Drinking Water Management System

Annual Report 2019/20

Goldenfields Water County Council

Date: December 2020

Version: 3.3

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Document Control

Date	Change made	Person
October 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

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 2019/20 financial year with the corresponding CCP number.

Jugiong	CCP1	CCP2	CCP3	CCP4	CCP5	CCP6
Number of CCP exceedances	0	0	5	3	0	0

Oura	CCP1	CCP2	CCP3	CCP4	CCP5	CCP6
Number of CCP exceedances	0	5	0	0	0	0

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 9 under Critical Limit Exceedances. The non-compliances have been mostly for low residual chlorines in the furthest extremities in each of the water source systems.

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	57	14	0	8	7

DWMS Reviews

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

This DWMS report is the third annual review report under the current adopted DWMS that has been undertaken by GWCC. This Annual Report has utilised the entire 2019/20 data for both the Jugiong and Oura 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 where required.

In addition to the general progression of the DWMS, GWCC engaged its internal Auditor (National Audits Group) 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

GWCC has a total of 126 reservoirs listed during the 2019/20 reporting year, with 8 surge tanks and 2 Break Pressure Tanks which are all visually inspected weekly. A more comprehensive inspection is conducted on the above on a quarterly basis, with the findings of these inspections summarised within this report under “Reservoir Inspections”. A more comprehensive reservoir inspection report is also undertaken every 2 to 3 years on reservoirs which the data has been downloaded from the ASAM website. This is the database that Aqualift provide when undertaking GWCC reservoir cleaning, maintenance and condition inspections. The report for reservoirs inspected during the 2019/20 FY is available in Appendix C of this report.

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 22,500 sq. km, between the Lachlan & Murrumbidgee Rivers in the South West 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 which supplies their northern Brucedale suburb.

At the end of the 2019/20 reporting period there were 11318 water connections across the entire drinking water scheme. This is an increase of 134 new connections across the Goldenfields County Council Drinking Water scheme. It should be noted that the bulk supply connections are identified as single connection only.

Jugiong Scheme

The Jugiong drinking water supply system is one of the largest water supply systems managed by Goldenfields Water. The majority of 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 (winter mode) and pump 2 operates at 300 L/s (summer mode). These pumps are currently not able to operate in parallel with each other.

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.

In August 2020 GWCC were advised under the Safe & Secure Risk Prioritisation Project Management Office that a review and re-assessment had been undertaken by the NSW Health Subject Matter Expert for the Jugiong Water Quality Risk ID 2083.

The re-assessment confirms that there is a change in the water quality risk, requiring an amendment to the initial water quality risk score of 1 to 4. This risk is directly related to the lack of online turbidity analysers connected to SCADA as a future CCP. Advice from NSW informs GWCC that this change in risk prioritisation does not identify an immediate risk of our DWMS or current operations, it is only intended to include an element of risk to improve our existing systems to achieve future online monitoring and control at each individual filter.

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 raw water pump arrangements at the plant can only produce around 23.8ML a day.

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

- Water from the Murrumbidgee River is pumped via 120 m of 600mm rising main to Jugiong WTP (capacity 40 ML/day) by two pumps in a duty/standby configuration. (185 or 300l/s)
- 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 317 kW pump that operate in a duty/standby/standby mode. CWPS1 distributes water to the 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 owned/managed by GWCC in the Jugiong system

The Jugiong drinking Water scheme has 686 connections an increase of 3 connections compared to 2018/19. The system also supplies GWCCs bulk customers, Hilltops and Coota-Gundagai. Jugiong retail Connections are broken down as follows:

- 20mm = 522
- 25mm = 155
- 32mm = 3
- 40mm = 3
- 50mm = 3
- 200mm X 1, Cootamundra town no#1(Bulk Supply)
- 100mm X 1, Cootamundra town no#2 (Bulk Supply)
- 300mm X 1, Young Terminal Storage (Bulk Supply)
- 100mm X 1, Young Town (Bulk Supply)

Upgrades to the System/System Improvements

GWCC staff have undertaken works to upgrade several assets within the Jugiong Drinking Water Scheme during the 2019/20 reporting period. A summary of those works are provided below:

- Jugiong CWPS1 Pump 3 - Actuator, Gear Box and Valve Replacement - $15,704
- Jugiong No.2 Pump Station - Pump 1 Renewal $79,121
- Jugiong CWPS2 Pump 3 Major Overhaul $167,251
- Jugiong No 1 Pump Stn No 1 Pump Rebuild $15,090
- Mains Replacement - Cootamundra Abattoirs Main $22,310
- Jugiong WTP - Raw Water Well $9,692
- Jugiong No2 P Stn Pump No2 Valve & Joint $10,700
- PRV Replacement - Jugiong $44,628
- New Non Residential Backflow - Jugiong $199,051
- Water Service Renewals - Jugiong $179,302
- New Water Service Connections - Jugiong $12,323
- Contract (backflow) $71,409
- GWCC RURAL $136,448
- ROSEHILL Pump Station Pump 2 Rebuild $17,429
- Reservoir Old Temora Rd $8,960
- Auto Valve - Pinkerton Road Cootamundra $53,131
- Jugiong WTP - Raw Water Well $44,210

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-potable water supply system located at Barellan as part of the Hylands Bridge scheme. Barellan has a duel supply system to residential properties for irrigation purposes.

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 fully secured and protected from external risks.

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 is yet to be fully commissioned however will be introduced within the cycle during the 2020/2021 reporting period.
- 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 operate 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, this is an increase of 2 reservoirs as compared to 2018/19 (Mandamah), 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 8829 connections, this is an increase of 107 connections as compared to 2018/19, this scheme also supplies bulk water to Riverina Water County Council. The Oura connections are broken down as follows:

- 20mm = 7887 connections
- 25mm = 725 connections
- 32mm = 84 connections
- 40mm = 64 connections
- 50mm = 57 connections
- 80mm = 5 connections
- 100mm = 7 connections

Upgrade to the System/System Improvements

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

• Dumaresq Street Mains Extension	$21,071
• Water Works Road Junee Water Main Replacement/ Lowering	$43,670
• Roediggers Lane Main Replacement	$272,744
• Wyalong BT Efficiency	$19,543
• Oura Pump Station Pump No 3 Pump Rebuild	$60,536
• New Water Refilling Station (Standpipe) - West Wyalong	$16,313
• Mandamah Pump Stn - Electrical	$44,446
• Mandamah Pump Stn - Pump and Pipework	$27,594
• Reservoir Recoating - Junee Balance Tank	$11,021
• Reservoir Recoating - Wyalong Balance Tank	$25,145
• Oura Bore 2	$44,137
• Meter & Taggle Replacement - Oura	$13,886
• New Water Refilling Station (Standpipe) - Temora	$24,086
• Mandamah Pump Station	$43,161
• Mandamah - Reservoirs	$17,379
• Bundawarrah Extension	$7,266
• PRV Replacement - Oura	$42,112
• New Non Residential Backflow - Oura	$213,884
• Water Service Renewals - Oura	$100,590
• New Water Service Connections - Oura	$62,918
• Contract (backflow)	$71,409
• GWCC RURAL	$136,448
• New Gantry Crane - Wyalong Pump Station	$11,061

- Junee Reefs Pump Station Pump Rebuild (asset 11100) $23,245
- Junee Reefs Pump Station Pump Rebuild (asset 11100) $5,777

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 is 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 1537 connections, the Mount Arthur connections are broken down as follows:

- 20mm = 1429 connections
- 25mm = 60 connections
- 32mm = 34 connections
- 40mm = 6 connections
- 50mm = 7 connections

- 100mm = 1 connection

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:

• Coolamon North High Level Reservoir - Cathodic Protection	$42,580
• Matong Bore 2 - Magflow	$107,938
• Commissioning Developer Provided Mains - Mt Arthur	$11,572
• PRV Replacement - Mt Arthur	$19,482
• New Non Residential Backflow - Mt Arthur	$53,076
• Water Service Renewals - Mr Athur	$10,120
• New Water Service Connections - Mr Arthur	$46,367
• Contract (backflow)	$285,637
• GWCC RURAL	$545,792

Mt Daylight System

The Mt Daylight drinking water system 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 (Hydroscience). 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 266 connections, these connections are broken down as follows:

- 20mm = 145 connections
- 25mm = 117 connections
- 32mm = 2 connection
- 40mm = 1 connection
- 50mm = 1 Connection

Upgrades to the System/System Improvements

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

• Hannan Pump Station Replacement	$136,095
• Daylight, Naradhan, and Hannan SB Renewals	$517,987
• Bootowa Road Pipeline	$139,917
• New Non Residential Backflow - Daylight	$116,365
• Contract (backflow)	$71,409
• GWCC RURAL	$136,448

It will be expected that additional Mt Daylight data will become available for the 2020/21 DWMS report with the recent roll out of ClearSCADA within the scheme.

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).

The work is being undertaken by contactors on behalf of Goldenfields Water. Backflow devices will be installed before the water meter and Goldenfields Water is responsible for the lifetime maintenance of the backflow device.

GWCC adopted the Backflow Prevention policy (PP06) in August 2016 and works began in May 2017. To date a total of 1347 RPZD have been installed within the GWCC area with 247 installed during the 2018/18 FY. There are currently approximately 120 installs 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

Critical Control Points

No Changes have been made to the CCP's during the 2019/20 reporting period.

Table 1. 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 2 Critical Limit Exceedances.

Table 2. Critical limit exceedances - Jugiong

Date	CCP 1	CCP 2	CCP 3	CCP 4	CCP 5	CCP 6	OCP 1	Water Quality Issue	Reason	Immediate Correction	Preventive Action
07/07/19			0.75						Analyser not working correctly	Clean and calibration	
21/07/19			0.33						Analyser issues	Clean and calibration	
12/08/19				0.15						Slowed flocculators, fluoride plant turned back on at 2pm	
20/08/19			0.65						Readings low due to plant not running for the day	Disinfection achieved readings registered low chlorine on plant start up after chlorine decay after extended periods of stagnation.	Future SCADA control systems upgrade to include a stagnated reading and calibration inhibit to eliminate incorrect CCP breach alerts
18/09/19			0.87						Analyser reading low	Clean and calibration	
05/11/19				0.83							
13/11/19							6.68		Soda Ash vibrator switched off		
07/01/20							6.98				
28/03/20			0.72						Analyser issues	Clean and calibration	
18/04/20				0.4					Low hopper		

Table 3. Critical limit exceedances - Oura

Date	CCP1	CCP2	CCP3	CCP4	Water Quality Issue	Reason	Immediate Correction	Preventative Action
21/01/20		0.70				Flow was 40 L/s less than usual	Checked for blockage and carried out drop test	Electrical and compliance officers investigating
18/02/20		0.81				Fluoride water flow fault caused plant shut down	Ran tests, swapped pumps	Monitor
20/04/20		0.26				Low water alarm shut plant down		
23/04/20		0.27					No incident Report	
23/06/20		0.29				No visible faults		

Critical Control Point Graphs

Figure 1. Jugiong water treatment plant - free chlorine.

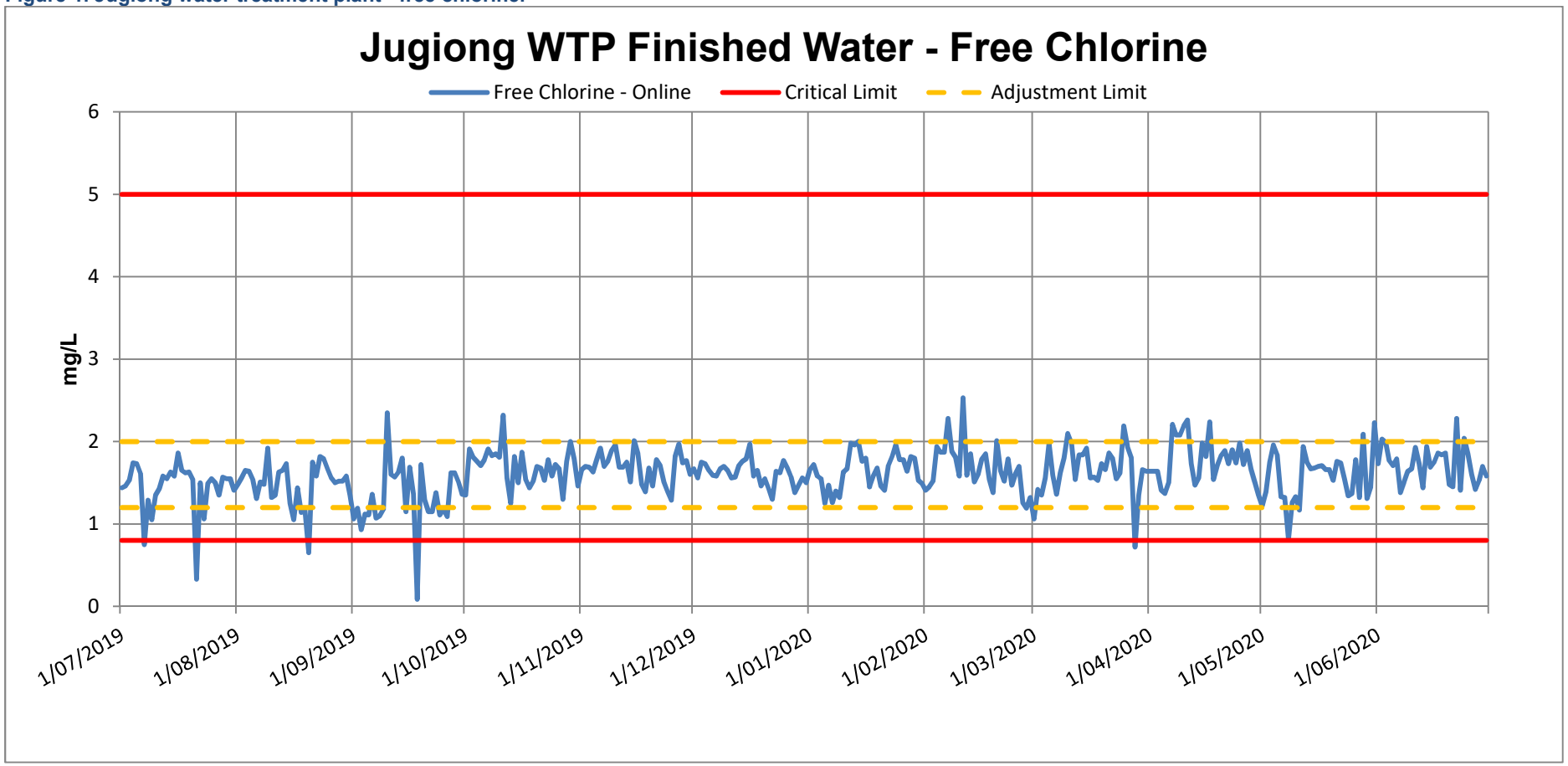


Figure 1 above is a representation of Free Chlorine in the water leaving the Jugiong Water Treatment Plant. The red lines are our Critical Control Points (CCP) for the concentration of chlorine in the water and the orange lines are our Operational control points. As is indicated above, GWCC is consistently within the CCP throughout the year with the exception of 4 exceedances. These exceedances are explained in Table 2 above, Critical Limit exceedances.

Figure 2. Jugiong water treatment plant - finished fluoride.

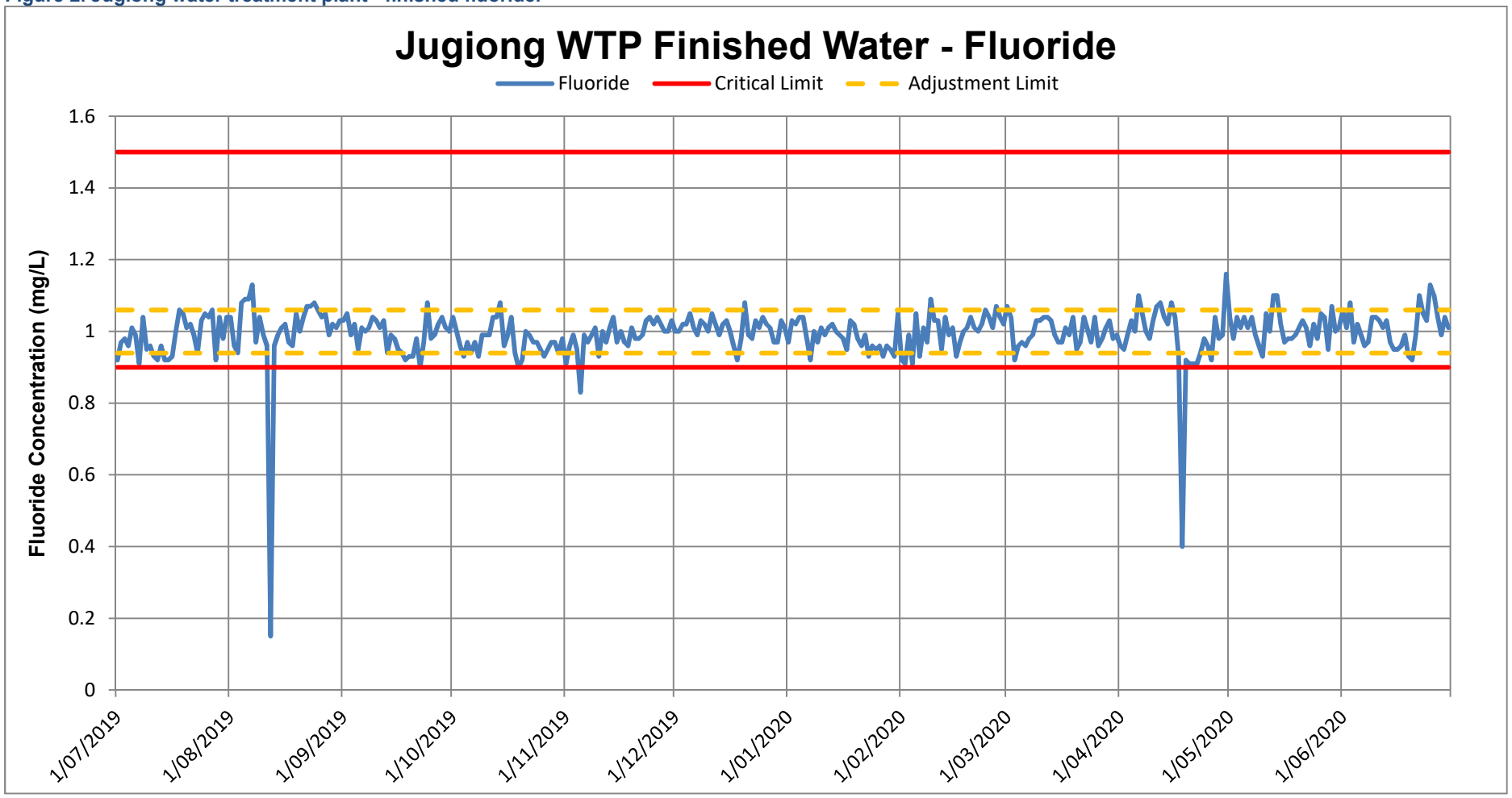


Figure 2 is a representation of the Finished Water Fluoride in the water leaving the Jugiong Water Treatment Plant. The red lines are our Critical Control Points (CCP) limits for the concentration of Fluoride in the water and the orange lines are our Operational control points. As is indicated above, GWCC is consistently within the CCP throughout the year with the exception of 3 exceedances as indicated above. These exceedances are explained in Table 2 above, Critical Limit exceedances.

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

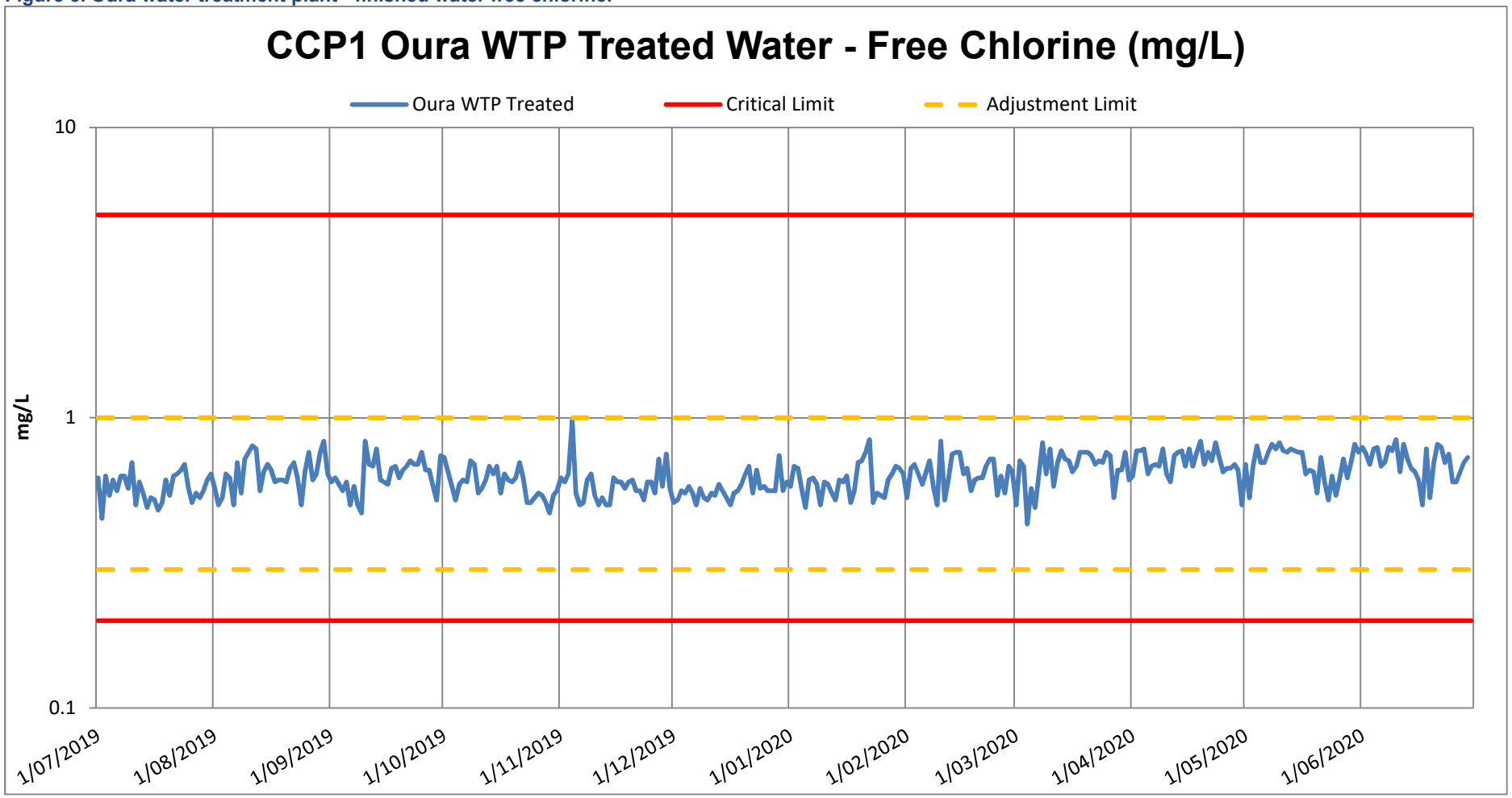


Figure 3 above is a representation of Free Chlorine in the water leaving the Oura Water Treatment Plant which employs a logarithmic scale on vertical axis. The red lines are our Critical Control Points (CCP) for the concentration of chlorine in the water and the orange lines are our Operational control points. As is indicated above, GWCC is consistently within the CCP throughout the year with no exceedances. However, there does exist data missing on days throughout the 2019/20 financial year.

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

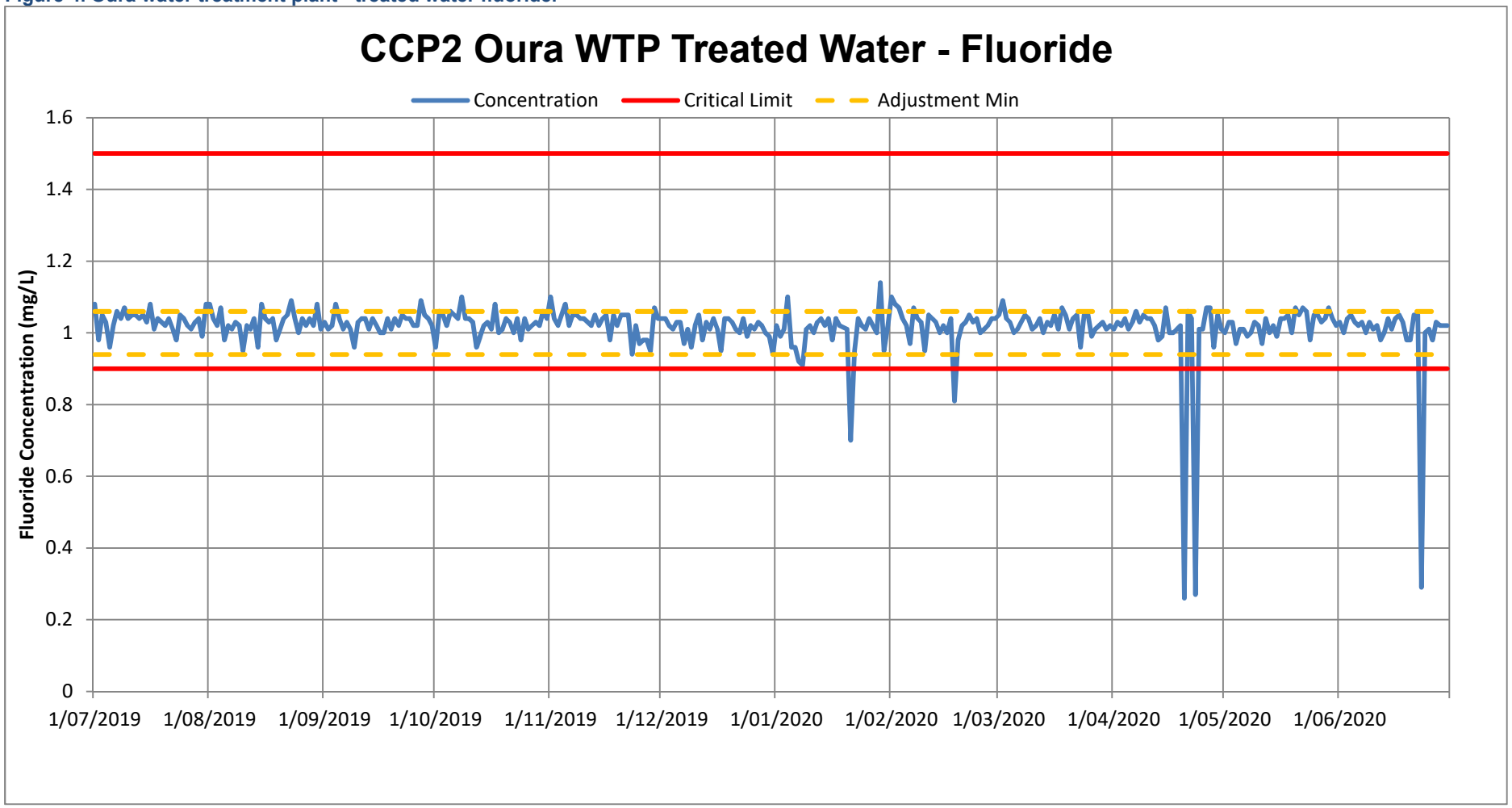


Figure 4 above is a representation of the Finished Water Fluoride in the water leaving the Oura Water Treatment Plant. The red lines are our Critical Control Points (CCP) limits for the concentration of Fluoride in the water and the orange lines are our Operational control points. As is indicated above, GWCC is consistently within the CCP throughout the year with the exception of the 5 exceedances as indicated above. These exceedances are explained in Table 3 above, Critical Limit Exceedances.

Fluoride Critical Limit exceedance

See Table 2. Critical limit exceedances - Jugiong and Table 3. Critical limit exceedances - Oura.

Table 4. Fluoride critical limit exceedances – Summary all results in (mg/L)

Date	Scheme	Recorded Concentration	Amount Exceeded By
12/08/2019	Oura	0.15	-0.75
05/11/2019	Oura	0.83	-0.07
21/01/2020	Jugiong	0.70	-0.20
18/02/2020	Jugiong	0.81	-0.09
18/04/2020	Oura	0.40	-0.50
20/04/2020	Jugiong	0.26	-0.64
23/04/2020	Jugiong	0.27	-0.63
23/06/2020	Jugiong	0.29	-0.61

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 and/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 and/or tested 'in-house' by GWCC Water Quality staff.

The drinking water is also tested throughout the period for chemicals which may be present in the water, a total of 168 water samples were carried out during the reporting period, and all were tested by NSW Health's FASS laboratory.

GWCC also undertake pesticide sampling of the drinking water across the entire scheme. These samples are tested by a NATA accredited laboratory for the 2019/20 FY a total of 10 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, as samples were tested last FY, no samples were tested for radiological characteristics during the 2019/20 FY. All bores will be tested in the 2020/21 FY for radiological characteristics and 2021/22 for surface water.

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 4149 chlorine test were conducted onsite throughout the year with hardcopy and softcopy results kept on file. These tests include both Total and Free chlorine. A running spreadsheet of results is constantly updated by office staff once data is received by the distribution staff and is now located in GWCC new database Content Manager (doc 18/1344). Water outlook was rolled out to the distribution staff during this reporting period to upload the results of the

chlorine tests via mobile platforms. Since this implementation of WaterOutlook to staff, there has been 2111 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. There was only 1 non-compliant sample taken during the reporting period, this was at Brawlin reservoir in the Jugiong supply system. A routine sample indicated the presence of E.coli, it was found that the manual chlorine dosing system had failed. To remedy the situation manual dosing of the reservoir and flushing of the mains was undertaken until a chlorine residual of at least 0.3mg/l was maintained at the furthest point from the reservoir.

Table 5. Micro sampling summary

Microorganisms Summary					
Tests conducted	**Tested by Pathology**	**Non-compliant samples**	**Tested In House**	**Non-compliant samples**	**(Total)**
Jugiong	78	0	208	1	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	0	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 6. 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	72	See table 7	14	See list below Some samples are Non-Compliant for more than 1 parameter

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 72 comprehensive chemical samples for our treated water and 93 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** – 33 raw water samples were taken from the duty bore each month and 27 Treated water samples taken from the distribution system.
- **Jugiong** – 15 raw water samples taken from the Murrumbidgee River and 15 Treated water samples were taken from the distribution system. A series of operational samples has also been taken from the Jugiong Water Treatment Plant at different stages of the treatment process throughout the year. A total of 21 samples were taken during this period.
- **Mt Daylight** – Raw water samples were taken from the duty bore each month a total of 21 samples for the reporting period 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 24 samples for the reporting period and 7 Treated water samples taken from the distribution system.

Table 7. Breakdown of number of samples with parameters exceeding ADWG values – Treated Water only.

Site	Indicator Non-Compliant							
	Aluminium	Iron	Manganese	Colour	Turbidity	pH	Fluoride	Lead
Distribution – Oura Scheme						6		
Distribution – Jugiong Scheme		1	1				2	
Distribution – Mt Arthur Scheme		2	1		1			

Note: Only shows treated water samples taken from the distribution systems.

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 78 samples were taken during the reporting period from a combination of Oura Bores, Mt Arthur Bores and Mt Daylight bores.

Chlorine Distribution Summary

Table 8 below

Table 8. GWCC entire distribution system chlorine management

Chlorine Distribution System Monitoring	in Situ test results from Chlorine spreadsheet	in Situ test results for Chlorine - Water Outlook
Entire Scheme	2038	2111

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 9 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 9. Results of radiological sampling

Date	Sample Description	Gross Alpha	Gross Beta
19/11/2018	Oura Bore 4	<0.03	0.03
	Oura Bore 3	<0.03	<0.03
	Matong Bore 2	0.3	0.12
	Daylight Pump 1	0.12	0.16
	daylight Pump 2	0.19	0.18

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 a 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.

Table 10. 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 11. 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

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.

Non-compliant data

Operational monitoring indicates there have been some incidences of high pH and low residual chlorine in the extremities of the Oura, Mt Daylight and Mt Arthur drinking water schemes. Results are indicated in Table 12 below.

Table 12. Summary of non-compliant water quality data from operational monitoring

Date	Location	Parameter	Exceedance	Correction	Preventive action	Notes
Jugiong Scheme						
14/11, 14/1, 3/3, 10/3, 17/3, 25/3, 31/3, 7/4, 15/4, 21/4, 28/4, 29/4. 5/5, 11/5, 18/5, 26/5, 28/5, 9/6, 30/6	Young Storage Outlet	Free Cl	0.07, 0.02, 0.03, 0.17, 0.09, 0.02, 0.14, 0.02, 0.04, 0.02, 0.07, 0.04, 0.02, 0.06, 0.02, 0.07, 0.00, 0.02, 0.14 (mg/L)	Manually Dose	Future SLA's to deal with this risk and issues with Hilltops.	GWCC cannot maintain residuals in this storage reservoir during low demand periods as Hilltops requires higher levels of storage to maintain their reticulation pressures.
1/4, 1/5	Harden Town offtake	Free Cl	0.02, 0.02 (mg/L)	Manually Dose harden Town res	Extra Monitoring Upstream	Renewal of Rosehill pipeline to occur in 2021 will remove a lot of chlorine demand.
14/1, 4/3, 15/4, 21/4, 5/5, 12/5, 28/5	Cowangs reservoir	Free Cl	0.04, 0.18 0.18, 0.18 0.14, 0.15 0.17 (mg/L)	Manual Dose	Chlorine booster station to be installed at	There is a chlorine booster station at

Date	Location	Parameter	Exceedance	Correction	Preventive action	Notes
					Rosehill Pump Station	Turners Lane to correct this issue with supply to Cootamundra
17/12, 14/1, 6/2, 4/3, 1/4, 28/4	New Horizon Gundagai Rd	Free Cl	0.02, 0.02 0.02, 0.02 0.02, 0.02	Manual Dose upstream	Investigate additional sodium CL2 options for maintaining residuals at extremities of system.	
6/2	New Horizons Gundagai Rd	Coliforms E. coli	6 cfu/100mL 1 cfu/100mL	Reservoirs upstream were dosed with liquid Chlorine and lines flushed to draw chlorinated water through pipes	Investigate additional sodium CL2 options for maintaining residuals at extremities of system.	
18/9, 6/2, 1/4, 28/4, 20/5	Stockinbingal Bowling Club	Free Cl	0.20, 0.02 0.09, 0.02 0.02 (mg/L)	Manual Dose	Monitor Cl in Distribution System	
14/1, 6/2, 3/3, 10/3, 17/3, 24/3, 1/4, 7/4, 15/4, 21/4, 28/4, 28/4, 5/5, 18/5, 26/5, 2/6, 9/6	Bauloora Res	Free Cl	0.05, 0.17 0.15, 0.11 0.1, 0.18 0.13, 0.04 0.02, 0.12 0.06, 0.20 0.04, 0.02 0.04, 0.20 0.07 (mg/L)	Manual Dose	Monitor Cl in Distribution system	Large storage reservoir site, works to investigate better turnover.
14/1, 6/2, 3/3, 10/3, 17/3, 24/3, 31/3, 1/4, 7/4, 15/4, 21/4, 28/4, 28/4, 5/5, 12/5, 20/5, 26/5, 22/6, 30/6	Dirnaseer reservoir	Free Cl	0.14, 0.16 0.1, 0.02 0.02, 0.12 0.13, 0.2 0.02, 0.02 0.10, 0.02 0.03, 0.17 0.08, 0.13 0.02, 0.18 0.02 (mg/L)	Manual Dose	Monitor Cl in Distribution system	Investigate additional sodium CL2 options for maintaining residuals at extremities of system.
6/2	Wallendbeen Roundabout	Free Cl	0.17	Manual Dose Upstream	Monitor Cl distribution	
21/8, 18/9, 14/11, 17/12, 23/1, 14/1, 6/2, 4/3, 1/4, 28/4, 27/5	Town offtake Springdale	Free Cl pH	0.16, 0.17 0.02, 0.02 0.02, 0.02 0.02, 0.02 0.02, 0.02	Manual dose	Monitor cl in Distribution system	Near the end of the line for the Jugiong system, little demand with

Date	Location	Parameter	Exceedance	Correction	Preventive action	Notes
			0.10 (mg/L) 8.62			large volume of water stored within pipe network.
14/1, 6/2	Town offtake Springdale	Coliforms	7, 1 (cfu/100mL)	Retest	Better sample techniques	
28/4 27/5	Wallendbeen School	Free Cl pH	0.02 mg/L 8.51	Manual Dose Upstream	Monitor Cl in distribution	
10/3, 15/4, 21/4, 28/4, 20/5, 2/6	Rosehill Pump Station	Free Cl	0.08, 0.11 0.06, 0.18 0.12, 0.20 (mg/L)	Manual Dose	Monitor Cl in distribution. Future dosing system to be installed at Rosehill pump station	
17/3, 25/3, 15/4, 28/4, 5/5, 18/5, 26/5, 9/6, 22/6, 30/6	Wallendbeen Res	Free Cl	0.02, 0.12 0.06, 0.1 0.02, 0.02 0.02, 0.05 0.08, 0.02 (mg/L)	Manual Dose	Monitor Cl in distribution	
3/3, 10/3, 17/3, 31/3, 7/4, 15/4, 21/4, 28/4, 12/5, 18/5, 26/5, 16/6, 22/6, 30/6	Brawlin Res	Free Cl	0.02, 0.06 0.02, 0.2 0.02, 0.02 0.02, 0.02 0.2, 0.11 0.02, 0.02 0.03, 0.08 (mg/L)	Manual Dose	Monitor Cl in distribution	Investigate additional sodium CL2 options for maintaining residuals at extremities of system.
3/3, 7/4, 15/4, 21/4, 28/4, 12/5, 9/6	Frampton Res	Free Cl	0.18, 0.18 0.04, 0.09 0.04, 0.07 0.18 (mg/L)	Manual Dose	Monitor Cl in distribution	
3/3, 10/3, 17/3, 31/3, 7/4, 15/4, 21/4, 28/4, 5/5, 12/5, 18/5, 26/5, 22/6, 29/6	Stockinbingal Res	Free Cl	0.02, 0.02 0.02, 0.02 0.01, 0.02 0.02, 0.02 0.03, 0.06 0.02, 0.02 0.03, 0.04 (mg/L)	Manual Dose	Monitor Cl in distribution	
Oura Scheme						
16/12 21/5, 17/6	Tara Pump Station Discharge	Free Cl pH	0.02 mg/L 8.88, 8.6	Manual Dose	Monitor Distribution System	
21/5	Ariah Park Res	pH	8.56			
12/9 15/8	Wellmans St, Ariah Park	Free Cl pH	0.11 9.31			
15/8, 12/9, 21/5	Beckom Hotel	pH	8.7, 8.66, 8.51			

Date	Location	Parameter	Exceedance	Correction	Preventive action	Notes
17/7, 15/8, 12/9, 21/5, 17/6	Ardlethan	pH	8.6, 8.6, 8.68, 8.56, 8.68		Mains Flushing/ Cleaning, pH correction	
4/12, 29/1, 26/2, 26/3 21/5, 17/6 26/3	Barellan Res	Free Cl pH Coliforms	0.1, 0.07, 0.14, 0.13 8.68, 8.66 1			
20/3, 4/7, 4/7, 17/12, 4/7, 4/7 4/7, 30/7, 3/6	Temora	Free Cl pH	0.12, 0.18, 0.16, 0.14, 0.11, 0.16 8.53, 8.64, 8.51			
17/7, 23/4, 3/6	Marrer	Free Cl	0.03, 0.02, 0.15			
8/4	Junee Public School	Free Cl	0.18			
4/7, 31/10, 21/11, 17/12, 11/2, 19/3 4/7, 8/4, 3/6	Illabo Hotel	Free Cl pH	0.18, 0.02, 0.02, 0.18, 0.02, 0.12 8.53, 8.7, 8.61	Manual Dose	Monitor Distribution	
4/7. 21/1, 19/3	Wantabadgery	Free Cl	0.16, 0.17, 0.17	Manual Dose	Monitor Distribution	
12/9, 17/6	Central School, Ariah Park	pH	8.72, 8.64			
17/7, 22/4	Ariah Park Golf Club	pH	8.6, 8.6		Flushing, pH correction	
21/1, 3/6	Bethungra	Free Cl	0.19, 0.14	Manual Dose	Monitor Distribution	
10/7, 8/8	Barmedman Park	pH	8.79, 8.77		Mains Flushing/ Cleaning, pH correction	
14/8, 23/5, 12/6	Wyalong Pump Station Meter	pH	8.77, 8.84, 8.53, 8.61		Mains Flushing/ Cleaning, pH correction	
10/7, 8/8, 18/2, 15/4, 13/5	Wyalong School, George Bland Ave	pH	8.87, 8.85, 8.61, 8.6, 8.66		Mains Flushing, pH correction	
10/7, 8/8, 4/9, 18/2, 15/4, 13/5	Perseverance St west Wyalong	pH	8.95, 8.8, 8.55, 8.68, 8.62, 8.7		Mains Flushing, pH correction	
10/7, 8/8, 18/2, 13/5	West Wyalong Public School	pH	8.8, 8.92, 8.59, 8.62		Mains Flushing/ Cleaning, pH correction	Near end of the line of Oura
10/7, 8/8, 18/2 11/5	West Wyalong Terminal Storage	pH Free Cl	8.68, 8.81, 8.59 0.13		Mains Flushing, pH correction	Near end of line of Oura

Date	Location	Parameter	Exceedance	Correction	Preventive action	Notes
10/7, 8/8. 4/9, 18/2, 18/3, 15/4, 13/5 22/1, 15/4	Calleen reservoir Outlet	pH Free Cl	9.06, 9.1, 8.78, 8.61, 8.61, 8.7, 8.67 0.14, 0.06		Mains Flushing/ Cleaning, pH correction	Near end of line of the Oura system
10/7, 8/8, 4/9, 22/1, 18/2, 18/3, 15/4 22/1, 18/3, 15/4 10/6	Ungarie town res	pH Free Cl Turbidity	9.22, 9.25, 8.83, 8.64, 8.75, 8.78, 8.84 0.11. 0.10, 0.16 37		Mains Flushing/ Cleaning, pH correction	Ungarie is the end of a long distribution system
4/9, 18/3 18/3	Bing Waller Park, Ungarie	pH Free Cl	8.98, 8.83 0.1		Mains Flushing, pH correction	End of a long system
10/7, 8/8, 23/10, 22/1, 18/2, 15/4, 13/5 22/1, 18/2, 15/4	Ungarie central School	pH Free Cl	9.32, 9.28, 8.63, 8.60, 8.75, 8.80, 8.90 0.11, 0.17, 0.12		Mains Flushing/ Cleaning, pH correction	End of a long system
14/4, 17/4, 4/5, 3/6	Temora East res	Free Cl	0.17, 0.07, 0.16, 0.02			Water can be from either Oura or Jugiong or both (end of Jugiong scheme)
Mt Arthur Scheme						
15/1, 4/2, 5/2, 6/2, 11/2, 23/3, 26/3, 22/4, 7/5 7/2, 12/2, 13/2, 14/2, 18/2, 17/6	Matong School	Free Cl pH	0.14, 0.06, 0.05, 0.15, 0.05, 0.18, 0.12, 0.14, 0.14 8.68. 8.7. 8.68. 8.76. 8.59, 8.59	Manual Dose	Monitor	
4/12, 29/1, 12/6 6/2	Coolamon	Free Cl pH	0.18, 0.03, 0.13 8.98	Manual Dose	Monitor	
17/7, 12/9, 5/11, 4/12, 15/1, 25/2, 4/2, 11/2, 12/2, 13/2, 26/2, 14/2, 19/2, 20/2, 24/2, 27/3, 31/3, 26/3, 8/4, 22/4, 21/5, 17/6, 29/6	Grong Grong	Free Cl	0.02mg/L – 0.13mg/L	Manual Dose	Monitor	
27/3, 31/3, 7/5, 29/6	Matong Public Toilets	Free Cl	0.02, 0.02, 0.12, 0.11	Manual Dose	Monitor	

Date	Location	Parameter	Exceedance	Correction	Preventive action	Notes
23/3, 27/3, 31/3, 8/4, 23/4, 7/5, 29/6	Grong Grong Res	Free Cl	0.02, 0.13, 0.16, 0.02, 0.02, 0.04, 0.04			
30/1, 4/2, 5/2, 7/2, 11/2, 12/2, 13/2, 14/2, 18/2, 19/2, 20/2	Coolamon South Res	Free Cl	0.17, 0.11 0.05, 0.02 0.02, 0.02 0.02, 0.02 0.02, 0.02 0.03	Manual dose	Monitor distribution	
5/2, 7/2, 11/2, 12/2, 13/2, 14/2, 18/2, 19/2, 20/2		pH	8.79, 8.96 9.04, 8.98 9.07, 9.0 8.98, 9.12 8.91			
Mt Daylight Scheme						
13/2, 18/3, 15/4, 16/4, 15/4	Hannan Res	Free Cl	0.02, 0.19, 0.1, 0.08, 0.10	Manual Dose	Monitor	
13/3, 23/4, 5/6	Naradhan res Outlet	Free Cl	0.02, 0.17, 0.11	Manual Dose	Monitor	
23/19, 11/12, 18/2, 15/4, 16/4, 10/6, 22/6	North Weethalle Res	Free Cl	0.16, 0.02, 0.14, 0.02, 0.16, 0.18, 0.08	Manual Dose	Monitor	
8/8, 23/10, 22/1, 18/2, 18/3, 15/4, 10/6, 22/6	Russell trading Weethalle	Free Cl	0.15, 0.07, 0.11, 0.04, 0.14, 0.02, 0.19, 0.15	Manual Dose	Monitor	
15/4	Russell trading Weethalle	Coliforms	2 cfu/100mL	Flushing	Maintain higher chlorine residuals	
18/2, 16/4, 27/4	Nariah Res	Free Cl	0.02, 0.09, 0.17	Manual Dose	Monitor	
27/4, 19/5, 19/6, 10/7, 11/12, 15/4, 13/5, 27/11, 18/3	Tallimba	Free Cl	0.14, 0.16, 0.08, 0.12, 0.11, 0.02, 0.02, 0.05, 0.11	Manual Dose	Monitor	
20/4, 27/4, 5/6, 22/6	Nobbies Res	Free Cl	0.13, 0.15, 0.17, 0.18	Manual Dose	Monitor	
16/4, 8/5, 19/6, 22/6	Weethalle Res	Free Cl	0.08, 0.11, 0.18, 0.11	Manual Dose	Monitor	
11/5	Ungarie Rural	Free Cl	0.09	Manual Dose	Monitor	

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 168 water samples were collected and tested for chemicals during the reporting period all were tested by NSW Health FASS Lab, 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 test are conducted routinely by the distribution staff and a total of 4149 chlorine test were conducted onsite. These tests include both Total and Free chlorine. A running spreadsheet of results is constantly updated by office staff once data is received by the distribution staff and is now located in GWCC new database Content Manager (doc 18/1344). *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.

Customer Complaints

Table 13. Customer complaints registered in the 2019/20 reporting period.

Month	Total Complaints	Discoloured Water	Odour Related	Taste Related	No Water	Air in System	No Category
Jul-19	8	8	0	0	0	0	0
Aug-19	1	1	0	0	0	0	0
Sep-19	23	23	0	0	0	0	0
Oct-19	12	12	0	0	0	0	0
Nov-19	4	3	0	1	0	0	0
Dec-19	14	14	0	0	0	0	0
Jan-20	9	8	1	0	0	0	0
Feb-20	7	7	0	0	0	0	0
Mar-20	4	4	0	0	0	0	0
Apr-20	7	6	0	0	0	1	0
May-20	5	5	0	0	0	0	0
Jun-20	3	3	0	0	0	0	0

There was a total of 97 complaints made during the reporting period 19/20. The majority of complaints that were made pertained to dirty or discoloured water totalling 94. These complaints allowed staff to determine that certain areas in the Coolamon and Junee townships required attention and from this GWCC has had reservoirs cleaned and dead ends flushed on numerous occasions. GWCC also conducted a study into the Mt Arthur system and related townships to better handle the issue causing customer complaints. It has also allowed GWCC to alleviate the dirty water by eliminating dead ends in certain areas.

GWCC has also 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 (accumulated results at time during flushing), 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 practically 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 14. Summary of incidents and emergencies, recommendations and preventative actions

Details of Incident/Emergency	Investigation Recommendations	Preventive Action Undertaken
Detection of E.coli in an operational micro sample from "New Horizons" in the Jugiong scheme	- *Conduct follow up sample* - *Chlorinate reservoir directly upstream and push chlorinated water through the system*	- *Increase monitoring of chlorine in the system* - *Continual monitoring of water downstream of reservoir in question*

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 15 below indicates all of the training that GWCC staff have undertaken during the reporting period of 2019/20.

Table 15. Full list of staff training for the 2019/20 reporting period.

Name	Course	Date Conducted
Barry Shepherd	Provide First Aid	17/12/2019
Aaron Burnett	Provide First Aid	17/12/2019
James Carr	Provide First Aid	17/12/2019
Justin Kerry	Provide First Aid	17/12/2019
Nigel Marion	Provide First Aid	17/12/2019
Mark New	Provide First Aid	17/12/2019
Liam Welch	Provide First Aid	17/12/2019
Sean Tiernan	Provide First Aid	31/6/2020
Dilrosh Jayawardene	Provide First Aid	31/6/2020
Brendon Ford	Provide First Aid	31/6/2020
Michael Diggins	Provide First Aid	31/6/2020
Andrew Derrick	Provide First Aid	31/6/2020
Matthew Cooper	Provide First Aid	31/6/2020
Rhys Collins	Provide First Aid	31/6/2020
Annie Coleman	Provide First Aid	31/6/2020
Matthew Bett	Provide First Aid	31/6/2020

Ian Basham	Provide First Aid	31/6/2020
Liam Welch	AQF3	25/06/2020
Rob Drummond	First Aid	2/03/2019
Michael Annetts	First Aid	2/03/2019
Tony Corby	First Aid	2/03/2019
Stephen Ledgard	First Aid	2/03/2019
Hannah Gillard	First Aid	2/03/2019
Michael Lewis	First Aid	8/06/2019
Steve Reardon	First Aid	8/06/2019
Andrew Ronning	First Aid	8/06/2019
Shane Hartshorn	First Aid	8/06/2019
Jack Stuart	First Aid	8/06/2019
Shane Baldry	First Aid	8/06/2019
Jack Fuller	First Aid	8/06/2019
Zane Cronk	First Aid	8/06/2019
Adam Ryall	First Aid	8/06/2019
Emma McAuley	First Aid	8/06/2019
Kathryn Lowe	First Aid	8/06/2019
Chris Fealy	First Aid	19/06/2019
Chris Scott	First Aid	19/06/2019
Luke Townsend	First Aid	19/06/2019
Daniel Flack	First Aid	19/06/2019
Shane Barrett	First Aid	19/06/2019
Rod Ryan	First Aid	19/06/2019
Blake Hingerty	First Aid	19/06/2019
Chris Breen	First Aid	19/06/2019
Mike Read	First Aid	19/06/2019
Paul Goesch	First Aid	19/06/2019
Brady Gilchrist	First Aid	19/06/2019
Robin Davis	First Aid	26/07/2019
Nicol Kelly	First Aid	26/07/2019
James Butler	First Aid	27/09/2019
Liam Welch	First Aid	17/12/2019
Barry Shepherd	First Aid	17/12/2019
James Carr	First Aid	17/12/2019
Mark New	First Aid	17/12/2019
Justin Kerry	First Aid	17/12/2019
Aaron Burnett	First Aid	17/12/2019
Nigel Marion	First Aid	17/12/2019
George Basham	First Aid	30/06/2020

Andrew Derrick	First Aid	30/06/2020
Matthew Cooper	First Aid	30/06/2020
Sean Tiernan	First Aid	30/06/2020
Michael Diggins	First Aid	30/06/2020
Matthew Bett	First Aid	30/06/2020
Dilrosh Jayawardene	First Aid	30/06/2020
Rhys Collins	First Aid	30/06/2020
Brendon Ford	First Aid	30/06/2020
Annie Coleman	First Aid	30/06/2020
Andrew Haley	Administering a SQL database infrastructure	28/07/2019
Annie Coleman	Code of Conduct for Staff	Jul-19
Andrew Derrick	Code of Conduct for Staff	Jul-19
Aaron Drenovski	Code of Conduct for Staff	Jul-19
Tony Goodyer	Code of Conduct for Staff	Jul-19
Andrew Haley	Code of Conduct for Staff	Jul-19
Andrew Ronning	Code of Conduct for Staff	Jul-19
Adam Ryall	Code of Conduct for Staff	Jul-19
Ali Wood	Code of Conduct for Staff	Jul-19
Breah Coleman	Code of Conduct for Staff	Jul-19
Brendon Ford	Code of Conduct for Staff	Jul-19
Brady Gilchrist	Code of Conduct for Staff	Jul-19
Blake Hingerty	Code of Conduct for Staff	Jul-19
Barry Shepherd	Code of Conduct for Staff	Jul-19
Chris Breen	Code of Conduct for Staff	Jul-19
Chris Fealy	Code of Conduct for Staff	Jul-19
Daniel Flack	Code of Conduct for Staff	Jul-19
Dilrosh Jayawardene	Code of Conduct for Staff	Jul-19
Emma McAuley	Code of Conduct for Staff	Jul-19
Eleni McCabe	Code of Conduct for Staff	Jul-19
Hannah Gillard	Code of Conduct for Staff	Jul-19
Hannah Maguire	Code of Conduct for Staff	Jul-19
Ian Basham	Code of Conduct for Staff	Jul-19
Jake Barrett	Code of Conduct for Staff	Jul-19
James Butler	Code of Conduct for Staff	Jul-19
Jack Fuller	Code of Conduct for Staff	Jul-19
Jamie Gordon	Code of Conduct for Staff	Jul-19
Jack Stuart	Code of Conduct for Staff	Jul-19
Kevin Barlow	Code of Conduct for Staff	Jul-19
Kate Lowe	Code of Conduct for Staff	Jul-19

Lyn Breust	Code of Conduct for Staff	Jul-19
Les Scott	Code of Conduct for Staff	Jul-19
Luke Townsend	Code of Conduct for Staff	Jul-19
Liam Welch	Code of Conduct for Staff	Jul-19
Mick Annetts	Code of Conduct for Staff	Jul-19
Matt Bett	Code of Conduct for Staff	Jul-19
Mick Diggins	Code of Conduct for Staff	Jul-19
Michele Curran	Code of Conduct for Staff	Jul-19
Mike Read	Code of Conduct for Staff	Jul-19
Mick Lewis	Code of Conduct for Staff	Jul-19
Myrka Robichaud	Code of Conduct for Staff	Jul-19
Nicol Kelly	Code of Conduct for Staff	Jul-19
Nigel Marion	Code of Conduct for Staff	Jul-19
Paul Goesch	Code of Conduct for Staff	Jul-19
Robert Barrett	Code of Conduct for Staff	Jul-19
Rhys Collins	Code of Conduct for Staff	Jul-19
Robin Davis	Code of Conduct for Staff	Jul-19
Robert Drummond	Code of Conduct for Staff	Jul-19
Rod Ryan	Code of Conduct for Staff	Jul-19
Shane Baldry	Code of Conduct for Staff	Jul-19
Shane Barrett	Code of Conduct for Staff	Jul-19
Simone Fouracre	Code of Conduct for Staff	Jul-19
Shane Hartshorn	Code of Conduct for Staff	Jul-19
Stephen Ledgard	Code of Conduct for Staff	Jul-19
Tony Corby	Code of Conduct for Staff	Jul-19
Zane Cronk	Code of Conduct for Staff	Jul-19
Zac Mahon	Code of Conduct for Staff	Jul-19
Sean Tiernan	Risk Management	10/09/2019
Andrew Derrick	Risk Management	10/09/2019
Chris Fealy	Risk Management	10/09/2019
Barry Shepherd	Risk Management	10/09/2019
Shane Hartshorn	Risk Management	10/09/2019
Mick Diggins	Risk Management	10/09/2019
Jack Stuart	Risk Management	10/09/2019
Liam Welch	Risk Management	10/09/2019
Shane Baldry	Risk Management	10/09/2019
Chris Breen	Risk Management	10/09/2019
Zane Cronk	Risk Management	10/09/2019
Blake Hingerty	Risk Management	10/09/2019

James Butler	Risk Management	10/09/2019
Rhys Collins	Risk Management	10/09/2019
Steve Ledgard	Risk Management	10/09/2019
Mike Read	Risk Management	10/09/2019
Gerard Carr	Risk Management	10/09/2019
Kate Lowe	Risk Management	10/09/2019
Eleni McCabe	Risk Management	10/09/2019
Hannah Maguire	Risk Management	10/09/2019
Sean Tiernan	Incident Reporting and Investigation	10/09/2019
Andrew Derrick	Incident Reporting and Investigation	10/09/2019
Chris Fealy	Incident Reporting and Investigation	10/09/2019
Barry Shepherd	Incident Reporting and Investigation	10/09/2019
Shane Hartshorn	Incident Reporting and Investigation	10/09/2019
Mick Diggins	Incident Reporting and Investigation	10/09/2019
Jack Stuart	Incident Reporting and Investigation	10/09/2019
Liam Welch	Incident Reporting and Investigation	10/09/2019
Chris Breen	Incident Reporting and Investigation	10/09/2019
Zane Cronk	Incident Reporting and Investigation	10/09/2019
Blake Hingerty	Incident Reporting and Investigation	10/09/2019
James Butler	Incident Reporting and Investigation	10/09/2019
Rhys Collins	Incident Reporting and Investigation	10/09/2019
Steve Ledgard	Incident Reporting and Investigation	10/09/2019
Mike Read	Incident Reporting and Investigation	10/09/2019
Gerard Carr	Incident Reporting and Investigation	10/09/2019
Kate Lowe	Incident Reporting and Investigation	10/09/2019
Eleni McCabe	Incident Reporting and Investigation	10/09/2019
Hannah Maguire	Incident Reporting and Investigation	10/09/2019
Aaron Drenovski	Incident Reporting and Investigation	10/09/2019
George Basham	Risk Management	11/09/2019
Micheal Lewis	Risk Management	11/09/2019
Rod Drummond	Risk Management	11/09/2019
Steve Reardon	Risk Management	11/09/2019
Andrew Ronning	Risk Management	11/09/2019
Shane Barrett	Risk Management	11/09/2019
Chris Scott	Risk Management	11/09/2019
Daniel Flack	Risk Management	11/09/2019
Mark New	Risk Management	11/09/2019
Matt Bett	Risk Management	11/09/2019
Rod Ryan	Risk Management	11/09/2019
Jack Fuller	Risk Management	11/09/2019

Brendon Ford	Risk Management	11/09/2019
Paul Goesch	Risk Management	11/09/2019
Nigel Marion	Risk Management	11/09/2019
Jamie Gordon	Risk Management	11/09/2019
Lyn Breust	Risk Management	11/09/2019
Hannah Gillard	Risk Management	11/09/2019
Zac Mahon	Risk Management	11/09/2019
Aaron Drenovski	Risk Management	11/09/2019
Emma McAuley	Risk Management	11/09/2019
George Basham	Incident Reporting and Investigation	11/09/2019
Micheal Lewis	Incident Reporting and Investigation	11/09/2019
Rod Drummond	Incident Reporting and Investigation	11/09/2019
Steve Reardon	Incident Reporting and Investigation	11/09/2019
Andrew Ronning	Incident Reporting and Investigation	11/09/2019
Chris Scott	Incident Reporting and Investigation	11/09/2019
Shane Barrett	Incident Reporting and Investigation	11/09/2019
Daniel Flack	Incident Reporting and Investigation	11/09/2019
Mark New	Incident Reporting and Investigation	11/09/2019
Matt Bett	Incident Reporting and Investigation	11/09/2019
Rod Ryan	Incident Reporting and Investigation	11/09/2019
Jack Fuller	Incident Reporting and Investigation	11/09/2019
Brendon Ford	Incident Reporting and Investigation	11/09/2019
Paul Goesch	Incident Reporting and Investigation	11/09/2019
Nigel Marion	Incident Reporting and Investigation	11/09/2019
Jamie Gordon	Incident Reporting and Investigation	11/09/2019
Lyn Breust	Incident Reporting and Investigation	11/09/2019
Hannah Gillard	Incident Reporting and Investigation	11/09/2019
Zac Mahon	Incident Reporting and Investigation	11/09/2019
Emma McAuley	Incident Reporting and Investigation	11/09/2019
Tony Goodyer	Risk Management	12/09/2019
Luke Townsend	Risk Management	12/09/2019
Les Scott	Risk Management	12/09/2019
Adam Ryall	Risk Management	12/09/2019
Tony Corby	Risk Management	12/09/2019
Rob Davis	Risk Management	12/09/2019
Dilrosh Jayawardene	Risk Management	12/09/2019
Myrka Robichaud	Risk Management	12/09/2019
Kevin Barlow	Risk Management	12/09/2019
Michele Curran	Risk Management	12/09/2019
Robert Barrett	Risk Management	12/09/2019

Andrew Haley	Risk Management	12/09/2019
Simone Fouracre	Risk Management	12/09/2019
Brady Gilchrist	Risk Management	12/09/2019
Annie Coleman	Risk Management	12/09/2019
Ali Wood	Risk Management	12/09/2019
Nicol Kelly	Risk Management	12/09/2019
Tony Goodyer	Incident Reporting and Investigation	12/09/2019
Luke Townsend	Incident Reporting and Investigation	12/09/2019
Les Scott	Incident Reporting and Investigation	12/09/2019
Adam Ryall	Incident Reporting and Investigation	12/09/2019
Tony Corby	Incident Reporting and Investigation	12/09/2019
Rob Davis	Incident Reporting and Investigation	12/09/2019
Dilrosh Jayawardene	Incident Reporting and Investigation	12/09/2019
Myrka Robichaud	Incident Reporting and Investigation	12/09/2019
Kevin Barlow	Incident Reporting and Investigation	12/09/2019
Michele Curran	Incident Reporting and Investigation	12/09/2019
Robert Barrett	Incident Reporting and Investigation	12/09/2019
Andrew Haley	Incident Reporting and Investigation	12/09/2019
Simone Fouracre	Incident Reporting and Investigation	12/09/2019
Brady Gilchrist	Incident Reporting and Investigation	12/09/2019
Annie Coleman	Incident Reporting and Investigation	12/09/2019
Ali Wood	Incident Reporting and Investigation	12/09/2019
Nicol Kelly	Incident Reporting and Investigation	12/09/2019
Shane Baldry	Incident Reporting and Investigation	12/09/2019
Aaron Drenovski	WHS Responsibilities for Managers and Coordinators	1/10/2019
Tony Goodyer	WHS Responsibilities for Managers and Coordinators	1/10/2019
Sean Tiernan	WHS Responsibilities for Managers and Coordinators	1/10/2019
George Basham	WHS Responsibilities for Managers and Coordinators	1/10/2019
Geoff Veneris	WHS Responsibilities for Managers and Coordinators	1/10/2019
Tony Corby	WHS Responsibilities for Managers and Coordinators	1/10/2019
Matt Bett	WHS Responsibilities for Managers and Coordinators	1/10/2019
Shane Baldry	WHS Responsibilities for Managers and Coordinators	1/10/2019
Michele Curran	WHS Responsibilities for Managers and Coordinators	1/10/2019
Gerard Carr	WHS Responsibilities for Managers and Coordinators	1/10/2019
Gerard Carr	WHS Responsibilities for Managers and Coordinators	1/10/2019
Robert Barrett	WHS Responsibilities for Managers and Coordinators	1/10/2019
Sammy Jung	WHS Responsibilities for Managers and Coordinators	1/10/2019
Nigel Marion	WHS Responsibilities for Managers and Coordinators	1/10/2019
Nicol Kelly	WHS Responsibilities for Managers and Coordinators	1/10/2019
Chris Breen	Chemical Dosing Systems Certificate	18/10/2019

Emma McAuley	Fraud Awareness	6/11/2019
Luke Townsend	Fraud Awareness	6/11/2019
Myrka Robichaud	Fraud Awareness	6/11/2019
Kevin Barlow	Fraud Awareness	6/11/2019
Rob Barrett	Fraud Awareness	6/11/2019
Hannah Gillard	Fraud Awareness	6/11/2019
Simone Fouracre	Fraud Awareness	6/11/2019
Michele Curran	Fraud Awareness	6/11/2019
Eleni McCabe	Fraud Awareness	6/11/2019
Nicol Kelly	Fraud Awareness	6/11/2019
Myrka Robichaud	Pumping Fundamentals	12/11/2019
Myrka Robichaud	Advanced Pumping	11/11/2019
James Carr	Drug & Alcohol Awareness	18/12/2019
Justin Kerry	Drug & Alcohol Awareness	18/12/2019
Jamie Gordon	Drug & Alcohol Awareness	18/12/2019
Stephen Reardon	Drug & Alcohol Awareness	18/12/2019
Matthew Cooper	Drug & Alcohol Awareness	18/12/2019
George Basham	Drug & Alcohol Awareness	18/12/2019
Chris Fealy	Drug & Alcohol Awareness	18/12/2019
Robert Barrett	Drug & Alcohol Awareness	18/12/2019
Leslie Scott	Drug & Alcohol Awareness	18/12/2019
Hannah Gillard	Drug & Alcohol Awareness	18/12/2019
Luke Townsend	Drug & Alcohol Awareness	18/12/2019
Aaron Burnett	verification of competency Excavator, skid Steer, Telehandler	Feb-20
Andrew Derrick	verification of competency Excavator, Skid Steer,	Feb-20
Andrew Ronning	verification of competency Excavator, Skid Steer,	Feb-20
Barry Shepherd	verification of competency Excavator, Skid Steer,	Feb-20
Chris Fealy	verification of competency Excavator, Skid Steer,	Feb-20
Chris Scott	verification of competency Excavator, Skid Steer,	Feb-20
Daniel Flack	verification of competency Excavator, skid Steer, Telehandler	Feb-20
George Basham	verification of competency Excavator, skid steer	Feb-20
Jack Stuart	verification of competency Excavator, skid Steer, Telehandler	Feb-20
Justin Kerry	verification of competency Excavator, skid Steer, Telehandler	Feb-20
Les Scott	verification of competency Excavator	Feb-20
Liam Welch	verification of competency Excavator, Skid Steer,	Feb-20

Luke Townsend	verification of competency Excavator, skid Steer, Telehandler	Feb-20
Matthew Cooper	verification of competency Excavator, Skid Steer,	Feb-20
Mick Annetts	verification of competency Excavator, Skid Steer,	Feb-20
Mick Diggins	verification of competency Excavator, Skid Steer,	Feb-20
Mick Lewis	verification of competency Excavator, Skid Steer,	Feb-20
Rob Drummond	verification of competency Excavator, Skid Steer,	Feb-20
Rod Ryan	verification of competency Excavator,	Feb-20
Sean Tiernan	verification of competency Excavator, Skid Steer,	Feb-20
Shane Baldry	verification of competency Excavator,	Feb-20
Shane Barrett	verification of competency Excavator, skid Steer, Telehandler	Feb-20
Shane Hartshorn	verification of competency Excavator, skid Steer,	Feb-20
Steve Reardon	verification of competency Excavator, skid Steer,	Feb-20
Zane Cronk	verification of competency Excavator	Feb-20

Continuous Improvement Plan

Table 16 below is a summary of all items in the Continuous Improvement plan that have been completed or actioned during the 2019/20 reporting period.

Table 16. Continuous improvement plan activities that have progressed, been completed or been added during the period 2019/20

Action no.	Item	Progress	Date for completion	Who is responsible
e.g. 5.2	*e.g. Review verification monitoring sites after first year to ensure sampling sites are representative*	*e.g. Sites have been reviewed. Three sample sites have been reallocated due to the expansion of the supply area.*	*Xx/xx*	*e.g. J. Smith*
1	*GWCC to consider installing an online free chlorine analyser at Oura disinfection point (after 30 min contact time).*	*Completed*	*June 2020*	*Manager Production and Services*
25	*GWCC to consider developing SOPs for chlorine testing to include manganese interference with reagent*	*Completed*	*June 2020*	*Manager Production and Services*
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*	*Completed*	*June 2020*	*Manager Engineering*
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*	*Completed*	*June 2020*	*Manager Production and Services*
32	*Develop and implement competency checklist/schedule on sampling methodology*	*Completed*	*June 2020*	*Manager Production and Services*

Action no.	Item	Progress	Date for completion	Who is responsible
33	*Implement backflow prevention program, including developing register of RPZs*	*Completed*	*June 2020*	*Manager Engineering*
34	*Develop a microbiological sampling SOP when bore head integrity has been potentially compromised (maintenance, flooding, vandalism)*	*Completed*	*June 2020*	*Manager Production and Services*
35	*Investigate options for electronic card systems on standpipes to record water carter access*	*Completed*	*June 2020*	*Manager Engineering*
36	*To complete and submit circular 18*	*Completed*	*June 2020*	*Manager Engineering*
76	*Bulk User Service Level Agreement*	*Added - In progress*		*Manager Production and Services*
77	*Complaints Management System*	*Added – In progress*	*June 2020*	*Manager Production and Services*
78	*Emergency response training*	*Added – In progress*	*June 2020*	*Manager Production and Services*
79	*Backflow Prevention*	*Added - Complete*	*June 2020*	*Manager Engineering*
80	*Water Quality reporting*	*Added – Complete*	*June 2020*	*Manager Production and Services*
81	*Drinking Water Management System review*	*Added – Closed*	*June 2020*	*Manager Production and Services*
82	*Evaluation and Audit*	*Added - Complete*	*June 2020*	*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 17. 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*

Date	Reviewer	Scope	Findings	Actions
FY 2019/20	*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 18. Summary of external reviews.

Date	Reviewer	Scope	Findings	Actions
			No external reviews have been undertaken	

Reservoir inspections

GWCC conducted regular reservoir inspections throughout the reporting period. They have a schedule for weekly 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 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 19. Summary of reservoir inspections and outcomes

Date	Reservoirs inspected	Findings	Corrective actions
28/5/20	Coolamon North HL	- The entry hatch is small for a safe diver entry or exit and there is no internal ladder present. - The CP system is slowly passivating the corrosion present on the walls, but some sections along the wall floor area are still active.	
29/5/20	Coolamon South HL	- The internal SS ladder is too short and it will not be effective if the water level drops down when a diver is inside the tank. It needs to be extended by another 5 metres to make the tank safe.	

		- The internal wall joint sealant material is either cracking or lifting off in most areas.
30/5/20	Ganmain HL	- The entry and roof hatches are unlocked. Not many people will be comfortable with climbing up and inspecting the roof area, so any hatches that blow open will go unnoticed until a water quality event occurs. - The overflow riser is heavily corroded and the outlet penetration is level with the floor, allowing sediments to enter the pipework. An HDPE safety screen with a raised base should be fitted to solve the contamination issue
30/5/20	Ganmain LL	- There is no internal ladder for self rescue within the tank. - The galvanised form work under the roof area is heavily corroded and has broken away in several areas. It needs to be established if this `left in place` form work is critical to the roof structural strength. - A hole in the centre of the roof allows roof drainage and vermin entry. It is only covered with a brick and is not sealed at all.
28/5/20	Grong Grong Town Res	- There is a handrail on the intermediate platform that obstructs easy access from one external ladder to the other. - The entry hatch is not locked and the roof hatch cover is bent on one edge from being partially forced open. - The main roof rafters are significantly corroded as the protective coating has peeled off. Some of the purlins are unsound due to corrosion steel loss.
31/5/20	Matong Pump Station	- The entry hatch internal frame is showing signs of corrosion. The mid wall area is weeping in most places and will probably become worse over time. - A directional inlet nozzle would prevent the current situation of incoming water passing directly to the outlet.
20/5/20	Oura Surge Tank	- *No data provided by Aqualift*

Appendix A – Water quality data

Water Quality Graphs

Jugiong Water Treatment Plan

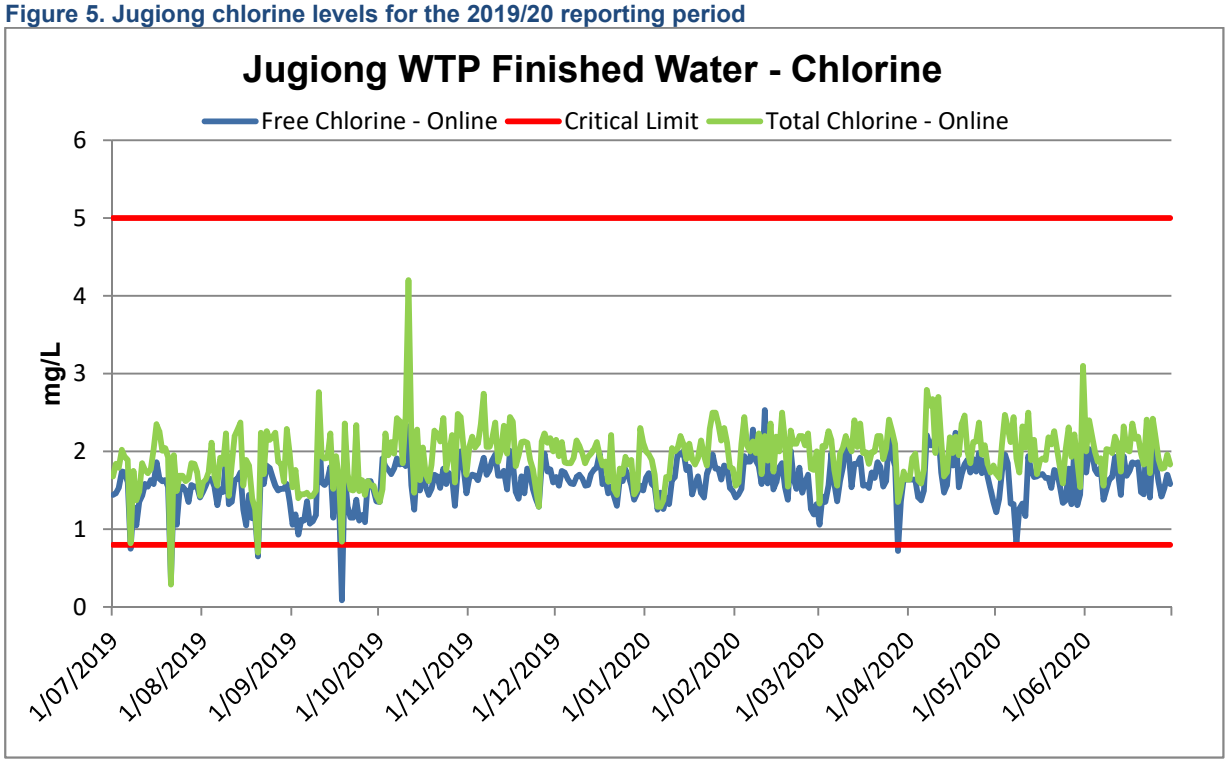
Jugiong Water Treatment Plant data has been represented in the following graphs and commentary. The following data has been taken from the new Water outlook Database that GWCC is currently building with an external party, Safegroup.

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.

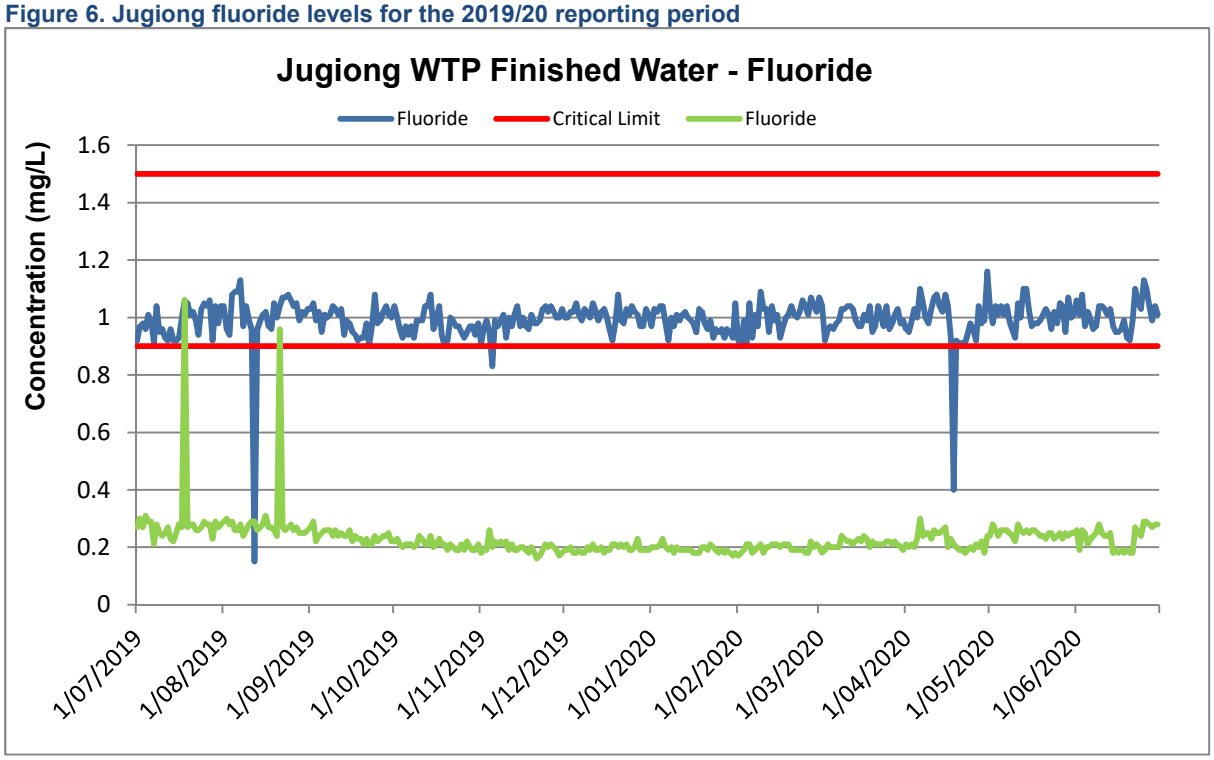
- The chlorine target leaving the WTP is 1.8mg/L with amber alerts sent if chlorine drops below 1.2mg/L or goes over 2mg/L.
- The alert becomes critical with DWMS protocols implemented when chlorine levels drop below 0.8mg/L in summer and 0.5mg/L in winter. Figure 5 below represents the Finished water 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 due to analyser error or CL2 decay of stored water. Each of these errors were validated with handheld analysers and grab samples.
- A free/residual chlorine of 0.087mg/L was the lowest recorded result on the 18/9/2019. The highest total cl recorded was on the 11/10/2019 with a value of 4.2mg/L.
- The average Free Chlorine for the reporting year was 1.71mg/L and average Total chlorine reading was 2.01mg/L.

Figure 5. Jugiong chlorine levels for the 2019/20 reporting period



Error! Reference source not found. 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 1.16 mg/L (Finished water Concentration). The Finished water Fluoride at the Jugiong Water Treatment Plant has breached its minimum value of 0.95mg/L on only 3 occasions throughout the reporting period. These breaches were due to equipment failure or breakdown where little no dosing was seen.

Figure 6. Jugiong fluoride levels for the 2019/20 reporting period



BOM rainfall data indicates that the spikes in the Jugiong raw water can be attributed to heavy and /or sustained rain events that occurred upstream of the Water Treatment Plant.

Figure 7. Jugiong raw water turbidity for the 2019/20 reporting period

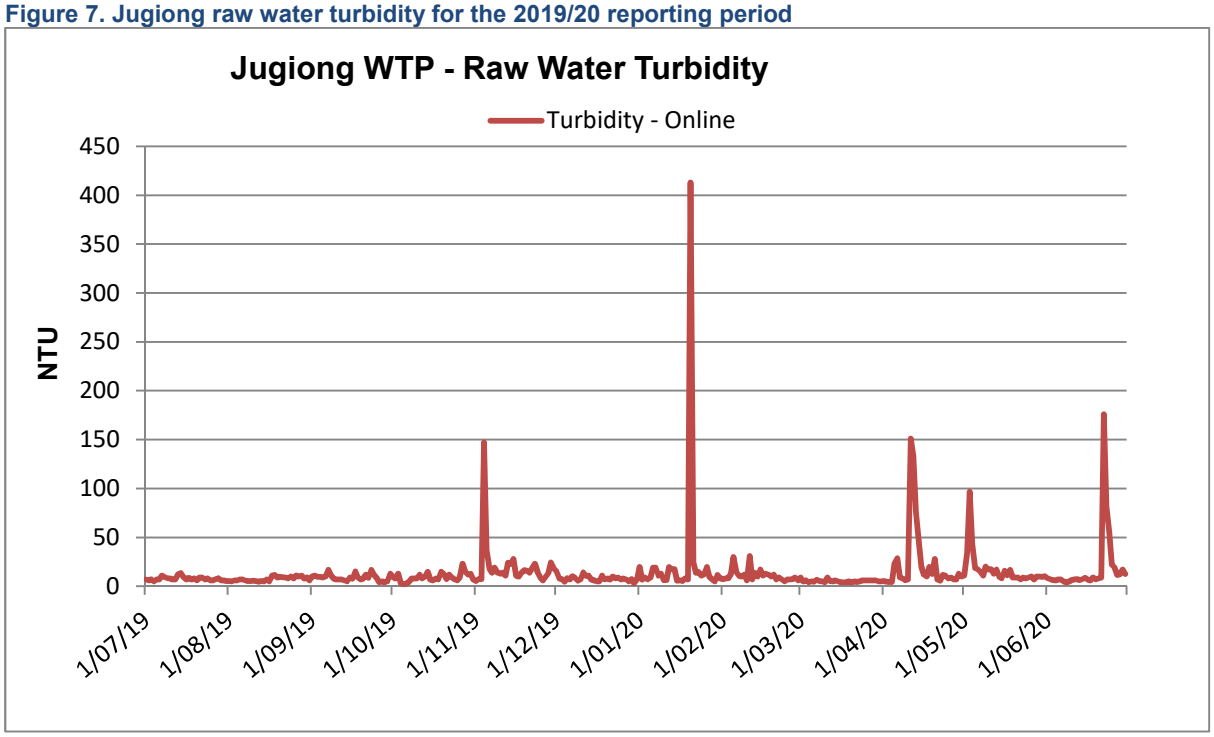


Figure 8. Jugiong finished water turbidity for the 2019/20 reporting period

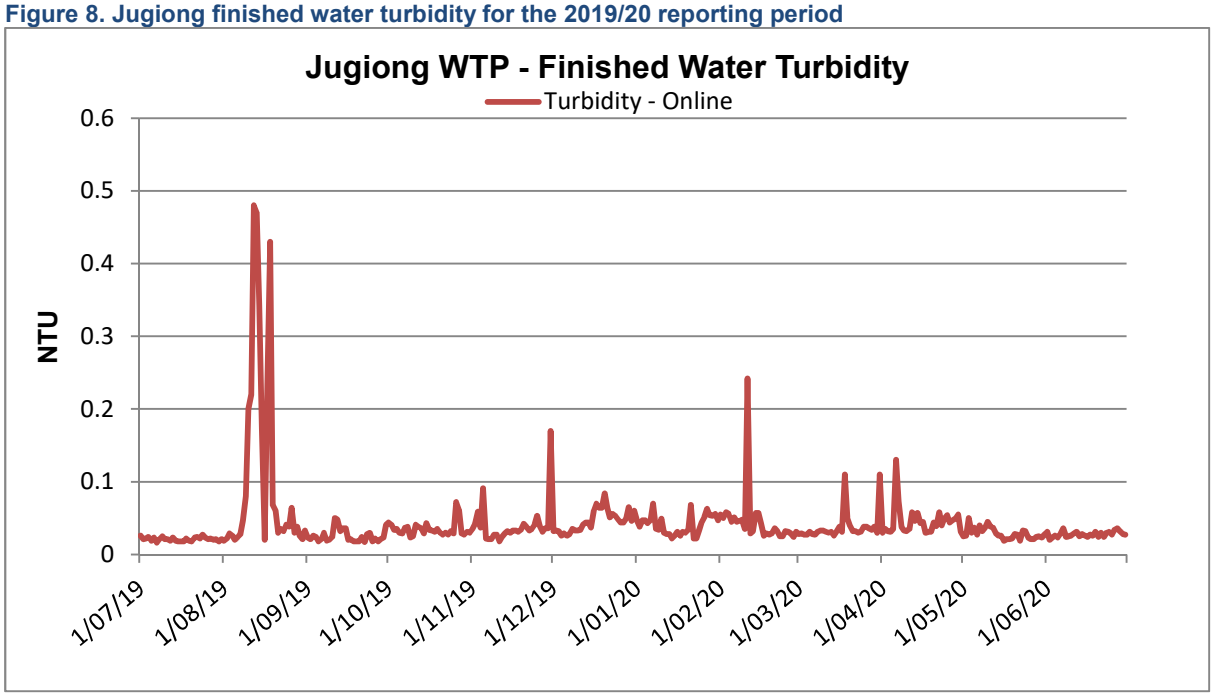
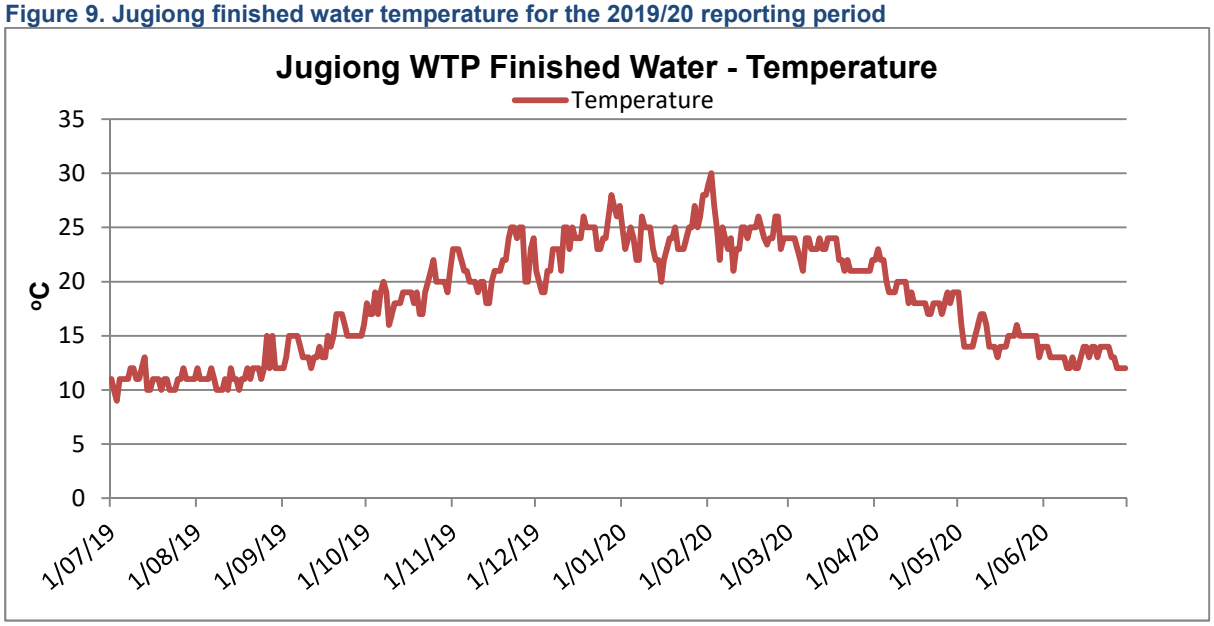


Figure 9. Jugiong finished water temperature for the 2019/20 reporting period



Oura Treatment Plant

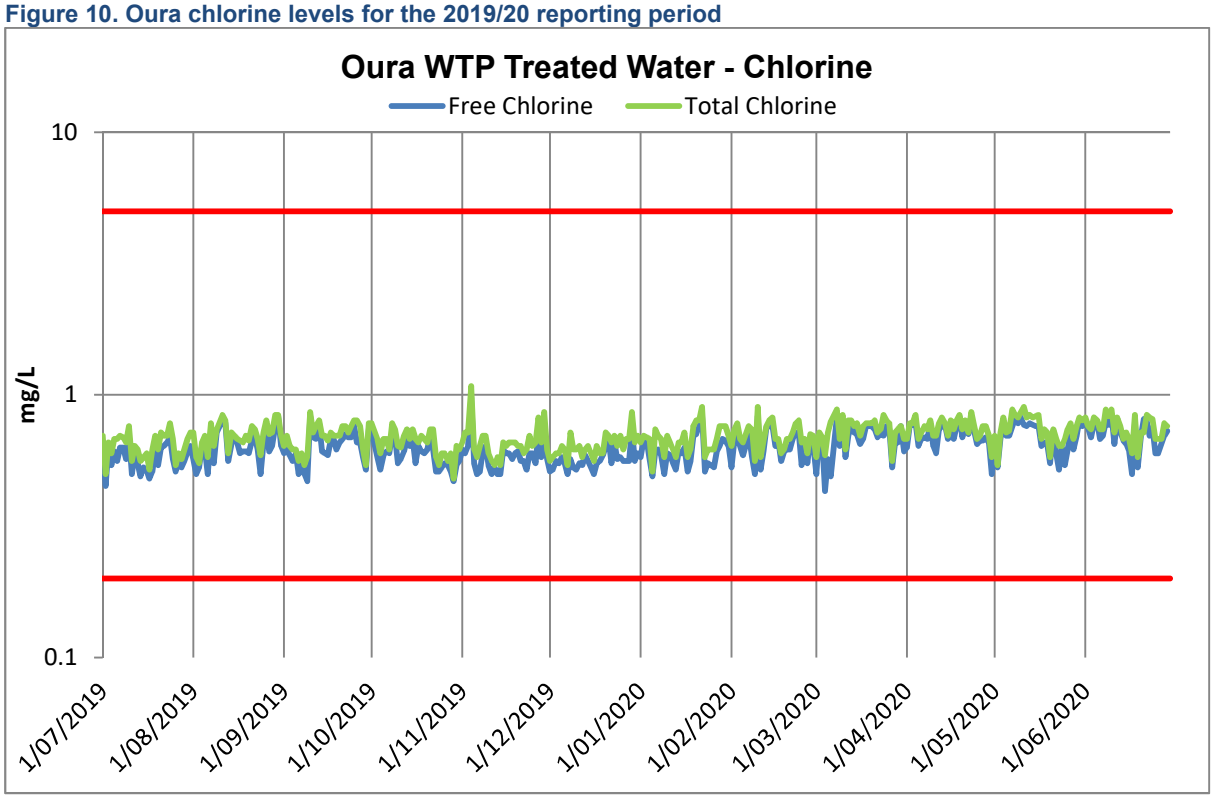
Since the implementation of Water Outlook at the Oura WTP some valuable data has been produced. This data is represented in the following graphs produced for the WTP's CCP's.

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 0.5mg/L. An amber alert is issued through SCADA/Wateroutlook when chlorine level drop below 0.3mg/L and when they rise above 1.0mg/L. A critical alarm is issued when chlorine levels drop below 0.2mg/L and rise above 5mg/L.

Fluoride is also added to the water at the Oura WTP. There is natural Fluoride of around 0.27mg/l 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.

As can be seen in Figure 9 above temperatures during summer months reach up to 30 degrees Celsius. This is around 10 degrees higher than the Oura system at the WTP which highlights the extended settlement time within the treatment process.

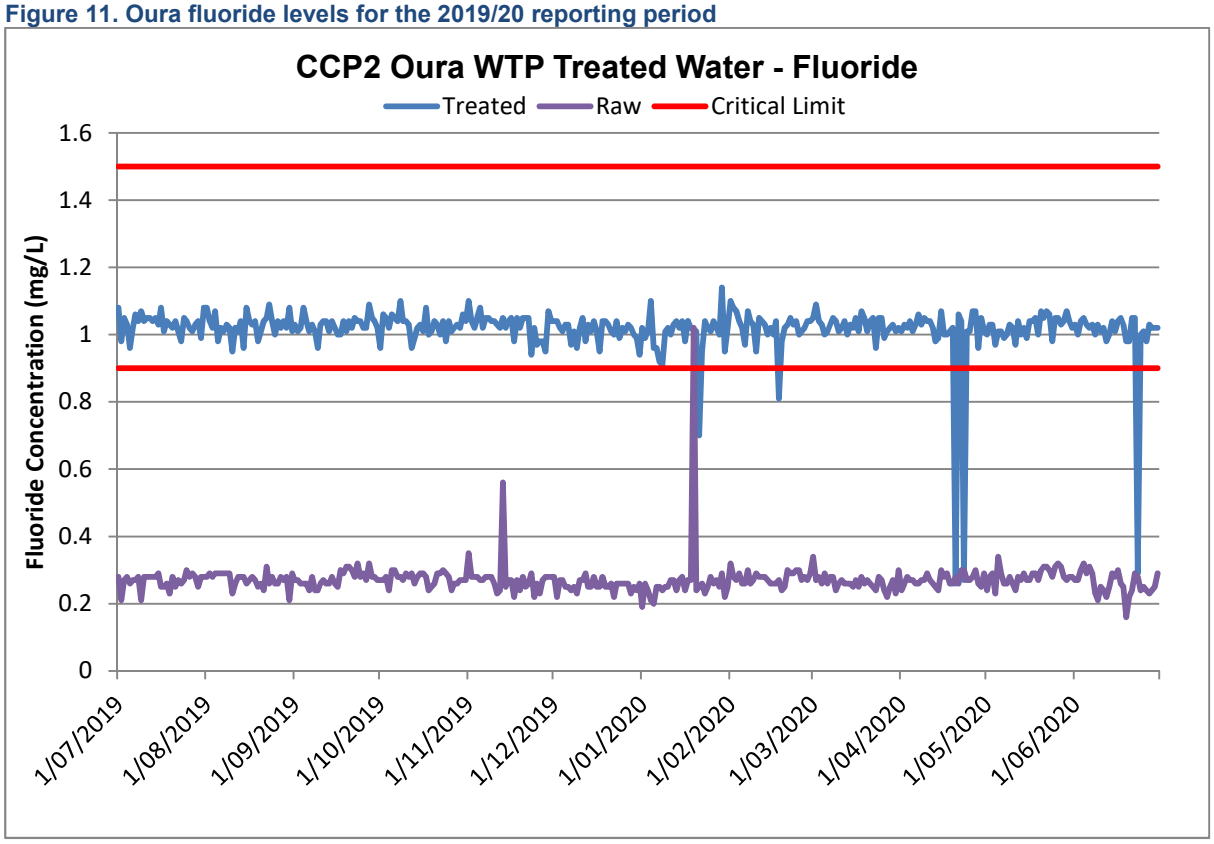
Figure 10. Oura chlorine levels for the 2019/20 reporting period



As can be seen in **Error! Reference source not found.** 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. 0.64 mg/L 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 2019/20 financial year.

Figure 11. Oura fluoride levels for the 2019/20 reporting period



As can be seen from the graph above 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 19/20. Raw water fluoride averaged 0.27mg/L for the 19/20 period.

The treated water fluoride was mostly consistent over the reporting period only recording 5 exceedances for achieving lower than targeted levels. All exceedances was attributed to equipment failure.

Figure 12. Oura collection tank turbidity levels for the 2019/20 reporting period

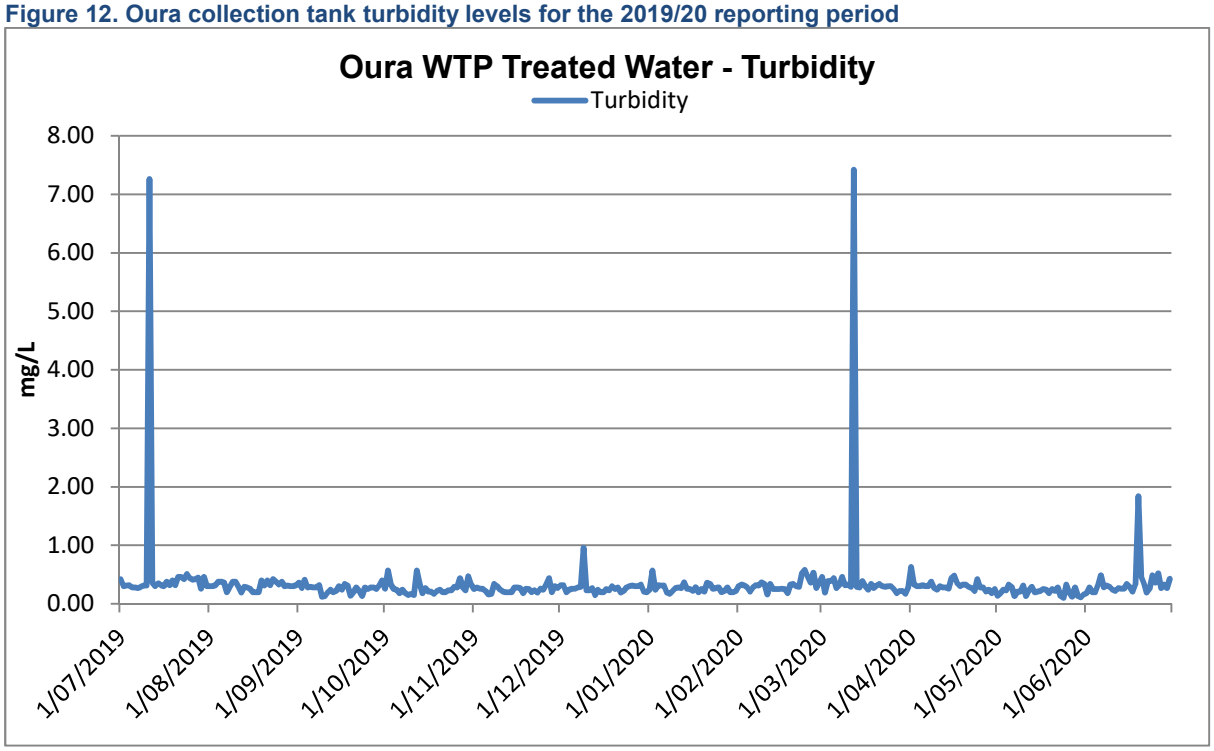


Figure 12 shows the turbidity at the Oura collection tank. Australian Drinking Water Guidelines (ADWG) indicates that turbidity should be <5 NTU (Nephelometric Turbidity Units). As can be seen, there exist 2 exceedances in accordance with the ADWG. These exceedances can be attributed to running Bore 2 without first flushing or works associated with pigging bore mains. Turbidity is not currently a CCP for the Oura WTP and scheme.

Figure 13. Oura treated water temperature for the 2019/20 reporting period

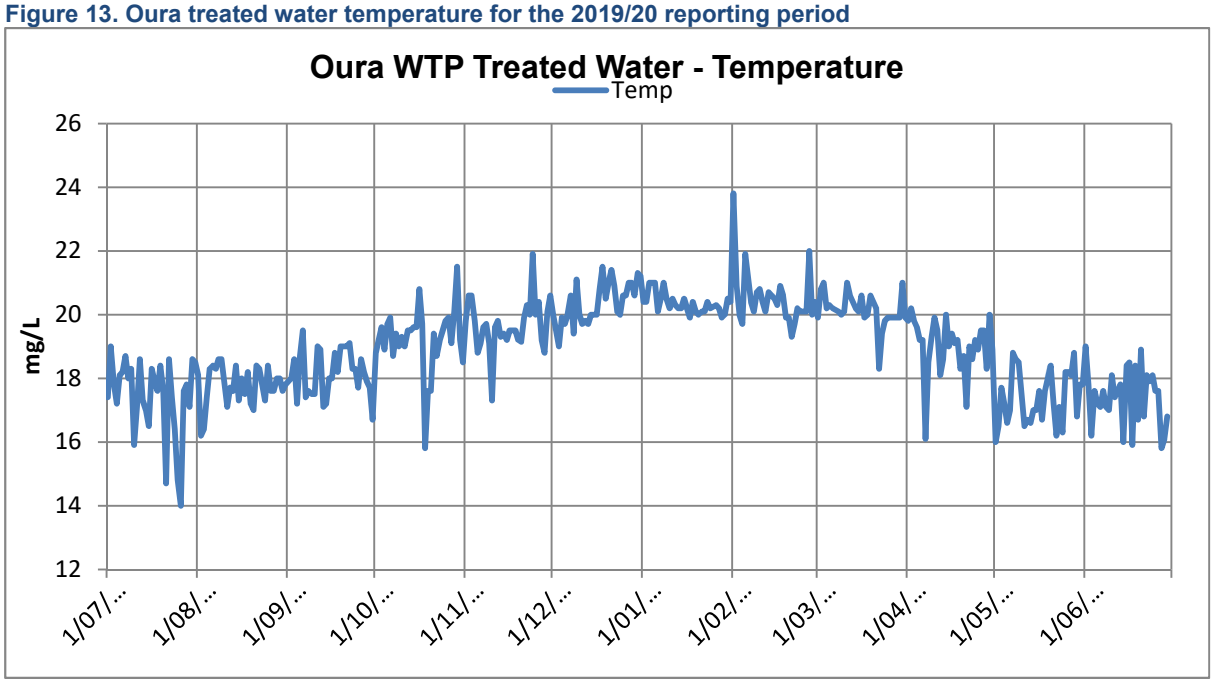


Figure 13 shows the relationship between the temperatures of the treated water with time over the reporting period. As you would surmise, it follows a seasonal trend in that the treated water is warmer in summer and colder in winter.

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 20. Raw water measured parameters pertaining to water quality in the 2019/20 reporting period - Jugiong

Parameter	Minimum	Average	Maximum	Lower Critical Limit	Upper Critical Limit	No. Samples
Fluoride	0.16	0.23	1.06			366
Turbidity - Online	0.33	2.14	24.06			366
Turbidity Offline	2.41	14.02	481			366
Colour	10	43	250			366
pH	6.54	7.70	8.31			366
Temperature	9	18.8	31			366

Table 21. Raw water measured parameters pertaining to water quality in the 2019/20 reporting period - Oura

Parameter	Minimum	Average	Maximum	Lower Critical Limit	Upper Critical Limit	No. Samples
Fluoride	0.16	0.27	1.02			366
pH	7.2	7.44	7.97			366
Temperature	14.8	18.7	22			360
Turbidity						

Table 22. Treated water measured parameters pertaining to water quality in the 2019/20 reporting period - Jugiong

Parameter	Minimum	Average	Maximum	Lower Critical Limit	Upper Critical Limit	No. Samples
Turbidity Online	0.015	0.04	0.257			366
Turbidity – Offline	0.029	0.15	0.49		1	366
Colour	5	5	10			366
pH	6.68	7.42	7.88	7	8	366
Temperature	9	18	30			366
Alkalinity	1.1	106.6	140			366

Hardness	1.1	119.1	220			366
Free Chlorine – Online	0.087	1.61	2.53	0.8	5	366
Total chlorine – Online	0.29	2.0	4.2			366
Fluoride	0.15	0.99	1.16	0.9	1.5	366

Table 23. Treated water measured parameters pertaining to water quality in the 2019/20 reporting period - Oura

Parameter	Minimum	Average	Maximum	Lower critical limit	Upper critical limit	No. samples
Fluoride	0.26	1.02	1.14	0.9	1.5	365
pH	7.14	7.44	7.7			366
Free Chlorine	0.43	0.64	0.98	0.2	5	360
Total Chlorine	0.48	0.70	1.08			360
Temperature	14	18.9	23.8			360

Reticulation Water Quality Reporting

Table 24. Water quality parameters in Jugiong reticulation

Parameter	Minimum	Average	Maximum	Upper Critical Limit	No. Samples
Aluminium	0.01	0.04	0.18	0.2	18
Antimony	0.0001	0.000143	0.0003	0.003	18
Arsenic	0.001	0.001882	0.006	0.01	18
Barium	0.03	0.038889	0.0503	2	18
Boron	0.01003	0.01289	0.0143	4	18
Cadmium	0.0002	0.0002	0.0002	0.002	18
Calcium	13.3	25.27778	31.4		18
Chloride	28	38.83333	54	250	18
Colour – True	0	0	0	5	18
Copper	1	1.222222	2	2	18
Cyanide	0.0021	0.020918	0.082	0.08	18
Fluoride	0	0	0	1.5	18
Total Hardness – CaCO3	0.61	0.842222	0.97	200	18
Iron	92.2	111.8333	126.7	0.3	18
Lead	0.01	0.079444	0.64	0.01	18
Magnesium	0.0002	0.002643	0.0135		18
Manganese	7.03	10.81889	13.33	0.1	18
Mercury	0.0162	0.051771	0.169	0.001	18
Molybdenum	0	0	0	0.05	18
Nickel	0.0003	0.000343	0.0004	0.02	18
Nitrate as N	0.0004	0.00075	0.0016	50	18
Nitrite as N	1	1	1	3	18
pH	0	0	0	6.5-8.5	18
Selenium	7.6	7.933333	8.3	0.01	18
Silver	0	0	0	0.1	18
Sodium	0	0	0	180	18
Sulphate	36	41.72222	50	250	18
TDS	38	56.61111	78	600	18
Tin	117	202.8333	322		18
Turbidity	0	0	0	5	18
Uranium	0.1	0.993333	3.1	0.17	18
Zinc	0.0001	0.0001	0.0001	3	18

Table 25. Water quality parameters in Oura reticulation

Parameter	Minimum	Average	Maximum	Upper Critical Limit	No. Samples
Aluminium	0.01	0.01375	0.02	0.2	28
Antimony	0.0003	0.0003	0.0003	0.003	28
Arsenic	0.001	0.001536	0.007	0.01	28
Barium	0.0129	0.017664	0.027	2	28
Boron	0.0182	0.01962	0.021	4	28
Cadmium	0	0	0	0.002	28
Calcium	11.2	18.08571	26.1		28
Chloride	18	36.07143	57	250	28
Colour – True	0	0	0	0.05	28
Copper	1	1	1	15	28
Cyanide	0.001	0.019214	0.121	2	28
Fluoride	0	0	0	0.08	28
Total Hardness – CaCO3	0.83	0.946071	1.02	1.5	28

Iron	61.9	87.28214	108.7	200	28
Lead	0.01	0.018333	0.09	0.3	28
Magnesium	0.0002	0.00056	0.0009	0.01	28
Manganese	6.87	10.24321	13.48		28
Mercury	0.0006	0.007206	0.0194	0.1	28
Molybdenum	0	0	0	0.001	28
Nickel	0.0001	0.000133	0.0002	0.05	28
Nitrate as N	0.0019	0.0019	0.0019	0.02	28
Nitrite as N	1	1.005882	1.1	50	28
pH	0	0	0	3	28
Selenium	7.7	8.314286	9.1	6.5 – 8.5	28
Silver	0.002	0.002	0.002	0.01	28
Sodium	0	0	0	0.1	28
Sulphate	17	26.71429	37	180	28
TDS	3	8.5	15	250	28
Tin	58	129.8929	319	600	28
Turbidity	0	0	0		28
Uranium	0.1	0.814286	2.1	5	28
Zinc	0.0003	0.00066	0.004	0.017	28

Table 26. Water quality parameters in Mt Arthur reticulation

Parameter	Minimum	Average	Maximum	Upper Critical Limit	No. Samples
Aluminium	0.01	0.933333	2.64	0.2	9
Antimony	0.0002	0.0002	0.0002	0.003	9
Arsenic	0.001	0.003	0.008	0.01	9
Barium	0.011	0.167167	1.3949	2	9
Boron	0.0343	0.04188	0.0516	4	9
Cadmium	0.0003	0.0003	0.0003	0.002	9
Calcium	9.2	17.13333	46.1		9
Chloride	35	51.77778	64	250	9
Colour – True	0.002	0.002	0.002	0.05	9
Copper	1	1.333333	2	5	9
Cyanide	0.002	0.245125	1.364	2	9
Fluoride	0	0	0	0.08	9
Total Hardness – CaCO3	0.36	0.555556	1.02	1.5	9
Iron	16.4	63.85556	107	200	9
Lead	0.04	35.89444	321.27	0.3	9
Magnesium	0.0008	0.00662	0.0251	0.01	9
Manganese	7.05	9.138889	13.98		9
Mercury	0.0062	1.449522	12.6189	0.01	9
Molybdenum	0	0	0	0.001	9
Nickel	0.0001	0.000175	0.0002	0.05	9
Nitrate as N	0.0004	0.00445	0.0085	0.02	9
Nitrite as N	1	1	1	50	9
pH	0	0	0	3	9
Selenium	7.6	7.9	8.4	6.5-8.5	9
Silver	0.002	0.002	0.002	0.01	9
Sodium	0	0	0	0.1	9
Sulphate	38	44	50	180	9
TDS	6	10.44444	14	250	9
Tin	81	186.5556	319	600	9
Turbidity	0	0	0		9
Uranium	0.2	58.575	428	5	9

Zinc	0.0024	0.0024	0.0024	0.17	9

Table 27. Water quality parameters in the Mt Daylight reticulation

Parameter	Minimum	Average	Maximum	Upper Critical Limit	No. Samples
Aluminium	0.01	0.01	0.01	0.2	3
Antimony	0.001	0.001	0.001	0.003	3
Arsenic	0.002	0.004333	0.009	0.01	3
Barium	0.069	0.080533	0.0906	2	3
Boron	0.0446	0.0446	0.0446		3
Cadmium	0	0	0	0.002	3
Calcium	23.8	25.43333	28.4		3
Chloride	79	95.33333	105	250	3
Colour – True	0	0	0	0.05	3
Copper	1	1	1	5	3
Cyanide	0.007	0.037667	0.09	2	3
Fluoride	0	0	0	0.08	3
Total Hardness – CaCO3	0.38	0.48	0.56	1.5	3
Iron	143	151.8333	164.7	173.6	3
Lead	0.01	0.135	0.26	0.3	3
Magnesium	0.0006	0.0006	0.0006	0.01	3
Manganese	20.29	21.45333	22.78		3
Mercury	0.009	0.009	0.009	0.1	3
Molybdenum	0	0	0	0.001	3
Nickel	0.0028	0.0028	0.0028	0.05	3
Nitrate as N	0.0007	0.0007	0.0007	0.02	3
Nitrite as N	1	1	1	50	3
pH	0	0	0	3	3
Selenium	7.6	7.6	7.6	6.5-8.5	3
Silver	0.002	0.002	0.002	0.01	3
Sodium	0	0	0	0.1	3
Sulphate	78	84	87	180	3
TDS	33	37.33333	40	250	3
Tin	325	344.3333	362	600	3
Turbidity	0	0	0		3
Uranium	0.6	0.65	0.7	5	3
Zinc	0.0038	0.0038	0.0038	0.17	3

Table 28. Microbiological results - Jugiong

Characteristic	Guideline Limit	Units	Mean	Median	Standard Deviation	Min	Max	Sample Count	Exception Count	95th Percentile	5th percentile	Meeting Guideline (%)
E. coli	0.0000	mpn/100 mL	0.0000	0.0000	0.0000	0	0	66	0	0	0	100.00
Free Chlorine	0.2 - 5	mg/L	0.3815	0.3550	0.3021	0.01	1.26	66	26	0.87	0.02	60.61
pH	6.5 - 8.5		7.9905	7.9500	0.2348	7.5	8.61	65	1	8.41	7.67	98.46
Temperature	30.0000	C	18.6985	19.7500	5.4312	8.5	26.4	66	0	26	9.6	100.00
Total Chlorine	5.0000	mg/L	0.5446	0.5500	0.3640	0.025	1.42	66	0	1.2	0.05	100.00
Total Coliforms	0.0000	mpn/100 mL	0.2121	0.0000	1.7233	0	14	66	1	0	0	98.48
Turbidity	5.0000	NTU	0.7714	0.6000	0.7215	0.2	5.69	66	1	1.69	0.25	98.48

Table 29. Microbiological results - Oura

Characteristic	Guideline Limit	Units	Mean	Median	Standard Deviation	Min	Max	Sample Count	Exception Count	95th Percentile	5th percentile	Meeting Guideline (%)
E. coli	0.0000	mpn/100 mL	0.0000	0.0000	0.0000	0	0	66	0	0	0	100.00
Free Chlorine	0.2 - 5	mg/L	0.3815	0.3550	0.3021	0.01	1.26	66	26	0.87	0.02	60.61
pH	6.5 - 8.5		7.9905	7.9500	0.2348	7.5	8.61	65	1	8.41	7.67	98.46
Temperature	30.0000	C	18.6985	19.7500	5.4312	8.5	26.4	66	0	26	9.6	100.00
Total Chlorine	5.0000	mg/L	0.5446	0.5500	0.3640	0.025	1.42	66	0	1.2	0.05	100.00
Total Coliforms	0.0000	mpn/100 mL	0.2121	0.0000	1.7233	0	14	66	1	0	0	98.48
Turbidity	5.0000	NTU	0.7714	0.6000	0.7215	0.2	5.69	66	1	1.69	0.25	98.48

Table 30. Microbiological results – Mt Arthur

Characteristic	Guideline Limit	Units	Mean	Median	Standard Deviation	Min	Max	Sample Count	Exception Count	95th Percentile	5th percentile	Meeting Guideline (%)
E. coli	0.0000	mpn/100 mL	0.0000	0.0000	0.0000	0	0	66	0	0	0	100.00
Free Chlorine	0.2 - 5	mg/L	0.3815	0.3550	0.3021	0.01	1.26	66	26	0.87	0.02	60.61
pH	6.5 - 8.5		7.9905	7.9500	0.2348	7.5	8.61	65	1	8.41	7.67	98.46
Temperature	30.0000	C	18.6985	19.7500	5.4312	8.5	26.4	66	0	26	9.6	100.00
Total Chlorine	5.0000	mg/L	0.5446	0.5500	0.3640	0.025	1.42	66	0	1.2	0.05	100.00
Total Coliforms	0.0000	mpn/100 mL	0.2121	0.0000	1.7233	0	14	66	1	0	0	98.48
Turbidity	5.0000	NTU	0.7714	0.6000	0.7215	0.2	5.69	66	1	1.69	0.25	98.48

Table 31. Microbiological results – Mt Daylight

Characteristic	Guideline Limit	Units	Mean	Median	Standard Deviation	Min	Max	Sample Count	Exception Count	95th Percentile	5th percentile	Meeting Guideline (%)
E. coli	0.0000	mpn/100 mL	0.0000	0.0000	0.0000	0	0	66	0	0	0	100.00
Free Chlorine	0.2 - 5	mg/L	0.3815	0.3550	0.3021	0.01	1.26	66	26	0.87	0.02	60.61
pH	6.5 - 8.5		7.9905	7.9500	0.2348	7.5	8.61	65	1	8.41	7.67	98.46
Temperature	30.0000	C	18.6985	19.7500	5.4312	8.5	26.4	66	0	26	9.6	100.00
Total Chlorine	5.0000	mg/L	0.5446	0.5500	0.3640	0.025	1.42	66	0	1.2	0.05	100.00
Total Coliforms	0.0000	mpn/100 mL	0.2121	0.0000	1.7233	0	14	66	1	0	0	98.48
Turbidity	5.0000	NTU	0.7714	0.6000	0.7215	0.2	5.69	66	1	1.69	0.25	98.48

Verification Monitoring – Jugiong

Table 32. Summary of NSW Health's drinking water monitoring program data for the Jugiong scheme

Analysis Type	Parameter	Min	Mean	Max	Guideline Value	Units	Exception Count	Sample Count
Chemistry	Aluminium	0.04	0.0800	0.12	0.2000	mg/L	0	2
	Antimony	0.0005	0.0005	0.0005	0.0030	mg/L	0	2
	Arsenic	0.0005	0.0008	0.001	0.0100	mg/L	0	2
	Barium	0.029	0.0475	0.066	2.0000	mg/L	0	2
	Boron	0.05	0.0500	0.05	4.0000	mg/L	0	2
	Cadmium	0.00025	0.0003	0.00025	0.0020	mg/L	0	2
	Calcium	22.2	27.3500	32.5	10000.0000	mg/L	0	2
	Chloride	34	61.0000	88	250.0000	mg/L	0	2
	Chromium	0.0025	0.0025	0.0025	0.0500	mg/L	0	2
	Copper	0.0025	0.0088	0.015	2.0000	mg/L	0	2
	Fluoride	0.81	0.9350	1.06	1.5000	mg/L	0	2
	Fluoride (WU result)	0.97	1.0200	1.07	1.5000	mg/L	0	2
	Fluoride Ratio	1.01	1.1050	1.2	0.8 - 1.2		0	2
	Iodine	0.01	0.0150	0.02	0.5000	mg/L	0	2
	Iron	0.01	0.0150	0.02	0.3000	mg/L	0	2
	Lead	0.001	0.0015	0.002	0.0100	mg/L	0	2
	Magnesium	11.67	15.8150	19.96	10000.0000	mg/L	0	2
	Manganese	0.048	0.0940	0.14	0.5000	mg/L	0	2
	Mercury	0.00005	0.0001	0.00005	0.0010	mg/L	0	2
	Molybdenum	0.0025	0.0025	0.0025	0.0500	mg/L	0	2
	Nickel	0.005	0.0050	0.005	0.0200	mg/L	0	2
	Nitrate	1	2.5000	4	50.0000	mg/L	0	2
	Nitrite	0.05	0.0500	0.05	3.0000	mg/L	0	2
	pH	7.8	7.8000	7.8	6.5 - 8.5		0	2
	Selenium	0.001	0.0010	0.001	0.0100	mg/L	0	2
	Silver	0.001	0.0010	0.001	0.1000	mg/L	0	2
	Sodium	38	55.5000	73	180.0000	mg/L	0	2
	Sulfate	44	76.0000	108	500.0000	mg/L	0	2
	Total Dissolved Solids (TDS)	185	275.0000	365	600.0000	mg/L	0	2
	Total Hardness as CaCO3	103.5	133.4000	163.3	200.0000	mg/L	0	2
	True Colour	0.5	0.5000	0.5	15.0000	Hazen Units (HU)	0	2
	Turbidity	0.05	0.3250	0.6	5.0000	NTU	0	2
	Uranium	0.0025	0.0025	0.0025	0.0170	mg/L	0	2
	Zinc	0.005	0.0125	0.02	3.0000	mg/L	0	2

Analysis Type	Parameter	Min	Mean	Max	Guideline Value	Units	Exception Count	Sample Count
Fluoride Barcode	Fluoride	0.8	0.9660	1.04	1.5000	mg/L	0	10
	Fluoride (WU result)	0.9	0.9720	1.1	1.5000	mg/L	0	10
	Fluoride Ratio	0.87	1.0120	1.18	0.8 - 1.2		0	10
Microbiology	E. coli	0	0.0000	0	0.0000	mpn/100 mL	0	66
	Free Chlorine	0.01	0.3815	1.26	0.2 - 5	mg/L	26	66
	pH	7.5	7.9905	8.61	6.5 - 8.5		1	65
	Temperature	8.5	18.6985	26.4	30.0000	C	0	66
	Total Chlorine	0.025	0.5446	1.42	5.0000	mg/L	0	66
	Total Coliforms	0	0.2121	14	0.0000	mpn/100 mL	1	66
	Turbidity	0.2	0.7714	5.69	5.0000	NTU	1	66
Operational Monitoring	Fluoride (daily WU)	0.09	0.9656	1.27	0.9 - 1.5	mg/L	11	366
	Fluoride (weekly WU)	0.14	0.9465	1.07	0.9 - 1.5	mg/L	2	89

Table 33. Summary of NSW Health's drinking water monitoring program data for the Oura scheme

Analysis Type	Parameter	Min	Mean	Max	Guideline Value	Units	Exception Count	Sample Count
Chemistry	Aluminium	0.04	0.0800	0.12	0.2000	mg/L	0	2
	Antimony	0.0005	0.0005	0.0005	0.0030	mg/L	0	2
	Arsenic	0.0005	0.0008	0.001	0.0100	mg/L	0	2
	Barium	0.029	0.0475	0.066	2.0000	mg/L	0	2
	Boron	0.05	0.0500	0.05	4.0000	mg/L	0	2
	Cadmium	0.00025	0.0003	0.00025	0.0020	mg/L	0	2
	Calcium	22.2	27.3500	32.5	10000.0000	mg/L	0	2
	Chloride	34	61.0000	88	250.0000	mg/L	0	2
	Chromium	0.0025	0.0025	0.0025	0.0500	mg/L	0	2
	Copper	0.0025	0.0088	0.015	2.0000	mg/L	0	2
	Fluoride	0.81	0.9350	1.06	1.5000	mg/L	0	2
	Fluoride (WU result)	0.97	1.0200	1.07	1.5000	mg/L	0	2
	Fluoride Ratio	1.01	1.1050	1.2	0.8 - 1.2		0	2
	Iodine	0.01	0.0150	0.02	0.5000	mg/L	0	2
	Iron	0.01	0.0150	0.02	0.3000	mg/L	0	2
	Lead	0.001	0.0015	0.002	0.0100	mg/L	0	2
	Magnesium	11.67	15.8150	19.96	10000.0000	mg/L	0	2
	Manganese	0.048	0.0940	0.14	0.5000	mg/L	0	2
	Mercury	0.00005	0.0001	0.00005	0.0010	mg/L	0	2
	Molybdenum	0.0025	0.0025	0.0025	0.0500	mg/L	0	2

Analysis Type	Parameter	Min	Mean	Max	Guideline Value	Units	Exception Count	Sample Count
	Nickel	0.005	0.0050	0.005	0.0200	mg/L	0	2
	Nitrate	1	2.5000	4	50.0000	mg/L	0	2
	Nitrite	0.05	0.0500	0.05	3.0000	mg/L	0	2
	pH	7.8	7.8000	7.8	6.5 - 8.5		0	2
	Selenium	0.001	0.0010	0.001	0.0100	mg/L	0	2
	Silver	0.001	0.0010	0.001	0.1000	mg/L	0	2
	Sodium	38	55.5000	73	180.0000	mg/L	0	2
	Sulfate	44	76.0000	108	500.0000	mg/L	0	2
	Total Dissolved Solids (TDS)	185	275.0000	365	600.0000	mg/L	0	2
	Total Hardness as CaCO3	103.5	133.4000	163.3	200.0000	mg/L	0	2
	True Colour	0.5	0.5000	0.5	15.0000	Hazen Units (HU)	0	2
	Turbidity	0.05	0.3250	0.6	5.0000	NTU	0	2
	Uranium	0.0025	0.0025	0.0025	0.0170	mg/L	0	2
	Zinc	0.005	0.0125	0.02	3.0000	mg/L	0	2
Fluoride Barcode	Fluoride	0.8	0.9660	1.04	1.5000	mg/L	0	10
	Fluoride (WU result)	0.9	0.9720	1.1	1.5000	mg/L	0	10
	Fluoride Ratio	0.87	1.0120	1.18	0.8 - 1.2		0	10
Microbiology	E. coli	0	0.0000	0	0.0000	mpn/100 mL	0	66
	Free Chlorine	0.01	0.3815	1.26	0.2 - 5	mg/L	26	66
	pH	7.5	7.9905	8.61	6.5 - 8.5		1	65
	Temperature	8.5	18.6985	26.4	30.0000	C	0	66
	Total Chlorine	0.025	0.5446	1.42	5.0000	mg/L	0	66
	Total Coliforms	0	0.2121	14	0.0000	mpn/100 mL	1	66
	Turbidity	0.2	0.7714	5.69	5.0000	NTU	1	66
Operational Monitoring	Fluoride (daily WU)	0.09	0.9656	1.27	0.9 - 1.5	mg/L	11	366
	Fluoride (weekly WU)	0.14	0.9465	1.07	0.9 - 1.5	mg/L	2	89

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

Analysis Type	Parameter	Min	Mean	Max	Guideline Value	Units	Exception Count	Sample Count
Chemistry	Aluminium	0.04	0.0800	0.12	0.2000	mg/L	0	2
	Antimony	0.0005	0.0005	0.0005	0.0030	mg/L	0	2
	Arsenic	0.0005	0.0008	0.001	0.0100	mg/L	0	2

Analysis Type	Parameter	Min	Mean	Max	Guideline Value	Units	Exception Count	Sample Count
	Barium	0.029	0.0475	0.066	2.0000	mg/L	0	2
	Boron	0.05	0.0500	0.05	4.0000	mg/L	0	2
	Cadmium	0.00025	0.0003	0.00025	0.0020	mg/L	0	2
	Calcium	22.2	27.3500	32.5	10000.0000	mg/L	0	2
	Chloride	34	61.0000	88	250.0000	mg/L	0	2
	Chromium	0.0025	0.0025	0.0025	0.0500	mg/L	0	2
	Copper	0.0025	0.0088	0.015	2.0000	mg/L	0	2
	Fluoride	0.81	0.9350	1.06	1.5000	mg/L	0	2
	Fluoride (WU result)	0.97	1.0200	1.07	1.5000	mg/L	0	2
	Fluoride Ratio	1.01	1.1050	1.2	0.8 - 1.2		0	2
	Iodine	0.01	0.0150	0.02	0.5000	mg/L	0	2
	Iron	0.01	0.0150	0.02	0.3000	mg/L	0	2
	Lead	0.001	0.0015	0.002	0.0100	mg/L	0	2
	Magnesium	11.67	15.8150	19.96	10000.0000	mg/L	0	2
	Manganese	0.048	0.0940	0.14	0.5000	mg/L	0	2
	Mercury	0.00005	0.0001	0.00005	0.0010	mg/L	0	2
	Molybdenum	0.0025	0.0025	0.0025	0.0500	mg/L	0	2
	Nickel	0.005	0.0050	0.005	0.0200	mg/L	0	2
	Nitrate	1	2.5000	4	50.0000	mg/L	0	2
	Nitrite	0.05	0.0500	0.05	3.0000	mg/L	0	2
	pH	7.8	7.8000	7.8	6.5 - 8.5		0	2
	Selenium	0.001	0.0010	0.001	0.0100	mg/L	0	2
	Silver	0.001	0.0010	0.001	0.1000	mg/L	0	2
	Sodium	38	55.5000	73	180.0000	mg/L	0	2
	Sulfate	44	76.0000	108	500.0000	mg/L	0	2
	Total Dissolved Solids (TDS)	185	275.0000	365	600.0000	mg/L	0	2
	Total Hardness as CaCO3	103.5	133.4000	163.3	200.0000	mg/L	0	2
	True Colour	0.5	0.5000	0.5	15.0000	Hazen Units (HU)	0	2
	Turbidity	0.05	0.3250	0.6	5.0000	NTU	0	2
	Uranium	0.0025	0.0025	0.0025	0.0170	mg/L	0	2
	Zinc	0.005	0.0125	0.02	3.0000	mg/L	0	2
Fluoride Barcode	Fluoride	0.8	0.9660	1.04	1.5000	mg/L	0	10
	Fluoride (WU result)	0.9	0.9720	1.1	1.5000	mg/L	0	10
	Fluoride Ratio	0.87	1.0120	1.18	0.8 - 1.2		0	10
Microbiology	E. coli	0	0.0000	0	0.0000	mpn/100 mL	0	66

Analysis Type	Parameter	Min	Mean	Max	Guideline Value	Units	Exception Count	Sample Count
	Free Chlorine	0.01	0.3815	1.26	0.2 - 5	mg/L	26	66
	pH	7.5	7.9905	8.61	6.5 - 8.5		1	65
	Temperature	8.5	18.6985	26.4	30.0000	C	0	66
	Total Chlorine	0.025	0.5446	1.42	5.0000	mg/L	0	66
	Total Coliforms	0	0.2121	14	0.0000	mpn/100 mL	1	66
	Turbidity	0.2	0.7714	5.69	5.0000	NTU	1	66
Operational Monitoring	Fluoride (daily WU)	0.09	0.9656	1.27	0.9 - 1.5	mg/L	11	366
	Fluoride (weekly WU)	0.14	0.9465	1.07	0.9 - 1.5	mg/L	2	89

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

Analysis Type	Parameter	Min	Mean	Max	Guideline Value	Units	Exception Count	Sample Count
Chemistry	Aluminium	0.04	0.0800	0.12	0.2000	mg/L	0	2
	Antimony	0.0005	0.0005	0.0005	0.0030	mg/L	0	2
	Arsenic	0.0005	0.0008	0.001	0.0100	mg/L	0	2
	Barium	0.029	0.0475	0.066	2.0000	mg/L	0	2
	Boron	0.05	0.0500	0.05	4.0000	mg/L	0	2
	Cadmium	0.00025	0.0003	0.00025	0.0020	mg/L	0	2
	Calcium	22.2	27.3500	32.5	10000.0000	mg/L	0	2
	Chloride	34	61.0000	88	250.0000	mg/L	0	2
	Chromium	0.0025	0.0025	0.0025	0.0500	mg/L	0	2
	Copper	0.0025	0.0088	0.015	2.0000	mg/L	0	2
	Fluoride	0.81	0.9350	1.06	1.5000	mg/L	0	2
	Fluoride (WU result)	0.97	1.0200	1.07	1.5000	mg/L	0	2
	Fluoride Ratio	1.01	1.1050	1.2	0.8 - 1.2		0	2
	Iodine	0.01	0.0150	0.02	0.5000	mg/L	0	2
	Iron	0.01	0.0150	0.02	0.3000	mg/L	0	2
	Lead	0.001	0.0015	0.002	0.0100	mg/L	0	2
	Magnesium	11.67	15.8150	19.96	10000.0000	mg/L	0	2
	Manganese	0.048	0.0940	0.14	0.5000	mg/L	0	2
	Mercury	0.00005	0.0001	0.00005	0.0010	mg/L	0	2
	Molybdenum	0.0025	0.0025	0.0025	0.0500	mg/L	0	2
	Nickel	0.005	0.0050	0.005	0.0200	mg/L	0	2
	Nitrate	1	2.5000	4	50.0000	mg/L	0	2
	Nitrite	0.05	0.0500	0.05	3.0000	mg/L	0	2
	pH	7.8	7.8000	7.8	6.5 - 8.5		0	2
	Selenium	0.001	0.0010	0.001	0.0100	mg/L	0	2
	Silver	0.001	0.0010	0.001	0.1000	mg/L	0	2

Analysis Type	Parameter	Min	Mean	Max	Guideline Value	Units	Exception Count	Sample Count
	Sodium	38	55.5000	73	180.0000	mg/L	0	2
	Sulfate	44	76.0000	108	500.0000	mg/L	0	2
	Total Dissolved Solids (TDS)	185	275.0000	365	600.0000	mg/L	0	2
	Total Hardness as CaCO3	103.5	133.4000	163.3	200.0000	mg/L	0	2
	True Colour	0.5	0.5000	0.5	15.0000	Hazen Units (HU)	0	2
	Turbidity	0.05	0.3250	0.6	5.0000	NTU	0	2
	Uranium	0.0025	0.0025	0.0025	0.0170	mg/L	0	2
	Zinc	0.005	0.0125	0.02	3.0000	mg/L	0	2
Fluoride Barcode	Fluoride	0.8	0.9660	1.04	1.5000	mg/L	0	10
	Fluoride (WU result)	0.9	0.9720	1.1	1.5000	mg/L	0	10
	Fluoride Ratio	0.87	1.0120	1.18	0.8 - 1.2		0	10
Microbiology	E. coli	0	0.0000	0	0.0000	mpn/100 mL	0	66
	Free Chlorine	0.01	0.3815	1.26	0.2 - 5	mg/L	26	66
	pH	7.5	7.9905	8.61	6.5 - 8.5		1	65
	Temperature	8.5	18.6985	26.4	30.0000	C	0	66
	Total Chlorine	0.025	0.5446	1.42	5.0000	mg/L	0	66
	Total Coliforms	0	0.2121	14	0.0000	mpn/100 mL	1	66
	Turbidity	0.2	0.7714	5.69	5.0000	NTU	1	66
Operational Monitoring	Fluoride (daily WU)	0.09	0.9656	1.27	0.9 - 1.5	mg/L	11	366
	Fluoride (weekly WU)	0.14	0.9465	1.07	0.9 - 1.5	mg/L	2	89

Appendix B - Continuous Improvement Plan

GWCCC DWMS Action and Improvement Plan

Table 36. 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.	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	In progress	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.	Low		GWCC DWMS Technical Note 2 Risk Assessment and Critical Control Point Workshop (HydroScience, 2015)
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	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)

	maintenance on solenoid valves leading into fluoride batching tank					
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 anlyser due to reliability f the unit. Trends are however being obtained.	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 repsonses 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	In progress	2017 risk assesment and report developed on the non-pot system and its potential for cross contamination. Further projects to progress to	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.)			investigation stage in 2018. 15/10/2019 - Works still outstanding 25/8/2020 Works still outstanding		
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, 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)

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 priority, which is the most remote	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)

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	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	In progress		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	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	Procedures and documentation	Closed	30/06/2019	15/10/2019 - consideration of developing SOP's has			GWCC DWMS Technical Note 2 Risk Assessment and Critical

	for chlorine testing to include manganese interference with reagent				been determined as not required.			Control Point Workshop (HydroScience, 2015)
26	GWCC to develop SOPs for operational and supporting activities, such as plant operation, mains break repair, mains flushing, etc.	Procedures and documentation	In progress		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 their activities e.g. mains breaks	Medium	Manager Operations	GWCC DWMS Technical Note 2 Risk Assessment and Critical Control Point Workshop (HydroScience, 2015)
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	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)

	the bore accesses the drinking water aquifer							
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 comissioning 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	Low	Manager Production & Services	GWCC DWMS Technical Note 2 Risk Assessment and Critical Control Point Workshop (HydroScience, 2015)

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	In progress		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	Medium	Human Resource Coordinator	Added as part of action and improvement plan review (25 November 2016)

					inductions where required however formal register yet to be developed.			
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	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. Emergency 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	High	Manager Engineering	Added as part of action and improvement plan review (25 November 2016)

					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			
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. 15/10/2019 - now complete	Manger Production and Services	Added as part of review/development of DWMS
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	Manger Production and Services	Added as part of review/development of DWMS

					available online for all staff.	
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 gone from 3 to 5 staff with an independant manager.	Manger Production and Services

46	Identify existing preventive measures from catchment to consumer for each significant hazard or hazardous event and estimate the residual risk	Investigative studies	In progress	ongoing	Ongoing risk reviews and actions are undetaken upon incident reporting/lessons learnt scenarios. As the organisations asset and operational maturity increases so to will the levels of assesment and outcomes.	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	In progress		See point 48 above. 15/10/2019 - This needs to be investigated and developed into a management plan for each supply scheme.	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	Monitoring	Complete	2017	Monitoring program to be audited every 12 months to ensure data		

	characteristic, including the location and frequency of sampling				is representative of the drinking water system		
53	Establish a consumer complaint and response program, including appropriate training of employee	Community engagement	In progress	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	Medium	Manger Production and Services
54	Define communication protocols with the involvement of relevent agencies and prepare a contact list of key people, agencies and businesses	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.		

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	In progress		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.	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 requirments 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	In progress	ongoing	Programs may include education of water quality, treatment processes, distribution works, new capital works etc	Medium	Manger Production and Services
61	Validate processes and procedures to ensure that they are effective at controlling hazards	Procedures and documentation	Implemented		Ongoing assesment 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 resepective 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 deing 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	a) 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	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.

					SLA between GWCC-Hilltops and GWCC and Coota Gundagai			
77	Complaints Mangement System	Procedures and documentation	In progress	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	In progress	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	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.

					councils to occur 2020/21			(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 updated as required in accordance with the Backflow Prevention Policy (PP06). (Kevin will need to familiarise himself with this)	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.
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	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

					Annual Reporting information available on Council's website.			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

25/08/2020

Date:	18/04/2016	**Client Name:**	Goldenfields Water
WS #:	031	**Reservoir Name:**	Coolamon North HL 031
Asset No:	031	**Location:**	Ardlethan Rd Coolamon
Job No:	026569	**Project Number:**	0
Cleaning Due:	28/5/2022	**Inspection Due:**	18/4/2018

External

Area	Priority	Status	Comments
Entry Hatch	2	F	The hatch is small and the cover is light weight. It is also not effectively sealed around the edges of the frame where the internal ladder stiles extend through.

Internal

Area	Priority	Status	Comments
Walls	2	A	There are a significant amount of corrosion nodules present on the lower wall areas. Most appear to be passivated, but there are still a few active sections present
Floor	2	A	There have been patch repairs carried out, but some sections are still displaying corrosion activity
Inlet	2	F	There is a common inlet outlet @ 6 oclock and another at 3 oclock. Both of these require directional nozzles to be fitted when the tank is recoated, to prevent the floor sediments from being disturbed

Comments

External Comment:

The hatch is small and the cover is light weight. It is also not effectively sealed around the edges of the frame where the internal ladder stiles extend through.

Internal Comment:

There are a significant amount of corrosion nodules present on the lower wall areas and most appear to be passivated.

However there have been patch repairs carried out across the floor and some sections are still displaying active corrosion.

The CP system needs to be monitored and adjusted accordingly.

Reservoir Critical Maintenance Priorities Report

25/08/2020

Date:	29/05/2020	**Client Name:**	Goldenfields Water
WS #:	033	**Reservoir Name:**	Coolamon South HL 033
Asset No:	0	**Location:**	off Dyces Rd Coolamon
Job No:	027542	**Project Number:**	0
Cleaning Due:	29/5/2021	**Inspection Due:**	29/5/2021

External

Area	Priority	Status	Comments

Internal

Area	Priority	Status	Comments
Ladder Internal	2	A	The SS ladder is too short and it will not be effectively in the water level drops down when a diver is inside the tank. It needs to be extended by another 5 metres to make the tank safe

Comments

External Comment:

The external areas appear to be in good condition.

Internal Comment:

The epoxy type sealant on the wall joints is either cracking or is peeling off in many areas.The SS ladder is too short and it will not be effective if the water level drops down when a diver is inside the tank. It needs to be extended by another 5 metres to make the tank safe.

Reservoir Critical Maintenance Priorities Report

25/08/2020

Date:	30/05/2020	**Client Name:**	Goldenfields Water
WS #:	044	**Reservoir Name:**	Ganmain HL 044
Asset No:	044	**Location:**	Dulah Rd Ganmain
Job No:	027545	**Project Number:**	0
Cleaning Due:	30/5/2024	**Inspection Due:**	30/5/2024

External

Area	Priority	Status	Comments
Entry Hatch	2	A	The entry hatch cover is lightweight and is not locked. If it blew open in a storm event it would likely go unnoticed until a water quality event occurs
Roof Hatches	2	A	The roof hatch cover is not locked. If it blew open in a storm event it would likely go unnoticed until a water quality event occurs

Internal

Area	Priority	Status	Comments
Roof Framing	2	F	The two main rafters have significant surface corrosion present, as the original coating has peeled off
Outlet	1	A	The outlet is level with the floor, so any sediments present will be drawn into the pipework
Overflow	2	A	The overflow riser is heavily corroded

Comments

External Comment:

The entry and roof hatch covers are lightweight and are not locked. If they blew open in a storm event it would likely go unnoticed until a water quality event occurs.

Internal Comment:

The two main rafters have significant surface corrosion present, as the original coating has peeled off. The outlet is level with the floor, so any sediments present will be drawn into the pipework.

Reservoir Critical Maintenance Priorities Report

25/08/2020

Date:	30/05/2020	**Client Name:**	Goldenfields Water
WS #:	045	**Reservoir Name:**	Ganmain LL 045
Asset No:	045	**Location:**	Dulah Rd Ganmain
Job No:	027544	**Project Number:**	0
Cleaning Due:	30/5/2024	**Inspection Due:**	30/5/2024

External

Area	Priority	Status	Comments
Roof	1	A	There is a hole in the centre of the roof area that needs to be sealed off. It is presently only covered with a brick and rain water and debris are entering into the tank
Electrical	2	A	There is a sensor box on the roof that needs to be removed if redundant or be more effectively sealed

Internal

Area	Priority	Status	Comments
Roof Framing	1	A	The galvanised form work under the roof area is heavily corroded and has broken away in several areas. It needs to be established if this type of form work is critical to the roof structural strength
Floor	2	F	There have been a lot of floor crack repairs carried out and the latest repair materials are blistered and in poor condition

Comments

External Comment:

There is a hole in the centre of the roof area that needs to be sealed off. It is presently only covered with a brick and rain water and debris are entering into the tank.

Internal Comment:

The galvanised form work under the roof area is heavily corroded and has broken away in several areas. It needs to be established if this type of form work is critical to the roof structural strength.

Reservoir Critical Maintenance Priorities Report

25/08/2020

Date:	28/05/2020	**Client Name:**	Goldenfields Water
WS #:	050	**Reservoir Name:**	Grong Grong Town 050
Asset No: 050		**Location:**	off Newell Highway, Nth of Grong Grong
Job No:	027540	**Project Number:**	0
Cleaning Due:	28/5/2024	**Inspection Due:**	28/5/2024

External

Area	Priority	Status	Comments
Ladder External	1	A	The ladder should be climbed by experienced personnel only and the platform handrails need to be modified to allow reasonable access from one ladder to the other
Entry Hatch	2	A	The hatch cover is lightweight and is not locked or secured
Roof	2	A	There are several corroded areas present where contamination can enter the tank. These areas will deteriorate further due to no ventilation being present
Roof Hatches	1	A	One roof hatch has been partially bent open
Handrails	2	A	An improved guard rail system is required to upgrade personnel safety around the platform area
Davit	2	A	The davit is only suitable for lowering personnel into the tank. It should not be used for a rescue down to the ground
Ventilation	2	A	There is no ventilation present and the roof sheets are corroding from the underside, along with the rafters and purlins

Internal

Area	Priority	Status	Comments
Roof Framing	1	A	Several rafters are significantly corroded due to coating failure and some purlins are corroded through and are unsound
Inlet corroded	2	A	The common inlet outlet penetration is heavily
Outlet	2	A	The inlet and outlet are common
Scour	2	A	The scour is heavily corroded
Overflow	1	A	The overflow base and riser sections are both heavily corroded
Ladder Internal	2	A	There is no ladder system fitted inside the tank. A Nextep FRP ladder system 4900mm long should be installed to improve the confined space access process

Comments

External Comment:

There are several corroded sections of roof sheeting present where contamination can enter the tank. These areas will deteriorate further due to no ventilation being present. The entry hatch cover is lightweight and is not locked or secured.

Internal Comment:

Several rafters are significantly corroded due to coating failure and some purlins are corroded through and are unsound.

There is no ladder system fitted inside the tank. A Nextep FRP ladder system 4900mm long should be installed to improve the confined space access process.

Reservoir Critical Maintenance Priorities Report

25/08/2020

Date:	31/05/2020	**Client Name:**	Goldenfields Water
WS #:	0	**Reservoir Name:**	Matong Pump Station
Asset No:	0	**Location:**	Matong North Rd Matong
Job No:	027546	**Project Number:**	0
Cleaning Due:	31/5/2022	**Inspection Due:**	31/5/2022

External

Area	Priority	Status	Comments
Walls	2	A	The mid wall area joint is weeping all the way around the tank circumference

Internal

Area	Priority	Status	Comments
Walls	2	A	The mid wall area joint is weeping all the way around the tank circumference
Inlet	2	F	The inlet should be directed up off the floor area, to avoid sediment disturbance and short circuiting towards the outlet

Comments

External Comment:

The mid wall area joint is weeping all the way around the tank circumference.

Internal Comment:

The zincalume type C section purlins are accumulating moisture and are showing signs of early corrosion. The inlet should be directed up off the floor area, to avoid sediment disturbance and short circuiting towards the outlet.

Reservoir Critical Maintenance Priorities Report

25/08/2020

Date:	25/10/2019	**Client Name:**	Goldenfields Water
WS #:	093	**Reservoir Name:**	Oura BT 093
Asset No: 0		**Location:**	off Wheel of Fortune Rd off Oura Rd
Job No:	027382	**Project Number:**	
Cleaning Due:	1/8/2021	**Inspection Due:**	25/10/2021

External

Area	Priority	Status	Comments
Walls	2	A	There is a significant amount of leakage occurring in the wall base area @ 3 oclock
Entry Hatch	1	A	The entry hatch area is totally unsealed against any sort of contamination entering the water
Roof Platforms	1	A	All the platform area is also unsealed
Roof	1	A	Some roof sheets are corroded through and the aeration system is totally unsealed where it sits on top of the roof area.
Roof Hatches	1	A	There is an unsealed cover over one of the stilling pipe areas
Ventilation	2	A	The tank is well ventilated with the aeration system, but nothing is sealed against contamination entry
Bird Proofing	1	A	Birds and nests are present inside the tank

Internal

Area	Priority	Status	Comments
Walls	2	A	There is water exiting the tank around the wall base area @ 3 oclock. The wall floor seals are in poor

			condition and there are several cracks also present that may be feeding the external leakage
Floor	2	A	The floor seals appear to be in poor condition
Inlet	2	A	There is a roof mounted aeration system present and it is totally unsealed against any sort of contamination event

Comments

External Comment:

The entry hatch and platform areas areas are totally unsealed against any sort of contamination entering the water. The roof mounted aeration system is also not secured against any sort of contamination entry and the timber frames are moldy and unclean.

Internal Comment:

There is water exiting the tank around the wall base area @ 3 oclock. The wall floor seals are in poor condition and there are several cracks also present that may be feeding the external leakage.

Reservoir Critical Maintenance Priorities Report

25/08/2020

Date:	29/05/2020	**Client Name:**	Goldenfields Water
WS #:	0	**Reservoir Name:**	Oura Surge Tank
Asset No:	0	**Location:**	Eunanoreenya
Job No:	027543	**Project Number:**	0
Cleaning Due:	20/5/2020	**Inspection Due:**	29/5/2020

External

Area	Priority	Status	Comments

Internal

Area	Priority	Status	Comments

Comments

External Comment:

No Comment

Internal Comment:

No Comment

Reservoir Critical Maintenance Priorities Report

25/08/2020

Date:	26/10/2019	**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:	027384	**Project Number:**	0
Cleaning Due:	26/10/2023	**Inspection Due:**	26/10/2023

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.

Appendix D - External Auditor Report Summary

Table 37. 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