DRINKING WATER MANAGEMENT SYSTEM

Annual Report 2018-19

Lithgow City Council

Date: October 2019

Document Control

Date	Change made	Person
15/07/2019	Draft	Daniel Buckens
27/09/2019	Review	Daniel Buckens
08/10/2019	Final	Daniel Buckens

Executive Summary

Water suppliers in New South Wales (NSW) are required to have a 'quality assurance program', referred to as a Drinking Water Management System (DWMS). An annual review of the DWMS is recommended to ensure that it is valid and being implemented effectively. Furthermore, an annual report is required to be prepared and submitted to the local Public Health Unit (PHU), NSW Health.

Lithgow City Council provides potable water through two schemes, the Lithgow Water Supply Scheme (LWSS) operated by Lithgow City Council which includes the Oakey Park Water Treatment Plant (OPWTP), and the Fish River Water Supply Scheme (FRWSS) operated by Water NSW. The LWSS services the majority of properties within the Lithgow urban area, while the FRWSS services the majority of properties in Marrangaroo, Wallerawang, Portland, Cullen Bullen, Lidsdale, Rydal and Glen Davis. Parts of Sodwalls and Hampton are also served with direct supply from the trunk main of the FRWSS. Either Scheme can service the whole of the reticulated area of the LGA if and when required.

There were 3 separate breaches of the ADWG health-based guidelines, exceedances were recorded for E.coli, returning a results of 3, Mercury returning a result of 0.0013mg/L which is n exceedance of 0.0003mg/L and Nickel returning a result of 0.03mg/L which is an exceedance of 0.01mg/L.

ADWG aesthetic guideline exceedance was noted for Iron which exceeded on two occasions at 0.56mg/L and 0.57mg/L, both at the same sample site location, for Aluminium returning a result of 0.72mg/L and True Colour returning a result of 22 HU.

Council maintained a moderate level of consumer satisfaction, with 180 water quality complaints received over the reporting period which is approximately 2.1% of connections. Council followed the appropriate processes when these complaints were received to ensure health of consumers was not jeopardised.

The Continuous Improvement Plan, which forms an integral part of the DWMS, demonstrates the practice of continual improvement, given the timing of this report a review of the Improvement Plan has not been undertaken. A full review of the Improvement Plan will be provided as part of the 2018/19 Annual Report.

Continuous Improvement Plan

Below is a summary of progress towards implementing continuous improvement plan actions.

Ref.	Actions	Responsibility	Priority	Timeframe	Status	Comments
1.1.1	Expand the strategic objective 'to provide safe drinking water' into a full drinking water quality policy.	Manager Water and Wastewater	NA	NA	Completed	A water quality policy has been developed. The policy will be tabled for council endorsement. The latest version of the Policy was adopted at the August 2018 Council Meeting
1.3.4	Formalise agreement with Centennial Coal re water quality and communication protocols if treatment fails at Clarence Colliery (see risk register CCS1).	Manager Water and Wastewater	Medium	NA	Completed	This is covered under the Clarence Colliery Pollution Incident Response Management Plan

1.3.5	Review asset ownership between council and WaterNSW (see risk register DR3).	Director Water and Wastewater	Low	Jul-20	Underway	
1.3.6	Make sure asset agreements are in place between LCC and WaterNSW (see risk register DR3).	Director Water and Wastewater	Low	Jul-20	Underway	Draft Agreement is with WaterNSW for execution
2.2.2	Ensure that when set up, data from Critical Control Points are logged (probably through SCADA) and analysed on a frequent basis (say monthly, initially) to allow for any emerging trends at these critical points to be picked up quickly.	Director Water and Wastewater	High	Jan-20	Underway	Process to report, record and review CCP exceedances has been set up, development of a database has been complete. SCADA implementation has commenced
2.3.4	Review pipeline location for input of Clarence Colliery Source in new configuration (see risk register CCS1).	Manager Water and Wastewater	Low	N/A	Closed	There is little opportunity to relocate the pipeline
4.2.2	Review procedures for bushfires in Emergency Response Plan including how Oakey Park WTP is managed (arose out of risk assessment 1 September 2011 and refers to risks FC2 and WOS1).	Manager Water and Wastewater	Medium	N/A	Completed	In accordance with the BCP Council has the ability to draw water from FRWS should the plant be damaged or destroyed.
4.2.3	Review how the septic system is managed at the Motorcycle club (arose out of risk assessment 1 September 2011 and refers to risks FC7).	Manager Water and Wastewater	High	N/A	Completed	Inspected by Council EHO and a 5 year licence to operate approved until 2019/20. System is operating satisfactorily
4.2.6	Develop calibration records (see risk register WOS6). Template to be prepared by NSW Public Works.	Manager Water and Wastewater	Medium	N/A	Completed	Calibrations undertaken under Service Delivery Agreement and records of calibrations

						provided by the contractor.
4.2.7	Consider moving to online telemetered monitoring for treated water pH, chlorine residual as well as online raw water monitoring (turbidity, EC, pH; see risk register pH1, pH2, Coag6, Dis2).	Manager Water and Wastewater	High	N/A	Completed	Online meters installed.
4.2.8	Develop a formalised procedure for this bypass of the clarifier during maintenance (see risk register Clar2).	Manager Water and Wastewater	Medium	N/A	Completed	Should maintenance on the clarifier be required than the whole plant will be shut down and water drawn from FRWS.
4.2.9	Review the need for individual filter turbidity meters (see risk register F1).	Manager Water and Wastewater	High	N/A	Completed	Online meters installed.
5.3.1	Ensure that customer requests relating to water quality are analysed for trends.	Manager Water and Wastewater	Medium	N/A	Completed	Samples are collected when a customer makes a compliant regarding water quality. These results are analysed for trends.
6.2.2	After scenario training has been conducted, review how the protocols were implemented in practice and ensure that any gaps are identified and incorporated into improvements to the protocols.	Director Water and Wastewater	Medium	Oct-20	To Start	Will be undertaken during mock exercise.
7.1.2	Ensure that service providers to Council are aware of water quality protection requirements when undertaking their jobs by including specific water quality awareness and protection clauses in contracts and ensuring that water	Director Water and Wastewater	Medium	Jul-21	To Start	

	quality awareness training is kept up to date.					
8.2.2	Ensure that residents on non-potable water are informed on a consistent basis that their water is not intended for drinking.	Director Water and Wastewater	High	every 12 months	Underway	Bill inserts were included in the final 2018/19 notice/account.
9.2.2	Ensure that the location of the Clarence Colliery pipeline is reviewed in terms of at least position of entry into the dam and likely impact on potential short-circuiting.	Manager Water and Wastewater	Medium	N/A	Completed	No other option is feasible.
9.2.9	Review reasons for pH increases including plant and reticulation issues (see risk register PD1).	Manager Water and Wastewater	High	N/A	Completed	DPIE Inspector had advised Operators to increase the pH due to low alkalinity to reduce the impact/potential to cause problems in the retic.
9.2.12	Adequacy of asset replacement program, asset management and condition assessment to be considered. Need to include cast iron mains in asset management program when developed. (See risk register D1, D9).	Director Water and Wastewater	Low	Jul-22	Underway	Asset Management System has been implemented as the first step in developing a full assessment management plan/strategies.
9.2.15	Consider undertaking a more in depth system modelling to better understand water balance (see risk register D12).	Director Water and Wastewater	Low	Jul-21	Underway	Implemented smart meters and installing bulk meters on reservoirs to provide required data to undertake more accurate balance.
10.1.1	Ensure that the records management policy is reviewed as it is currently two	Manager Water and Wastewater	Low	NA	Completed	Records Management Policy was reviewed and adopted Nov 2017. Next review due 2020/21.

	years past its review date.					
10.1.2	Ensure that a SOP is written to cover standardisation of file naming for later ease of searching.	Director Water and Wastewater	Medium	N/A	Completed	All water quality records are stored against a subject index with Council Electronic Records Management System.
10.1.2	Consider reviewing how water quality data/incidents and records are stored at Council to improve access to data and records.	Manager Water and Wastewater	Medium	N/A	Completed	Records are held within Council's ERM within a specific archive folder.
10.1.3	Make sure that all asset inspections are logged, not just those that fall out of hours.	Director Water and Wastewater	Low	Jul-20	Underway	Council has implemented the Asset Management System and purchased the Worx.Online module for implementation in 2019/20.
11.1.1	Consider improving use of the NSW Health Drinking Water Database to help with long-term trending and review of water quality data.	Manager Water and Wastewater	Medium	N/A	Completed	
11.2.1	Formalise and record inspections undertaken by the operators (use templates, checklists etc. to facilitate direction of inspections).	Director Water and Wastewater	Medium	Jul-20	Underway	Council has purchased the Worx.Online module for implementation in 2019/20.

A summary of CCP exceedances for the reporting period are provided below with further detail provided in Section 4.

Critical Control Points

	CCP1	CCP2	CCP3	CCP4
Number of CCP exceedances	0	0	1	0

Reservoir Inspections

A summary of reservoir inspections undertaken by Aqualift is provided below.

Date	Reservoirs inspected	Findings	Corrective actions
29/03/02019	Cook Street High	The internal coating is past its design life and significant deterioration is occurring. The sacrificial CP is slightly assisting in corrosion prevention, but there are still lots of active corrosion nodules.	Repairs options are being investigated for inclusion as Capital Project 2020/21.
29/03/02019	Cook Street Low	The FRP platform mesh is deteriorating and is an itching hazard to personnel. Rock impact damage to the roof is occurring from one particular area outside the security fence. There is a small rock ledge and a pathway leading up to it. The entry hatch was open upon arrival to site. The roof area has been repaired at present.	This area needs to be coated with a weather proof paint to resolve the issue. If this ledge was to be removed, a lot of the current vandalism would be avoided. Regular site inspections are required to make sure it stays in good condition and security is not compromised.
29/03/02019	South Bowenfels	There is evidence of unauthorised access to the roof area and the entry hatch cover has been bent open at one stage. The hinges are easy to open by removing the pivot bolts and one of them is already missing. There appears to have been a lot of attempts to seal off the tank - poor workmanship or design would have to be the contributing factors in all of this, so strict supervision should have been applied to keep things on course. The platform area has a centre join and this is not sealed, allowing water to drain back into the tank. The internal ductile iron pipework will begin to corrode and affect the water quality. The inlet nozzle arrangement is wrong in terms of design and direction. It should be removed and have an effective HDPE customised nozzle fitted to better circulate the water within the tank. The coating on the centre roof post is delaminating and corrosion is setting in.	No corrective actions have investigated/determined.

1 Report Purpose

Water suppliers in the New South Wales (NSW) are required to establish and adhere to a 'quality assurance program', referred to as a Drinking Water Management System (DWMS). The DWMS is a risk based approach to managing drinking water quality.

An annual review of the DWMS is recommended to ensure that it is valid and is being implemented effectively. In addition, an annual report is required to be prepared and submitted to the local Public Health Unit (PHU), NSW Health. The DWMS Annual Report covers a 12-month period from 1 July 2018 to 30 June 2019. This report summarises Lithgow City Council's drinking water quality performance for the reporting period and the progress on the implementation of the improvement plan.

The report only covers water treated and supplied through the Oakey Park Water Filtration Plant and water that is purchased from Water NSW's Fish River Water Supply Scheme and reticulated by Council.

2 Scheme Summary

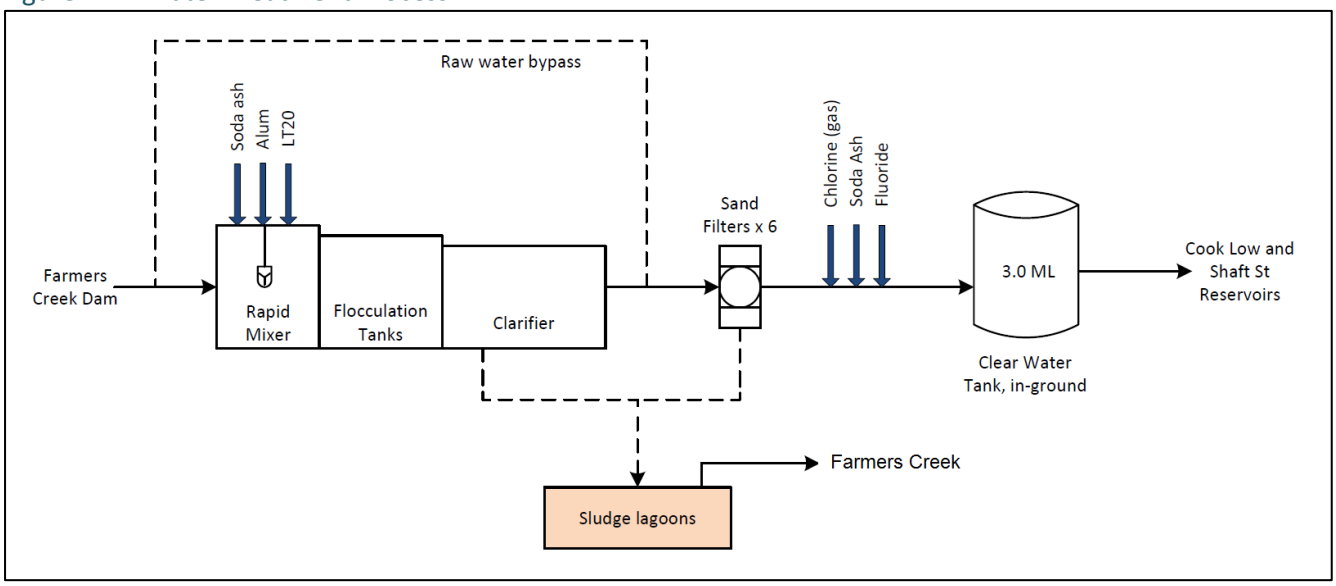
Lithgow City Council provides potable water through two schemes, the Lithgow Water Supply Scheme (LWSS) operated by Lithgow City Council which includes the Oakey Park Water Treatment Plant (OPWTP) which treats water from the Farmers Creek Dam, and the Fish River Water Supply Scheme (FRWSS) operated by Water NSW where water is sourced from the Oberon Dam and treated at the Duckmaloi Filtration Plant. FRWSS delivers bulk water to LCC at various points within the system before LCC operates the reticulation network in the towns and villages. The Annual Report covers water treated and supplied through the Oakey Park Water Filtration Plant and water that is purchased from Water NSW's Fish River Water Supply Scheme and reticulated by Council.

Raw water for the water supply to Lithgow is sourced from Farmers Creek Dam No.2, which is located about 5.5 kilometres north-east of the centre of Lithgow. The original lower dam (Dam No.1) was built in 1896 and is no longer used. The upper dam (Dam No.2) which was built in 1907 has a capacity of 410 ML and has a top water level of 1000 m AHD. If required, water can be transferred to the dam from the Clarence Colliery Water Transfer Scheme (CWTS) to address water shortages, particularly in dry, hot weather and under drought scenarios. Following recent infrastructure mediation work, the delivery capacity of the CWTS has been augmented from 5 ML/day to deliver up to 14 ML/day. Currently the system, when operating, delivers 7 ML.

The Farmers Creek catchment is a forested area of approximately 12km^2, with minor recreation such as four wheel driving and hiking. There is a dirt bike complex within the catchment that has a septic system which is inspected by Council's Environmental Health Officers at the required intervals. The catchment is unfenced and there are a few dirt tracks and fire trails in the catchment.

The Oakey Park Water Treatment Plant (WTP) treats raw water received from Farmers Creek Dam. The plant was commissioned in August 1985, and has a maximum capacity of 15 ML/day. The primary purpose of the plant is to provide the residents and businesses of Lithgow with potable water, meeting the Australian Drinking Water Guidelines (ADWG). The plant also houses the central monitoring facility for the telemetry system that controls and monitors all components of the LWSS.

Figure 2-1 - Water Treatment Process



The treatment process consists of the following steps: chemical additive of soda ash, alum and polyelectrolyte, flocculation, clarification (horizontal flow), filtration (mono media) and post dosing of chlorine, soda ash and fluoride.

The LWSS services the majority of properties within the Lithgow urban area, while the FRWSS services the majority of properties in Marrangaroo, Wallerawang, Portland, Cullen Bullen, Lidsdale, Rydal and Glen Davis. Parts of Sodwalls and Hampton are also served with direct supply from the trunk main of the FRWSS. Either Scheme can service the whole of the reticulated area of the LGA if and when required.

Figure 2-2 - LWSS Service Area

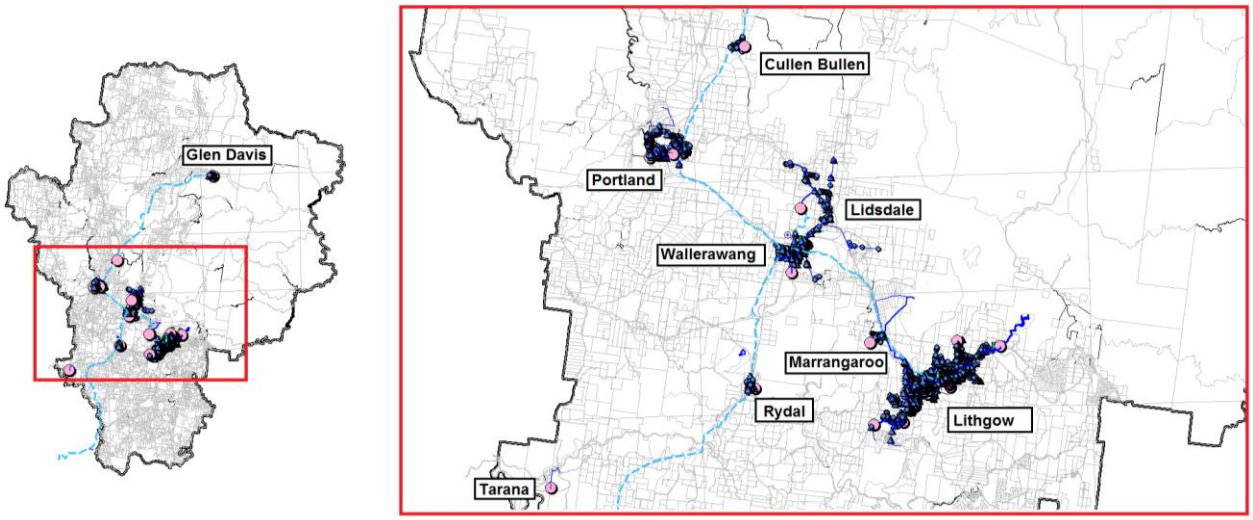
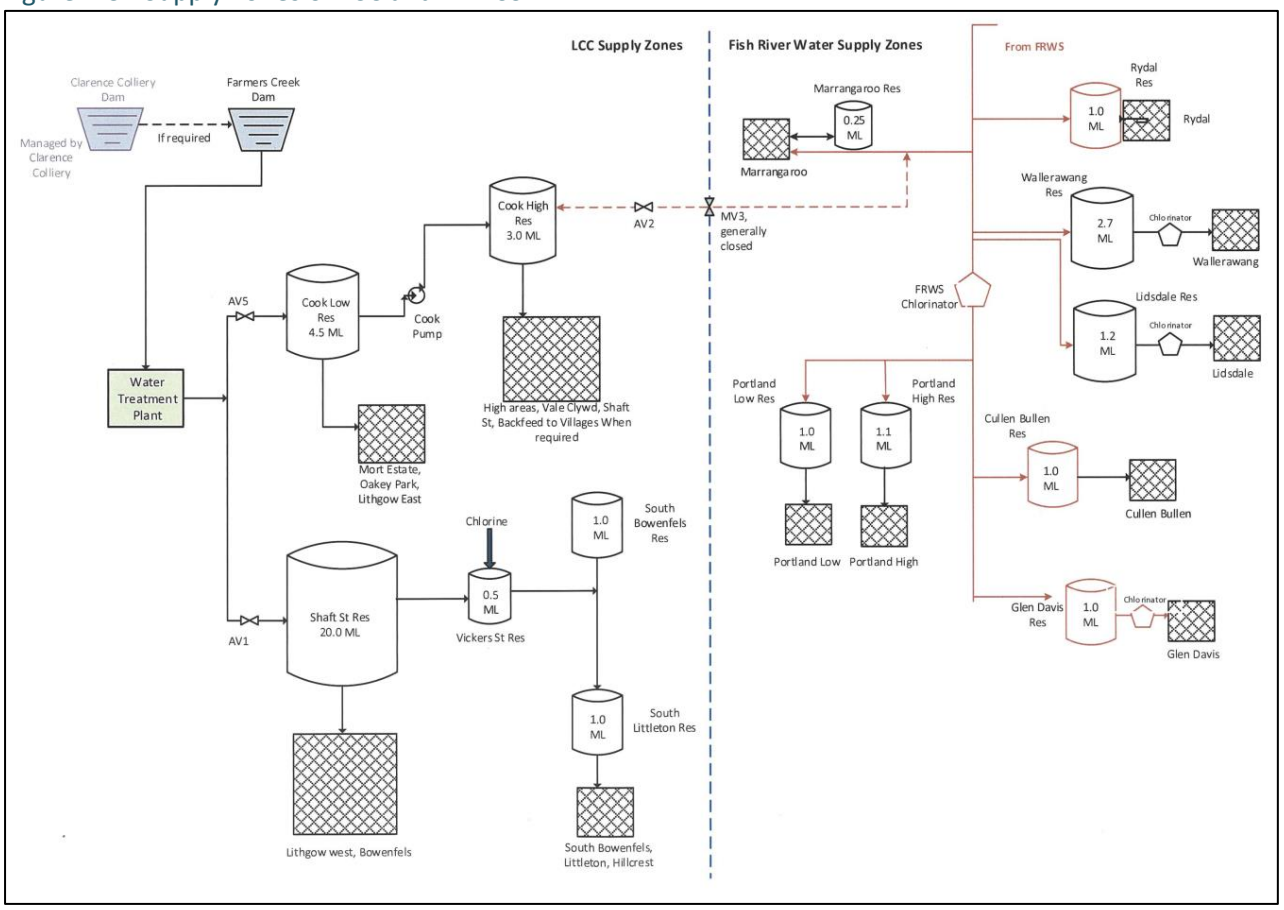


Figure 2-3 - Supply Zones of LCC and FRWSS



Council provides water to three categories of users; residential, business and industrial. In 2018/19 Council had 8413 meter connections across the three categories ranging in size from 20mm connection up to 100mm connections.

During the reporting period, Council undertook a major refurbishment of the Shaft Street Reservoir. The Shaft Street Old Reservoir has been offline since late 1990's due to structural issues. This reservoir was refurbished and recommissioned to allow works to be undertaken on the Shaft Street New Reservoir. The Shaft Street New Reservoir was refurbished after inspection identified major structural issues. The issues have now been resolved and the reservoir has been recoated to prevent further degradation of the steel tank, cathodic protection installed and roof repairs to improve security.

Council undertook water mains renewal as part of the asset renewal program.

First stage of works was undertaken to move toward the installation of SCADA control at the OPWTP. This work will not be complete till late 2020.

Checklist	
Have there been any system upgrades within the reporting period?	☒
Upgrade or system improvements details have been provided	☒

3 DWMS Document Control

The below provides a summary of the updates to the DWMS.

Document History:	Template	Annalisa Contos	2/8/2011	
	Version 1	Annette Davison	8/9/2011	Sent to Daniel Buckens (cc Annalisa Contos) for first review.
	Version 1.1	Daniel Buckens	27/9/2011	Content added.
	Version 1.2	Annette Davison	31/10/2011	Revised post meeting with Chris Lane, 25/10/2011
	Version 1.3	Annette Davison, Josh Tickell	9/12/2011	Revised post project meeting 8/12/2011 and sent in entirety to Lithgow City Council, NSW Health and Project Team Members
	Version 2	Annette Davison	1/5/12	Additions made to capture comments from NSW Health.
	Version 2.1		2014	Review and update of plan
	Version 3	Tasleem Hasan, Viridis Consultants	10/08/15	Review and detailed update of document
	Version 3.1	Rhys Brownlow	18/09/17	LCC Review

4 Critical Control Points

The below table provides a summary of the Critical Control Points for the scheme. The other important operational monitoring is captured in the operational monitoring plan and is being implemented, including reservoir integrity.

Table 4-1. - Summary of critical control points

CCP	Parameter	How	Where	When	Target	Alert level	Critical limit
Filtration	Turbidity	Grab	Post filters	Daily	<0.3 NTU	>0.5 NTU for any one sample	>1 NTU for any two immediate consecutive samples
Disinfection	Free chlorine	Grab	Post clear water tank	Daily	1.6-1.9 mg/L	<1.0 and >2.5 mg/L for any one sample	<0.5 and >5 mg/L for any two immediate consecutive samples
	pH				7.5-8.0	>8.0 for any one sample	>8.5 for any two immediate consecutive samples
Fluoridation	Fluoride	Grab	Post clear water tank	Daily	0.9-1.0 mg/L	<0.9 mg/L for more than 72 hours or >1.1 mg/L for any one sample	>1.5 mg/L for any two immediate consecutive samples

4.1 Critical Limit Exceedance

There were ten exceedances of the Critical Control Point limits, not all exceedances resulted in exceedance of the Critical Limits. These exceedances are shown below in the Exceedance Summary table. Seven of the exceedances are a result of the overdosing of Soda Ash due to operational issues with the feeder. It was identified that blockages within the hopper were leading to inconsistent feed. These blockages were caused by Soda Ash clumping due to moisture in the hopper which would restrict the feed rate until such time as the clump was broken up and subsequently then feed through the hopper resulting in overdose.

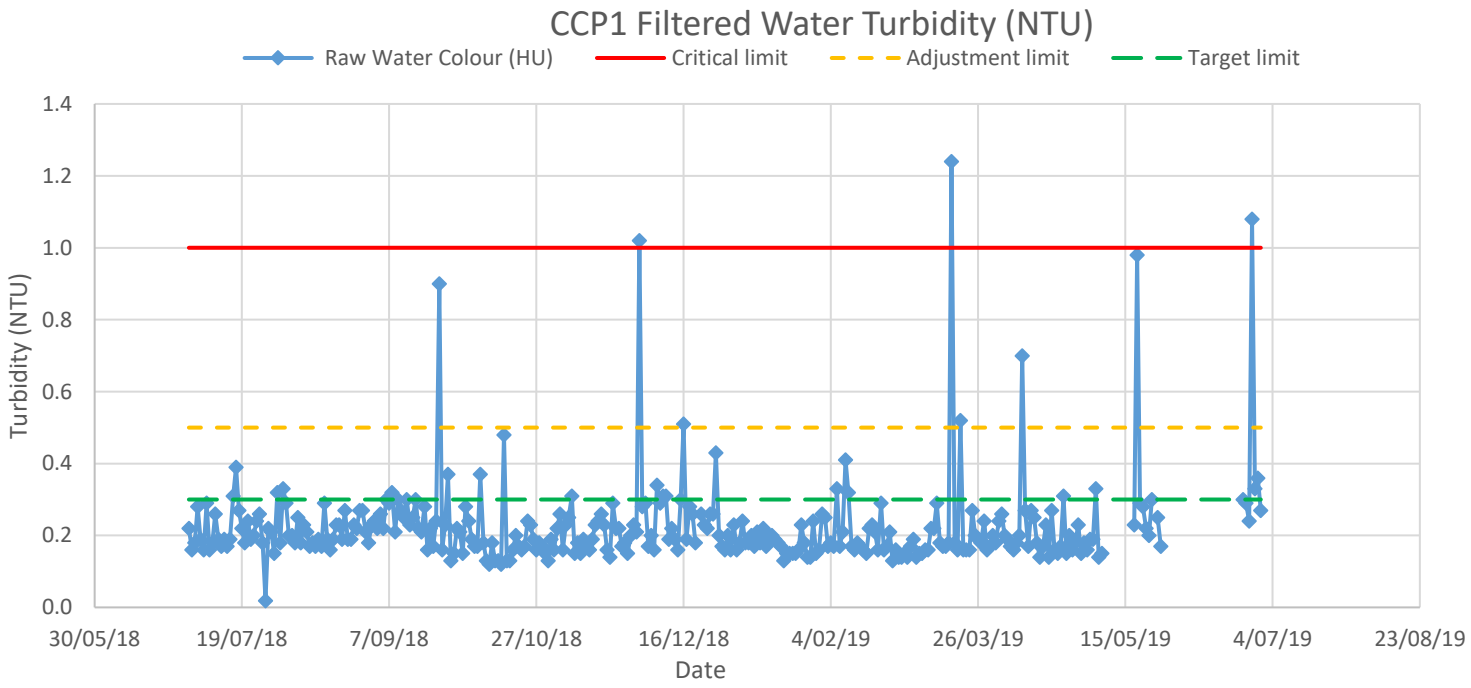
It has also been determined during a review of the Improvement Plan that exceedances of the Alert Level of pH values occur regularly. The operators have subsequently advised that the DPIE Inspector recommended that pH values should be higher due to the low alkalinity to protect the downstream infrastructure. This has resulted in levels regularly being at the Alert Level and exceeding the Critical value. There was one incident where the critical limit as per the CCP was exceeded but not reported in accordance with the protocol.

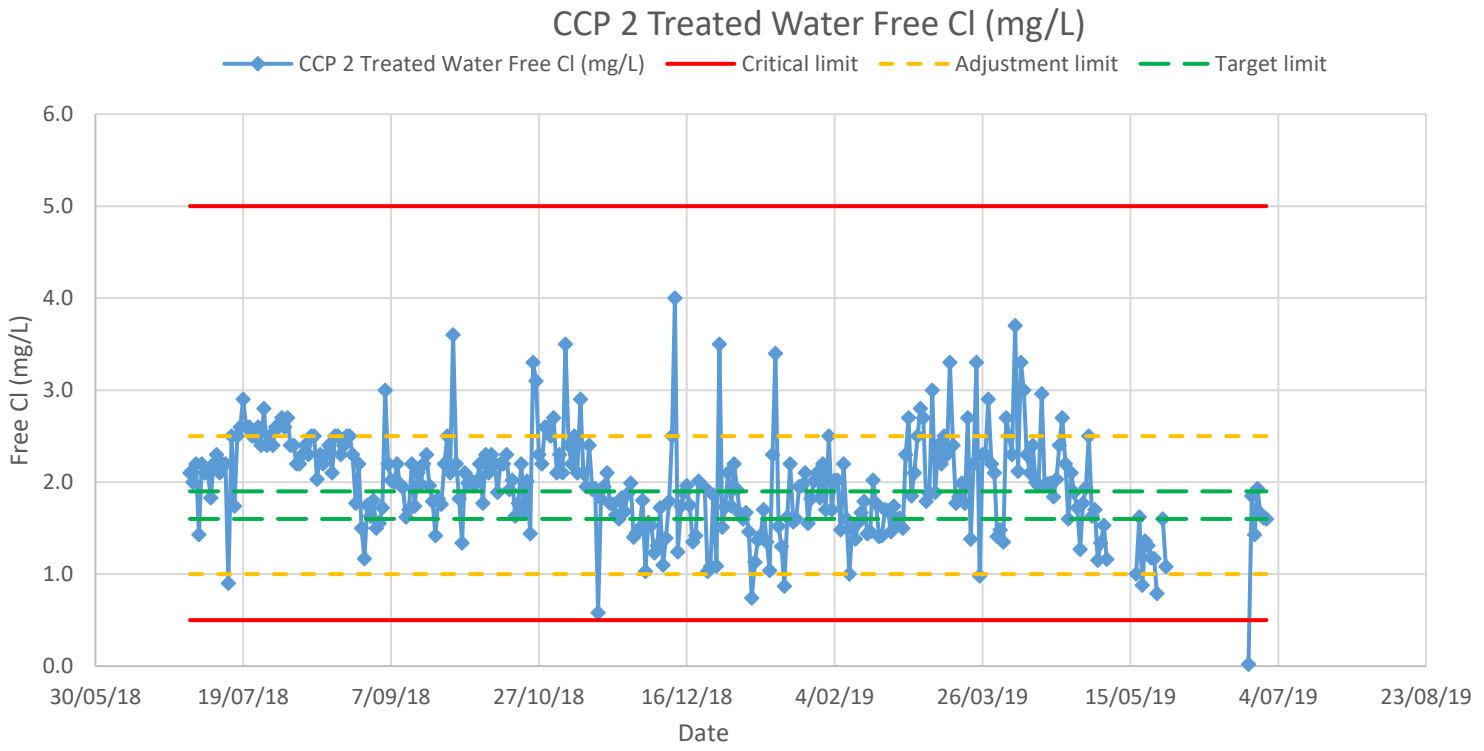
These results shown are single exceedances which breached the CCP other than the single event described above.

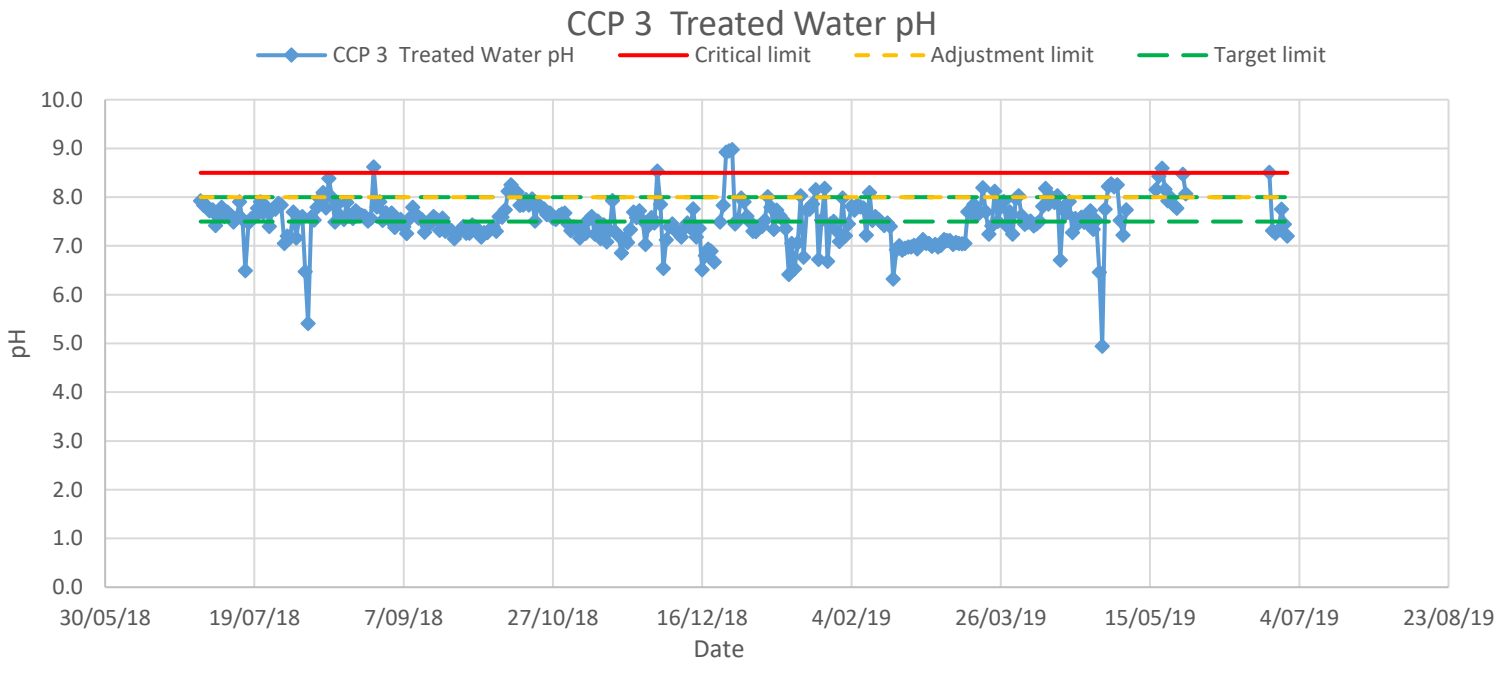
Table 4-2. Critical Limit Exceedances

Date	CCP 1 Turbidity	CCP 2 Free Chlorine	CCP 3 pH	CCP 4 Fluoride
28/08/2018			8.62	
1/12/2018	1.02		8.53	
24/12/2018			8.92	
25/12/2018			8.95	
26/12/2018			8.97	
17/03/2019	1.24			
19/05/2019			8.59	
24/06/2019		0.02	8.51	
27/06/2019	1.08			
Total	**3**	**1**	**7**	**0**

Figure 4-1. Critical Control Points

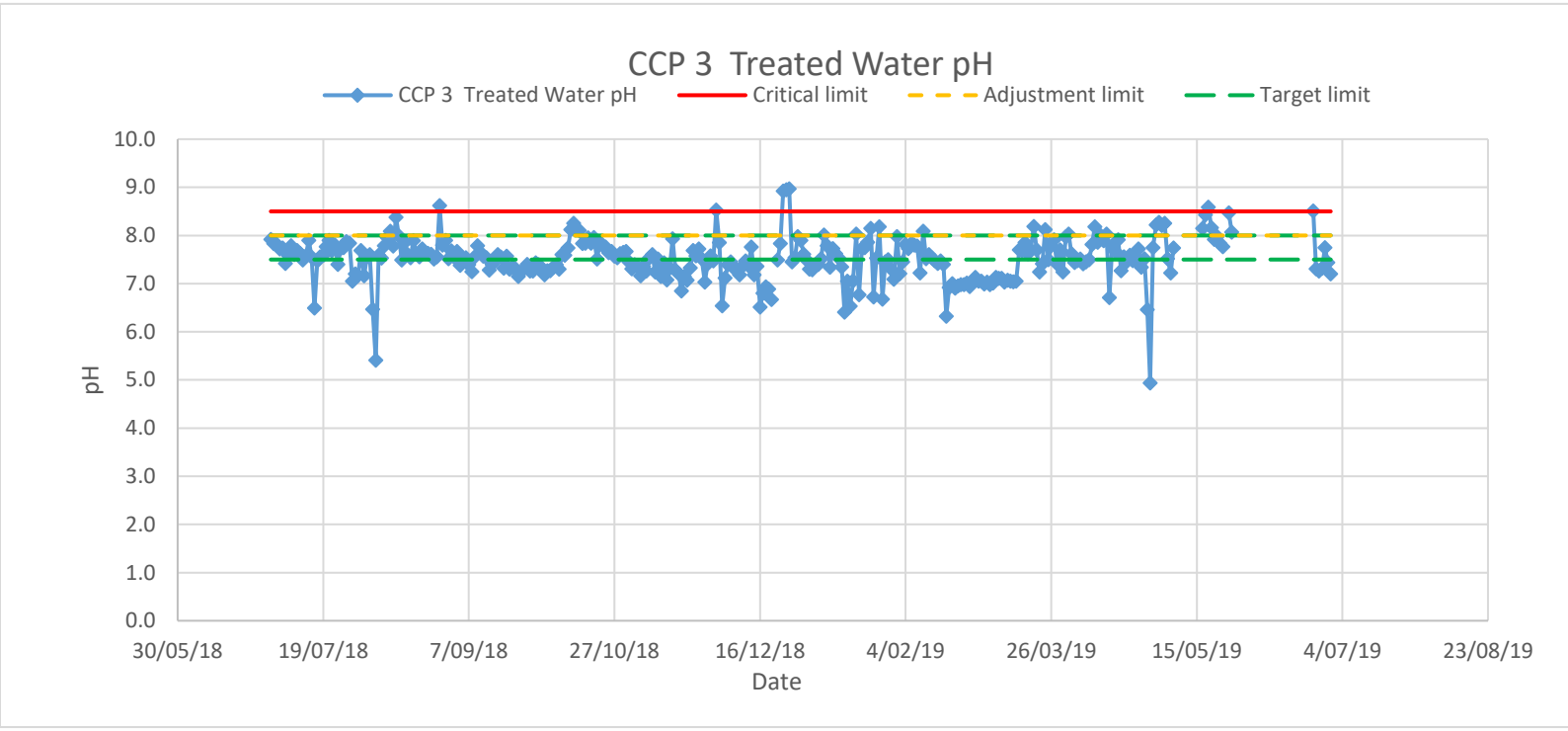



CCP 2 Treated Water Free Cl (mg/L)
CCP 2 Treated Water Free Cl (mg/L)
Critical limit
Adjustment limit
Target limit
Free Cl (mg/L)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
30/05/18
19/07/18
7/09/18
27/10/18
16/12/18
4/02/19
26/03/19
15/05/19
4/07/19
23/08/19
Date


CCP 3 Treated Water pH
CCP 3 Treated Water pH
Critical limit
Adjustment limit
Target limit
pH
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
30/05/18
19/07/18
7/09/18
27/10/18
16/12/18
4/02/19
26/03/19
15/05/19
4/07/19
23/08/19
Date

4.2 Fluoride Critical Limit Exceedance

Council did not exceed the Critical Limits for Fluoride during the reporting period.



5 Water Quality

Verification of drinking water quality provides an assessment of the overall performance of the system and the ultimate quality of drinking water being supplied to consumers. This incorporates monitoring drinking water quality as well as assessment of consumer satisfaction.

Maintaining a Chlorine residual in the network still remains a problem.

Samples that fail to meet the ADWG values occur consistently at the same sample point. A review of this indicates that the sample is taken from a tap within a public reserve and that the only water that is used is to collect the sample. An alternate sample location should be provided to ensure results are indicative of the water quality within the network where water is turned over on a regular frequency.

5.1 Data Collection

Drinking water quality monitoring is a wide-ranging assessment of the quality of water in the distribution system and importantly, as supplied to the consumer. It includes regular sampling and testing to assess whether water quality is complying with ADWG values.

Monitoring of drinking ate us regarded as the final check that, overall, the barriers and preventative measures implemented to protect public health are working effectively. The drinking water quality performance of the schemes is presented in Appendix A (extracted from the NSW Health Water Quality Database), the below provides a summary of the exceedances.

There were three separate breaches of the ADWG health-based guidelines, exceedances were recorded for E.coli, returning a result of 3, Mercury returning a result of 0.0013mg/L which is an exceedance of 0.0003mg/L and Nickel returning a result of 0.03mg/L which is an exceedance of 0.01mg/L.

There were three results that returned a positive result for Total Coliforms. There is no guideline value for total coliforms in drinking water, but is used as an indicator for inadequate treatment or breakdown in system integrity.

ADWG aesthetic guideline exceedance was noted for Iron which exceeded on two occasions at 0.56mg/L and 0.57mg/L both at the same sample site location, for Aluminium returning a result of 0.72mg/L and True Colour returning a result of 22 HU. Aesthetic exceedances do not pose any threat to the health of consumers but may cause staining and customer complaints and reduce the efficacy of chlorine residual as a barrier against recontamination.

5.2 Non-Compliant Data

Table 5-1. Summary of non-compliant water quality data

Date	Location	Parameter	Exceedance	Correction	Preventive action	Notes
07/08/2018	Site 116	Aluminium	0.72	Repeat sample collected 21/08/2018. Field samples collected on notification and results returned less than the guideline value	Review the operation of the Alum dosing pumps.	
04/12/2018	Site 112	Total Coliforms	1	PHU notified, mains flushed and confirmation of Free and Total Chlorine. Resampled		
18/12/2018	Site 125	E.coli	3	PHU notified, mains flushed and confirmation of Free and Total Chlorine. Immediate resample	New sample tap installed away from the Public Toilets	Late but tested
18/12/2018	Site 125	Total Coliforms	4	As above	As above	Late but tested
05/03/2019	Site 222	Iron	0.56			
05/03/2019	Site 222	True Colour	22.00			
02/04/2019	Site 222	Total Coliforms	2	PHU notified, mains flushed and confirmation of Free and Total Chlorine. Immediate resample		
18/06/2019	Site 222	Iron	0.57	PHU notified, mains flushed and repeat sample collect at the normal frequency		No preacidified bottle record by the lab
18/06/2019	Site 222	Nickel	0.03	PHU notified, mains flushed and repeat sample collect at the normal frequency		No preacidified bottle record by the lab
25/06/2019	Site 111	Mercury	0.0013	PHU notified, mains flushed and immediate resample. Investigation into possible sources of contamination	The cause of the exceedance was not determined and repeat sample provide levels below the ADWG.	

5.3 Water Quality Discussion

Council had one E.coli result. Council managed the positive test in accordance with the Drinking Water Management System and the Protocol for an E.coli Detection. Investigation into the result

determined that the result was most likely caused by a contaminated sample. Sample was collected from a tap within a public toilet with disinfection of the tap via flaming or other appropriate method.

In all instances where Council received positive microbiological samples are analysed for free and total chlorine, water mains are flushed and repeat samples are collected. Where samples return values higher health or aesthetic values of ADWG, water samples are collected and the water mains flushed.

6 Consumer Complaints

Council received 180 water quality complaints during the reporting period. A review of these complaints reveals a trend and relates to consumers on dead-end mains. Where there is a known issue, Council undertakes a regular flushing program to maintain water quality. A program of works is being developed to link up dead-ends to deal with these water quality issues.

Council has over the reporting period used one supply source, either OPWTP or FRWS to supply the LGA. Review of the water quality complaints show a trend that when a single source is used that there are fewer water quality complaints.

7 Development and Training

No staff development of training was provided in the reporting period.

8 Continuous Improvement Plan

The below provides a summary of continuous improvement plan activities that have progressed, been completed or been added during the reporting period. The full continuous improvement plan is provided in Appendix B.

Table 8-1 Continuous improvement plan activities that have progressed, been completed or been added during the 18/19 reporting period

Ref.	Actions	Responsibility	Priority	Timeframe	Status	Comments
1.1.1	Expand the strategic objective 'to provide safe drinking water' into a full drinking water quality policy.	Manager Water and Wastewater	NA	NA	Completed	A water quality policy has been developed. The policy will be tabled for council endorsement. The latest version of the Policy was adopted at the August 2018 Council Meeting.
1.3.4	Formalise agreement with Centennial re water quality and communication protocols if treatment fails at Centennial Coal (see risk register CCS1).	Manager Water and Wastewater	Medium	NA	Completed	This is covered under the Clarence Colliery Pollution Incident Response Management Plan.

1.3.5	Review asset ownership between council and WaterNSW (see risk register DR3).	Director Water and Wastewater	Low	Jul-20	Underway	
1.3.6	Make sure asset agreements are in place between LCC and WaterNSW (see risk register DR3).	Director Water and Wastewater	Low	Jul-20	Underway	Draft Agreement is with WaterNSW for execution.
2.2.2	Ensure that when set up, data from Critical Control Points are logged (probably through SCADA) and analysed on a frequent basis (say monthly, initially) to allow for any emerging trends at these critical points to be picked up quickly.	Director Water and Wastewater	High	Jan-20	Underway	Process to report, record and review CCP exceedances has been set up, development of a database has been complete. SCADA implementation has commenced.
2.3.4	Review pipeline location for input of Clarence Colliery Source in new configuration (see risk register CCS1).	Manager Water and Wastewater	Low	N/A	Closed	There is little opportunity to relocate the pipeline.
4.2.2	Review procedures for bushfires in Emergency Response Plan including how Oakey Park WTP is managed (arose out of risk assessment 1 September 2011 and refers to risks FC2 and WOS1).	Manager Water and Wastewater	Medium	N/A	Completed	In accordance with the BCP Council has the ability to draw water from FRWS should the plant be damaged or destroyed.
4.2.3	Review how the septic system is managed at the Motorcycle club (arose out of risk assessment 1 September 2011 and refers to risks FC7).	Manager Water and Wastewater	High	N/A	Completed	Inspected by Council EHO and a 5 year licence to operate approved until 2019/20. System is operating satisfactorily.

4.2.6	Develop calibration records (see risk register WOS6). Template to be prepared by NSW Public Works.	Manager Water and Wastewater	Medium	N/A	Completed	Calibrations undertaken under Service Delivery Agreement and records of calibrations provided by the contractor.
4.2.7	Consider moving to online telemetered monitoring for treated water pH, chlorine residual as well as online raw water monitoring (turbidity, EC, pH; see risk register pH1, pH2, Coag6, Dis2).	Manager Water and Wastewater	High	N/A	Completed	Online meters installed.
4.2.8	Develop a formalised procedure for this bypass of the clarifier during maintenance (see risk register Clar2).	Manager Water and Wastewater	Medium	N/A	Completed	Should maintenance on the clarifier be required than the whole plant will be shut down and water drawn from FRWS.
4.2.9	Review the need for individual filter turbidity meters (see risk register F1).	Manager Water and Wastewater	High	N/A	Completed	Online meters installed.
5.3.1	Ensure that customer requests relating to water quality are analysed for trends.	Manager Water and Wastewater	Medium	N/A	Completed	Samples are collected when a customer makes a compliant regarding water quality. These results are analysed for trends.
6.2.2	After scenario training has been conducted, review how the protocols were implemented in practice and ensure that any gaps are identified and incorporated into improvements to the protocols.	Director Water and Wastewater	Medium	Oct-20	To Start	Will be undertaken during mock exercise.

7.1.2	Ensure that service providers to Council are aware of water quality protection requirements when undertaking their jobs by including specific water quality awareness and protection clauses in contracts and ensuring that water quality awareness training is kept up to date.	Director Water and Wastewater	Medium	Jul-21	To Start	
8.2.2	Ensure that residents on non-potable water are informed on a consistent basis that their water is not intended for drinking.	Director Water and Wastewater	High	every 12 months	Underway	Bill inserts were included in the final 2018/19 notice/account.
9.2.2	Ensure that the location of the Clarence Colliery pipeline is reviewed in terms of at least position of entry into the dam and likely impact on potential short-circuiting.	Manager Water and Wastewater	Medium	N/A	Completed	No other option is feasible.
9.2.9	Review reasons for pH increases including plant and reticulation issues (see risk register PD1).	Manager Water and Wastewater	High	N/A	Completed	DPIE Inspector had advised Operators to increase the pH due to low alkalinity to reduce the impact/potential to cause problems in the retic.
9.2.12	Adequacy of asset replacement program, asset management and condition assessment to be considered. Need to include cast iron mains in asset management	Director Water and Wastewater	Low	Jul-22	Underway	Asset Management System has been implemented as the first step in developing a full assessment management plan/strategies.

	program when developed. (See risk register D1, D9).					
9.2.15	Consider undertaking a more in depth system modelling to better understand water balance (see risk register D12).	Director Water and Wastewater	Low	Jul-21	Underway	Implemented smart meters and installing bulk meters on reservoirs to provide required data to undertake more accurate balance
10.1.1	Ensure that the records management policy is reviewed as it is currently two years past its review date.	Manager Water and Wastewater	Low	NA	Completed	Records Management Policy was reviewed and adopted Nov 2017. Next review due 2020/21
10.1.2	Ensure that a SOP is written to cover standardisation of file naming for later ease of searching.	Director Water and Wastewater	Medium	N/A	Completed	All water quality records are stored against a subject index with Council Electronic Records Management System
10.1.2	Consider reviewing how water quality data/incidents and records are stored at Council to improve access to data and records.	Manager Water and Wastewater	Medium	N/A	Completed	Records are held within Council's ERM within a specific achieve folder
10.1.3	Make sure that all asset inspections are logged, not just those that fall out of hours.	Director Water and Wastewater	Low	Jul-20	Underway	Council has implemented the Asset Management System and purchased the Worx.Online module for implementation in 2019/20
11.1.1	Consider improving use of the NSW Health Drinking Water Database to help with long-term trending and review of water quality data.	Manager Water and Wastewater	Medium	N/A	Completed	

11.2.1	Formalise and record inspections undertaken by the operators (use templates, checklists etc. to facilitate direction of inspections).	Director Water and Wastewater	Medium	Jul-20	Underway	Council has purchased the Worx.Online module for implementation in 2019/20

9 Review of DWMS Implementation

The below provides a summary of any internal or external reviews of the DWMS and implementation. It includes details of relevant findings and any actions taken or identified.

Table 9-1. Summary of internal reviews

Date	Reviewer	Scope	Findings	Actions
18/09/2017	*Rhys Brownlow*	*Internal Review of Section 3*	*Details out of date*	*Provide additional roles with the water quality team and assign responsibilities*
18/09/2017	*Rhys Brownlow*	*Internal Review of Section 4.4.1*	*Some works have been complete*	*Update the table to reflect additional requirements or those of which the status has changed*
18/09/2017	*Rhys Brownlow*	*Internal Review of Section 4.4.4*	*Online monitoring equipment is installed and an annual service agreement has been implemented with ABB for servicing of instruments*	*Actions are now reflected in the DWMS*

Table 9-2. Summary of external reviews

Date	Reviewer	Scope	Findings	Actions
10/08/2015	*Viridis Consultants*	Review and detailed update of document		

10 Reservoir Inspections

Reservoir inspections and cleaning are undertaken by Aqualift. The full report is provided in Appendix C.

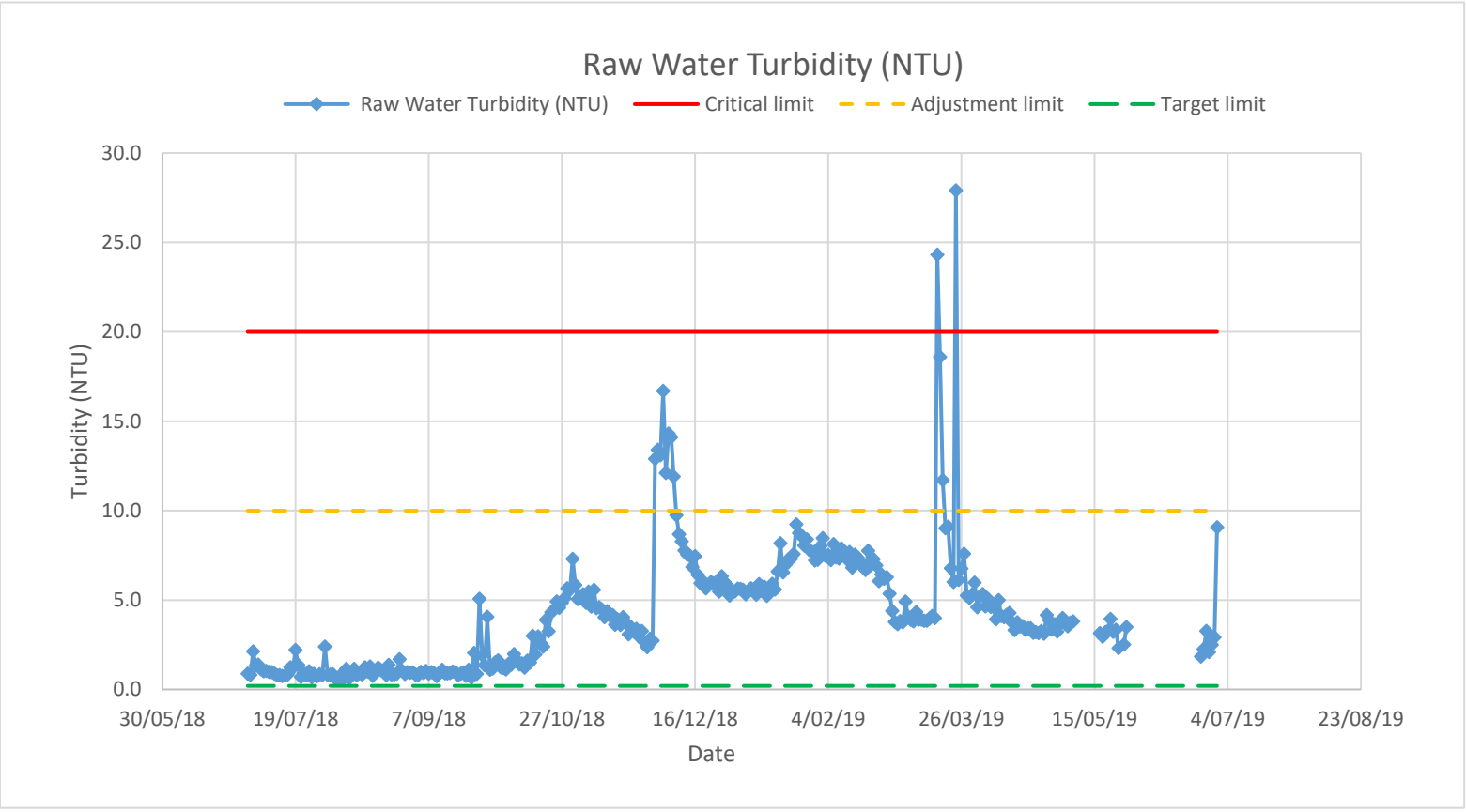
Random site inspections of the reservoirs occurred throughout the reporting period and corrective actions were undertaken as required. Records of such works are recorded in the Plant Diary and no other records are available. Council is implementing an Asset Management System which once fully implemented will capture this information and store records within Council's Electronic Records Management System.

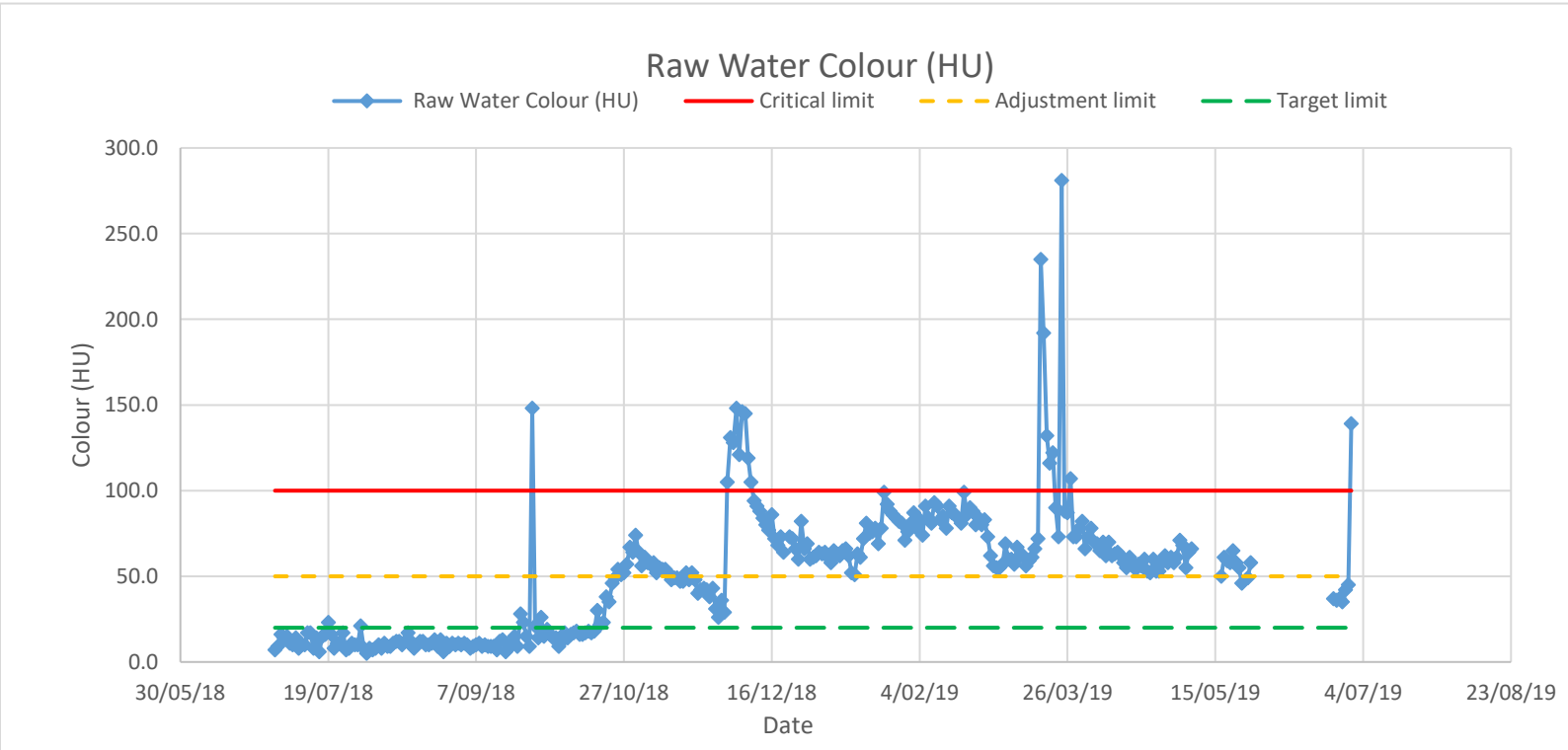
During the reporting period Council undertook a major refurbishment of the Shaft Street Reservoir. The Shaft Street Old Reservoir has been offline since late 1990's due to structural issues. This reservoir was refurbished and recommissioned to allow works to be undertaken on the Shaft Street New Reservoir. The Shaft Street New Reservoir was refurbished after inspection identified major structural issues. The issues have now been resolved and the reservoir has been recoated to prevent further degradation of the steel tank, cathodic protection installed and roof repairs to improve security.

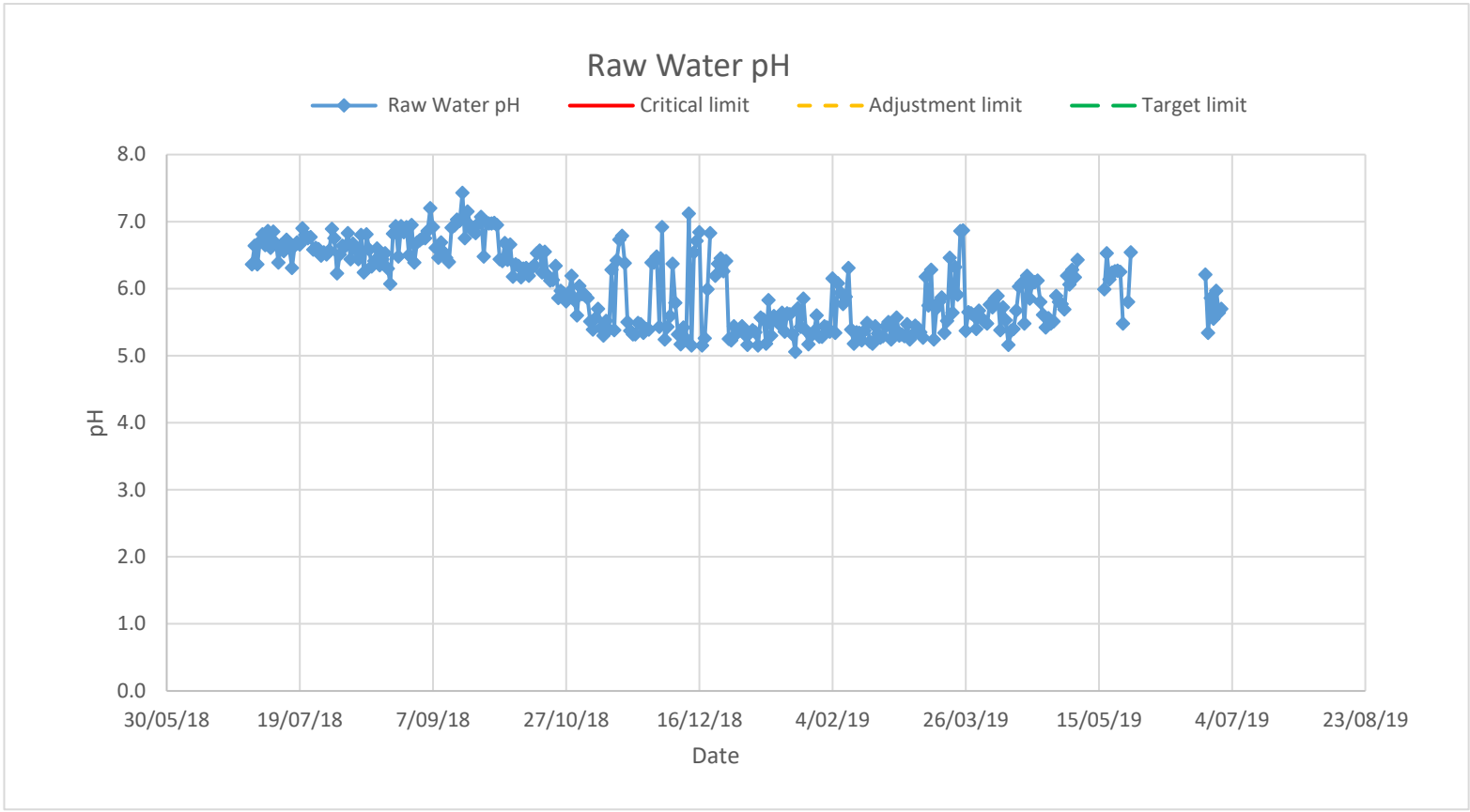
Appendix A Water Quality Data

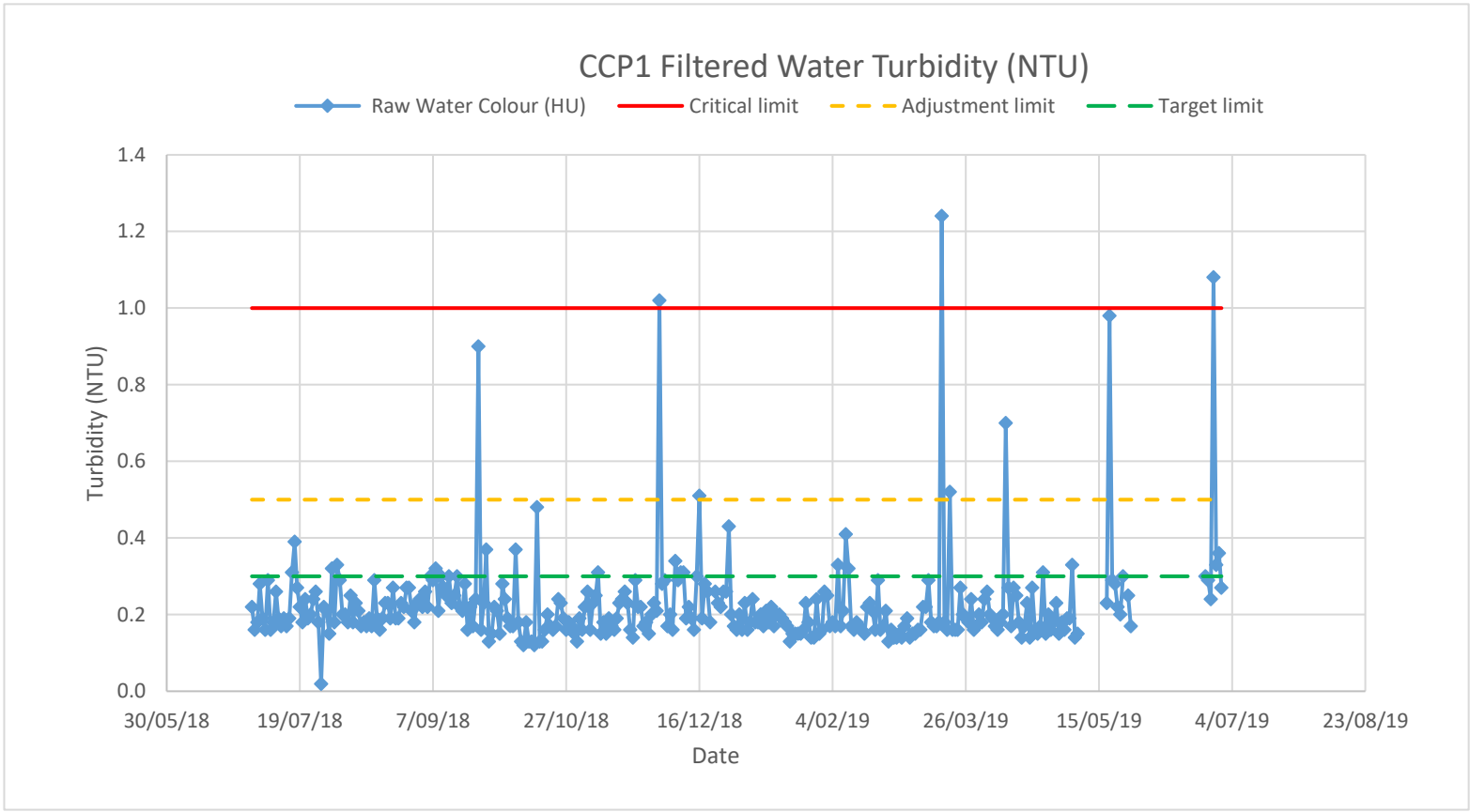
A.1 Water Quality Graphs

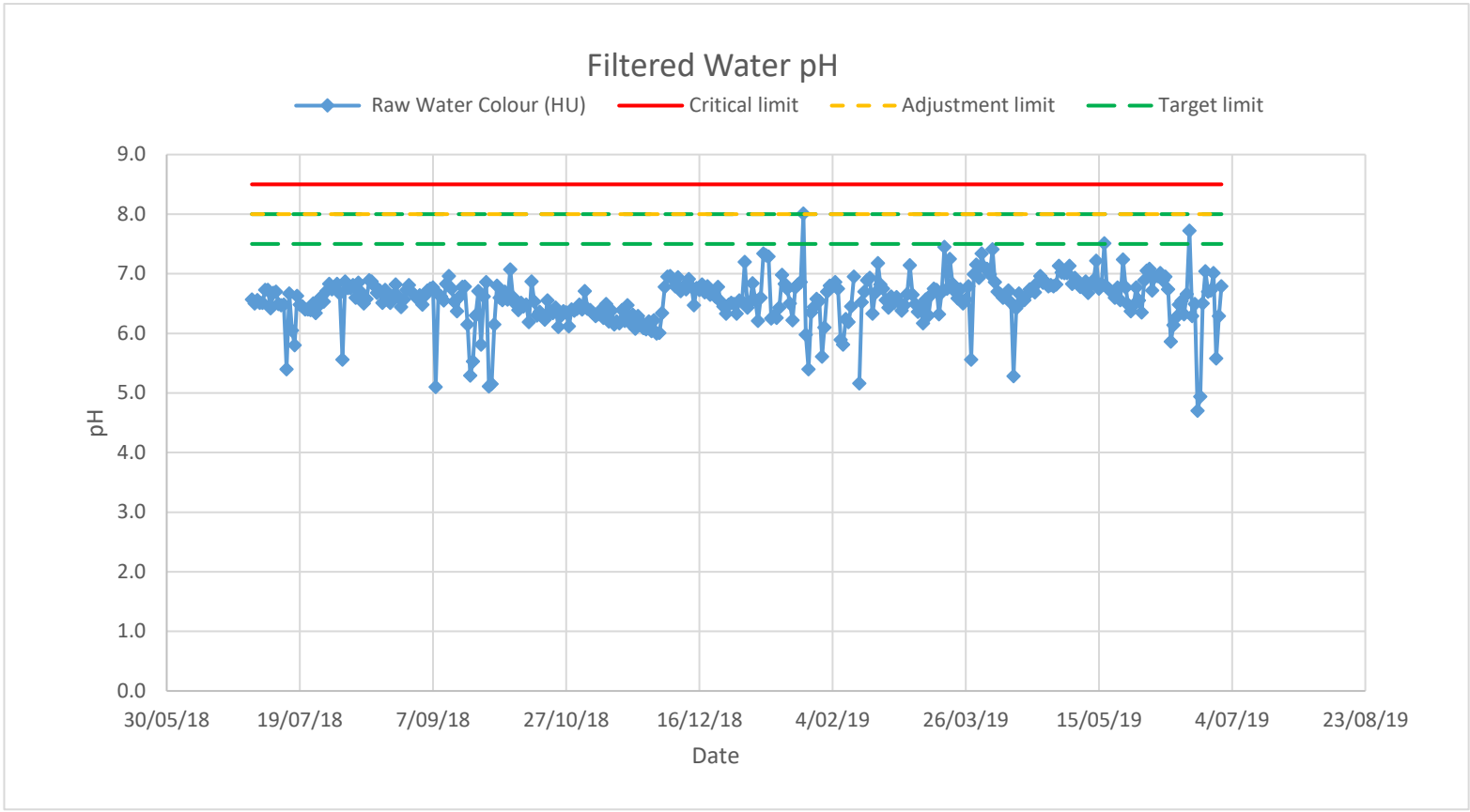
Note: the gaps in the data are indicative of the water treatment plant being offline. Water during this period is taken from the FRWS.

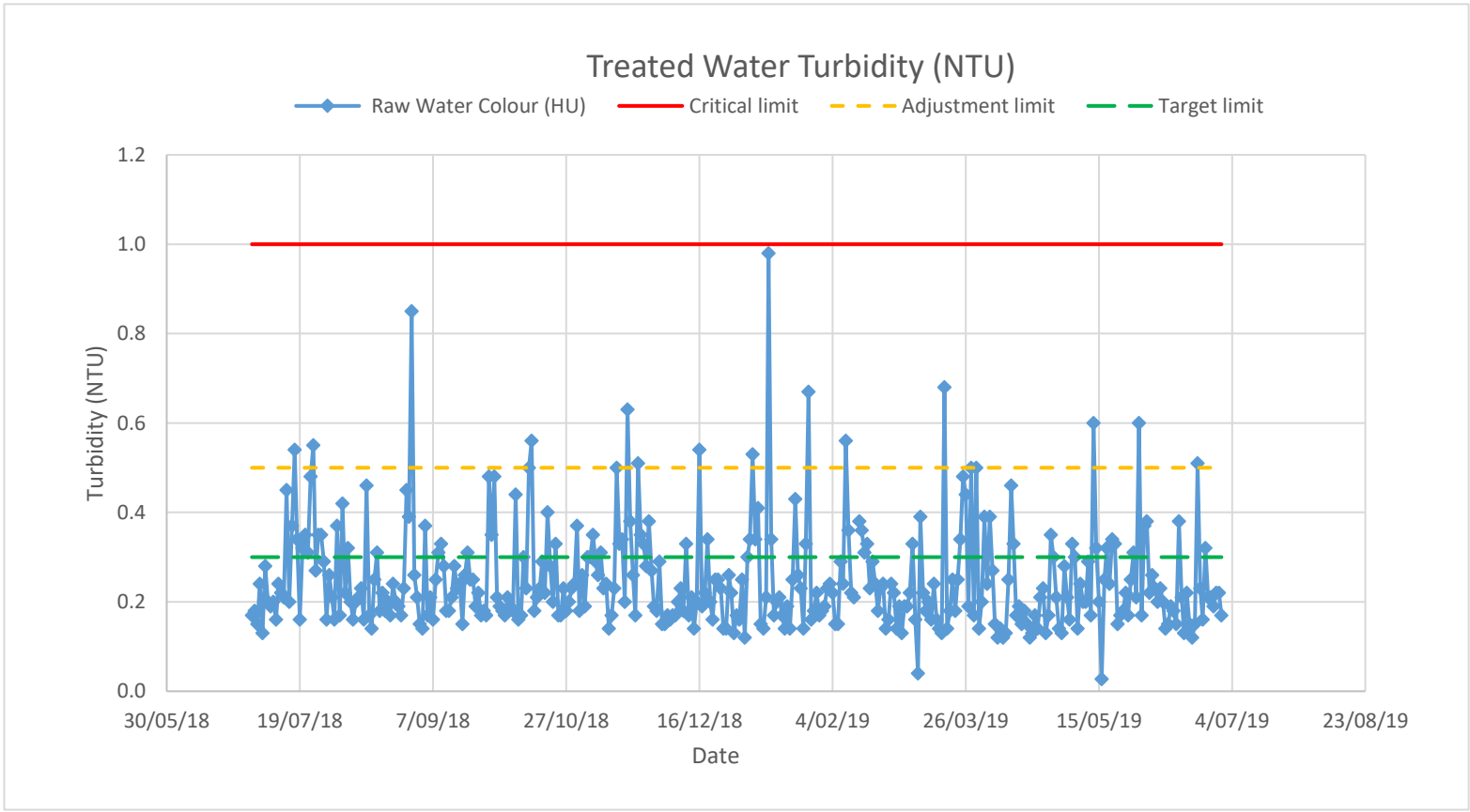


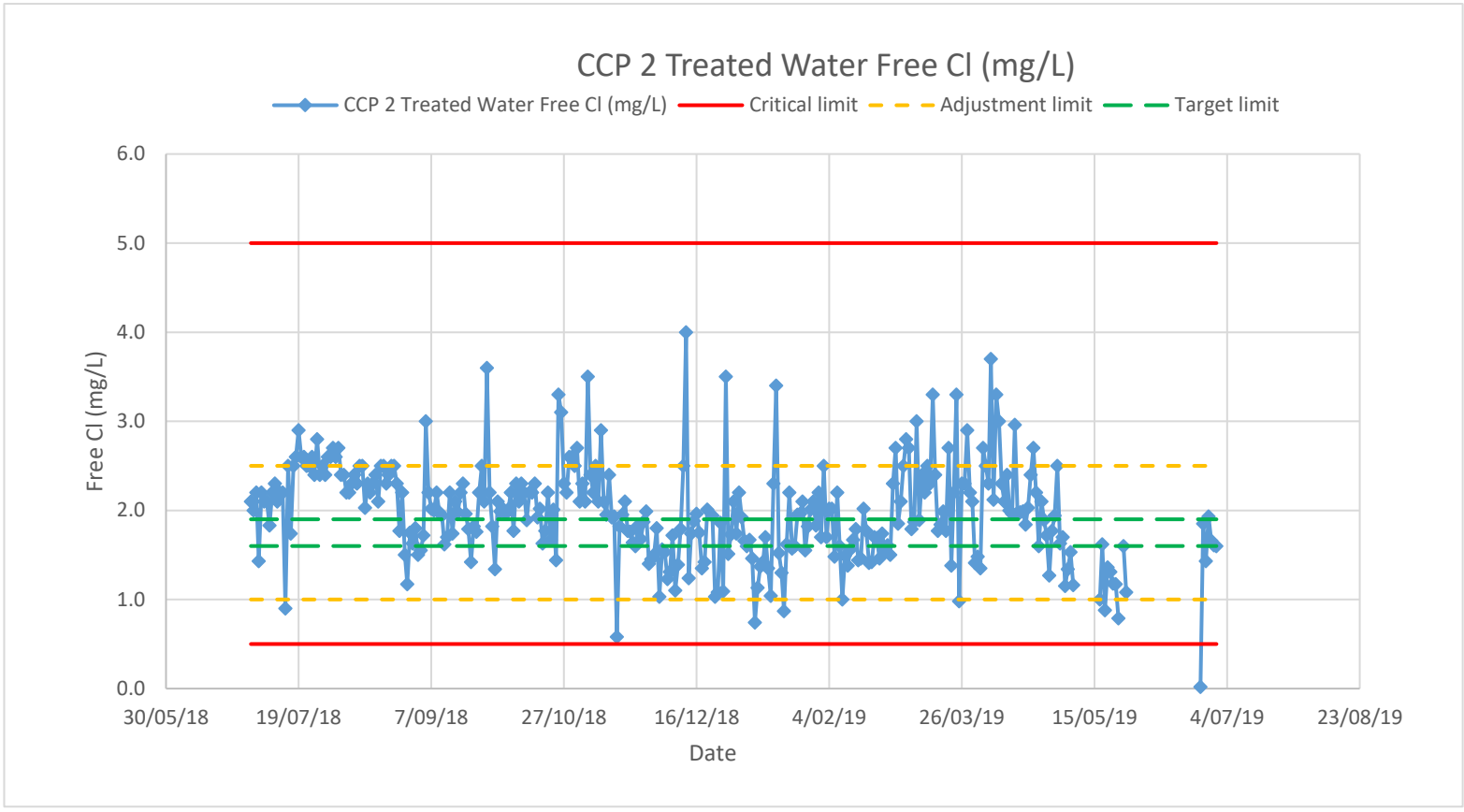


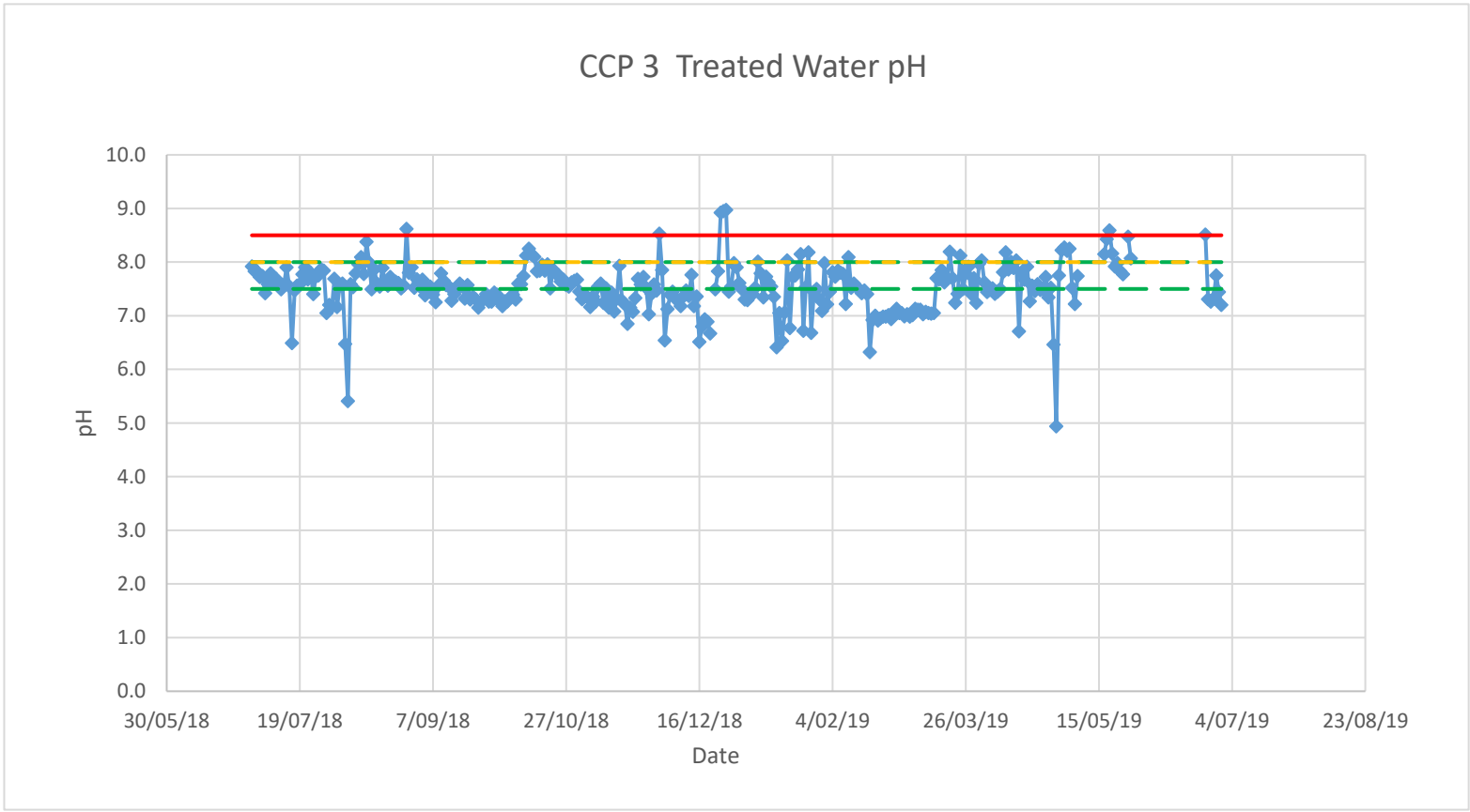

Raw Water pH
Raw Water pH
Critical limit
Adjustment limit
Target limit
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
pH
30/05/18
19/07/18
7/09/18
27/10/18
16/12/18
4/02/19
26/03/19
15/05/19
4/07/19
23/08/19
Date

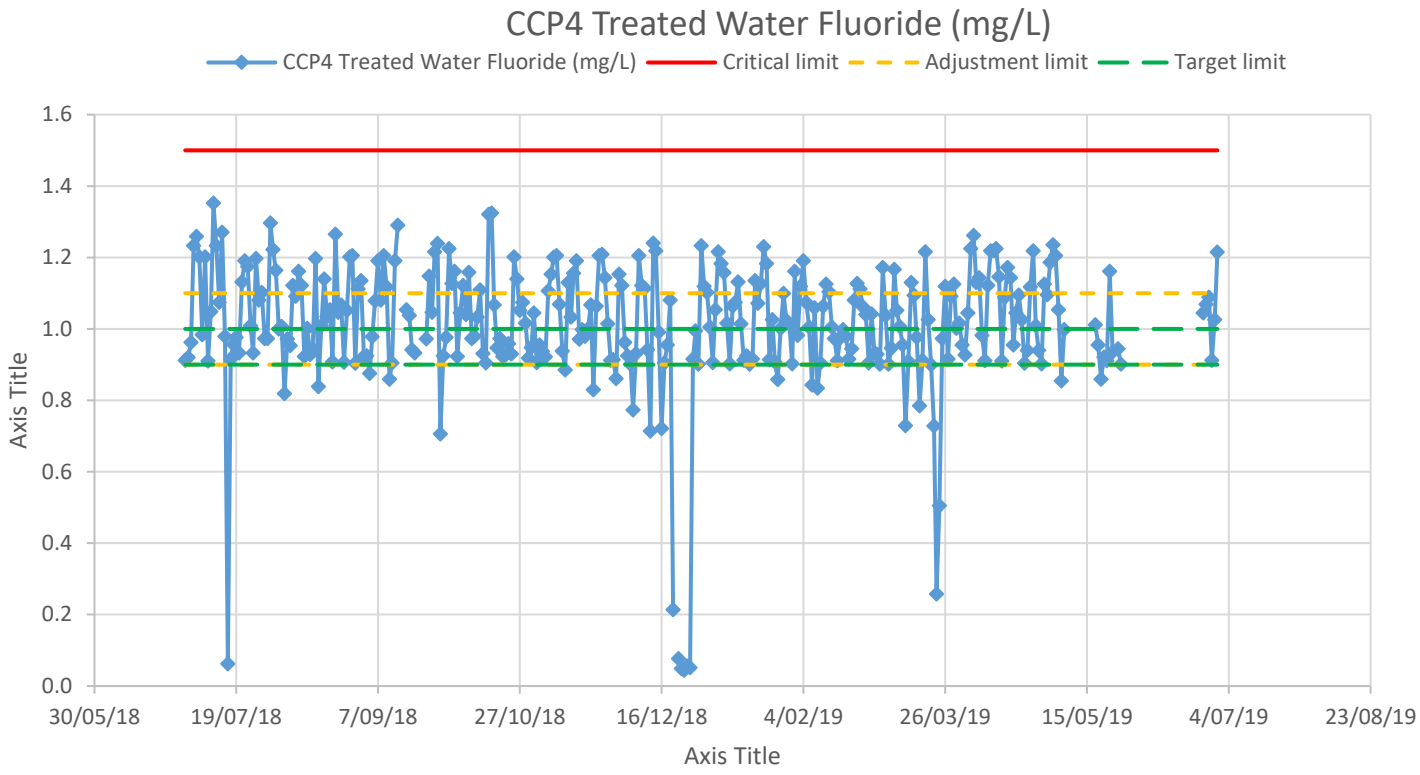

CCP1 Filtered Water Turbidity (NTU)
Raw Water Colour (HU)
Critical limit
Adjustment limit
Target limit
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Turbidity (NTU)
30/05/18
19/07/18
7/09/18
27/10/18
16/12/18
4/02/19
26/03/19
15/05/19
4/07/19
23/08/19
Date


Filtered Water pH
Raw Water Colour (HU)
Critical limit
Adjustment limit
Target limit
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
pH
30/05/18
19/07/18
7/09/18
27/10/18
16/12/18
4/02/19
26/03/19
15/05/19
4/07/19
23/08/19
Date


Treated Water Turbidity (NTU)
Raw Water Colour (HU)
Critical limit
Adjustment limit
Target limit
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Turbidity (NTU)
30/05/18
19/07/18
7/09/18
27/10/18
16/12/18
4/02/19
26/03/19
15/05/19
4/07/19
23/08/19
Date


CCP 2 Treated Water Free Cl (mg/L)
CCP 2 Treated Water Free Cl (mg/L)
Critical limit
Adjustment limit
Target limit
Free Cl (mg/L)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
30/05/18
19/07/18
7/09/18
27/10/18
16/12/18
4/02/19
26/03/19
15/05/19
4/07/19
23/08/19
Date


CCP 3 Treated Water pH
pH
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
30/05/18
19/07/18
7/09/18
27/10/18
16/12/18
4/02/19
26/03/19
15/05/19
4/07/19
23/08/19
Date



A.2 Water Quality Summary

i. Raw Water

Parameter	Minimum	Average	Maximum	Lower critical limit	Upper critical limit	No. samples
Turbidity (NTU)	0.53	4.23	27.9		20	327
Colour (HU)	5	51.45	281		100	327
pH	5.06	6.03	7.43			327

ii. Filtered Water

Parameter	Minimum	Average	Maximum	Lower critical limit	Upper critical limit	No. samples
Turbidity (NTU)	0.019	0.22	1.24		1	326
pH	4.70	6.56	8.01		8.5	364

iii. Treated Water

Parameter	Minimum	Average	Maximum	Lower critical limit	Upper critical limit	No. samples
Turbidity (NTU)	0.027	0.25	0.98		1	364
Free Cl	0.002	1.98	4	1	5	327
pH	4.94	7.52	8.97		9	326
Fluoride	0.04	1.01	1.35		1.5	320

A.3 Verification Monitoring

Below is a summary of NSW Health's Drinking Water Monitoring Program data.

Characteristic	Guideline Value	Units	Mean	Median	Min	Max	Sample Count	Exception Count	95th Percentile	5th Percentile	% meeting guideline values
Aluminium	0.2000	mg/L	0.0500	0.0200	0.005	0.72	25	1	0.09	0.005	96.00
Antimony	0.0030	mg/L	0.0005	0.0005	0.0005	0.0005	25	0	0.0005	0.0005	100.00
Arsenic	0.0100	mg/L	0.0007	0.0005	0.0005	0.001	25	0	0.001	0.0005	100.00
Barium	2.0000	mg/L	0.0114	0.0090	0.007	0.023	25	0	0.023	0.007	100.00
Boron	4.0000	mg/L	0.0500	0.0500	0.05	0.05	25	0	0.05	0.05	100.00
Cadmium	0.0020	mg/L	0.0003	0.0003	0.00025	0.00025	25	0	0.00025	0.00025	100.00
Calcium	10000.0000	mg/L	10.7880	7.1000	2	28.1	25	0	27.5	3.5	100.00
Chloride	250.0000	mg/L	9.2400	9.0000	6	16	25	0	14	6	100.00
Chromium	0.0500	mg/L	0.0027	0.0025	0.0025	0.008	25	0	0.0025	0.0025	100.00
Copper	2.0000	mg/L	0.0655	0.0170	0.0025	0.36	25	0	0.34	0.0025	100.00
Fluoride	1.5000	mg/L	0.4992	0.5300	0.05	1.12	25	0	1.1	0.05	100.00
Fluoride (WU result)	1.5000	mg/L	0.8462	0.8800	0.35	1.2	13	0	1.2	0.35	100.00
Fluoride Ratio	0.8 - 1.2		1.0654	1.0700	0.87	1.35	13	1	1.35	0.87	92.31
Iodine	0.5000	mg/L	0.0132	0.0100	0.01	0.02	25	0	0.02	0.01	100.00
Iron	0.3000	mg/L	0.1032	0.0300	0.005	0.57	25	2	0.56	0.005	92.00
Lead	0.0100	mg/L	0.0013	0.0010	0.001	0.002	25	0	0.002	0.001	100.00
Magnesium	10000.0000	mg/L	3.4044	3.6100	0.59	6.13	25	0	6.02	0.78	100.00
Manganese	0.5000	mg/L	0.0097	0.0090	0.0025	0.047	25	0	0.026	0.0025	100.00
Mercury	0.0010	mg/L	0.0002	0.0001	0.00005	0.0013	25	1	0.0004	0.00005	96.00
Molybdenum	0.0500	mg/L	0.0026	0.0025	0.0025	0.006	25	0	0.0025	0.0025	100.00
Nickel	0.0200	mg/L	0.0078	0.0050	0.005	0.03	25	1	0.02	0.005	96.00
Nitrate	50.0000	mg/L	0.6400	0.5000	0.5	1	25	0	1	0.5	100.00
Nitrite	3.0000	mg/L	0.0500	0.0500	0.05	0.05	25	0	0.05	0.05	100.00
pH	6.5 - 8.5		7.4200	7.4000	7.1	7.7	25	0	7.6	7.1	100.00
Selenium	0.0100	mg/L	0.0010	0.0010	0.001	0.001	25	0	0.001	0.001	100.00
Silver	0.1000	mg/L	0.0012	0.0010	0.001	0.005	25	0	0.001	0.001	100.00
Sodium	180.0000	mg/L	13.8800	14.0000	5	24	25	0	23	5	100.00
Sulfate	500.0000	mg/L	31.8800	17.0000	1	99	25	0	99	1	100.00
Total Dissolved Solids (TDS)	600.0000	mg/L	75.3600	59.0000	44	142	25	0	142	47	100.00
Total Hardness as CaCO3	200.0000	mg/L	40.9560	33.0000	7.4	94.4	25	0	93.9	12.4	100.00
True Colour	15.0000	Hazen Units (HU)	2.9400	1.0000	0.5	22	25	1	9	0.5	96.00
Turbidity	5.0000	NTU	0.4700	0.2000	0.05	3.7	25	0	1.5	0.05	100.00
Uranium	0.0170	mg/L	0.0025	0.0025	0.0025	0.0025	25	0	0.0025	0.0025	100.00
Zinc	3.0000	mg/L	0.0288	0.0200	0.005	0.1	25	0	0.09	0.005	100.00

E. coli	0.0000	mpn/100 mL	0.0155	0.0000	0	3	194	1	0	0	99.48
Free Chlorine	0.2 - 5	mg/L	0.9311	0.7000	0	3.4	194	58	2.6	0.07	70.10
pH	6.5 - 8.5		7.2170	7.1500	6.01	8.9	191	8	7.85	6.75	95.81
Temperature	30.0000	C	19.2500	19.1000	15.9	22.8	6	0	22.8	15.9	100.00
Total Chlorine	5.0000	mg/L	0.9747	0.7300	0	3.3	193	0	2.5	0.07	100.00
Total Coliforms	0.0000	mpn/100 mL	0.0361	0.0000	0	4	194	3	0	0	98.45
Turbidity	5.0000	NTU	6.9000	6.9000	6.9	6.9	1	1	6.9	6.9	0.00
Fluoride (daily WU)	0.9 - 1.5	mg/L	1.0134	1.0160	0.0445	1.4	320	25	1.232	0.819	92.19
Fluoride (weekly WU)	0.9 - 1.5	mg/L	1.0268	1.0210	0.782	1.324	86	2	1.18	0.902	97.67

Appendix B Continuous Improvement Plan

Improvement Plan						Date Reviewed: SEP 2019
Ref.	**Actions**	**Responsibility**	**Priority**	**Timeframe**	**Status**	**Comments**
1.1.1	Expand the strategic objective 'to provide safe drinking water' into a full drinking water quality policy.	Manager Water and Wastewater	NA	NA	Completed	A water quality policy has been developed. The policy will be tabled for council endorsement. The latest version of the Policy was adopted at the August 2018 Council Meeting
1.1.2	Communicate the drinking water quality policy throughout the organisation once developed (examples include through awareness programs, posting policy on the intranet in the 'Water' and 'Policy' sections, including policy in induction materials and stating requirement to understand policy content in position descriptions).	Manager Water and Wastewater	NA	NA	Completed	Policy has been developed, relevant water staff have been made aware of the policy through the DWMS implementation training.
1.2.1	Develop and maintain the currency of a Drinking Water Legal and Formal Compliance Register. The register should include at least the jurisdiction of the instrument, the type, the relevance to drinking water, who is responsible for keeping the document current and the next review date.	Manager Water and Wastewater	NA	NA	Completed	A LORR register has been developed in Excel.
1.2.2	Ensure that the drinking water compliance requirements are communicated to employees and contracts (examples include articulating responsibilities in position descriptions, within the Drinking Water Quality Policy, via the website).	Manager Water and Wastewater	NA	NA	Completed	The policy states that compliance will be through the DWMS, relevant staff have been made aware of the policy, and policy is part of the DWMS Training package.
1.3.1	Develop a drinking water specific Stakeholder Register and show how Council's current activities relate to stakeholder communication. The document should include at least the stakeholder, the jurisdiction, the	Manager Water and Wastewater	NA	NA	Completed	The DWQ IERP contacts register contains list of key stakeholders and when to

	relevance to the drinking water system, mode of communication (MoU, seminar etc.), current responsible position from Council and currency of the register.					contact them in relation to drinking water incidents.
1.3.2	Review how interagency communication is currently undertaken (to be partly covered by procedure developed by NSW Public Works in relation to incident response plan: see risk register FC10).	Manager Water and Wastewater	NA	NA	Completed	Is part of the DWQ IERP.
1.3.3	Improve council departmental communication (to be partly covered by procedure developed by NSW Public Works in relation to clarifier bypass procedure, see risk register FC10).	Director Water and Wastewater	Medium	Jul-20	To Start	
1.3.4	Formalise agreement with Centennial re water quality and communication protocols if treatment fails at Centennial (see risk register CCS1).	Manager Water and Wastewater	Medium	NA	Completed	This is covered under the Clarence Colliery Pollution Incident Response Management Plan
1.3.5	Review asset ownership between council and WaterNSW (see risk register DR3).	Director Water and Wastewater	Low	Jul-20	Underway	
1.3.6	Make sure asset agreements are in place between LCC and WaterNSW (see risk register DR3).	Director Water and Wastewater	Low	Jul-20	Underway	Draft Agreement is with WaterNSW for execution
1.3.7	Review how the non-potable water system is dealt with in terms of communication and education (see guidance from NSW Health) (see risk register NPW1).	Manager Water and Wastewater	NA	NA	Closed	Discussed later in 8.2.2
2.1.1	Develop a clear team details table to show current positions and responsibilities for drinking water quality to help improve compliance with this component. The table should include at least the position, drinking water responsibilities and Drinking Water Management System responsibilities in particular.	Manager Water and Wastewater	NA	NA	Completed	The DWMS and DWQ IERP includes responsibilities, the DWMS implementation training discussed staff responsibilities.

2.1.2	Responsibility for the currency of the conceptual system flow diagram needs to be assigned. It is suggested that the Water and Wastewater Manager be assigned this responsibility.	Manager Water and Wastewater	NA	NA	Closed	Responsibility stated in the DWMS, Manager Water and Wastewater is responsible for facilitating updates to the DWMS.
2.2.1	Ensure that a comprehensive water quality database is set up to facilitate trend analysis of data in the future.	Manager Water and Wastewater	NA	NA	Completed	A spreadsheet has been set up to record and trends water quality data.
2.2.2	Ensure that when set up, data from Critical Control Points are logged (probably through SCADA) and analysed on a frequent basis (say monthly, initially) to allow for any emerging trends at these critical points to be picked up quickly.	Director Water and Wastewater	High	Jan-20	Underway	Process to report, record and review CCP exceedances has been set up, development of a database has been complete. SCADA implementation has commenced
2.3.1	Ensure that responsibility for maintenance of currency of the Risk Register is assigned to someone within the water quality team.	Manager Water and Wastewater	NA	NA	Closed	Responsibility stated in the DWMS, Manager Water and Wastewater is responsible for facilitating updates to the DWMS.
2.3.2	Ensure that a review frequency is set for the Risk Register and record when the Risk Register is reviewed and any changes made.	Manager Water and Wastewater	NA	NA	Closed	Mentioned in the DWMS.
2.3.3	Review water quality results that Centennial has to report on as part of its Environment Protection Licence (see risk register CCS1).	Manager Water and Wastewater	NA	NA	Closed	1.3.4 Will encompass this also.
2.3.4	Review pipeline location for input of Clarence Colliery Source in new configuration (see risk register CCS1).	Manager Water and Wastewater	Low	N/A	Closed	There is little opportunity to relocate the pipeline
2.3.5	Check hydrocarbons in the Clarence Colliery Source water to better assess risk (see risk register CCS1).	Director Water and Wastewater	Low	Jul-20	To Start	

4.2.1	Formalisation and development of operational procedures, covering all aspects of the water supply system from catchment to tap are required. Training in the formalised procedures will also be required.	Director Water and Wastewater	Medium	Jul-21	Underway	List of procedures to be developed has been compiled, CCP procedures have been developed.
4.2.2	Review procedures for bushfires in Emergency Response Plan including how Oakey Park WTP is managed (arose out of risk assessment 1 September 2011 and refers to risks FC2 and WOS1).	Manager Water and Wastewater	Medium	N/A	Completed	In accordance with the BCP Council has the ability to draw water from FRWS should the plant be damaged or destroyed.
4.2.3	Review how the septic system is managed at the Motorcycle club (arose out of risk assessment 1 September 2011 and refers to risks FC7).	Manager Water and Wastewater	High	N/A	Completed	Inspected by Council EHO and a 5 year licence to operate approved until 2019/20. System is operating satisfactorily
4.2.4	CCP response procedures required (to be developed by NSW Public Works).	Manager Water and Wastewater	NA	NA	Completed	Reviewed and developed by Viridis.
4.2.5	Develop a list of SOPs for WTP and Retic operations. A list and some SOPs to be developed by Public Works.	Manager Water and Wastewater	NA	NA	Completed	List of procedures to be developed has been compiled by Viridis.
4.2.6	Develop calibration records (see risk register WOS6). Template to be prepared by NSW Public Works.	Manager Water and Wastewater	Medium	N/A	Completed	Calibrations undertaken under Service Delivery Agreement and records of calibrations provided by the contractor
4.2.7	Consider moving to online telemetered monitoring for treated water pH, chlorine residual as well as online raw water monitoring (turbidity, EC, pH; see risk register pH1, pH2, Coag6, Dis2).	Manager Water and Wastewater	High	N/A	Completed	online meters installed
4.2.8	Develop a formalised procedure for this bypass of the clarifier during maintenance (see risk register Clar2).	Manager Water and Wastewater	Medium	N/A	Completed	Should maintenance on the clarifier be required than the whole plant will be shut down and water drawn from FRWS

4.2.9	Review the need for individual filter turbidity meters (see risk register F1).	Manager Water and Wastewater	High	N/A	Completed	online meters installed
4.2.10	Consider undertaking individual filter monitoring once the media has been changed (see risk register F1, F4).	Manager Water and Wastewater	NA	NA	Closed	Already discussed in 4.2.9
4.2.11	Develop a procedure for Filter inspection and backwash including review of need for filter to waste (see risk register F2, F4).	Director Water and Wastewater	Medium	Jul-20	Underway	Draft is available, needs to be finalised
4.2.12	Review chlorination procedures (plant shut down on chlorine failure etc.) (see risk register Dis2; NSW Public Works).	Manager Water and Wastewater	NA	NA	Completed	CCP developed for Disinfection
4.2.13	Formalise current procedures for managing chlorination and testing (see risk register Dis2; NSW Public Works).	Manager Water and Wastewater	NA	NA	Completed	CCP developed for Disinfection
4.2.14	Develop SOP for managing the raw water bypass including the O&M of the bypass infrastructure (see risk register RWB1).	Director Water and Wastewater	Low	Jul-17	To Start	Bypass cannot be opened without valve key, it's inside a pit. Pit can be padlocked and labelled.
4.2.15	Consider having reservoir inspection procedures and checklists (see risk register DR1, DR5; NSW Public Works template).	Director Water and Wastewater	High	Mar-20	Underway	Draft is available, needs to be finalised
4.2.16	Formalise mains repair procedures including review of ADWG guidance (see risk register D3, D4).	Director Water and Wastewater	Medium	Jul-20	To Start	
4.2.17	Formalise procedures relating to switching between water supplies (FRWS/LCC).	Director Water and Wastewater	Medium	Jul-20	To Start	
4.2.18	Ensure that a register is in place for all backflow devices installed and checking frequencies (see risk register D7)	Director Water and Wastewater	Medium	Jul-21	To Start	Will take time to identify and investigate

4.2.19	Procedure required for mains flushing (see risk register D8).	Director Water and Wastewater	Medium	Mar-20	To Start	
4.2.20	Review areas of dead ends to see if they can be reticulated (see risk register D8).	Director Water and Wastewater	Low	Jul-21	To Start	Long term investment.
4.5.1	Consider having a system in place where operators check chemicals delivered against a range of set criteria for each chemical e.g. observation of chemical state (colour, smell (where safe to do so), liquid, solid etc.) and record of findings for each delivery.	Director Water and Wastewater	Medium	Jul-20	To Start	Chemical control SOP will be developed.
4.5.2	The hypochlorite used in the booster chlorinators will have to be added to a purchasing policy and included in a stock rotation roster.	Manager Water and Wastewater	NA	NA	Closed	Chemical control procedure when developed should be sufficient for this.
4.5.3	The purchasing policy was not included in the policy list on the Council website and will need to be posted there for completeness. Other specific purchasing information (such as tender documentation) may be commercial in confidence and would not be expected to be made available on Council's website (see also risk register WOS2).	Manager Water and Wastewater	NA	NA	Closed	Chemical control SOP will be developed.
4.5.4	Ensure that the procurement policy specifically includes water quality assessment when purchasing chemicals and materials in contact with drinking water. Standards which could be specified for compliance with include *AS/NZS 4020:2005 Testing of products for use in contact with drinking water*.	Manager Water and Wastewater	NA	NA	Closed	Chemical control SOP will be developed.
4.5.5	Ensure that a procedure is in place for appropriate storage and rotation of all chemicals used (see risk register CB3).	Manager Water and Wastewater	NA	NA	Closed	Chemical control SOP will be developed.

5.1.1	Review the sampling program against the requirements of the NSW Health Drinking Water Monitoring Program and ADWG Part III guidance and check that the samples are representative of the system (also arose in risk assessment 1 September 2011 and refers to risks FC9; will be partly addressed by NSW Public Works) (see also risk register Dis4).	Director Water and Wastewater	Medium	Dec-20	To Start	
5.1.2	Review raw water monitoring program (see risk register FCD6).	Director Water and Wastewater	Medium	Jul-16	Underway	
5.2.2	Review how call centre employees are trained in taking and dealing with water quality complaints.	Director Water and Wastewater	Medium	Jul-17	Underway	
5.2.3	Review how water quality complaint records are designed and filled out to enable all required water quality issues to be comprehensively documented.	Manager Water and Wastewater	NA	NA	Completed	A system (spreadsheet) has been developed.
5.2.4	Review how Dataworks and Proclaim can be better integrated to provide for a more comprehensive customer water quality complaint analysis.	Manager Water and Wastewater	NA	NA	Closed	A system (spreadsheet) has been developed to better capture water quality complaints.
5.3.1	Ensure that customer requests relating to water quality are analysed for trends.	Manager Water and Wastewater	Medium	N/A	Completed	Samples are collected when a customer makes a compliant regarding water quality. These results are analysed for trends
5.3.2 and 5.4.1	Ensure that short-term evaluation of results and reporting of findings is formalised.	Manager Water and Wastewater	NA	NA	Completed	Process to review results has been established.
6.1.1	Review Business Continuity Plan and ensure that drinking water provisions are adequately covered. Also review for sewerage provisions (see risk register FCD2).	Director Water and Wastewater	Low	Sep-20	To Start	

6.1.2	Review how Council deals with the media in the event of a drinking water quality incident – examples include having a draft media statement prepared ready to tailor for the situation encountered.	Manager Water and Wastewater	NA	NA	Completed	Included as part of the DWQ IERP
6.1.3	Ensure that a formally documented protocol is in place on responsibilities for providing information to the media on drinking water quality issues (this action may be satisfied by reviewing the information in the ERP).	Manager Water and Wastewater	NA	NA	Completed	Included as part of the DWQ IERP
6.1.4	Ensure that Council has a formal system in place for recording water quality incidents and how they are dealt with (cross reference with Element 10 actions below).	Manager Water and Wastewater	NA	NA	Completed	Included as part of the DWQ IERP
6.2.1	Review how incidents are managed at Council including undertaking scenario training (with appropriate records) of incidents.	Manager Water and Wastewater	NA	NA	Completed	Included as part of the DWQ IERP
6.2.2	After scenario training has been conducted, review how the protocols were implemented in practice and ensure that any gaps are identified and incorporated into improvements to the protocols.	Director Water and Wastewater	Medium	Oct-20	To Start	Will be undertaken during mock exercise
6.2.3	Consider having an agreement in place with emergency services in the event that something happens in the water supply catchment (arose out of risk assessment 1 September 2011 and refers to risks FC4 and FC5).	Director Water and Wastewater	Low	Jul-22	To Start	
6.2.4	Review procedures for bushfires in Emergency Response Plan (see risk register FCD4). Incident response plan template to be developed by NSW Public Works).	Manager Water and Wastewater	NA	NA	Closed	Mentioned earlier in 4.2.2
7.1.1	Ensure that water quality issues are added to the agenda of the daily operator meetings.	Manager Water and Wastewater	NA	NA	Completed	Discussed with the Supervisor/Manager, water quality and CCP review process encompasses this.

7.1.2	Ensure that service providers to Council are aware of water quality protection requirements when undertaking their jobs by including specific water quality awareness and protection clauses in contracts and ensuring that water quality awareness training is kept up to date.	Director Water and Wastewater	Medium	Jul-21	To Start	
7.2.1	Ensure that all staff in Council undertakes water quality awareness training and competency assessment (the level being dependent on the role within Council).	Manager Water and Wastewater	NA	NA	Closed	Relevant water staff underwent DWMS implementation and general water quality awareness training in July 2015.
7.2.2	Review how contractors and outgoing staff are currently managed. May need to develop an employee exit procedure (see risk register WOS5).	Manager Water and Wastewater	NA	NA	Closed	Not an issue for drinking water quality management. Development of the DWMS ensures all water procedures have been documented.
8.2.1	Consider placing the DWMS (or a summary of it if information is considered too sensitive) on the website when finalised.	Manager Water and Wastewater	NA	NA	Closed	Policy when finalised can be placed on the website.
8.2.2	Ensure that residents on non-potable water are informed on a consistent basis that their water is not intended for drinking.	Director Water and Wastewater	High	every 12 months	Underway	Bill inserts were included in the final 2018/19 notice/account
8.2.3	Consider signage in the catchment (sect 632 LGA) to indicate that the catchment is used as a water supply catchment and to report any contamination to LCC (arose out of risk assessment 1 September 2011 and refers to risks FC6, FC8 and FC9).	Manager Water and Wastewater	NA	NA	Completed	
9.1.2	Consider using distribution system modelling techniques to track water distribution and age for chlorine residual maintenance purposes.	Director Water and Wastewater	Medium	Jul-21	To Start	
9.2.1	Ensure that Council liaises with FRWS over the management of water quality at the Lithgow/FRWS handover points.	Director Water and Wastewater	High	Dec-15	To Start	

	Agreement between LCC and WaterNSW needs to be reviewed and tightened in terms at least water quality to meet ADWG levels, communication protocols in case of non-conformance, chlorine residual adequacy in the water supplied to Rydal and Wallerawang and Fe and Mn management (see risk register FRS1).	Director Water and Wastewater	High	Jul-16	To Start	
9.2.2	Ensure that the location of the Clarence Colliery pipeline is reviewed in terms of at least position of entry into the dam and likely impact on potential short-circuiting.	Manager Water and Wastewater	Medium	N/A	Completed	No other option is feasible
9.2.3	Review raw water quality data and inflows to reservoir (mm rain) to see if a relationship can be established (see risk register FCD3).	Director Water and Wastewater	Medium	Jul-21	To Start	
9.2.4	Review water quality monitoring program for catchment for sources of hazards such as Cryptosporidium (see risk register F4).	Director Water and Wastewater	Medium	Jul-21	To Start	Crypto load is presumed to be low as the catchment is enclosed, there is no cattle, and only source could be the Motor Cycle Club septic.
9.2.5	Consider improving the chlorine dosing system (see risk register Dis1).	Director Water and Wastewater	Medium	Jul-21	To Start	
9.2.6	Confirm chlorine CT for the plant (see risk register Dis1).	Manager Water and Wastewater	NA	NA	Completed	This was calculated in July 2015 by Viridis.
9.2.7	Review how pH is monitored and where (see risk register Dis3).	Manager Water and Wastewater	NA	NA	Completed	CCP for disinfection and the operational monitoring plan cover this.
9.2.8	Consider whether stabilisation of water is needed (see risk register Dis3).	Manager Water and Wastewater	NA	NA	Closed	CCP for Disinfection has set limits where actions will be undertaken for pH correction.

9.2.9	Review reasons for pH increases including plant and reticulation issues (see risk register PD1).	Manager Water and Wastewater	High	N/A	Completed	DPIE Inspector had advised Operators to increase the pH due to low alkalinity to reduce the impact/potential to cause problems in the retic
9.2.10	Consider shock dosing of reservoirs (see risk register DR1: NSW Public Works procedure).	Director Water and Wastewater	Medium	Jul-16	To Start	
9.2.11	Consider undertaking a security vulnerability assessment on all assets (see risk register DR4).	Director Water and Wastewater	Low	Jul-18	To Start	
9.2.12	Adequacy of asset replacement program, asset management and condition assessment to be considered. Need to include cast iron mains in asset management program when developed. (See risk register D1, D9).	Director Water and Wastewater	Low	Jul-22	Underway	Asset Management System has been implemented as the first step in developing a full assessment management plan/strategies
9.2.13	Review system for examination and management of reticulation water age issue (see risk register D6).	Manager Water and Wastewater	NA	NA	Closed	Mentioned earlier in 9.1.2
9.2.14	Review how contractors check their equipment (see risk register D10).	Manager Water and Wastewater	NA	NA	Closed	Requirements to protect contamination while working on the supply system will be covered in the relevant SOPs and provided to contractors. This should cover this aspect.
9.2.15	Consider undertaking a more in depth system modelling to better understand water balance (see risk register D12).	Director Water and Wastewater	Low	Jul-21	Underway	Implemented smart meters and installing bulk meters on reservoirs to provide required data to undertake more accurate balance

9.3.1	Ensure that the fluoridation equipment and operation is validated appropriately (commissioned).	Manager Water and Wastewater	NA	NA	Completed	Fluoridation has been installed and commissioned, by Prominent.
10.1.1	Ensure that the records management policy is reviewed as it is currently two years past its review date.	Manager Water and Wastewater	Low	NA	Completed	Records Management Policy was reviewed and adopted Nov 2017. Next review due 2020/21
10.1.2	Ensure that a SOP is written to cover standardisation of file naming for later ease of searching.	Director Water and Wastewater	Medium	N/A	Completed	All water quality records are stored against a subject index with Council Electronic Records Management System
10.1.2	Consider reviewing how water quality data/incidents and records are stored at Council to improve access to data and records.	Manager Water and Wastewater	Medium	N/A	Completed	Records are held within Council's ERM within a specific archive folder
10.1.3	Make sure that all asset inspections are logged, not just those that fall out of hours.	Director Water and Wastewater	Low	Jul-20	Underway	Council has implemented the Asset Management System and purchased the Worx.Online module for implementation in 2019/20
11.1.1	Consider improving use of the NSW Health Drinking Water Database to help with long-term trending and review of water quality data.	Manager Water and Wastewater	Medium	N/A	Completed	
11.2.1	Formalise and record inspections undertaken by the operators (use templates, checklists etc. to facilitate direction of inspections).	Director Water and Wastewater	Medium	Jul-20	Underway	Council has purchased the Worx.Online module for implementation in 2019/20
11.2.2	Ensure that a formalised audit schedule is developed for the system then implement it.	Manager Water and Wastewater	NA	NA	Completed	This is mentioned in the DWMS now.

Appendix C Reservoir Inspection Reports

Reservoir Maintenance Priorities Report

7/04/2019

Date:	30/03/2019	**Client Name:**	Lithgow City Council
WS #:	01	**Reservoir Name:**	Cook St HL
Asset No:	01	**Location:**	off Hassens Lookout Rd
Job No:	027242	**Project Number:**	0
Cleaning Due:	30/3/2021	**Inspection Due:**	30/3/2021

External

Area	Priority	Status	Comments
Compound	4	F	The fence is constantly being damaged and security is difficult to maintain
Vandalism	4	D	Appears to be in good order
Walls	4	D	Appears to be in good order
Ladder External	4	D	Appears to be in good order
Entry Hatch	4	D	Appears to be in good order
Roof Platforms	4	D	Appears to be in good order
Walkways	Na	Na	No Comment
Roof	3	F	There is a lot of rock impact damage present
Roof Hatches	Na	Na	No Comment
Handrails	4	D	Appears to be in good order
Davit	Na	Na	No Comment
Ventilation	4	D	Appears to be in good order
Bird Proofing	4	D	Appears to be in good order
Electrical	Na	Na	No Comment
Level Indicator	Na	Na	No Comment

Priority 0 Item requires immediate attention.
Priority 1 Item is in poor condition or otherwise non functional.
Priority 2 Item is to receive precedence during maintenance
Priority 3 Item is functional but deteriorated/ not in operational order.
Priority 4 Item is in good condition.

Status A = Attention Required
Status F = Item to be Reassessed
Status D = Item to be Deferred until next Inspection

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Internal

Area	Priority	Status	Comments
Walls	2	A	Heavy corrosion nodules are forming on the lower wall areas
Columns	1	A	The posts and bases are heavily corroded
Roof Spider	4	D	Appears to be in good order
Roof Framing	4	F	The tank water level is set high and the rafters may become submerged at times
Floor	1	A	Heavy corrosion nodules are spread across most of the floor and are very aggressive. Pitting is occuring and recoating should be carried out in the next two years to preserve the structure of the tank
Inlet	4	D	Appears to be in good order
Outlet	4	D	Appears to be in good order
Scour	4	D	Appears to be in good order
Overflow	2	A	The overflow is corroded on the flanges
Mixer Motor	Na	Na	No Comment
Motor Type	Na	Na	No Comment
Supports	Na	Na	No Comment
Supports Type	Na	Na	No Comment
Ladder Internal	2	A	The ladder is heavily corroded and should be replaced with a Nextep vertical FRP ladder system 5300mm long when the tank is recoated
Electrical	Na	Na	No Comment

Comments

External Comment:
Security will always be a problem unless more attention is given to the tank. Regular site inspections are required to check on unauthorized access and contamination issues.

Internal Comment:
Heavy corrosion nodules are spread across most of the floor area. Significant pitting is occuring and recoating should be carried out in the next two years to preserve the structure of the tank.

Priority 0 Item requires immediate attention.
Priority 1 Item is in poor condition or otherwise non functional.
Priority 2 Item is to receive precedence during maintenance
Priority 3 Item is functional but deteriorated/ not in operational order.
Priority 4 Item is in good condition.

Status A = Attention Required
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Version: 1, Version Date: 08/04/2019

Reservoir Maintenance Priorities Report

7/04/2019

Date:	28/03/2019	**Client Name:**	Lithgow City Council
WS #:	02	**Reservoir Name:**	Cook St LL
Asset No:	02	**Location:**	end of Cook Street
Job No:	027240	**Project Number:**	0
Cleaning Due:	28/3/2020	**Inspection Due:**	28/3/2020

External

Area	Priority	Status	Comments
Compound	4	D	Appears to be in good order
Vandalism	1	A	The tank site has a history of vandalism, so regular onsite checks are required to maintain security and water quality
Walls	4	D	Appears to be in good order
Ladder External	4	D	Appears to be in good order
Entry Hatch	2	A	The entry hatch was open upon arrival to site, so more stringent site visits are required
Roof Platforms	2	A	The FRP mesh has been burnt in one area and it is displaying surface delamination. The FRP mesh needs to be painted with a weather proof coating to resolve the issue
Walkways	Na	Na	No Comment
Roof	4	F	The main damaged sections of roof have been repaired, but the flashings will need to be re-secured over time to maintain a good sealed area
Roof Hatches	Na	Na	No Comment
Handrails	4	D	Appears to be in good order
Davit	Na	Na	There is no rescue system fitted
Ventilation	4	D	Appears to be in good order
Bird Proofing	4	D	Appears to be in good order
Electrical	Na	Na	No Comment
Level Indicator	Na	Na	No Comment

Priority 0 Item requires immediate attention.
Priority 1 Item is in poor condition or otherwise non functional.
Priority 2 Item is to receive precedence during maintenance
Priority 3 Item is functional but deteriorated/ not in operational order.
Priority 4 Item is in good condition.

Status A = Attention Required
Status F = Item to be Reassessed
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Internal

Area	Priority	Status	Comments
Walls	4	D	Appears to be in good order
Columns	4	D	Appears to be in good order
Roof Spider	4	D	Appears to be in good order
Roof Framing	4	D	Appears to be in good order
Floor	4	D	Appears to be in good order
Inlet	4	D	Appears to be in good order
Outlet	2	A	The mesh screen has fallen apart and needs removing to avoid pieces from entering the pipework
Scour	4	D	Appears to be in good order
Overflow	4	D	Appears to be in good order
Mixer Motor	N/A	N/A	No Comment
Motor Type	N/A	N/A	No Comment
Supports	N/A	N/A	No Comment
Supports Type	N/A	N/A	No Comment
Ladder Internal	4	D	Appears to be in good order
Electrical	N/A	N/A	No Comment

Comments

External Comment:
The tank site has a history of vandalism so regular onsite checks are required to maintain security and water quality. Most of the earlier rock impact damage to the roof is occurring from one particular area outside the security fence. There is a small rock ledge and a pathway leading up to it. If this ledge was to be removed, a lot of the current vandalism would be avoided.

Internal Comment:
The mesh outlet screen has fallen apart and needs removing to avoid the pieces from entering the pipework.

Priority 0 Item requires immediate attention.
Priority 1 Item is in poor condition or otherwise non functional.
Priority 2 Item is to receive precedence during maintenance
Priority 3 Item is functional but deteriorated/ not in operational order.
Priority 4 Item is in good condition.

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Version: 1, Version Date: 08/04/2019

Reservoir Maintenance Priorities Report

7/04/2019

Date:	28/03/2019	**Client Name:**	Lithgow City Council
WS #:	0	**Reservoir Name:**	South Bowenfels
Asset No:	0	**Location:**	LHS opp 132 Magpipe Hollow Rd Sth Bowenfels
Job No:	027241	**Project Number:**	0
Cleaning Due:	28/3/2021	**Inspection Due:**	28/3/2021

External

Area	Priority	Status	Comments
Compound	4	D	Appears to be in good order
Vandalism	2	A	There is evidence of unauthorised access to the roof area and the entry hatch cover has been damaged
Walls	3	F	There have been a lot of weeps initially so a long operating life may not be achieved as the tank was poorly constructed
Ladder External	4	D	Appears to be in good order
Entry Hatch	1	A	The entry hatch hinge bolts are not secure, allowing unauthorised access to occur. One bolt is already missing, leaving the hatch security compromised
Roof Platforms	1	A	The main centre join has not been sealed and water drains back into the tank
Walkways	Na	Na	No Comment
Roof	4	D	Appears to be in good order
Roof Hatches	2	A	There is a small roof hatch on the platform that was open upon arrival to site. There is no method of securing it closed at present
Handrails	4	D	Appears to be in good order
Davit	Na	Na	There is no davit fitted
Ventilation	2	A	There is one rotating vent present and it has been damaged. It needs to be replaced before it fails and leaves the tank open to bird or vandal entry
Bird Proofing	4	D	Appears to be in good order
Electrical	2	A	The electrical box on the platform area was open upon arrival to site
Level Indicator	Na	Na	No Comment

Priority 0 Item requires immediate attention.
Priority 1 Item is in poor condition or otherwise non functional.
Priority 2 Item is to receive precedence during maintenance
Priority 3 Item is functional but deteriorated/ not in operational order.
Priority 4 Item is in good condition.

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Version: 1, Version Date: 08/04/2019

Internal

Area	Priority	Status	Comments
Walls	3	F	There are multiple patch repairs over the initial coating, indicating poor application
Columns	2	A	The centre steel column has corrosion areas developing and the coating is delaminating in significant areas
Roof Spider	Na	Na	No Comment
Roof Framing	4	D	Appears to be in good order
Floor	4	D	Appears to be in good order
Inlet	2	A	The inlet nozzle design is not effective - its purpose has been guessed at rather than being quantified. This existing arrangement should be removed before the riser begins to corrode and a customised HDPE directional nozzle should be installed in its place
Outlet	4	D	Appears to be in good order
Scour	4	D	Appears to be in good order
Overflow	3	F	The overflow is ductile iron and it will begin to corrode due to contact with the SS bolts and supports. Better materials should have been used to guarantee a longer design life
Mixer Motor	Na	Na	No Comment
Motor Type	Na	Na	No Comment
Supports	Na	Na	No Comment
Supports Type	Na	Na	No Comment
Ladder Internal	4	D	Appears to be in good order
Electrical	Na	Na	No Comment

Comments

External Comment:
The main centre join in the platform has not been sealed and water drains back into the tank. The rotating vent has been damaged and needs to be replaced before it fails and creates a bird or vandal entry area to the tank. There is also evidence of unauthorised access to the roof area and the entry hatch cover has been damaged.

Internal Comment:
The centre steel column has corrosion areas developing and the coating is delaminating in significant areas. The inlet nozzle design is not effective - its purpose has been guessed at rather than being quantified. This existing arrangement should be removed before the riser begins to corrode and a customised HDPE directional nozzle should be installed in its place.

Priority 0 Item requires immediate attention.
Priority 1 Item is in poor condition or otherwise non functional.
Priority 2 Item is to receive precedence during maintenance
Priority 3 Item is functional but deteriorated/ not in operational order.
Priority 4 Item is in good condition.

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Reservoir General Report

7/04/2019

Lithgow City Council

Name	WS No.	Location	Shape	Diameter (m)	Depth (m)	Area (m²)	Capacity (ML)	Screen	Mixer	CP
Cook St HL	01	off Hassens Lookout Rd	OnGround	28.00	5.25	615.44	3.00	No	No	Yes
Cook St LL	02	end of Cook Street	Inground	35.00	7.00	1,000.00	6.68	No	No	No
Lidsdale	03	100m before 233 Brays Ln Wallerawang	OnGround	19.00	4.50	283.34	1.26	No	No	No
Lithgow WTP CWW	13	Oaky Creek Water Treatment Plant	Inground	17.80	5.00	124.36	0.62	No	No	No
Marrangaroo	05	end of Girraween Dv Marrangaroo	OnGround	10.00	3.20	78.50	0.23	No	No	No
Portland HL	06	Ridge St Portland	OnGround	18.00	4.00	254.34	1.00	No	No	No
Portland LL	07	off Purcell St Portland	OnGround	16.00	5.50	200.96	1.10	No	No	No
Shaft St No2	08	off Shaft Street, Lithgow	OnGround	61.00	7.40	2,920.00	20.00	No	Yes	No
South Bowenfels	0	LHS opp 132 Magpipe Hollow Rd Sth Bowenfels	OnGround	15.50	12.50	188.59	2.40	No	No	No
South Littleton	10	Southern end of Woodlands Drive South Bowenfels	OnGround	15.00	5.50	176.63	0.97	No	No	No
Tarana	0	Tarana	Inground	0.00	0.00	0.00	0.00	No	No	No
Vickers St	11	off Vickers Street	OnGround	7.40	2.50	42.99	0.10	No	No	No
Wallerawang	12	Lot 1 Forest Ridge Drive Wallerawang	OnGround	20.00	8.50	314.00	2.67	No	No	No

Reservoir Analysis Report

7/04/2019

Lithgow City Council

Name	Cleaned Date	Cleaning Interval (yrs)	Clean Due	Inspection Date	Inspection Interval (yrs)	Inspection Due	Clean Time (hrs)	Sediment Depth (mm)	Waste Volume (KL)
Cook St HL	30/03/2019	2	30/03/2021	30/03/2019	2	30/03/2021	2.20	30.00	60.00
Cook St LL	28/03/2019	1	28/03/2020	28/03/2019	1	28/03/2020	2.20	50.00	54.00
Lidsdale	27/01/2017	3	27/01/2020	27/01/2017	3	27/01/2020	0.40	5.00	16.00
Lithgow WTP CWW	04/02/2018	2	04/02/2020	04/02/2018	2	04/02/2020	0.50	10.00	24.00
Marrangaroo	29/01/2017	4	29/01/2021	29/01/2017	4	29/01/2021	0.25	5.00	11.00
Portland HL	28/01/2017	3	28/01/2020	28/01/2017	3	28/01/2020	0.30	10.00	12.00
Portland LL	28/01/2017	3	28/01/2020	28/01/2017	3	28/01/2020	0.30	10.00	12.00
Shaft St No2	03/02/2018	1	03/02/2019	03/02/2018	1	03/02/2019	5.10	15.00	130.00
South Bowenfels	28/03/2019	2	28/03/2021	28/03/2019	2	28/03/2021	1.00	20.00	25.00
South Littleton	24/01/2017	2	24/01/2019	24/01/2017	2	24/01/2019	1.00	30.00	25.00
Tarana	29/03/2003	2	29/03/2005	29/03/2003	2	29/03/2005	1.20	20.00	350.00
Vickers St	26/01/2017	4	26/01/2021	26/01/2017	4	26/01/2021	0.20	10.00	8.00
Wallerawang	27/01/2017	3	27/01/2020	27/01/2017	3	27/01/2020	0.45	10.00	18.00

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