	0	0.0000	0	31	100.00
	Free Chlorine	0.2 - 5	0.02	0.2987	0.75	31	61.29
	pH	6.5 - 8.5	7.08	7.6374	8.12	31	100.00

	Temperature	30.0000	12.2	20.7194	29.3	31	100.00
	Total Chlorine	5.0000	0.12	0.4681	0.92	31	100.00
	Total Coliforms	0.0000	0	0.0000	0	31	100.00
	Turbidity	5.0000	0.08	0.5539	2.8	31	100.00

Appendix B - Continuous Improvement Plan

GWCCC DWMS Action and Improvement Plan

Table 38. GWCC DWMS Action and Improvement Plan

No.	Action	Type	Status	Date completed/ closed	Comments	Priority	Responsibility	Action reference
1	GWCC to consider installing an online free chlorine analyser at Oura disinfection point (after 30 min contact time).	Capital works	Complete		25/11/2016 - 9 analysers purchased. As Oura is not disinfecting for primary kill, the analyser should be located as close as practical to the disinfection point. 15/10/2019 - Blueeye analyser installed; however has been found to be unreliable. Analyser has not be implemented for control however is registering trends. A new Burket system will now be installed as a replacement. 1/9/2021 - Burkert Analyser has been installed and operating since early 2020	Very High	Manger Production and Services	GWCC DWMS Technical Note 2 Risk Assessment and Critical Control Point Workshop (HydroScience, 2015)

2	GWCC to consider training staff in backflow prevention	Training	Complete	Sep-16			GWCC DWMS Technical Note 2 Risk Assessment and Critical Control Point Workshop (HydroScience, 2015)
3	GWCC to consider conducting internal training on chlorine residual testing	Training	Complete	2017			GWCC DWMS Technical Note 2 Risk Assessment and Critical Control Point Workshop (HydroScience, 2015)
4	GWCC to conduct internal training (or refresher training) on correct sampling techniques	Training	Complete	2017	25/11/2016 - Register needs to be updated to capture internal training completed 15/10/2019 - All Water Qual staff have been inducted into proper sampling techniques; however a role out of all staff across the organisation whom may require sampling as part of their role will need to be undertaken. 25/8/2020 All new distribution staff inducted internally however; a register is yet to be developed. 1/9/2021 - all compliance sampling is conducted by Water Quality Staff now who are trained and specialised. The only	Low		GWCC DWMS Technical Note 2 Risk Assessment and Critical Control Point Workshop (HydroScience, 2015)

					testing that occurs from distribution staff is now just chlorine operational samples. Water Quality Staff continue development and all maintain their cert 3 in water treatment plant operations.		
5	GWCC to consider conducting a community education program on backflow prevention	Community engagement	Closed	25-Nov	25/11/2016 - Action closed due to changed process. Refer to action 33 (implement backflow prevention program)		GWCC DWMS Technical Note 2 Risk Assessment and Critical Control Point Workshop (HydroScience, 2015)
6	GWCC to conduct bacto sampling after storm event if visual check of bores show signs of being compromised	Monitoring	Closed	25-Nov	25/11/2016 - Action closed due to changed process. Refer to action 33 (implement backflow prevention program)		GWCC DWMS Technical Note 2 Risk Assessment and Critical Control Point Workshop (HydroScience, 2015)

7	GWCC to install an online turbidity meter in Murrumbidgee River to predict water quality decline	Capital works	Closed	Nov-16	25/11/2016 - Turbidity meter purchased. However this action is no longer required. Controls for WTP are established at the plant through the upgrade to ClearScada control system. Raw water turbiditity is already measured and shuts the plant down if variation >20% occurs. Contact with WaterNSW will also provide any release changes that may impact on river turbidity.		GWCC DWMS Technical Note 2 Risk Assessment and Critical Control Point Workshop (HydroScience, 2015)
8	GWCC to roll out system of different levels of key access to increase security	Operations and maintenance	Complete	2016	25/11/2016 - Keys purchased 25/8/2020, majority of all sites now completed with only remote site remaining		GWCC DWMS Technical Note 2 Risk Assessment and Critical Control Point Workshop (HydroScience, 2015)
9	GWCC to consider performing preventative maintenance on solenoid valves leading into fluoride batching tank	Operations and maintenance	Closed	Nov	25/11/2016 - Considered as part of maintenance		GWCC DWMS Technical Note 2 Risk Assessment and Critical Control Point Workshop (HydroScience, 2015)

10	GWCC to check data entry to ensure no errors and record all incidents and causes of high readings (e.g. data entry error, human error, etc.)	Monitoring	Closed	2017	the implementation of a new water quality database (Wateroutlook) has allowed for the centralisation of all test results and automated reporting for any non-conformances.		GWCC DWMS Technical Note 2 Risk Assessment and Critical Control Point Workshop (HydroScience, 2015)
11	GWCC to consider purchasing electronic chlorine analyser to eliminate manganese interference with chlorine residual testing as per DPI Water recommendation (e.g. chloro-sense kits)	Capital works	Closed	2014	25/11/2016 - One at Jugiong and one at Oura		GWCC DWMS Technical Note 2 Risk Assessment and Critical Control Point Workshop (HydroScience, 2015)
12	GWCC to consider increasing monitoring of chlorine residual throughout system during power outages	Monitoring	Closed	25-Nov	25/11/2016 - Covered within incident management. 9 chlorine analysers to be installed 15/10/2019 - multiple sites now online via SCADA with battery backup operations.		GWCC DWMS Technical Note 2 Risk Assessment and Critical Control Point Workshop (HydroScience, 2015)

13	GWCC to consider installing online chlorine analysers at Oura PS	Capital works	Closed	25/11/2016 - analyser purchased. Currently being installed and connected to SCADA 2017. 15/10/2019 - Analyser installed in lab. Reliability of the Blueeye unit is not good and a new unit will be installed in 2019. System is currently operating however no controls have been engaged from the analyser due to reliability f the unit. Trends are however being obtained. 1/9/2021 works were complete and commissioned in early 2020		GWCC DWMS Technical Note 2 Risk Assessment and Critical Control Point Workshop (HydroScience, 2015)

14	GWCC to develop a register for water carters	Procedures and documentation	Closed		2017 - Letters issued to all known water carters within supply area. No responses received from water caters regarding potable water services. Process will be controlled greater via the installation of automated filling stations which will be delivered as an ongoing capital delivery project. 15/10/2019 - Filling stations installed at Temora, Bardmedman and West Wyalong. No commercial water carters for potable services have been registered.			GWCC DWMS Technical Note 2 Risk Assessment and Critical Control Point Workshop (HydroScience, 2015)
15	GWCC to develop and maintain a register of RPZs within distribution system	Procedures and documentation	Closed		To be completed as part of *Action33 Implement backflow prevention program*			GWCC DWMS Technical Note 2 Risk Assessment and Critical Control Point Workshop (HydroScience, 2015)
16	GWCC to consider and investigate and install the most suitable BFPD on the connection between Oura	Capital works	Complete		2017 risk assesment and report developed on the non-pot system and its potential for cross contamination. Further projects to progress to investigation stage in	High	Manager Engineering	GWCC DWMS Technical Note 2 Risk Assessment and Critical Control Point Workshop (HydroScience, 2015)

	and Hylands Bridge (e.g. RPZ, break tank with air gap, etc.)			2018. 15/10/2019 - Works still outstanding 25/8/2020 Works still outstanding 1/1/2022 A stop valve and non-return valve has been put in place to reduce any risk of backflow		
17	GWCC to ensure all hatches on reservoirs comply with AS/NZS	Operations and maintenance	Rolled into other action	To be completed as part of *Action 36 To complete and submit circular 18*		GWCC DWMS Technical Note 2 Risk Assessment and Critical Control Point Workshop (HydroScience, 2015)
18	GWCC to implement a formal water quality monitoring regime at Mt Arthur to monitor pH, turbidity, free, and total chlorine	Monitoring	Rolled into other action	To be completed as part of *Action 37 Complete formal review of monitoring plan, against ADWG, NSW Health*		GWCC DWMS Technical Note 2 Risk Assessment and Critical Control Point Workshop (HydroScience, 2015)
19	GWCC to implement a formal water quality monitoring regime at Mt Daylight to monitor pH, turbidity, free,	Monitoring	Rolled into other action	To be completed as part of *Action 37 Complete formal review of monitoring plan, against ADWG, NSW Health*		GWCC DWMS Technical Note 2 Risk Assessment and Critical Control Point Workshop (HydroScience, 2015)

	and total chlorine					
20	GWCC to install a backflow prevention device between the GWCC reservoir and the reservoir managed by Carathool Shire Council to protect water quality in the Mt Daylight drinking water supply	Capital works	Closed		25/11/2016 - Part of broader discussion on governance with Carathool Shire Council 25/8/2020 there is an airgap between water in reservoir and inlet therefore restricting any backflow	GWCC DWMS Technical Note 2 Risk Assessment and Critical Control Point Workshop (HydroScience, 2015)
21	GWCC to consider purging reservoir as part of emergency response if contamination is suspected	Operations and maintenance	Closed		25/11/2016 - Considered as part of emergency procedures	GWCC DWMS Technical Note 2 Risk Assessment and Critical Control Point Workshop (HydroScience, 2015)
22	GWCC to consider alarming all reservoir hatch doors in case of sabotage or vandalism. Mt Daylight reservoir is a	Operations and maintenance	Closed		25/11/2016 - Been considered, but currently not practical. Managed with weekly and quarterly inspections.	GWCC DWMS Technical Note 2 Risk Assessment and Critical Control Point Workshop (HydroScience, 2015)

	priority, which is the most remote							
23	GWCC to complete live chlorine monitoring system for reticulation system (in progress)	Capital works	Complete		25/11/2016 - analyser purchased 15/10/2019 - analysers will be installed on demarcation boundaries for Bulk customers retics. No considerations for online retic monitoring is being considered at this stage as water quality team are building data to inform future decisions such as apporpriate locailities that warrant online monitoring. 25/8/2020 as per previous note on 15/10/2019 - 1/9/2021 as per previous advice and note that staff undertake significant amount of additional operational testing for the retic systems.	Low	Manager Production & Services	GWCC DWMS Technical Note 2 Risk Assessment and Critical Control Point Workshop (HydroScience, 2015)

24	GWCC to consider developing SOP for fluoride hopper cleaning	Procedures and documentation	Complete		15/10/2019 - External training consultant required to facilitate, training and development of an SOP for Trades. This will occur upon completion of the new Code of Practice. 25/8/2020 SOP has been drafted and induction to be provided for all trades and WTP operators - 1/9/2021 new induction procedure was completed and implemented in 2020	Very High	Manager Production & Services	GWCC DWMS Technical Note 2 Risk Assessment and Critical Control Point Workshop (HydroScience, 2015)
25	GWCC to consider developing SOPs for chlorine testing to include manganese interference with reagent	Procedures and documentation	Closed	30/06/2019	15/10/2019 - consideration of developing SOP's has been determined as not required.			GWCC DWMS Technical Note 2 Risk Assessment and Critical Control Point Workshop (HydroScience, 2015)
26	GWCC to develop SOPs for operational and supporting activities, such as plant operation, mains break repair,	Procedures and documentation	Complete		15/10/2019 - SOPS for WTP's and Water Quality division have been completed. Distribution SOP's now required in line with relevant training 25/8/2020 distribution staff to develop SOPS for	Medium	Manager Operations	GWCC DWMS Technical Note 2 Risk Assessment and Critical Control Point Workshop (HydroScience, 2015)

	mains flushing, etc.				their activities e.g. mains breaks - 1/9/2021 GWCC have now established a WHS committee and officers, continual improvement processes are in place and managed as part of this process. This includes all WHS documentation and SOP needs for the organisation			
27	GWCC to include drinking water quality management in the annual report, as recommended in Element 10 of the ADWG	Procedures and documentation	Complete	2018	First report and submitted in October 2018.			GWCC DWMS Technical Note 2 Risk Assessment and Critical Control Point Workshop (HydroScience, 2015)
28	Educate community member that owns the private bore in close proximity to Oura Borefield to ensure they are aware that the bore accesses the drinking water aquifer	Community engagement	Complete	30/06/2020	25/11/2016 - Refer to new action 38	High	Manager Engineering	GWCC DWMS Technical Note 2 Risk Assessment and Critical Control Point Workshop (HydroScience, 2015)

29	GWCC to consider installing online chlorine residual analyser at outlet of settling tanks to ensure 30 minutes contact time (Mt Arthur system)	Capital works	In progress		25/11/2016 - Analyser purchased. Unit has been installed at Ganmain; however just waiting on connection for discharge water to sewer before commissioning occurs. 15/10/2019 - Analysers and Maglows to be installed in the Mt Arthur System to provide more data for potential treatment requirements. Investigations to Occur from January 2020 as part of MIPPS student placement. -25/8/2020 MIPPS student investigation project complete June 2020, further investigations in treatment options to occur - 1/9/2021 magflow and analysers installed however not connected to clearscada system. - 1/11/2022 Mt Arthur SCADA/Telemetry network to commence upgrade in 2022/23 financial year.	Low	Manager Production & Services	GWCC DWMS Technical Note 2 Risk Assessment and Critical Control Point Workshop (HydroScience, 2015)

					Connection of water quality instrumentation to be completed after this.			
30	GWCC to consider changing location of online chlorine analyser in the Mt Daylight system to ensure free chlorine measurement after 30 min contact time. Both the chlorine dosing and the chlorine analyser are located at the reservoir inlet	Capital works	Closed	30/06/2020	Consider as part of analyser installation. 15/10/2019 - Analyser installed at Naradhan Res's providing residual levels 15km down stream of dosing point. Anlayser needs to include controls to inhibit Daylight pumps if residuals or CL2 dosing stops.	Medium	Manager Production & Services	GWCC DWMS Technical Note 2 Risk Assessment and Critical Control Point Workshop (HydroScience, 2015)

31	Determine the level of water quality training required for new staff and add to induction program	Training	Complete	15/10/2019 - Consideration of training will need to be developed in accordance with each individuals role. However in terms of induction and competancy based requirements for all field staff, this needs to be developed. 25/8/2020 all new starter within WQ and distribution teams have been provided relevent inductions where required however formal register yet to be developed. - 1/9/2021 water quality staff now managing all compliance requirements of the DWMS. Their training is being developed in line with the National Training Package 2020. We are working with the NSW Water Directorate and TWRRP Team for access to new training providers which has delayed our continual development	Medium	Human Resource Coordinator	Added as part of action and improvement plan review (25 November 2016)

				requirements. Staff undertake a review of their Staff Development Plans every 6 months				
32	Develop and implement competency checklist/schedule on sampling methodology	Training	Closed	30/06/2020	15/10/2019 - Will be considered as part of an induction and training program for water quality testing. Internally competency sign off required 25/8/2020 has been considered and will form part of induction process and register - 1/9/2021 All compliance sampling conducted by Quality staff now whom hold a minimum of cert 3 in water treatment operations.	Low	Manager Production & Services	Added as part of action and improvement plan review (25 November 2016)

33	Implement backflow prevention program, including developing register of RPZs	Capital works	Closed	30/06/2020	25/11/2016 - Budget approved, project underway. 15/10/2019 - Program has commenced and is nearing its completion for all rural high risk connections.25/8/2020 RPZD register of high risk connections has been completed	Very High	Manager Engineering	Added as part of action and improvement plan review (25 November 2016)
34	Develop a microbiological sampling SOP when bore head integrity has been potentially compromised (maintenance, flooding, vandalism)	Procedures and documentation	Closed	30/06/2019	15/10/2019 - in line with action item 6 above. Emergancy Response SOP's have been developed. Routine raw water testing now undertaken.			Added as part of action and improvement plan review (25 November 2016)
35	Investigate options for electronic card systems on standpipes to record water carter access	Capital works	Closed	30/06/2019	Temora and West Wyalong have been determined as priority locations for installation during the 18/19 financial year. 15/10/2019 - West Wyalong, Temora and Barmedman now installed and operational.			Added as part of action and improvement plan review (25 November 2016)

36	To complete and submit circular 18	Operations and maintenance	Complete		The development of routine inspections and standard operating procedures have been completed in 2017. Work on the development of a centralised database that can issue out work orders and retain asset corrective action data is now being developed through Wateroutlook. 15/10/2019 - formal submission Circular 18 has not recieved any feedback from 2017. Consideration of new submission to be made. 25/8/2020 No change still no feedback from DPIE	High	Manager Engineering	Added as part of action and improvement plan review (25 November 2016)
37	Complete formal review of monitoring plan, against ADWG, NSW Health	Monitoring	Complete	2017	Works completed with independent review completed by Atom consulting in 2017. 15/10/2019 - Annual DWMS review is undertaken in October of every year and reported to NSW Health upon completion.			Added as part of action and improvement plan review (25 November 2016)

38	Investigate bore 5 private ownership and licensing, in liaison with DPI Water. Considering water quality contamination risks from bore	Investigative studies	Closed	30/06/2019	15/10/2019 - contact with Land Holder and DOI Water to occur 25/8/2020 no indication of active bore, GWCC to continue to monitor raw water of existing borefield	High	Manager Engineering	Added as part of action and improvement plan review (25 November 2016)
39	Ensure bore 1 wellhead security e.g. secure gaps in casement	Capital works	Closed	2019	contact with land holder to gain access and investigate bore closure to occur in 2018 15/10/2019 - 100% confirmation is not possible. Continued monitoring of our borefield raw water will identify any issues if such shall arise.			Added as part of action and improvement plan review (25 November 2016)
40	Review operational monitoring data	Monitoring	Complete	ongoing	Independent monitoring report completed by Atom Consulting with internal review also undertaken for development of better operational data gathering for population of Wateroutlook system.			Added as part of action and improvement plan review (25 November 2016)
41	Formulate a Drinking Water Quality Policy	Procedures and documentation	Closed	2018	Formulate a drinking Water Policy, to be completed before August council meeting.		Manger Production and Services	Added as part of review/development of DWMS

					15/10/2019 - now complete		
42	Ensure Drinking Water Quality policy is communicated and understood by staff	Training	Closed	2018	Once policy has been adopted by council it is to communicated and understood by staff 15/10/2019 - all policies are submitted to the Consultative Committee for review and made available online for all staff.	Manger Production and Services	Added as part of review/development of DWMS
43	construct Flow diagrams of water supply system from catchment to consumer	Procedures and documentation	Complete	2017	flow diagrams were updated to be placed into DWMS		
44	Assemble pertinent information and document key characteristics of the water supply system	Procedures and documentation	Complete	2017	Information was generated for production of DWMS	Manger Production and Services	
45	Assemble a team with appropriate knowledge and expertise	Procedures and documentation	Closed	2019	Asset management asset required. 15/10/2019 - Water Quality team now established with more room to grow trainees in future years. Engineering team has	Manger Production and Services	

					gone from 3 to 5 staff with an independant manager.		
46	Identify existing preventive measures from catchment to consumer for each significant hazard or hazardous event and estimate the residual risk	Investigative studies	Complete	ongoing	Ongoing risk reviews and actions are undertaken upon incident reporting/lessons learnt scenarios. As the organisations asset and operational maturity increases so to will the levels of assessment and outcomes. - 1/9/2021 GWCC staff monitor and maintain its raw water systems via monthly monitoring lab results. In addition to that we are altered by any changes to Murrumbidgee discharges from Water NSW.	Low	
47	Evaluate alternative or additional preventive measures where improvement is required		Closed	ongoing	25/8/2020 as per item 46 above		

48	Document all procedures and compile into an operations manual	Procedures and documentation	Closed	2019	SOPs have been generated and reviewed; they will need to be finalised. SWMS are currently being developed 15/10/2019 - All SOP's for WTP operations have now been complete. All documents have been made available on WaterOutlook. An operations manual is not deemed required at this stage.		Manger Production and Services
49	Identify procedures required for processes and activities from catchment to consumer	Procedures and documentation	Complete		See point 48 above. 15/10/2019 - This needs to be investigated and developed into a management plan for each supply scheme. - 1/9/2021 this is documented and managed as part of our DWMS and associated annual reviews.	Medium	Manger Production and Services

50	Ensure monitoring data is representative and reliable	Monitoring	Complete	ongoing	Ongoing data auditing every 12 months will help confirm data is representative of water supplies. 15/10/2019 - Wateroutlook provides monthly data reports for review by the water quality team. All data is reviewed annually for consideration of any new improvements required for data and operational consistancy.		Manger Production and Services
51	Determine the characteristics to be monitored in the distribution system and in water as supplied to the customer	Monitoring	Complete	2017	monitoring is carried out as per NSW Health drinking water Monitoring Program and operational requirments of GWCC.		
52	Establish and document a sampling plan for each characteristic, including the location and frequency of sampling	Monitoring	Complete	2017	Monitoring program to be audited every 12 months to ensure data is representative of the drinking water system		

53	Establish a consumer complaint and response program, including appropriate training of employee	Community engagement	Complete	2017	A register of customer complaints and outcomes and feedback to be developed. 15/10/2019 - CRM processes and indicators to be developed over the next 12 months with data recording and reporting mechanisms to be developed as well. This is an outstanding item in both Internal audit and NPR Audit. 25/8/2020 Draft operating proceedure for complaints handling completed - 1/9/2020 process is now business as usual with utilisation of councils customer service complaints system utilised to log and report on issues	Medium	Manger Production and Services
54	Define communication protocols with the involvement of relevent agencies and prepare a contact list of key people,	Procedures and documentation	Closed	2018	A register of conacts has been completed and Emergency Response Management Plan will need to be reviewed to add the list. 15/10/2019 - works now complete and reviewed annually.		

	agencies and businesses						
55	develop a public and media communuications strategy	Community engagement	Complete	2019	See Ryan for update. 15/10/2019 - complete		
56	Develop mechanisms and communication procedures to increase employees awareness of and participation in drinking water quality management	Procedures and documentation	Complete		Suggested by GM to have all staff trained in Cert II Water Operations. 15/10/2019 - induction based training should be undertaken by operational staff. Discussions with HR Coordinator to occur to develop long term plan. - 1/9/2021 GWCC issue relevant update emails, SOP's and guidelines to all staff when changes occur. Additional training including scenario training is undertaken as well. Scenario training was conducted with Bulk Councils involved in late 2020.	High	Manger Production and Services

57	Develop a comprehensive strategy for community consultation	Community engagement	Closed	2019	Have communications officer develop comms strategy. 15/10/2019 - Complete		
58	Assess requirements for effective community involvement	Community engagement	Complete	2019	15/10/2019 - As per Local Government Act, IP&R Framework and the Best Practice requirements for Water & Sewer.		
59	Use information to improve management of the Water Supply system	Investigative studies	Implemented	ongoing	Information will help GWCC to evolve with the requirements of its customers	Low	Manger Production and Services
60	establish programs to increase understanding of the water supply system	Community engagement	Complete	ongoing	Programs may include education of water quality, treatment processes, distribution works, new capital works etc - 1/9/2021 GWCC continue to develop hydraulic models, P&ID, and validation systems for Councils networks. Council have also developed and undertaken an education program called "Depth Days" which provides tours of Jugiong WTP and gives an overview of	Medium	Manger Production and Services

					catchment to tap process for students and/or community groups if requested.	
61	Validate processes and procedures to ensure that they are effective at controlling hazards	Procedures and documentation	Implemented		Ongoing assessment current procedures will help produce and highlight the need for new or additional processes or information	
62	Revalidate processes periodically or when variations in conditions occur	Procedures and documentation	Implemented		See Action and Improvement Plan Action item 61 above	
63	Validate the selection and design of new equipment and infrastructure to ensure continuing reliability	Investigative studies	Implemented	2017	Ongoing	
64	Periodically review documentation and revise as nessesary	Procedures and documentation	Implemented	2017	Ongoing document will be review and updated as per the document review dates	

65	develop a document control system to ensure current versions are in use	Procedures and documentation	Complete		Systematic approach with all review documents and their respective review dates to be determined and a suitable timeline developed to make sure all docs are updated as required 25/8/2020 all systems built into Water Outlook	High	Manger Production and Services
66	Establish a records management system and ensure that employees are trained to fill out records	Procedures and documentation	Implemented	2018	Wateroutlook is being developed by Safe group with a number of avenues of data collection to be made availble once fully rolled out. 15/10/2019 - Additional CRM system is avaialble for registering all documents, emails and correspondance		Manger Production and Services
67	Document information pertinent to all aspects of drinking water quality mangement	Procedures and documentation	Implemented		This will evolve as GWCC move forward, relevant information e.g. reservoir inspection sheets to be enetered into a database for reporting and so that any works can be followed up on and actioned if not complete	Very High	Manger Production and Services

68	produce an annual report to be made available to customers, regulatory authorities and stakeholders	Procedures and documentation	Implemented		DWMS Report may be made available once Water Quality Technical Officer has completed in July/August. 15/10/2019 - The annual report will be completed, submitted and made available to all relevant authorities in October of every year.	High	Manger Production and Services
69	establish procedures for effective internal and external reporting	Procedures and documentation	Closed	2017	The DWMS annual report to NSW Health will but completed for the first time by GWCC and the annual performance report will also be undertaken by GWCC staff as usual on an annual basis		
70	Document and report results	Monitoring	Complete	2017	This will an evolving and ongoing		
71	Collect and evaluate longterm data to assess performance and identify problems	Monitoring	Complete	2017	This will an evolving and ongoing		
72	Document and communicate audit results	Monitoring	Complete	2017	Audit results are always documented and communicated so that any issues can be attended to or so that good results are		

					communnicated for good reason			
73	Establish processes for internal and external audits	Procedures and documentation	Complete	2019	15/10/2019 - Internal Audit undertaken this year and shoulld be completed every 3 years. Consideration of external audits should be undertaken at least every 5 years.			
74	Evaluate the need for change	Investigative studies	Closed	ongoing				
75	Senior Executive review of the effectiveness of the management system	Investigative studies	Complete		15/10/2019 - Manex to review the Annual report and provide advice on any required changes. 25/8/2020 MANEX and council review annual report			
76	Bulk User Service Level Agreement	Procedures and documentation	In Progress	Ongoing	Formal Service level agreement be developed and implemented for councils bulk water users; and b) This action be included into action and improvement plan within DWMS 25/8/2020 Funding has been awarded for the facilitation and development of WQ SLA between GWCC- Hilltops	Medium	Manager production and Services	Part B has been added to action and improvements plan (Oct 2019); PART A is in progress, Staff have submitted a request to Public Health for the engagement of an external facilitator to undertake the development of a new Service Level Agreement between GWCC and its Bulk Customers. Project to commence upon approval from Public Health for funding of the Consultant.

					and GWCC and Coota Gundagai - 1/9/2021 Water Qual component has been completed and a draft is currently being developed by Lindsay Taylor Lawyers. - 1/11/22 draft SLA completed and currently under review. Change in staff at bulk councils has made it difficult to resolve outstanding items for agreement.			
77	Complaints Mangement System	Procedures and documentation	Implemented	Ongoing	Investigate options for a complaints handling system that integrates with Council's Asset Management and GIS Systems, and meets the requirements of the framework for the management of drinking water and Council's performance.	Medium	Manager production and Services	Management is unaware if a fully integrated complaints management system exists that could be implemented within GWCC cost effectively. However, Management will seek to improve its current capture of complaints through a more secure reporting system. This could be undertaken through tools such as Civica or WaterOutlook

78	Emergency response traiing	Training	Complete	ongoing	Incident and emergency response traiing to be developed and refererred to in DWMS and undertaken by relevent employees and stakeholders. (To be Included in DWMS) 25/8/2020 - Health have funded the facilitation of Emergency response training including bulk councils to occur 2020/21 - 1/9/2020 GWCC and Hilltops and CGRC all participated within a scenario training workshop held late 2020 at Jugiong WTP. Council also has developed Incident Protocols for water quality incidents that are to be used for management.	Medium	Manager production and Services	Managemet have issued a request for this scenario training to be funded and facilitated through Public Health. If funding and facilitated by Health GWCC will seek to undertake the training as soon as practicably possible. It should be noted that internal training is undertaken annualy for emergancy reponse maement at the Jugiong Water Treatment Plant as part of Council's Pollution Incident Response Management Plan. (HAS been included into DWMS under Traing)
79	Backflow Prevention	Procedures and documentation	Complete	2019	a) The Backflow Prevention Policy be referred to within the Drinking Water Management System; (COMPLETE under sectionRural Backflow Prevention Program) and b) Backflow device register be	Medium	Manager production and Services	Staff will include Backflow Prevention commentary within the DWMS Annual Report which is set to be completed and submitted to Council by December 2019.

					updated as required in accordance with the Backflow Prevention Policy (PP06). (Kevin will need to familiarise himself with this)			
80	Water Quality reporting	Procedures and documentation	Complete	2019	Consideration be given to making water quality information publicly available. For example, through the formal reporting to Council meetings, and/or making the DWMS Annual Reporting information available on Council's website.	Low	Manager Production and Services	Staff will submit the Annual DWMS Report to Council for acknowledgment between October and December every year. (Report will be submitted to December Council meeting and subsequently displayed on the public website for the public to see
81	Drinking Water Management System review	Procedures and documentation	Closed	30/06/2020	a) Following the annual review, the Drinking Water Management System be updated to reflect any changes that have been made; and b) Evidence of any review be retained such as meeting minutes, investigative studies, and reports to Council's Senior Management Team and/or Board Members.	low	Manager production and Services	As above

82	Evaluation and audit	Procedures and documentation	Complete	2019	a) Consult with the Local Public Health Unit to clarify their expectations regarding independent audit requirements; and b) Detail the scope and frequency of the independent audit of the Drinking Water Management System (DWMS) in the DWMS.	Low	Manager production and Services	Management are constantly engaged with Public Health and have formally requested a recommendation for a fixed auditing period. No fixed period has been provided, with feedback stating that a requirement for an independant and external audit will be required when Health direct GWCC to do so.

Appendix C - Full Reservoir Inspection Report 2019/20

Reservoir Critical Maintenance Priorities Report

11/07/2022

Date:	8/11/2021	**Client Name:**	Goldenfields Water
WS #:	014	**Reservoir Name:**	Bethungra No1 014
Asset No:	014	**Location:**	off Bethungra Rd
Job No:	027828	**Project Number:**	0
Cleaning Due:	8/11/2025	**Inspection Due:**	8/11/2025

External

Area	Priority	Status	Comments
Roof Platforms	2	A	There is no effective platform area present to work or rescue off if required
Handrails	2	A	There are no guard rails around the edge of the roof

Internal

Area	Priority	Status	Comments
Columns	1	A	The galvanised post base is corroded and the post is also deteriorated on the water line area. An Aquapost is an easy solution to fix the problem
Overflow	2	A	The overflow base is heavily corroded

Comments

External Comment:
There is no effective platform area present to work or rescue off if required

Internal Comment:
The galvanised post base is corroded and the post is also deteriorated on the water line area. An Aquapost is an easy
solution to fix the problem.

Reservoir Critical Maintenance Priorities Report

11/07/2022

Date:	8/11/2021	**Client Name:**	Goldenfields Water
WS #:	015	**Reservoir Name:**	Bethungra No2 015
Asset No:	015	**Location:**	off Bethungra Rd
Job No:	027829	**Project Number:**	0
Cleaning Due:	8/11/2025	**Inspection Due:**	8/11/2025

External

Area	Priority	Status	Comments
Entry Hatch	1	A	The entry hatch is not sealed or secured and contamination can enter the tank
Roof Platforms	2	A	There is no effective platform area present to work or rescue off if required
Handrails	2	A	There are no guard rails around the edge of the roof

Internal

Area	Priority	Status	Comments
Columns	1	A	The galvanised post base is corroded and the post is also deteriorated on the water line area. An Aquapost is an easy solution to fix the problem

Comments

External Comment:
The entry hatch is not sealed or secured and contamination can enter the tank.

Internal Comment:
The galvanised post base is corroded and the post is also deteriorated on the water line area. An Aquapost is an easy solution to fix the problem.

Reservoir Critical Maintenance Priorities Report

11/07/2022

Date:	6/11/2021	**Client Name:**	Goldenfields Water
WS #:	018	**Reservoir Name:**	Black Range 18
Asset No:	18	**Location:**	off Kingsvale Rd Young
Job No:	027757	**Project Number:**	0
Cleaning Due:	6/11/2025	**Inspection Due:**	6/11/2025

External

Area	Priority	Status	Comments
Walls	1	A	There is calcification on the walls and significant spalling internally, so the external areas must also be suspect
Entry Hatch	1	A	The entry hatch cover is not sealed around the edges and where the ladder stiles extend through
Roof Platforms	1	A	The platform is not sealed around the entry hatch area
Roof Hatches	1	A	The hatch covers are not sealed around the edges
Level Indicator	1	A	The level indicator is non functional and should be removed. The roof pulley is creating an entry point for contamination events

Internal

Area	Priority	Status	Comments
Walls	1	A	There is severe concrete spalling on the upper wall area at 5 oclock. The horizontal reinforcing steel is exposed and heavily corroded
Overflow	2	F	The overflow riser is corroded
Ladder Internal	1	A	The internal ladder is heavily corroded and is not safe to use if the tank is empty. It should be replaced with a Nextep vertical FRP system 11600mm long

Comments

External Comment:
The entry hatch and rescue hatch covers are not sealed around the edges.

Internal Comment:
There is severe concrete spalling on the upper wall area at 5 oclock. The horizontal reinforcing steel is exposed and heavily

corroded. This issue should be addressed ASAP before further structural damage develops. The internal ladder is heavily
corroded and is not safe to use if the tank is empty. It should be replaced with a Nextep vertical FRP system 11600mm long.

Reservoir Critical Maintenance Priorities Report

11/07/2022

Date:	8/11/2021	**Client Name:**	Goldenfields Water
WS #:	037	**Reservoir Name:**	Dirnaseer No1 037
Asset No:	037	**Location:**	off Dirnaseer Rd
Job No:	027826	**Project Number:**	0
Cleaning Due:	8/11/2025	**Inspection Due:**	8/11/2025

External

Area	Priority	Status	Comments
Roof Platforms	2	A	There is no effective platform area present to work or rescue off if required
Handrails	2	F	There are no guard rails around the edge of the roof
Ventilation	2	A	One turbine vent is missing, but the opening is closed off

Internal

Area	Priority	Status	Comments

Comments

External Comment:
There is no effective platform area present to work or rescue off if required.

Internal Comment:
The internal areas appear to be in good condition.

Reservoir Critical Maintenance Priorities Report

11/07/2022

Date:	8/11/2021	**Client Name:**	Goldenfields Water
WS #:	038	**Reservoir Name:**	Dirnaseer No2 038
Asset No:	038	**Location:**	off Dirnaseer Rd
Job No:	027827	**Project Number:**	0
Cleaning Due:	8/11/2025	**Inspection Due:**	8/11/2025

External

Area	Priority	Status	Comments
Roof Platforms	2	A	There is no effective platform area present to work or rescue off if required
Handrails	2	F	There are no guard rails around the edge of the roof

Internal

Area	Priority	Status	Comments
Columns	2	F	The concrete mound around the post base is breaking up

Comments

External Comment:
There is no effective platform area present to work or rescue off if required

Internal Comment:
The concrete mound around the post base is breaking up.

Reservoir Critical Maintenance Priorities Report

11/07/2022

Date:	7/11/2021	**Client Name:**	Goldenfields Water
WS #:	042	**Reservoir Name:**	Frampton No1 042
Asset No:	042	**Location:**	off Olympic Hwy
Job No:	027822	**Project Number:**	0
Cleaning Due:	7/11/2025	**Inspection Due:**	7/11/2025

External

Area	Priority	Status	Comments
Walls	2	A	There are significant cracks present, particularly around the base areas, where weepage may be occurring
Entry Hatch	1	A	The entry hatch cover is lightweight and could be bent upwards when locked. It is also unsealed around the edges
Roof Platforms	1	A	There is no effective platform area present to work or rescue off if required
Ventilation	2	A	There is no ventilation system in place, but the roof edge ridge caps are allowing air flow to occur

Internal

Area	Priority	Status	Comments
Walls	2	A	The external cracks will be mirrored internally
Columns	1	A	The post base has corroded through and is only sitting on the floor area
Roof Spider	2	A	The connections are corroded, so replacement is recommended
Roof Framing	1	A	The roof framing has significant corrosion present and will need to be replaced soon, before the roof fails

Comments

External Comment:

There are significant cracks present, particularly around the base areas, where weepage may be occurring. The entry hatch cover is lightweight and could be bent upwards when locked. It is also unsealed around the edges.

Internal Comment:

The roof framing has significant corrosion present and will need to be replaced soon, before the roof fails.

Reservoir Critical Maintenance Priorities Report

11/07/2022

Date:	7/11/2021	**Client Name:**	Goldenfields Water
WS #:	043	**Reservoir Name:**	Frampton No2 043
Asset No:	043	**Location:**	off Olympic Hwy
Job No:	027823	**Project Number:**	0
Cleaning Due:	7/11/2025	**Inspection Due:**	7/11/2025

External

Area	Priority	Status	Comments
Walls	2	A	There are significant cracks present, particularly around the base areas, where weepage may be occurring
Entry Hatch	1	A	The entry hatch cover is lightweight and could be bent upwards when locked. It is also unsealed around the edges
Roof Platforms	1	A	There is no effective platform area present to work or rescue off if required
Ventilation	2	A	There is no ventilation system in place, but the roof edge ridge caps are allowing air flow to occur

Internal

Area	Priority	Status	Comments
Walls	2	A	The external cracks will be mirrored internally
Columns	1	A	The post base has corroded through and is only sitting on the floor area
Roof Framing	2	A	The framing has surface corrosion and is lightweight

Comments

External Comment:
There are significant cracks present, particularly around the base areas, where weepage may be occurring. The entry hatch cover is lightweight and could be bent upwards when locked. It is also unsealed around the edges.

Internal Comment:
The post base has corroded through and is only sitting on the floor area.

Reservoir Critical Maintenance Priorities Report

11/07/2022

Date:	9/11/2021	**Client Name:**	Goldenfields Water
WS #:	053	**Reservoir Name:**	Illabo No1 053
Asset No:	053	**Location:**	off Stanyer Rd
Job No:	027830	**Project Number:**	0
Cleaning Due:	9/11/2025	**Inspection Due:**	9/11/2025

External

Area	Priority	Status	Comments
Walls	2	F	There are a few minor weeps around the external wall base area

Internal

Area	Priority	Status	Comments
Roof Framing	2	A	The roof framing has significant corrosion present on the main rafters and the wall connection areas, which are uncoated

Comments

External Comment:
There are a few minor weeps around the external wall base area.

Internal Comment:
The roof framing has significant corrosion present on the main rafters and the wall connection areas, which are uncoated.

Reservoir Critical Maintenance Priorities Report

11/07/2022

Date:	9/11/2021	**Client Name:**	Goldenfields Water
WS #:	054	**Reservoir Name:**	Illabo No2 054
Asset No:	054	**Location:**	off Stanyer Rd
Job No:	027831	**Project Number:**	0
Cleaning Due:	9/11/2025	**Inspection Due:**	9/11/2025

External

Area	Priority	Status	Comments
Walls	2	F	There are a few minor weeps around the external wall base area

Internal

Area	Priority	Status	Comments
Roof Framing main rafters and	2	A	The roof framing has significant corrosion present on the the wall connection areas, which are uncoated

Comments

External Comment:
There are a few minor weeps around the external wall base area.

Internal Comment:
The roof framing has significant corrosion present on the main rafters and the wall connection areas, which are uncoated.

Reservoir Critical Maintenance Priorities Report

11/07/2022

Date:	21/03/2022	**Client Name:**	Goldenfields Water
WS #:	055	**Reservoir Name:**	Jugiong BT 055
Asset No:	055	**Location:**	off Rosehill Rd
Job No:	027913	**Project Number:**	0
Cleaning Due:	21/3/2026	**Inspection Due:**	21/3/2026

External

Area	Priority	Status	Comments

Internal

Area	Priority	Status	Comments
Columns	2	F	The galvanised coating is deteriorated
Ladder Internal	2	F	The existing ladders, platform and upper cage section need to be replaced with an FRP vertical ladder system when the tank is re-coated

Comments

External Comment:
There is no secure compound around the tank but it is fairly isolated and no vandalism activity is present.

Internal Comment:
The overall internal coating is stained but there is no significant corrosion present at this time. The galvanised areas such as the centre post, overflow support brackets and internal ladder system appear to have micro biological corrosion nodules present on the surfaces.

Reservoir Critical Maintenance Priorities Report

11/07/2022

Date:	21/03/2022	**Client Name:**	Goldenfields Water
WS #:	056	**Reservoir Name:**	Jugiong CWT 056
Asset No:	056	**Location:**	Jugiong WTP
Job No:	027914	**Project Number:**	0
Cleaning Due:	21/3/2026	**Inspection Due:**	21/3/2026

External

Area	Priority	Status	Comments

Internal

Area	Priority	Status	Comments
Ladder Internal	2	F	The galvanised ladder and platform has corrosion present. It should be replaced with a Nextep FRP vertical ladder 9300mm long

Comments

External Comment:
The security enclosure for the ladder is showing signs of surface corrosion.

Internal Comment:
There is one minor section of concrete spalling present, due to shallow steel cover. The galvanised ladder and platform has
corrosion present - it should be replaced with a Nextep FRP vertical ladder 9300mm long.

Reservoir Critical Maintenance Priorities Report

11/07/2022

Date:	7/11/2021	**Client Name:**	Goldenfields Water
WS #:	063	**Reservoir Name:**	Mannings Road No1 063
Asset No:	063	**Location:**	290 Old Cootumundra Rd Cootamundra
Job No:	027824	**Project Number:**	0
Cleaning Due:	7/11/2025	**Inspection Due:**	7/11/2025

External

Area	Priority	Status	Comments
Walls	2	A	The concrete walls have cracks present along the base area
Roof Platforms	2	A	There is no safe working area on the roof
Ventilation	2	F	One turbine roof vent appears to have frozen

Internal

Area	Priority	Status	Comments

Comments

External Comment:
The concrete walls have cracks present but nothing is evident internally. One turbine roof vent appears to have frozen.

Internal Comment:
The internal areas appear to be OK.

Reservoir Critical Maintenance Priorities Report

11/07/2022

Date:	7/11/2021	**Client Name:**	Goldenfields Water
WS #:	064	**Reservoir Name:**	Mannings Road No2 064
Asset No:	0	**Location:**	290 Old Cootumundra Rd Cootamundra
Job No:	027825	**Project Number:**	0
Cleaning Due:	7/11/2025	**Inspection Due:**	7/11/2025

External

Area	Priority	Status	Comments
Roof Platforms	2	A	There is no safe working area on the roof

Internal

Area	Priority	Status	Comments

Comments

External Comment:
The concrete walls have cracks present but nothing is evident internally.

Internal Comment:
The internal areas appear to be OK.

No Comment

Reservoir Critical Maintenance Priorities Report

11/07/2022

Date:	9/11/2021	**Client Name:**	Goldenfields Water
WS #:	068	**Reservoir Name:**	Marrar Pinnacle No1 068
Asset No:	068	**Location:**	off Rockview Rd Marrar Pinnacle
Job No:	027832	**Project Number:**	0
Cleaning Due:	9/11/2025	**Inspection Due:**	9/11/2025

External

Area	Priority	Status	Comments
Entry Hatch	2	F	The entry hatch is small for a safe diver entry or rescue situation. It should be enlarged when the platform is upgraded
Handrails	2	A	An improved guard rail system is required to upgrade personnel safety around the platform area

Internal

Area	Priority	Status	Comments
Roof Framing	2	A	The two main roof beams are un-coated and have heavy surface corrosion present. This should not present a structural issue in the short term (5 years), but they should be monitored for future deterioration
Ladder Internal	2	F	The galvanised ladder has corrosion present. It needs to be replaced with a Nextep FRP ladder 4300mm long

Comments

External Comment:
The entry hatch is small for a safe diver entry or rescue situation. It should be enlarged when the platform is upgraded. An improved guard rail system is also required to upgrade personnel safety around the platform area.

Internal Comment:
The two main roof beams are un-coated and have heavy surface corrosion present. This should not present a structural issue in the short term (5 years), but they should be monitored for future deterioration. The galvanised

ladder has surface
corrosion present. It needs to be replaced with a Nextep FRP ladder 4300mm long.

External Comment:
No Comment

Internal Comment:
No Comment

Reservoir Critical Maintenance Priorities Report

11/07/2022

Date:	20/03/2022	**Client Name:**	Goldenfields Water
WS #:	105	**Reservoir Name:**	Wantabadgery No1 105
Asset No:	105	**Location:**	off Mcgledes Hill Rd
Job No:	027911	**Project Number:**	0
Cleaning Due:	20/3/2026	**Inspection Due:**	20/3/2026

External

Area	Priority	Status	Comments
Walls	1	A	There are some significant weeping horizontal cracks in the walls
Entry Hatch	1	A	The small entry hatch is neither secure against unauthorised access or sealed against contamination ingress
Roof Platforms	1	Na	There is no dedicated platform set up on the roof area
Roof Hatches	2	F	The roof hatch is also unsealed
Handrails	1	A	There are no guard rails around the edge of the roof or entry hatch area
Ventilation	2	F	The edges of the roof sheets will be allowing the tank to vent

Internal

Area	Priority	Status	Comments
Walls	1	A	There are some significant weeping horizontal cracks in the walls which are mirrored externally. The cracks are too numerous to repair, so an internal liner may be a good medium term solution to extend the life of the tank
Columns	1	A	The centre roof support post is heavily corroded and should

be replaced			with an Aquapost. The corroded base plate is 400mm square
Outlet	2	F	The penetration is heavily corroded
Overflow	2	F	The overflow base is heavily corroded

Comments

External Comment:
The small entry hatch is neither secure against unauthorised access or sealed against contamination ingress. There are some significant weeping horizontal cracks in the walls which are mirrored internally. The cracks are too numerous to repair, so an internal liner may be a good medium term solution to extend the life of the tank.

Internal Comment:
The centre roof support post is heavily corroded and should be replaced with an Aquapost. The corroded base plate is 400mm square.

Reservoir Critical Maintenance Priorities Report

11/07/2022

Date:	20/03/2022	**Client Name:**	Goldenfields Water
WS #:	106	**Reservoir Name:**	Wantabadgery No2 106
Asset No:	106	**Location:**	off Mcgledes Hill Rd
Job No:	027912	**Project Number:**	0
Cleaning Due:	20/3/2026	**Inspection Due:**	20/3/2026

External

Area	Priority	Status	Comments
Entry Hatch	1	A	The small entry hatch is neither secure against unauthorised access or sealed against contamination ingress
Roof Platforms	1	A	There is no dedicated platform set up on the roof area
Roof Hatches	2	F	The roof hatch is also unsealed
Handrails	1	A	There are no guard rails around the edge of the roof or entry hatch area
Ventilation	2	F	The edges of the roof sheets will be allowing the tank to vent

Internal

Area	Priority	Status	Comments
Columns	1	A	The centre roof support post is heavily corroded and should be replaced with an Aquapost. The corroded base plate is 400mm square
Outlet	2	F	The penetration is heavily corroded
Overflow	2	F	The overflow base is heavily corroded

Comments

External Comment:
The small entry hatch is neither secure against unauthorised access or sealed against contamination ingress.

Internal Comment:
The centre roof support post is heavily corroded and should be replaced with an Aquapost. The corroded base plate is
400mm square.

Reservoir Critical Maintenance Priorities Report

11/07/2022

Date:	12/07/2021	**Client Name:**	Goldenfields Water
WS #:	112	**Reservoir Name:**	West Wyalong Terminal 112
Asset No:	103451637	**Location:**	off the Mid Western Hwy West Wyalong
Job No:	027767	**Project Number:**	0
Cleaning Due:	12/7/2025	**Inspection Due:**	12/7/2025

External

Area	Priority	Status	Comments

Internal

Area	Priority	Status	Comments
Walls	2	F	There have been a lot of patch repairs carried out, but no obvious corrosion is present. There are some patches of iron oxide on the upper walls but these do not appear to be causing any deterioration to the coating
Floor	2	A	There have been a significant number of patch repairs carried out across the floor, some better than others. There is no obvious corrosion present and CP has been upgraded to a more effective impressed system
Overflow	2	F	The overflow riser is asbestos cement pipe and should be replaced when the tank is recoated

Comments

External Comment:
The external areas appear to be OK.

Internal Comment:
There have been a significant number of patch repairs carried out across the floor, some better than others. There is no obvious corrosion present and CP has been upgraded to a more effective impressed system.

Reservoir Critical Maintenance Priorities Report

11/07/2022

Date:	11/07/2021	**Client Name:**	Goldenfields Water
WS #:	110	**Reservoir Name:**	Wyalong BT 110
Asset No:	110	**Location:**	Depot at cnr Newell Hwy and Goldenfields Way
Job No:	027766	**Project Number:**	0
Cleaning Due:	11/7/2025	**Inspection Due:**	11/7/2025

External

Area	Priority	Status	Comments

Internal

Area	Priority	Status	Comments

Comments

External Comment:
The external areas have been renovated and appear to be in good condition.

Internal Comment:
The internal areas have been recoated and appear to be in good condition, now that some patch repairs were carried out on
the floor during the warranty defects inspection.

Reservoir Critical Maintenance Priorities Report

11/07/2022

Date:	13/07/2021	**Client Name:**	Goldenfields Water
WS #:	115	**Reservoir Name:**	Young Terminal 115
Asset No:	115	**Location:**	off Kingsvale Rd Young
Job No:	027760	**Project Number:**	0
Cleaning Due:	13/7/2025	**Inspection Due:**	13/7/2025

External

Area	Priority	Status	Comments
Roof Hatches and there is no	2	A	The roof hatch at 11 oclock has upstream ponding present lock fitted

Internal

Area	Priority	Status	Comments
Overflow delaminating	2	A	The upper section of the asbestos cement riser is

Comments

External Comment:
The platform and entry hatch areas have been renovated and now appear to be sealed against contamination events.
Padlocks are required on both the entry hatch and roof hatch to secure them from unauthorised access.

Internal Comment:
The upper section of the asbestos cement overflow riser is delaminating.

Appendix D - External Auditor Report Summary

Table 39. External auditor report summary

Number	Issue	Risk Rating	Recommendation	Management Response	Responsible Person	Action Date
1	Bulk User Service Level Agreements	Medium	a) Formal service level agreements be developed and implemented for Council's bulk water users; and b) This action be included in the Action and Improvement Plan within the Drinking Water Management System	Staff have submitted a request to Public Health for the engagement of an external facilitator to undertake the development of a new Service Level Agreement between GWCC and its Bulk Customers. Project to commence upon approval from Public Health for funding of the Consultant.	Manager Production & Services	Aug-20
2	Complaints Management	Medium	Investigate options for a complaints handling system that integrates with Council's Asset Management and GIS Systems, and meets the requirements of the framework for the management of drinking water and Council's performance.	Management is unaware if a fully integrated complaints management system exists that could be implemented within GWCC cost effectively. However, Management will seek to improve its current capture of complaints through a more secure reporting system. This could be undertaken through tools such as Civica or WaterOutlook	Manager Corporate Services	Jun-21

Number	Issue	Risk Rating	Recommendation	Management Response	Responsible Person	Action Date
3	Emergency Response Training	Medium	Incident and emergency response plan training be developed and referred to in the Drinking Water Management System and undertaken by relevant employees and external stakeholders.	Management have issued a request for this scenario training to be funded and facilitated through Public Health. If funding and facilitated by Health GWCC will seek to undertake the training as soon as practicably possible. It should be noted that internal training is undertaken annually for emergency response management at the Jugiong Water Treatment Plant as part of Council's Pollution Incident Response Management Plan.	Manager Production & Services	Dec-20
4	Backflow Prevention	Medium	a) The Backflow Prevention Policy be referred to within the Drinking Water Management System; and b) Backflow device register be updated as required in accordance with the Backflow Prevention Policy (PP06).	Staff will include Backflow Prevention commentary within the DWMS Annual Report which is set to be completed and submitted to Council by December 2019.	Manager Production & Services	Ongoing

Number	Issue	Risk Rating	Recommendation	Management Response	Responsible Person	Action Date
5	Water Quality Reporting	Low	Consideration be given to making water quality information publicly available. For example, through the formal reporting to Council meetings, and/or making the DWMS Annual Reporting information available on Council's website.	Staff will submit the Annual DWMS Report to Council for acknowledgment between October and December every year.	Manager Production & Services	Ongoing
6	Drinking Water Management System Review	Low	a) Following the annual review, the Drinking Water Management System be updated to reflect any changes that have been made; and b) Evidence of any review be retained such as meeting minutes, investigative studies, and reports to Council's Senior Management Team and/or Board Members.	As per item 5 above. Staff will submit the Annual report to Council between the October and December period. The report will highlight any issues, modifications and achievements gained throughout the year.	Manager Production & Services	Ongoing

Number	Issue	Risk Rating	Recommendation	Management Response	Responsible Person	Action Date
7	Evaluation and Audit	Low	a) Consult with the Local Public Health Unit to clarify their expectations regarding independent audit requirements; and b) Detail the scope and frequency of the independent audit of the Drinking Water Management System (DWMS) in the DWMS.	Management are constantly engaged with Public Health and have formally requested a recommendation for a fixed auditing period. No fixed period has been provided, with feedback stating that a requirement for an independent and external audit will be required when Health direct GWCC to do so.	Manager Production & Services	Complete