ANNUAL REPORT 2020/2021 (FINANCIAL YEAR)





SPID	506
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Report contains	Activities undertaken over the 2020/2021 financial year in operating Townsville City Council's (Council) drinking water service
	Summary of drinking water quality for Townsville's three drinking water schemes.
	Summary of Council's performance in implementing their approved Drinking Water Quality Management Plans (DWQMP).



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Abbreviations and Acronyms

Acronvm	Definition
ADWG	Australian Drinking Water Guidelines
BWA	Boil Water Advisory
ССР	Critical Control Point
DBP	Disinfection By Product
DO	Dissolved Oxygen
DW	Dirty Water
DNRME	Department of Natural Resources. Mines and Energy
DWQMP	Drinking Water Quality Management Plan
GAC	Granular Activated Carbon
LIMS	Laboratory Information Management System
MW	Milky Water
NATA	National Association of Testing Authorities
OS	Owner's Side
PAC	Powdered Activated Carbon
RMIP	Risk Management Improvement Program
RRD	Ross River Dam
тнм	Trihalomethanes
TLS	Townsville Laboratory Services
T&O	Taste and Odour
WTP	Water Treatment Plant

Approvals

In signing this approval:

I agree that the report meets the standards required and approve the report to be submitted to Water Supply Regulation, Department of Regional Development, Manufacturing and Water.

Travis Richards

General Manager - Water and Resource Recovery Townsville City Council

Water Supply in Townsville 2020/21 Fast Facts



Highest daily water demand **206 ML**



B Drinking water supply schemes



2,664 km







of residential drinking water supplied to 229,385 residents



0.26 customer water quality complaints per 1,000 connections



87,440 properties connected



\$956,536,000 replacement cost of Townsville's water assets

1. Executive Summary

Townsville City Council's (Council) Drinking Water Quality Management Plan (DWQMP) was approved in August 2012. Included in the approval notice was the requirement to submit an annual water quality report to outline the performance of Townsville Water against their DWQMP as required under the Water Supply (Safety and Reliability) Act 2008.

Townsville Water has met all requirements under its DWQMP, the Australian Drinking Water Guidelines 2011 (ADWG) and the *Public Health Regulation 2005* for the reporting period. The reporting period being the 2020/2021 financial year.

Council has three Drinking Water Schemes (DWS): Townsville DWS, Giru/Cungulla DWS and Paluma DWS and although their DWQMPs are separate, one annual report for all three schemes is submitted to the Office of the Water Supply Regulator (the Regulator).

Annual compliance with the *Public Health Regulation* 2005 (the regulation) for *Escherichia coli* (*E. coli*) for the three schemes was met with 99.8% compliance for Townsville Drinking Water Scheme, 100% compliance rate for Giru/Cungulla Drinking Water Scheme and a compliance rate of 99.2% for Paluma Drinking Water Scheme. (The regulation requires that 98% of samples taken in a 12-month period should not detect *E. coli*).

Twelve notifications of non-compliance and three events were submitted to the Regulator for the three schemes for the reporting period:

- 6 E. coli detections
- 3 disinfection-by-product exceedances
- 1 chlorine exceedance
- 2 metal (lead and manganese) exceedances
- 3 events

There were 700 customer complaints regarding drinking water quality:

- 621 discolouration event related complaints
- 49 dirty water complaints
- 2 milky water complaints
- 15 taste/odour complaints
- 13 owner's side issues.

The regulatory audit was performed by Northern Water Management in December 2020. The plan review was submitted in August 2021 to the Regulator for approval.

COVID-19 and its restrictions in Queensland throughout the year did not impact on water treatment, water quality or water sampling.

This DWQMP annual report is made available to our customers through our public website, upon request through email **enquiries@townsville.qld.gov.au** or for inspection upon request at the Customer Service Centre, 103 Walker Street, Townsville City.

2. Overview

Townsville Water is a significant business activity of Council and is a registered service provider under the Water Supply (Safety and Reliability) Act 2008. Townsville Water is responsible for the management of the city's potable water supply network and provision of safe and reliable water to the residents of Townsville, Paluma Township and Cungulla Township. Public health is protected through proactive identification and minimisation of public health related risks associated with drinking water.

Council's DWQMP was submitted to the Regulator on 21 June 2011. It was approved with conditions on 29 August 2012. Townsville's first DWQMP Audit was undertaken in July of 2016. The plan was reviewed, with significant amendments made in January 2018. The amendments were approved with conditions on 23 April 2018. The plan is reviewed every two years with an external audit undertaken every four years. The latest regulatory audit was undertaken in December 2020 and the plan review was submitted for approval in August 2021.

Townsville Water services a population of approx. 194,072 with 87,440 connected properties, in three drinking water schemes: Townsville Drinking Water Scheme, Paluma Drinking Water Scheme and Giru/ Cungulla Drinking Water Scheme. This annual report relates to all three schemes.

Table 1. Summary of Townsville's Drinking Water Schemes

Scheme Name	Water Treatment Plant	Water Source	Treatment Processes	Treatment Capacity	Towns Supplied
Townsville Drinking Water Scheme	Douglas Water Treatment Plant (Angus Smith Drive)	Ross River Dam (with water supplemented from the Burdekin Dam through the Haughton Pipeline when required)	Conventional treatment with chlorine disinfection	232 ML/D	Townsville
	Northern Water Treatment Plant (Kinduro)	Paluma Dam Crystal Creek	Ultrafiltration with chlorine disinfection	40 ML/D	_
Giru/Cungulla Drinking Water Scheme	Giru Water Treatment Plant (Cromarty Creek Road)	Haughton River	Conventional treatment with chlorine disinfection	2 ML/D	Cungulla township
Paluma Drinking Water Scheme	Paluma Water Treatment Plant (Lennox Crescent)	Paluma Weir	Ultrafiltration with UV and chlorine disinfection	90 KL/D	Paluma township

Giru Water Treatment Plant (WTP) supplies water to Cungulla township and Giru township. Water is supplied to Giru township through agreement with the Burdekin Shire Council. Management of Giru's drinking water quality is covered under the Burdekin Shire Council's DWQMP.

45,767 ML of potable water was produced in the 2020/2021 financial year. Townsville Water maintains

and operates 2 dams (Ross River Dam and Paluma Dam), 2 weirs (Paluma Weir and Blacks Weir), 23 water pumping stations, 18 chlorinators, 41 reservoirs (treated water storage facilities) and 2,658.3 km of water distribution mains.

3. Actions taken to implement the DWQMP

Management of Council's DWQMP

The DWQMP is managed by the Water Quality Officer. Both the Team Leader Water Treatment and Water Quality Officer's role is to monitor, regulate and improve water quality for Townsville. They deal with all water quality non-compliances, water quality complaints and queries from customers, monitor all Critical Control Points (CCPs), the water sampling plan and the subsequent data it generates. They are part of a broader Water Quality Team which also includes the Water Operations Coordinator, Commercial Compliance Officer, Bulk Water Maintenance Officer and the Water Operators. These Officers have operational and technical expertise in relation to water quality and supply.

The Water Quality Team hold a weekly water quality meeting, with water quality also discussed at weekly planning meetings and at toolbox meetings with staff as required. A water quality governance meeting is held with management every two months and is chaired by the General Manager Townsville Water and Waste. This year a Technical Team was established to provide advice and solutions for the management of the cyanobacteria bloom and the water treatment and supply issues it creates, and the team includes representatives from Council, Trility, Townsville Laboratory Scientists and Hunter H₂O.

Training

The "Aqua card" must be obtained by all staff involved with water treatment and supply and this is managed through our internal Learning Management System. Aqua card is a QldWater course which gives an overview of water quality risks, particularly when working on or around water infrastructure. It provides a simple overview of what contaminants are, the risks that they pose, how they can enter a drinking water system and the responsibilities of those working on infrastructure to reduce that risk. It includes practical guidance on how to operate within work sites including good housekeeping and disinfection practices.

Ten staff members have completed the Water Industry Worker Program, and four more staff are working towards it. The Water Industry Worker program was developed in partnership with QldWater, government, industry and training providers to help retain skilled staff and improve future opportunities for workers through industry specific training. The program is focused on the formal recognition of skills and training employees within the construction and maintenance field in the water industry. A large component of this training is drinking water quality and the role of the worker in maintaining safe supply as a public health requirement of their role.

Operation of Douglas Water Treatment Plant and Northern Water Treatment Plant

Trility are engaged to operate Douglas WTP and Northern WTP under a managed contract with Council. The contract is managed through informal weekly operations meetings, formal monthly operational management team meetings and formal quarterly contract management committee meetings. Any issues arising between these times are dealt with through phone calls, emails, face to face and ad hoc meetings.

Education

Townsville Water delivers education programs to provide awareness of water operations, water treatment and water supply and to encourage smart water usage. School engagements during 2020/2021 recommenced during the second half of the financial year following disruptions and restrictions from the COVID-19 pandemic. Townsville Water engaged approx. 950 school students in various face-to-face eco-catchment tours and classroom visits. Online virtual tours also supported learning with 1,338 visits to the virtual tours on Council's website.

The new Water Demonstration Garden at Anderson Gardens was completed in October 2020 with a soft launch to officially open the gardens to the public. In December 2020, the Giant Water Hunt event was held at the new Water Demonstration Garden, with just over 100 community members attending the event.

Townsville Water continues to work on curriculum linked education resources and various fact sheets for schools and early learning centres. The in-class water education program was redeveloped to align with demand management strategies and boost student's engagement while increasing awareness of Townsville's water supply.

Major Capital Projects

The new laboratory building located adjacent to Douglas WTP was officially opened in May 2021, following a \$5 million expansion. A method for algal toxin testing was developed this year in-house by Townsville Laboratory Services (TLS). It has meant significantly faster turnaround time for results from approx. two weeks to two days. This enables a greater understanding of our toxin risk under the current cyanobacteria bloom.

In May 2021 Council awarded tender for construction of two new clarifiers at Douglas WTP in front of modules three and four (Direct Filtration modules), With works expected to be completed by end of December 2022. The new clarifiers will improve treatment capacity and add an additional log reduction value to modules three and four (for protazoa and virus risk).

On Friday 11 December 2020 a leak was detected on the 1300mm raw water main from Ross River Dam (RRD) to Douglas WTP. This main is the sole feed for Douglas WTP. Black Weir Emergency Intake was brought online. Black Weir Emergency Intake does not have the capacity to meet demand without water restrictions in place. The water supply system was reconfigured so that water could be fed from Northern WTP into the entire network to take pressure off Douglas WTP. Residents were placed on restrictions on Friday night and communication with residents was undertaken through Council's Communications and Marketing department through text, email, disaster dashboard and Facebook from Friday night and continued over the weekend as the repair progressed.

Repairs were completed on Sunday 13 December 2020 with the pipe being refilled by 3pm. Water was fed through the pipeline to Douglas WTP through gravity flow and Black Weir Emergency Pumps were switched off. Restrictions remained in place so the reservoirs in the network could be refilled. Restrictions were eased from Monday 14 December 2020 with water being allowed for indoor use. On Tuesday 15 December 2020 restrictions were eased again with outdoor use for handheld hoses and cars and boats washed by bucket. Restrictions were lifted Thursday 17 December 2020 with Douglas WTP treating water to demand in the network. During the event there was no concern for public health as all water was being treated as per normal through Douglas WTP and Northern WTP (albeit at a reduced volume) and so a Public Health Notice was not required.

Due to the failure of the raw water main into Douglas WTP and resultant loss of supply a temporary pumped raw water intake has been established immediately upstream of the Douglas WTP to provide continuation of water supply to the treatment plant in the event of a failure of the raw water pipeline that runs from RRD to Douglas WTP. The pumped intake is located on the bank of the Ross River immediately to the south of the treatment plant site to supply up to 110ML/D to help ensure continuity of supply in the event of another raw pipeline break.

To further increase security of supply and to minimise risk of disruption to water supply a project has begun to duplicate the raw water pipeline from RRD to Douglas WTP. Tenders for the construction of the duplicate raw water pipeline commenced in September 2021. The duplicate pipeline will cross the river closer to the dam and run parallel to the river through the Department of Defence's Mount Stuart Training Area before connecting to the Douglas WTP.

For additional security of supply during drought conditions the tender for stage two design of the

Haughton Pipeline Project was awarded in November 2020. Stage two of the project will see the existing pipeline extended from the Haughton River to the Burdekin River near Clare and will include around 30km of pipe as well as the construction of a new pump station and high voltage power supply infrastructure. Stage one of the pipeline is complete with construction of stage two currently planned to commence at the end of 2022.

Risk Management Improvement Program

The risk management improvement program (RMIP) implementation plan is included in Appendix A.

4. Research activities

Ross River Dam Catchment Plan Scoping Report (Stage 1)

Townsville Water engaged Alluvium to assist with the development of the RRD Catchment Plan. The first scoping report was completed in June 2021. The report included the catchment overview, a high-level understanding of catchment issues and risks, strategic action areas and scoping for stage 2.

In recent years, the water quality in the impoundment has declined with harmful algal blooms associated with high concentrations of cyanobacteria becoming prevalent. These blooms indicate that there are significant quantities of bio-available nutrients in the water column, but that these may also be the result of organic matter from the catchment depositing in the deeper areas of the dam. This is confirmed by higher occurrences of taste and odour compounds, and dissolved organic matter, within the raw water extracted from the dam for drinking water treatment and supply.

Whilst there are a number of treatment responses available to improve the quality of drinking water being supplied from the RRD, effective management of the catchment can also address some of the causes of poor water quality and provide a more resilient reservoir for the city.

The report summarises an initial investigation of the key issues and potential management responses for improving management of the catchment draining to RRD. It also scoped further investigations for a second stage that can evaluate the most appropriate responses for investment in catchment remediation activities. The key outcomes from this scoping stage are the need to focus on several management themes, including planning, compliance and community engagement and education. These are likely to highlight management actions and interventions suitable for implementation to reduce water guality risks and improve catchment health.

Ross River Dam In-Water Interventions Multi-Criteria Analysis

The multi-criteria analysis undertaken by Alluvium assessed 20 options for in-water interventions to aid with the management of cyanobacteria blooms in RRD across social, financial, environmental and overall feasibility (at scale). It provided several recommendations and indicative costings for all options with recommendations to apply, research, test or ignore*.

The top four options in order were:

Rank	Option	Recommendation
1	Permanent emergent planting to the water body perimeter	Apply
2	Biomanipulation	Research
3	Planting submerged aquatic plants	Apply
4	PhoslockTM only	Test

*

Ready for immediate action
Likely to have merit but somewhat uncertain
Likely to have merit but suggest initial small-scale application
Unlikely to have merit

Council is currently investigating the application of these options.

5. Information supplied to the regulator regarding non-compliances and prescribed incidents

There were 12 non-compliances with water quality criteria and 3 water supply events reported for the 2020/2021 financial year.

DWI-506-20-08504 - Townsville DWS - High Chlorine

On 24 August 2020 Operator daily checks detected a high chlorine residual of 7.3mg/L in Dahl Reservoir and 6.75 mg/L in reticulation supplied by Dahl Reservoir. The dosing pumps were disabled, and the affected area was extensively flushed. The reservoir was refilled with minimally chlorinated water to dilute the water that was in the reservoir. Investigation confirmed that the pump had been manually left on 100%, after bleeding to remove an air bubble, over the weekend in error. The site is not attended at weekends.

A Grundfos DDA pump will be installed December 2021. This type of pump has a button which is depressed when bleeding/priming pumps, and once finger is removed it returns to normal pump configuration so removing the "human error" factor. This will mitigate against the pump being set to 100%.

DWI-506-20-08510 - Townsville DWS - E. coli

On 27 August 2020 routine lab sampling detected 3MPN/100ml *E. coli* in Picnic Bay Reservoir. Resample did not detect *E. coli*. Investigation showed that there had been no water treatment issues, no integrity issues with no pipe breaks and reservoir roof is maintained. Chlorine, pH and turbidity were all within range for adequate disinfection. No other *E. coli* were detected in the network on this day or on days prior.

Was determined to be a sampling error.

DWI-506-20-08522 - Townsville DWS - E. coli

On 10 September 2020 routine lab sampling detected 2 MPN/100ml *E. coli* at Valley Drive, Oak Valley. An electricity surge knocked off the chlorine dosing system at Mt Jack Chlorinator, Brookhill the night before. The chlorinator was reset but a glug of chlorinated water entered the system. Area was extensively flushed, and residual chlorine monitored until adequate chlorine residual was obtained throughout the network. Area was extensively sampled for *E. coli* with none detected in any of the resamples.

When the electricity surge happened, the generator should have automatically turned on to maintain chlorine dosing. Council Instrument Technicians fixed the generator faulting issue so that when the generator starts the chlorine dosing pumps start automatically.

DWI-506-20-08554 - Paluma DWS - E. coli

On 12 October 2020 routine lab sampling detected 3MPN/100ml *E. coli* at Lennox Crescent, Paluma. Resample did not detect *E. coli*. Investigation showed that there had been no water treatment issues, no integrity issues with no pipe breaks and reservoir roof is maintained. Chlorine, pH and turbidity were all within range for adequate disinfection. No other *E. coli* were detected in the network on this day or on days prior.

Was determined to be a sampling error.

DWI-506-20-08733 - Paluma DWS - THMs

Routine lab sampling on 11 December 2020 detected 266µg/L trihalomethanes (THMs) at a Lennox Crescent Ned Kelly sample point. Investigation determined chlorine analyser was not reporting correctly for a few days prior to THM sample being taken. The analyser couldn't react in a timely manner to adjust chlorine dose according to incoming treated water flow. It was difficult to adjust manually, which made it hard to maintain CCPs. Raw water trihalomethane (THM) formation potential was also high in the days preceding the incident. The chlorine analyser was fixed prior to result of the high THM and the reservoir had emptied in between the time of result also. Resample THM was back within limits.

The chlorine analyser was overhauled and fixed. Sodium hypochlorite is managed closely at this site to reduce chlorate formation. Preventative backwashing of the Granular Activated Carbon (GAC) was undertaken to help reduce THM formation.

DWI-506-20-08807 – Townsville DWS – Loss of supply event

On Friday 11 December 2020 a leak was detected on the 1300mm raw water main from RRD to Douglas WTP. This main is the sole feed for Douglas WTP. Black Weir Emergency Intake was brought online. Black Weir Emergency Intake does not have the capacity to meet demand without restrictions in place. The water supply system was reconfigured so that water could be fed from Northern WTP into the entire network to take pressure off Douglas WTP. Residents were placed on restrictions on Friday night and communication with residents was undertaken through Council's Communications and Marketing department through text, email, disaster dashboard and Facebook from Friday night and continued over the weekend as the repair progressed.

Repairs were completed on Sunday 13 December with the pipe being refilled by 15.00. Water was fed through the pipeline to DWTP through gravity flow and Black Weir Emergency Pumps were switched off. Restrictions remained in place so the reservoirs in the network could be refilled. Restrictions were eased from Monday 14 December with water being allowed for indoor use. On Tuesday 15 December restrictions were eased again with outdoor use for handheld hoses and cars and boats washed by bucket. Restrictions were lifted Thursday 17 December with DWTP treating water to demand in the network. During the event there was no concern for public health as all water was being treated as per normal through Douglas WTP and Northern WTP (albeit at a reduced volume) and so a Public Health Notice was not required.

Due to the failure of the raw water main into DWTP and resultant loss of supply a temporary pumped raw water intake has been established immediately upstream of the DWTP to provide continuation of water supply to the treatment plant in the event of a failure of the raw water pipeline that runs from RRD to Douglas WTP. The pumped intake is located on the bank of the Ross River immediately to the south of the treatment plant site to supply up to 110ML/D.

To further increase security of supply and to minimise risk of disruption to water supply a project has begun to duplicate the raw water pipeline from RRD to Douglas WTP. Tenders for the construction of the duplicate raw water pipeline commenced in September 2021. The duplicate pipeline will cross the river closer to the dam and run parallel to the river through the Department of Defence's Mount Stuart Training Area before connecting to the Douglas WTP.

DWI-506-21-08835 – Townsville DWS – E. coli

On 6 January 2021 routine lab sampling detected 2 MPN/100ml *E. coli* at a Wulguru Ned Kelly sample point and 1 MPN/100ml at an Annandale Ned Kelly sample point. Resample did not detect *E. coli*. Investigation showed that there had been no water treatment issues, no integrity issues with no pipe breaks and reservoir roof is maintained. Chlorine, pH and turbidity were all within range for adequate disinfection. No other *E. coli* were detected in the network on this day or on days prior. However, Townsville was experiencing monsoonal rain on the day the samples were taken. Rain makes it difficult to ensure aseptic technique is followed. It was determined that environmental contamination was the most likely cause.

DWI-506-21-08835 – Giru/Cungulla DWS – Raw Water High Turbidity Event

Giru WTP was bypassed due to high turbidity raw water (>600 NTU). This was an operational requirement for staffing issues and fatigue management and there was adequate storage in the treated water reservoirs.

The short term turbidity spike in run of river passed and WTP was brought back online. This operational requirement has been written in the latest review of the DWQMP.

DWI-506-21-08862 – Townsville DWS – Cyanobacteria Event resulting in discoloured water and reduced supply

Cyanobacteria have been detected in RRD since 2018. Cell numbers (and biovolume) have been increasing each summer since. Numbers increased significantly (>120,000 cells/ml) in January and February and diatoms numbers also increased significantly (>80,000 cells/ ml). This caused filter binding at Douglas WTP and water production decreased from the 30 January 2021. It also caused filter breakthrough which resulted in a yellow hue to the treated water. In RRD the cyanobacteria experienced a die off phase which dropped dissolved oxygen (DO) levels in the dam at all levels in the profile. As low DO was at all offtake layers this low DO water was taken into the WTP. This low DO water was high in soluble manganese (low DO enables soluble manganese to be released from the sediments in the bottom of the dam). This soluble manganese passed through the filters and resolubilised to total manganese at the chlorination step in the clear water storages.

Pre-chlorination was added to the filters in module 1 and module 2. This effectively removed the manganese, improved cyanobacterial cell removal, reduced net sodium hypochlorite load on the WTP and improved DO across the WTP. The initial high sodium hypochlorite dose required increased Disinfection By-Product (DBP) formation in the short term but has since reduced due to the reduced sodium hypochlorite dose required for pre-chlorination and the overall net chlorine use across the plant.

Pre-chlorination remains in place and is now prior to filtration on all modules. Powdered Activated Carbon (PAC) dosing is in place to mitigate toxin risk if required. Construction of clarifiers pre-direct filtration modules has begun with a construction end date of December 2022. A Catchment Management Plan is being developed.

DWI-506-21-08870 - Townsville DWS - Chlorates

On 9 February 2021 chlorates above DWQMP targets were detected at Douglas WTP and in the network. Chlorates above DWQMP targets were detected for much of March. This was the same body of water moving through the system. This was due to the high initial dosing of sodium hypochlorite on module one and two filters to establish a coated media process for the removal of soluble manganese. The issue was compounded by the hot weather and the inability to flush water due to water production issues. Once the coated media process was established the sodium hypochlorite dose pre-filter was significantly reduced and a corresponding decrease in chlorate concentration occurred. Ongoing management of sodium hypochlorite stock in Townsville occurs as per the DWQMP.

DWI-506-21-08878 – Townsville DWS – Manganese

Due to the discolouration event (DWI-506-21-08862) an increase of manganese monitoring was occurring across the network. These samples detected manganese above ADWG limits. As per event DWI-506-21-08862 description. These results were from dead ends of the network with possible inadequate flushing before sampling. All resamples detected manganese (whilst above aesthetic limits) back within health guideline limits. Once pre-chlorination was established the filter media coating removed the soluble manganese.

Pre-chlorination has been set up across all modules (Mod 1-4). DO analysers have been installed at DWTP as prewarning that raw water quality has reduced. Aeration has been installed in RRD and operated to improve DO in bottom layers and throughout the profile.

DWI-506-21-08892 - Townsville DWS - THMs

On 2 March 2021 routine lab sampling detected 0.275mg/L THMs at Ponti Road Reservoir. This was a result of the increase in sodium hypochlorite dose required for prechlorination for manganese during the discoloration event (DWI-506-21-08862). Once pre-chlorination had been established, sodium hypochlorite dose was reduced and THMs (and chlorates) have returned to normal levels in the network. Pre-chlorination of the filters has resulted in a net reduction of chlorine dose across the plant which has reduced DBP concentrations overall.

DWI-506-21-08896 – Townsville DWS – E. coli

On 2 March 2021 routine lab sampling detected 2 MPN/100ml *E. coli* in a Kelso Ned Kelly sample point. Resample did not detect *E. coli*. Investigation showed that there had been no water treatment issues, no integrity issues with no pipe breaks and reservoir roof is maintained. Chlorine, pH and turbidity were all within range for adequate disinfection. No other *E. coli* were detected in the network on this day or on days prior.

Due to the high metal content in the sample (DWI-506-21-08898) and the significant decrease in the metal content post flushing for resamples, it was determined that inadequate flushing of the sample occurred and so this was not a representative sample of water. The procedure for sampling outlining the requirement for flushing prior to the sample being taken was reiterated with TLS.

DWI-506-21-08898 - Townsville DWS - Lead

On 4 March 2021 routine sampling detected 0.025 mg/L lead in Kelso Ned Kelly sample point. Please note this was the same sample as DWI-506-21-08896 *E. coli* detection. Resample did not detect lead. There had been no treatment issues at the WTP, other samples on this date did not detect lead above guideline limits. No lead was detected in the treated water from the WTP. This Ned Kelly style sample point was installed in February 2019. 26 samples have been taken since its installation and have not detected lead above ADWG.

Due to the high metal content in the sample for all metals, and the significant decrease in the metal content post flushing for resamples it was determined that inadequate flushing of the sample occurred and so this was not a representative sample of water. The procedure for sampling outlining the requirement for flushing prior to the sample being taken was reiterated with TLS.

DWI-506-21-08926 - Townsville DWS - E. coli

On the 31 March 2021 routine lab sampling detected 1 MPN/100ml Kirwan Ned Kelly sample point. Resample did not detect *E. coli*. Investigation showed that there had been no water treatment issues, no integrity issues with no pipe breaks and reservoir roof is maintained. Chlorine, pH and turbidity were all within range for adequate disinfection. No other *E. coli* were detected in the network on this day or on days prior.

Was determined to be a sampling error.

6. Compliance with water quality criteria for drinking water

Townsville Water has a comprehensive sampling regime "from catchment to tap" which covers catchments, raw water supply, water treatment and water distribution. Over 100,000 tests are taken annually for various parameters including but not limited to chlorine, pH, turbidity, alkalinity, metals, chemical, pesticides, disinfection by products, per- and polyfluoroalkyl substances and microbiological.

Treated water samples are taken from dedicated sample points in Council owned parks and open spaces. These sample points are housed in secure vandal proof casings - "Ned Kellys".

All samples are taken and analysed by TLS which are National Association of Testing Authorities (NATA) accredited. Results are emailed to the water quality team as soon as they are verified and finalised by the laboratory. The water quality team also have access to the Laboratory Information Management System (LIMS) to obtain results as required. All results above ADWG limits are called through immediately to the Water Quality Officer (Team Leader Water Treatment if Water Quality Officer is not available). Exceedance reports are generated weekly or as required. All water quality data is monitored, and trends analysed throughout the year by the Water Quality Officer.

COVID-19 restrictions did not affect sampling type or frequency. Townsville Water has been largely compliant with the water quality criteria for the financial year, having 12 water quality incidents and three events.

Six reportable incidents were due to *E. coli* detections, three disinfection by-products above the ADWG limit (DWQMP limits for chlorates) one for chlorine and two for metals. There were three water supply events reported. Details for the incidents and events are included in section 5 above.

Council were compliant with the *Public Health Regulation* 2005 which requires "nil cfu/100ml found in 98% of the samples taken for a 12-month period" for all three schemes for the period.

There were five *E. coli* incidents as outlined in table 3. for Townsville Drinking Water Scheme with a 99.8% compliance rate. And one incident in Paluma DWS with a 99.2% compliance rate. There was no *E. coli* detected at Giru/Cungulla DWS. Table 4: Number of E. coli Incidents and Percentage Annual Compliance with the Public Health Regulation 2005.

Drinking Water Scheme	No. of samples taken	Number of Incidents	% Annual Compliance
Townsville	3348	5	99.8%
Paluma	135	1	99.2%
Giru/ Cungulla	206	0	100%

There have been no failures to meet sampling frequencies and all locations have been sampled.

Drinking water quality performance (verification monitoring) is included in Appendix B. This is a snapshot of the most relevant water quality parameters for the three schemes.

If further more detailed information is required residents (or businesses) are asked to contact the Water Quality Officer through email enquiries@townsville.qld.gov.au or by calling Customer Service on 13 48 10.

7. Details of complaints made to the provider about the drinking water service supplied to the customers

All customer water quality complaints are lodged through Council's 24-hour Operations Centre, with all information regarding the complaint and how it was rectified recorded in the Property and Rating (TechnologyOne) system. Each complaint has a unique identification number which enables the complaint to be followed from start to finish with comments added at each step.

There were 700 drinking water quality complaints for the reporting period; the large increase driven by the discolouration event that occurred in February and March 2021. 81 complaints were received outside the event and this number is in line with what is received on an annual basis.

Graph 1: Number of drinking water quality complaints per financial year.



Table 5: Number of dirty water complaints by type.

There were six main types of water quality complaints in Townsville as outlined below:

Type of Water Quality Complaint	Dirty Water	Milky Water	Taste/Odour	Suspected illness/ Customer concern	Owner's side	Event related
No. of complaints 2020/21	49	2	15	2	13	+600

Dirty Water (DW)

There were 49 dirty water (DW) complaints. DW results when sediments from the bottom of the pipes are stirred up due to works occurring in the area such as pipe repairs, water trucks filling from hydrants and construction works with heavy machinery. It can also be caused by changing velocities in pipes stirring up the sediment.

When a DW complaint is lodged, a water reticulation crew is dispatched to flush the area until the DW is removed, and the chlorine residuals are back within specification. Customers are advised to flush their side by running sprinklers.

Customers receive a call the following day to ensure water remains clear before their complaint is closed out.

Milky Water (MW)

There were two MW complaints. MW is caused when air becomes trapped in the water under pressure, forming tiny air bubbles. As these air bubbles escape, they cause the water to look milky. MW occurs following large main repairs or when new mains are commissioned. The issue usually resolves itself once all the air has escaped but if it doesn't the mains are flushed.

Taste and Odour (T&O)

There were 15 taste and odour (T&O) complaints. T&O complaints in Townsville are generally caused by:

- DW events
- MIB/Geosmin
- High chlorine (or sudden changes in chlorine concentration)
- · Old or new pipework on customer's side of the meter
- Old hot water systems.

Townsville Water liaises with all customers for all T&O complaints, flush where required and take samples for further investigation if warranted.

Owner's Side Issues

Owner's side issues are caused by:

 Flick mix taps - near the end of the life of flick mix taps (after seven to ten years) the inside braided hose degrades and leaves a black oily residue in the water. This issue is rectified through a phone call to customers to explain the issue and the requirement for a private plumber to install new taps.

- Hot water systems nearing the end of their life and the breakdown of the anode inside. Townsville Water analyse samples through TLS where required and communicate with customers throughout these issues.
- Internal pipework.

Suspected Illness

There were two suspected illness complaints this year. These were the results of the water tasting "off". Residents were contacted and water from their residence analysed through TLS showing that water met the ADWG limits and was safe to drink.

Discolouration Event

Over 600 water discolouration complaints were lodged during the discolouration event. An outline of what occurred during the discolouration event is in section 5, DWI-506-21-08862. The discolouration was caused first by reconfiguring the network and stirring up sediments in mains, then by cyanobacteria breakthrough and then by total manganese in the water supply.

An increased media strategy helped reduce the call number until water quality was restored through prechlorination. Pre-chlorination removes the manganese, improves dissolved oxygen levels and assists cyanobacteria cell removal through the filters.

8. Outcome and recommendations of audit

The regulatory audit was due by the end of August 2020 but an extension was granted for 23 April 2020 due to COVID-19 travel restrictions and working from home government mandate. The audit was undertaken by Northern Water Management in December 2020.

The outcome of the audit was:

The auditor believes that Council:

- Demonstrated an acceptable level of compliance with the regular audit imposed by the Water Supply (Safety and Reliability) Act 2008 during the audit period
- Has written three DWQMPs that adequately manage risk to public health and provides a framework for the safe delivery of drinking water to its customers
- Was found to have reasonable processes for managing drinking water incidents and progressing the RMIP.

The audit concluded that Council:

- Provided evidence that it had been providing accurate monitoring and performance data to the Regulator
- Has implemented its DWQMPs to manage risks to public health
- Maintained the relevance of the three DWQMPs.

The overall summary of compliance is shown in table 6. In total 60 questions were repeated in the field to confirm that management requirements were implemented.

Table 6 Council Regulatory Audit 2021 Number of Findings

Compliance Code		Number of findings
Compliant	Compliant	37
Compliant with opportunity for improvement	OFI	16
Minor Non-Compliant	Minor	5
Major Non-Compliant	Major	0
Critical Non-Compliant	Critical	0
Not applicable or combined with another observation		2
Total		60

Recommendations

There were a low number of minor non-conformances identified. There were several opportunities for improvement identified as outlined below. All are included in and managed through the RMIP.



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Appendix A. **Risk Management Improvement Program**

Component	Improvement Action Target Dates	Target Date	Actions taken to Date	Status and revised Target Date	Responsible Officer	Complete	Comments
			Douglas	WTP			
Douglas WTP Turbidity (Common and Modules 1 and 2)	Pre-treatment Clarifer - confirm design envelope for the clarifiers and ensure that it is utilised.	Design 17/18 FY with construct 19/20 FY	Design finalised	End 17/18 FY for design	Manager Water and Waste	Complete	Design complete. Construction has begun.
Douglas WTP Turbidity (Common and Modules 1 and 2)	Sludge Handling – Confirm the amount of time available to 'stop' recycle to ensure that criticality is appropriate for the supernatant recycle system.		Supernatant return standard operating procedure to be developed 2019.	1 Jul 2019	Trility Operations Manager	Complete	Scenario sheet developed and several case studies available. Summary was submitted to Council Nov 2020.
Douglas WTP Turbidity (Common and Modules 1 and 2)	Reservoirs – The reservoir cleaning program has stalled, for a number of reasons, but should be re-instated and prioritised.		Reservoir cleaning program has been reinstalled with first reservoirs to be cleaned in January 2019. From then on the reservoirs will be cleaned on a rotation with approx. 16 reservoirs cleaned each year.	Jan 2019	Water Treatment Engineer and Drinking Water Quality Officer	Complete	Contract Finalised and awarded to Southern Cross June 2021.
Douglas WTP Turbidity (Common and Modules 1 and 2)	Data is required to be assembled and reviewed to validate that the reactivator has been optimised.		Data readily available via online and daily grab sample results. Jar tests regularly conducted and alarms in place on reactivator clear water turbidity meter.	Summary of performance data and activities to be submitted Dec 2018. PCP to be added to WQP.	Trility Operations Manager	Complete	Trility has developed a summary of performance of the reactivators given the Good Practice guide and LT2ESWTR. Performance in 2019 and 2020 shows good alignment to both standards. Provided to Council Nov 2020.
Douglas WTP Turbidity (Modules 3 & 4 Direct Filtration)	Pre-treatment and Filtration – Performance trials are planned to confirm the raw water range under which the system can operate to produce safe water.		Operations Modification Program 5 has trialled under some conditions but not all. – Performance criteria agreed with <i>Council</i> .	Aim to complete further trials in 2019, subject to suitable raw water conditions.	Trility Operations Manager, Contract Compliance Officer	Complete	Existing data from flood period reviewed June 2020.
Douglas WTP Pathogens - Crypto	Modelling is being undertaken to help clarify the likelihood of the presence of Crypto. and Giardia in 2017. This is to be used to increase certainty.	Feb 2018	Modelling complete with RRD report from GHD finalised Feb 2018. Requirement for clarifier/ UV to conform to HBTs.	Feb 2018	Water Quality Officer	Complete	GHD Crypto Modelling Feb 2018
Douglas WTP Pathogens - Crypto	Filtration - Compare performance against ADWG value of 0.20 and HBT guideline of 0.15NTU as 95 percentiles. Contract uses higher turbidity targets.		Performance checked as part of the RRD Crypto report. Shows that the plant meets for Mod 1 & 2.	Feb 2018	Water Quality Officer	Complete	
Douglas WTP Pathogens - Crypto	Sludge Handling - Confirm the control around returning supernatant. Including turbidity target.		Supernatant alarms 4.5 NTU H, 5 NTU HH and shutdown on High trip 10 NTU as per WQ plan. 10 minutes at or above these limits will trigger alarm, the trip will trigger a shutdown.	Complete 20 Nov 2018	Trility - Operations Support Engineer	Complete	

Component	Improvement Action Target Dates	Target Date	Actions taken to Date	Status and revised Target Date	Responsible Officer	Complete	Comments
Douglas WTP Pathogens - <i>E. coli</i> and Virus	Disinfection point Chlorination - Complete tracer testing to confirm modelling of C.t.		Tracer study completed November 2017, report complete with executive summary review and report submission to client by end of November.	Dec 2018	Operations Manager	Complete	
Douglas WTP Pathogens - <i>E. coli</i> and Virus	Disinfection point Chlorination - Investigate dedicated C.t chlorine analyser (prior to trim dose).		Options to be investigated in FY 2019 R&R plan.	Mar 2019	Operations Manager	Complete	
Douglas WTP Pathogens - <i>E. coli</i> and Virus	Review Disinfection Control Plan to make sure that control philosophy is locked in and that there is no opportunity to control in a way that would jeopardise the C.t.		Chlorine disinfection system upgraded for stable monitoring, control and alarms (PSDs). Baffles installed increasing C.t.	Online C.t. calculation planned early 2019	Operations Manager	Complete	
Pathogens - N. fowleri	Investigate and confirm the response of <i>N. fowleri</i> to settling.		Research project to be undertaken in Townsville, Paluma and Cungulla.	Project undertaken by Water Quality Officer to sample for <i>N. fowleri</i> to increase Council's understanding of the risk.	Water Quality Officer	Complete	Project undertaken by Water Quality Officer to sample for <i>N. fowleri</i> to increase Council's understanding of the risk. <i>N. fowleri</i> was not detected but chlorine residual will be maintained at endpoints (0.5mg/L) to mitigate the theoretical risk (high water temperatures).
Pathogens - N. fowleri	Pipes/reservoirs - Need to investigate the prevalence of <i>N. fowleri</i> .				Drinking Water Quality Officer	Complete	Project Undertaken by Water Quality Officer to sample for <i>N. fowleri</i> to increase Council's understanding of the risk. <i>N. fowleri</i> was not detected but chlorine residual will be maintained at endpoints (0.5mg/L) to mitigate the theoretical risk (high water temperatures).
Pathogens - N. fowleri	Pipes/reservoirs - High and low turnover -Investigate options to increase the chlorine residual above 0.5 mg/L (reservoirs, lines, dead ends) to ensure effective barrier to <i>N. fowleri</i> .				Drinking Water Quality Officer	Complete	Project Undertaken by Water Quality Officer to sample for <i>N. fowleri</i> to increase Council's understanding of the risk. <i>N. fowleri</i> was not detected but chlorine residual will be maintained at endpoints (0.5mg/L) to mitigate the theoretical risk (high water temperatures)
Organics and Colour	Pipes/reservoirs – Documentation of system 'age' optimisation is required to ensure continuity. Currently this is primarily undertaken by one person.		Further people to be trained and documentation of procedures to occur.	Dec 2021	Water Treatment Team Leader and WQ Officer		Another FTE has been trained into this role providing redundancy. Procedure to be documented.
High Chlorine	Investigate Julago system cut-off to ensure that it minimises the risk of over-dosing chlorine.			Jun 2019	Water Treatment Engineer	Complete	

Component	Improvement Action Target Dates	Target Date	Actions taken to Date	Status and revised Target Date	Responsible Officer	Complete	Comments
Water Emergency Response Plan	Updated copy to be included in DWQMP.	Jan 2019	Undergoing updates and changes currently.	Jan 2019	Manager Water Operations	Complete	
НАССР	Requires updating (last updated 2009). This will be included in Trility's water quality plans due to be finalised 2018.		Critical control points regularly reviewed and tested as part of water quality management system. 2019 Undertake review of HACCP and consider consolidating HACCP and WQP.	Dec 2019	Trility - Operations Manager	Complete	The latest version of Trility Water Quality Plans for DWTP and NWTP have been supplied.
Chlorates in Network	Investigate replacing Sodium Hypochlorite dosing system with a chlorine gas dosing system.	2020	Design to be undertaken in 2018 financial year.	Submitted to the State for comments on the Major Hazard Facility - Out of control of Council	Principle Lead Engineering and Design - Engineering and Assets Department	Complete	Design completed and determined it would be a Major Hazard Facility (MHF) Ongoing discussions with Queensland safety, Queensland Health and OWSR has determined that a MHF poses more risk than the level of chlorates we are seeing in the network. Council will continue to mange chlorates as they are doing currently.
Network Schematic	Requires updating to include recent infrastructure.	Jan 2019		Jan 2019	Water Quality Officer	Complete	
Crypto Model	Clarification and UV required at Douglas Water Treatment Plant to reduce Cryptosporidium risk.	2021	Construction of clarifier pre mod 3 and 4 has begun with end date of 2022 on track.	2025/2026 construction to begin	General Manager Townsville Water and Waste		UV design underway. To go to construction in 2025/26.
			Northern	WTP			
Northern WTP - Turbidity	Filtration Node – False positives have been identified in the past and an investigation into sample preparation to eliminate false positives is underway.		Trility have replaced turbidity analysers (with a different brand) to see if this false positives. Ongoing to see if this has been successful.		Rob D	Complete	No false positives have occurred since new turbidity analysers have been installed.
Northern WTP - Pathogens - Crypto	Modelling is being undertaken to help clarify the likelihood of the presence of Cryptosporidium and Giardia in 2017.		GHD Cryptosporidium report submitted August 2018. Confirms the requirement for UV addition on NWTP to conform to HBTs.		Water Quality Officer	Complete	
Northern WTP - Pathogens - <i>E. coli</i> and virus	Confirm virus removal capability of the membrane and whether coagulant is or is not required to claim virus removal with the membranes.		Confirmed the virus log removal of the membranes is 4.0 without coagulant. Supporting documentation provided to Council.	29 Nov 2018		Complete	
	Confirm the C.t (max flow, min level, Chlorine minimum (1)) available at the WTP and compare this to the typical target C.t of 15 mg.min/L.		Supporting data and calculations to be provided.	1 Feb 2019	Operations Support Engineer	Complete	

Component	Improvement Action Target Dates	Target Date	Actions taken to Date	Status and revised Target Responsible Officer Date		Complete	Comments
Geosmin (Taste and Odour)	Consider measuring the level of geosmin in the open channel between Paluma and Crystal creek intake to confirm the source of Geosmin as well as continuing to investigate the source water.	Jun 2019	Dependent upon geosmin being detected in concentrations high enough to cause an issue.	Parked	Drinking Water Quality Officer	Parked.	Parked as the geomin concentration has decreased in the raw (and thereby treated) water and presently is low enough to not cause any issues. There has been some discussion that the increase in geosmin was caused by an increase in organics in Paluma Dam post Cyclone Yasi.
Geosmin (Taste and Odour)	Aste Treatment strategies to remove geosmin are to be investigated, including PAC dosing even though this was noted as having a negative impact on membrane performance/life.		Trility have engaged Hunter H ₂ O to investigate the removal of geosmin and MIB with PAC at both DWTP and NWTP. Temporary PAC dosing has been installed at DWTP to negate cyanobacteria toxin risk. This may also be useful for MIB/geosmin removal. Trial occurring currently.	2024	Team Manager Water Operations	Ongoing	Temp PAC dosing has been installed at DWTP. Permanent solution is in design stage . Issues with installing PAC on membranes at NWTP and Geosmin levels have reduced in this part of the network so not required at this stage.
Iron	Confirm iron results in raw and treated water. There is a discrepancy between the numbers in the raw (soluble) and the performance of the membranes. Essentially all of the soluble should pass through the membranes but the monitoring suggests that the membranes are pulling out 'soluble' iron. This could mean that the iron is colloidal and not 'true' soluble.	Jun 2020	As this is not causing an issue with water quality it has been pushed out to June 2020. Monitoring will be ongoing to enable the collection of sufficient data.		Water Quality Officer	Complete	Raw water iron for both soluble and total is monitored since April 2017, Treated water is monitored for total iron. Iron levels in retic are low.
Iron	Include event based monitoring to investigate iron spikes in the raw water.				Water Quality Officer	Complete	Event based monitoring also occurs unless the WTP is switched off for safety or operational concerns.
НАССР	Requires updating (last updated 2009). This will be included in Trility's Water quality plans due to be finalised 2018.		As per DWTP HACCP			Complete	Latest versions have been supplied by Trility and are included in Council's DWQMP.
Crypto Model	UV may be required for NWTP. This requires investigating and funding if required.		Report August 2018 shows UV is required for NWTP to meet HBTs. Design specs for UV funded for this financial year.	Jun 2019	Manager Water and Wastewater	Complete	Designs have been completed. Will present for approval to include in the 2023/24 Capital Program.
Vermin Control	Install gauze to the whirly bird roof vent on the clear water storage tank to prevent vermin entry.	1 Nov 2021	Initial inspection and measurement by contractor complete.	End Dec 2021	Trility		
Reagent Management	Ensure that all reagents are in date.	1 Aug 2021	All reagents have been checked and are in date.		Trility	Complete	

Component	Improvement Action Target Dates	Target Date	Actions taken to Date	Status and revised Target Date	Responsible Officer	Complete	Comments
Reagent Management	Dispose of expired chemicals.	1 Aug 2021	Monthly check added to monthly inspection schedule. Complete 20 Jul 2021.		Trility	Complete	
Reagent Management	Produce a procedure to ensure that the daily operator checks for calibration include a check for expired chemicals.	1 Aug 2021	Corporate procedure already requires "Prior to commencing the calibration, ensure that the calibration standards or other related materials in use are within their expiry dates". Reminder also added to daily lab sheet. Complete 21 Jul 2021.		Trility	Complete	
Reagent Management	Stop the practice of using decanted chemicals.	1 Aug 2021	Decanted chemicals necessary for pH calibration. Work instruction updated to ensure pH buffer solutions disposed on completion of daily calibration. Complete 21 Jul 2021		Trility	Complete	
Chain of Custody	It was suggested that the lab numbering system and Trility numbering system for samples could be aligned and pre- labelled bottles could be used to ensure an efficient process.	1 Jan 2022	TRILITY external WQ data management system will assign bottle numbers. Meta-data and scheduling complete, trouble- shooting of COC errors underway.	In Progress	Trility		
Monitoring Instruments	It is recommended that the NWTP SCADA trend/history display settings be updated to ensure that the information aligns with the instantaneous readings.	1 Oct 2021	Team Leader and Process Controller completed spot check of all meters. Check to be added to each annual instrument service.	In Progress	Trility		
			Townsville Cit	ty Council			
Instrument Management Program	Ensure that all Council instruments on all sites are covered under a regular external calibration program and all regular calibrations are recorded in operational spreadsheets.				Team Leader Water Treatment	Complete	Verifications occur in house on a schedule using standards. It is cheaper and easier to replace instruments than send for calibration externally. All handheld chlorine analysers are calibrated by Townsville Laboratory Services on a scheduled program.
Reagent Management	Ensure that all reagents are in date.		All reagents have been checked and out of date chemicals removed at both Paluma WTP and Giru WTP.		Team Leader Water Treatment	Complete	

Component	Improvement Action Target Dates	Target Date	Actions taken to Date	Status and revised Target Date	Responsible Officer	Complete	Comments
Reagent Management	Dispose of expired chemicals.		All reagents have been checked and out of date chemicals removed at both Paluma WTP and Giru WTP.		Team Leader Water Treatment	Complete	
Reagent Management	Produce a procedure to ensure that the daily operator checks for calibration include a check for expired chemicals.					pH buffer labelled, hypo not on site long enough to expire, other chemicals do not have use by dates	
Reagent Management	Stop the practice of using decanted chemicals.		Procedure in place for decanting chemicals?		Team Leader Water Treatment	Hypo - safe handling of chemicals, smaller quantities required mitigate chlorate risk	
RMIP Implementation	Many RMIP actions in the DWQMPs were not complete by due dates. It is recommended that new dates are chosen with internal consultation undertaken to ensure this work is approved and time frames set. Discuss changes to the RMIP with the Regulator and revise the DWQMPs accordingly.		Meeting held July 2021 with GM Water and Waste, Team Manager Water and Wastewater, Water Treatment Team Leader and Water Quality Officer to revise target dates and work through all OFI raised in the December Audit (which have been included in the RMIP).	Jul 2021		Complete	
Program Structure	It is suggested that regular/monthly DWQM meetings are restarted to ensure that program review and other DWQMP areas are added.		These have been scheduled to begin August 2021 and occur quarterly.		General Manager Water and Waste	Complete	
Program Structure	It is suggested that the flushing and testing results be entered into an electronic spreadsheet to assist in planning and program operational responses due to seasonal issues.	Dec 2021	This is not an operational issue currently (data is kept on worksheets and WQO has access to these if required) and we do not have staff capability at the moment. Project is underway to capture all data in lIms and this will be included in the project.	Dec 2023	Water quality Officer and Team Leader Water Treatment		
Geographical Zone Coverage	Continue with plans to add the sampling locations to a GIS layer in Townsville Maps.	Jun 2022	All assets have asset numbers and GPS. These have been provided to GIS for mapping.	Jan 2024	Water Quality Officer		All data has been supplied to GIS. Waiting on data to be mapped.

Component	Improvement Action Target Dates	Target Date	Actions taken to Date	Status and revised Target Date	Responsible Officer	Complete	Comments
Sampling Frequencies	Review the large number of monitoring zones and resulting monthly samples to determine if efficiencies can be made.		A large scale review was undertaken five years ago. The plan is constantly looked at and updated as needs are required, such as the inclusion of new suburbs/reservoirs and as water quality changes occur.		Water Quality Officer	Complete	Not required at the present time.
Process Management	As an added layer of protection, it is suggested that the Lims system automatically send through weekly exceedance reports or an alternative be used to ensure that this list has been addressed via cross-checking of those actions raised in paradigm.		This cannot be automated. Has been added as an outlook reminder to occur weekly by the Water Quality Officer.		Water Quality Officer	Complete	
Cross Check of SCADA and Reported Results	It is suggested that the site results to formalise in a procedure to match the site test results with SCADA results to ensure that the SCADA information is accurate. This should be undertaken for CCPs.				Team Leader Water Treatment	Complete	Daily verification is undertaken on analysers by rained operators- check analysers and this is fed back from SCADA. Instrument PM schedule also picks up SCADA values.
SCADA Alarm Management	Create an access procedure for manager rights to be only allowed to change set-point values.	Dec 2021	Discussions with SCADA techs to define scope.	Mar 2022	Manager Water and Waste		
SCADA Alarm Management	Include conditions where and when set-points are permissible such as temperature changes from winter to summer and vice versa.	Dec 2021	Discussions with SCADA techs to define scope.	Mar 2022	Manager Water and Waste		
SCADA Alarm Management	Add a process to alert the administrator if someone leaves or changes roles.	Sep 2021		Mar 2022	Manager Water and Waste		
Cross- Contamination Management	Update procedures to include machinery disinfection prior to use in water management situations where cross-contamination may be a risk.	Sep 2021		Dec 2021	Manager Water and Waste		
Cross- Contamination Mitigation	Continue with plans to produce a detailed flushing and disinfection procedure. It is suggested that machinery disinfection is included in the procedure.	Sep 2021		Dec 2021	Manager Water and Waste		

Component	Improvement Action Target Dates	Target Date	Actions taken to Date	Status and revised Target Date	Responsible Officer	Complete	Comments
Sourcing of Quality Assured Materials	Continue with plans to complete a purchasing procedure for materials that come into contact with drinking water to ensure that all drinking water materials that come into contact with drinking water to ensure that all drinking water materials purchased are certified to Australian Standards or are WaterMark approved.	Dec 2021	This is included in contracts for purchase?	Mar 2022	Manager Water and Waste		
Security of Supply	Raw Water Pipeline Break - Duplication of raw water pipeline.	Dec 2023	Tenders commenced Sept 2021.		Manager Assets		
Chlorine target limits	Grundfos Pump required at Dahl Reservoir.	Dec 2021	Submitted to assets for procurement and installation.		Water Treatment Team Leader		
Water Quality	Complete analytical review of WQ data for all schemes.	Aug 2022			Water Quality Officer		
Hazards and Risks	Update Risk Assessment and generate RMIP.	Aug 2022			Water Quality Officer		
GIS Mapping	GIS Map supply zones for Townsville DWS.	Aug 2022			Water Quality Officer		
Vulnerable Customers	Describe the process for contacting and informing vulnerable customers.	Aug 2022			Water Quality Officer		

				Status and			
				revised			
Component	Improvement Action Target Dates	Target Date	Actions taken to Date	Target Date	Responsible Officer	Complete	
			Paluma W	ТР			
Turbidity	The values and times in the PLC/ HMI need to be confirmed as aligning with the Control plan for CCP1.	Aug 2019	Can check values in the plant settings, however will not know if this will actually occur until it happens. These values are correct, however they are short-lived and do not reflect membrane performance.		Water Treatment Engineer	Complete	
Turbidity	Validate shutdown on High Turbidity	Aug 2019	Can check values in the plant settings, however will not know if this will actually occur until it happens. These values are correct, however they are short-lived and do not reflect membrane performance.		Water Treatment Engineer	Complete	
Turbidity	Record the turbidity profile following a GAC backwash to ensure that spurious CCP1 alarms do not occur following a GAC backwash.	Apr 2019	Can check values in the plant settings, however will not know if this will actually occur until it happens. These values are correct, however they are short-lived and do not reflect membrane performance.		Water Treatment Engineer	Complete	
Turbidity	Include the Supernatant turbidity in the plant log sheet as an operational control point with a target and warning levels for the Operator to take action.	Aug 2019	Can check values in the plant settings, however will not know if this will actually occur until it happens. These values are correct, however they are short-lived and do not reflect membrane performance.		Water Treatment Engineer	Complete	
Pathogens - Crypto	Formulate and institute an onsite effluent management system policy including an inspection regimen for high risk systems that if failure occurs increases the pathogen load on the WTP.		If failure occurs on any part of the plant the plant will automatically shut down.		Water Treatment Engineer	Complete	
Pathogens - Crypto	Training on the identification and repair of damaged membranes is required to allow action following an integrity failure.	Oct 2019	Pinning kit has been bought. Training occurred as part of Cert III Operator Training. Aquamanage attended site 2019 to train staff and audit site.		Bulk Water Engineer	Complete	
Pathogens - Crypto	Consider training work crews on the risk of contamination of potable mains during repair works.	Aqua Card roll out 2020/2021 to all work crews	New procedure on mains disinfection has been drafted and is being commented on currently by supervisors.		Water Quality Officer Team Manager Water and Waste		Aqucard has been rolled out, Procedure in draft and with safety department for sign off.

				Status and revised			
Component	Improvement Action Target Dates	Target Date	Actions taken to Date	Target Date	Responsible Officer	Complete	
Pathogens - <i>E. coli</i> and viruses	Confirm the Virus removal capacity of the membranes and the impact of stopping coagulation.	Apr 2019	Minimal impact to virus removal after stopping coagulation. Membrane modules have a pore size of 0.04µm and post UV disinfection and chlorination.		Water Treatment Engineer	Complete	
Pathogens - <i>E. coli</i> and viruses	Confirm the C.t of the reservoir operating at minimum level.		Reservoir has a contact time of days. The inlet and outlet are not common and short circuiting does not occur.		Water Treatment Engineer	Complete	
Pathogens - N. fowleri	Continue to engage with Public Health around the risk associated with <i>N. fowleri</i> and any additional actions that may be recommended.		<i>N. fowleri</i> testing is currently being undertaken in Townsville to understand the risk further. Samples will be taken in Paluma summer 2020.		Water Quality Officer	Complete	N. fowleri has not been detected in any sampling undertaken. Risk will continue to be managed by ensuring a chlorine of 0.5mg/L through the distribution network.
	Inspect the treated water reservoir for sediment build up that could shield <i>N. fowleri</i> and schedule cleaning if excessive sediment is found.		Reservoir was cleaned prior to plant installation and has a roof. Reservoir is inspected for sediments regularly.		Water Treatment Engineer	Complete	Reservoir condition assessment completed April 2021. "It is not considered the current condition of the reservoir would present any significant adverse impacts to water quality or developing water quality issues".
Organics and THMs	Consider using ACH 100% of the time to extend the life of the GAC adjusting the dose so as not to negatively impact on the operation of the membranes.	Oct 2019	Consulted Aquamanage - Not necessary - colour - binding membranes and wasting chemical.		Water Treatment Engineer	Complete	Aquamanage were consulted to confirm if this was the case. They confirmed it was not necessary as it may result in binding membranes and will waste chemical. It may be used in the future if colour becomes an issue.
	Consider replacing the GAC in the months prior to the wet season when the THMs appear to be at their highest. New GAC will have the greatest capacity to adsorb organics and limit THM formation.		Investigations currently underway around THM formation potential (NPOC and dissolved NPOC) pre and post GAC (and from the weir itself) to understand how the GAC is currently working and to greater understand the type of organics in the system.		Water Treatment Engineer	Operational Issue	Ongoing monitoring of THM formation potential (pre and post GAC) will drive when GAC needs to be replaced.

				Status and revised		
Component	Improvement Action Target Dates	Target Date	Actions taken to Date	Target Date	Responsible Officer	Complete
Iron	Consider monitoring for soluble iron in the supernatant to increase confidence that soluble iron is not being returned at a high level and impacting performance.	Jun 2019	Iron testing of supernatant occurs. Soluble iron included so that performance can be monitored.		Water Treatment Team Leader	Ongoing
Chlorate	Investigate the opportunity to utilise chlorine gas, including the cost, WHS elements and the impact on the treatment process (chlorine gas will lower the pH and pre- caustic will need to be utilised).	2022	This has been removed from the budget as not considered a priority by Council.		Team Manager Water and Wastewater	Parked
Security	Ensure Backwash clarifier is locked to prevent sabotage risk.		Once fence is erected it will negate the clarifier risk. Both have been rolled in to one.	Dec 2021	Team Manager Water and Wastewater	Complete
Security	Continue plans to erect security fencing around Paluma WTP.		Once fence is erected it will negate the clarifier risk. Both have been rolled in to one.	Dec 2021	Team Manager Water and Wastewater	Complete
Chemical storage and in Date	Ensure that the PWTP hypochlorite injection tank and spare container are stored in a bund.		This is a 50 litre hypo container. Storage area is too small for a bund even a small pallet bund. If the hypo tank splits the chlorine will dissipate into the surrounding hardstand.		Team Manager Water and Wastewater	Complete
Chemical storage and in Date	Ensure that there is a safe work procedure for hypochlorite decanting at Deep Creek and PWTP, and also for diluting or mixing of other chemicals.		Procedure in place		Water Treatment Team Leader	Complete
Chemical storage and in Date	Ensure that Operators are on-site for all chemical deliveries or introduce a security system to ensure only authorised external persons can deliver chemicals and is traceable. Consider a dual tank system for hypochlorite to ensure chemical turnover for degredation reasons including the formation of chlorates.		There is a contract in place for elite to deliver and manage. A Trility Audit is occuring and Mike will look into this issue also.		Team Manager Water and Wastewater	
Chemical storage and in Date	There needs to be a quality assured batch certificate for chemical deliveries which identifies the concentration of chemical being supplied. Each delivery docket number must link to that certificate. The service provider must also be checked for ongoing quality compliance.		Panel of providers in place. Not enough FTEs to attend every site on delivery.		Team Manager Water and Wastewater	Complete

				Status and revised		
Component	Improvement Action Target Dates	Target Date	Actions taken to Date	Target Date	Responsible Officer	Complete
Water Stabilisation	It is suggested that the sodium hydroxide dosing recommences at Paluma WTP with acid dosing for pH adjustment. This will assist in prolonging asset life.		pH injection point is close to analyser. Reticulation pH is consistently between 6.5-8.5 and it has been decided to leave sodium hydroxide dosing off for now.		Team Manager Water and Wastewater	Complete
Plant Bypass	It is suggested that the bypass at the PWTP be physically removed and blank phlanges be installed.		Painted locked caps are on the bypass. Security fence to be installed by December 2021. Very difficult for anyone to open the bypass. Decision made to leave as it.		Team Manager Water and Wastewater	Complete
Jar testing	Complete the Paluma Jar Testing methodology document as it should include a proforma.		This is not an OCP or CCP. Decision made to leave as it.		Team Manager Water and Wastewater	Complete
Jar testing	Add the jar testing records to an electronic operational monitoring spreadsheet to allow future reference for troubleshooting.		This is not an OCP or CCP. Decision made to leave as it.		Team Manager Water and Wastewater	Complete
Water Quality	Complete analytical review of WQ data for all schemes.	Aug 2022			Water Quality Officer	
Hazards and Risks	Update Risk Assessment and generate RMIP.	Aug 2022			Water Quality Officer	
			Giru/Cungull	a DWS		
Turbidity	Incorporate routine supernatant monitoring to add certainty to the performance of residuals handling.		Reclaim lagoon water quality is monitored monthly. Online Turbidity Analyser has been installed and alarmed on SCADA.	Jun 2019	Water Treatment Engineer	Complete
Turbidity	Coagulation Control needs to be documented to ensure that everyone is targeting the same thing.		Diary notes kept. Jar test to target the best flocculation. With dose changed accordingly.	Jan 2019	Water Treatment Engineer	Complete
Turbidity	Confirm the correct location for the filtered water outlet turbidity meter (individual filter turbidity is the benchmark).		Filtered water turbidity meter was installed in December. 1. Below the filter media and 2. Return to service water line. This is monitored.	Dec 2018	Water Treatment Engineer	Complete
Turbidity	Align filter turbidity target, alert and critical limits with ADWG and best practice.		Instrument techs to write code to retain turbidity values only when the plant is operational and to calculate the 95th percentile compliance Complete. SADA alarms at 0.3NTU and max at 1NTU.	Jun 2019	Water Treatment Engineer	Complete

				Status and revised			
Component	Improvement Action Target Dates	Target Date	Actions taken to Date	Target Date	Responsible Officer	Complete	
Turbidity	Supernatant flows monitored, not yet alarmed or online. Opportunity to include allowing for early detection of failure, disturbance, particularly when the wash-water system is stressed.		Project determined that susceptible to air and sand during backwash resulting in nuisance alarms every time a backwash occurs. There is no advantage to this.	Jun 2019	Water Treatment Engineer	Complete	
Pathogens - Crypto	Operational Control Point required to be documented and put into practice to assist in management of supernatant return.	Mar 2019		Jun 2021	Water Treatment Team Leader	Complete	
	High level tank is a risk, budget allocated for tank replacement and action should be pursued. Pressure pumps to be utilised in the interim.	Jun 2019	Tank, decking and tower on track to be replaced this financial year. Pressure pumps currently installed and being utilised.	Jun 2019	Bulk Water Engineer	Complete	Tank and decking has been replaced and reinstated.
Pathogens – E. coli and Virus	Free chlorine analyser to be installed and alarming incorporated into the system control.	Jun 2018	Free chlorine analyser has been installed and feedback is on SCADA.		Water Treatment Engineer	Complete	
Pathogens – E. coli and Virus	Free chlorine analyser to be installed and alarming incorporated into the system control.		Project in place to alarm in SCADA.	Apr 2019	Water Treatment Engineer	Complete	
Pathogens - N. fowleri	As per <i>E. coli</i> move towards an online continuous free chlorine analyser to confirm that chlorine has been dosed and a C.t has been achieved and a minimum of 0.5 mg/L free chlorine is maintained leaving the WTP.		Free chlorine analyser has been installed and feedback is on SCADA.		Water Treatment Engineer	Complete	
Pathogens - N. fowleri	Need to investigate the prevalence of <i>N. fowleri</i> .		Project undertaken in Townsville.		Water Quality Officer	Complete	
Pathogens - N. fowleri	Investigate options to increase the chlorine residual above 0.5 mg/L (reservoirs, Cungulla Balance Tank, lines and dead ends).		Target limit for chlorine has been increased in the CWS to > 0.5mg/L. Townsville aims to maintain free chlorine in reservoirs and at dead ends through extensive monitoring program and flushing where appropriate. Where required additional re-chlorination is installed i.e. Brookhill Reservoir.		Water Quality Officer	Complete	
Organics and Colour	Suggest that measuring true colour of filtered water on jar testing will assist in managing coagulation (helps to identify the 'best' dosing regimen).		A palintest kit has been purchased. Training need to be organised and its use implemented.	Jun 2019	Water Treatment Engineer	Parked	
рН	Ensure that coagulation pH targets are recorded and utilised by all staff.		Coagulation pH range of 6.4 to 7.2 has been established and communicated to operators.	Jun 2018	Water Treatment Engineer	Complete	

				Status and revised		
Component	Improvement Action Target Dates	Target Date	Actions taken to Date	Target Date	Responsible Officer	Complete
	Need to incorporate triggers for operating soda ash, when does it turn on/off.		Too difficult to set an absolute number. Depends upon many factors and the Water Treatment Engineer decides operationally when this is to occur.	Jun 2018	Water Treatment Engineer	Complete
Verification of Drinking Water Quality	Undertake project to acquire handheld devices and store all water quality results in Lims1.		Project currently underway to get operators recording data in tablets. Then this data can be transferred and stored in LIMS.		Bulk Water Engineer	
Water Emergency Response Plan	Updated copy to be included in DWQMP.	Jan 2019	Response plan is being updated and changed presently.		Water Quality Officer	Complete
Development of algae/algal toxin Trigger Scenarios	Procedure for detection of Algae/ Algal toxins requires to be developed. This is not of high risk as algal blooms have not been detected in the Haughton River supply but a procedure should still be in place.	Dec 2019	Considered low risk as previously not detected and water source is run of river.	Dec 2022	Water Quality Officer	To incorporate lessons learned in Townsville DWS and use same target and trigger scenarios
Water Quality	Complete analytical review of WQ data for all schemes.	Aug 2022			Water Quality Officer	
Hazards and Risks	Update Risk Assessment and generate RMIP.	Aug 2022			Water Quality Officer	

Appendix B. Drinking Water Quality Performance

GIRU/CUNGULLA DRINKING WATER SCHEME

	Scheme			Unit of	Limit of Reporting		# of samples	# DW Guidelines					
	Component	Parameter Category	Parameter	Measure	(LOR)	Count	detected	Value	Min Value	Max Value	Avg Value	95th %tile	Comments
iru	Source Water	Thermotolerant Coliforms	Total Coliform	org/100ml	1	48	48	0	7	14100	611	1410	
	Giru Raw Water	Thermotolerant Coliforms	E. coli	MPN/100ml	1	49	49	0	<lor< td=""><td>200</td><td>7</td><td>6</td><td></td></lor<>	200	7	6	
	(Haughton River)	Turbidity	Turbidity	NTU	0.1	49	49	0	1.1	242	16.22	45.8	DWI-506-21-08845
		рН	рН	pH Units	1	49	49	0	6.72	8.01	7.46	7.99	
		Metals	Iron, Total	mg/L	0.005	49	49	0	0.05	4.5	0.58	1.38	
		Metals	Manganese, Total	mg/L	0.001	49	49	0	0.001	0.12	0.03	0.06	
5	Water Treatment	Thermotolerant Coliforms	Total Coliform	org/100ml	1	49	49	0	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	
	Plant	Thermotolerant Coliforms	E. coli	MPN/100ml	1	49	49	0	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	
	Water Storage	Turbidity	Turbidity	NTU	0.1	49	49	0	0.1	1	0.36	0.70	
		рН	рН	pH Units	1	49	49	0	6.23	7.62	7.04	7.41	
		Metals	Iron, Total	mg/L	0.005	49	49	0	<lor< td=""><td>0.06</td><td>0.02</td><td>0.06</td><td></td></lor<>	0.06	0.02	0.06	
		Metals	Manganese, Total	mg/L	0.001	49	49	0	0.0003	0.02	0.004	0.01	
	Transmission Cungulla Pesenvoir	Thermotolerant Coliforms	Total Coliform	org/100ml	1	48	48	0	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	
		Thermotolerant Coliforms	E. coli	MPN/100ml	1	48	48	0	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	
	Reservoir	Turbidity	Turbidity	NTU	0.1	48	48	0	0.1	0.4	0.24	0.40	
		рН	рН	pH Units	1	48	48	0	7.07	7.92	7.47	7.9	
		Metals	Iron, Total	mg/L	0.005	48	48	0	<lor< td=""><td>0.19</td><td>0.01</td><td>0.01</td><td></td></lor<>	0.19	0.01	0.01	
		Metals	Manganese, Total	mg/L	0.001	48	48	0	<lor< td=""><td>0.02</td><td>0.002</td><td>0.005</td><td></td></lor<>	0.02	0.002	0.005	
		Disinfection Residual	Chlorine (free)	mg/L	0.05	48	48	0	0.84	2.2	1.49	1.89	
		Disinfection Residual	Chlorine (Total)	mg/L	0.05	47	47	0	0.94	2.59	1.74	2.24	
Illa		Disinfection By products	Chlorates	µg/L	15	11	11	0	85	594	292	583	
ngr		Disinfection By products	Trihalomethanes	µg/L	2	47	47	0	<lor< td=""><td>75</td><td>36</td><td>62</td><td></td></lor<>	75	36	62	
5	Reticulation	Thermotolerant Coliforms	Total Coliform	org/100ml	1	95	95	0	<lor< td=""><td>18</td><td>0.22</td><td><lor< td=""><td></td></lor<></td></lor<>	18	0.22	<lor< td=""><td></td></lor<>	
	Cungulla Houses	Thermotolerant Coliforms	E. coli	MPN/100ml	1	95	95	0	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	
		Turbidity	Turbidity	NTU	0.1	94	94	0	0.10	0.50	0.21	0.30	
		рН	рН	pH Units	1	94	94	0	6.91	7.92	7.44	7.78	
		Metals	Iron, Total	mg/L	0.005	47	47	0	<lor< td=""><td>0.02</td><td>0.003</td><td>0.009</td><td></td></lor<>	0.02	0.003	0.009	
		Metals	Manganese, Total	mg/L	0.001	47	47	0	<lor< td=""><td>0.007</td><td>0.0008</td><td>0.0027</td><td></td></lor<>	0.007	0.0008	0.0027	
		Metals	Lead	mg/L	0.0006	47	47	0	<lor< td=""><td>0.002</td><td>0.0003</td><td>0.001</td><td></td></lor<>	0.002	0.0003	0.001	
		Disinfection Residual	Chlorine (free)	mg/L	0.05	95	95	0	0.75	2.07	1.27	1.80	
		Disinfection Residual	Chlorine (Total)	mg/L	0.05	95	95	0	0.95	2.53	1.51	2.09	

PALUMA DRINKING WATER SCHEME

Calcura			11.16.16	Limit of			# DW					
Scheme	Parameter Category	Parameter	Unit of Measure	(LOR)	Count	# of samples detected	Guidelines Value	Min Value	Max Value	Avg Value	95th %tile	Comments
Source Water Paluma Weir	Thermotolerant Coliforms	Thermotolerant Coliforms	MPN/100ml	1	12	12	0	10	2200	287	1276	
	Thermotolerant Coliforms	E. coli	MPN/100ml	1	12	12	0	10	2200	287	1276	
	рН	рН	pH Units	1	12	12	0	5.89	7.18	6.5	7.16	
	Metals	Iron	mg/L	0.002	12	12	0	0.27	1.2	0.6	1.1	
	Metals	Manganese	mg/L	0.0003	12	12	0	0.008	0.03	0.02	0.03	
	Turbidity	Turbidity	NTU	0.1	12	12	0	2.1	5.6	3.30	5.10	
	Cryptosporidium	Cryptosporidium	cells/10 Li	1	2	0	0	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	
	Giardia	Giardia	cells/10 Li	1	2	1	0	<lor< td=""><td>4</td><td>2</td><td>4</td><td></td></lor<>	4	2	4	
	рН	рН	pH Units	1	44	44	0	6.47	6.97	6.76	6.9	
	Turbidity	Turbidity	NTU	0.1	44	44	0	0.1	0.8	0.39	0.7	
Water Treatment	Colour	Colour, true	Pt-Co Units	1	44	17	0	<lor< td=""><td>5</td><td>0.90</td><td>4.00</td><td></td></lor<>	5	0.90	4.00	
Filtered Water)	Colour	Colour, apparent	Pt-Co Units	1	44	34	0	<lor< td=""><td>12</td><td>2.64</td><td>5.85</td><td></td></lor<>	12	2.64	5.85	
	Metals	Iron	mg/L	0.002	44	44	0	0.008	0.18	0.04	0.09	
	Metals	Aluminium	mg/L	0.0003	44	24	0	<lor< td=""><td>0.07</td><td>0.01</td><td>0.04</td><td></td></lor<>	0.07	0.01	0.04	
	Thermotolerant Coliforms	Total Coliform	org/100ml	1	14	1	0	<lor< td=""><td>1</td><td>0.07</td><td><lor< td=""><td></td></lor<></td></lor<>	1	0.07	<lor< td=""><td></td></lor<>	
	Thermotolerant Coliforms	E. coli	MPN/100ml	1	14	0	0	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	
	Disinfection Residual	Chlorine (free)	mg/L	0.05	12	12	0	1.24	2.75	1.88	2.53	
Transmission	Disinfection Residual	Chlorine (total)	mg/L	0.05	12	12	0	1.43	2.85	2.11	2.81	
Paluma Reservoir	рН	рН	pH Units	1	12	12	0	6.8	7.62	7.19	7.56	
	Turbidity	Turbidity	NTU	0.1	12	12	0	0.2	0.6	0.28	0.43	
	Metals	Iron	mg/L	0.002	12	12	0	0.02	0.09	0.04	0.09	
	Metals	Manganese	mg/L	0.0003	12	12	0	0.001	0.007	0.003	0.006	
	Metals	Aluminium	mg/L	0.0003	12	6	0	<lor< td=""><td>0.04</td><td>0.01</td><td>0.03</td><td></td></lor<>	0.04	0.01	0.03	
Transmission	Metals	Lead	mg/L	0.0006	12	1	0	<lor< td=""><td>0.0006</td><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	0.0006	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	
Paluma Reservoir	Disinfection By-product	Chlorates	µg/L	50	12	12	0	124	515	355	507	
	Disinfection By-product	Trihalomethanes	µg/L	5	12	11	0	<lor< td=""><td>249</td><td>63</td><td>166.50</td><td></td></lor<>	249	63	166.50	
	Thermotolerant Coliforms	Total Coliform	org/100ml	1	25	2	0	<lor< td=""><td>19</td><td>0.88</td><td>2.4</td><td></td></lor<>	19	0.88	2.4	
	Thermotolerant Coliforms	E. coli	MPN/100ml	1	72	1	1	<lor< td=""><td>3</td><td>0.04</td><td><lor< td=""><td>DWI-506-20-08554</td></lor<></td></lor<>	3	0.04	<lor< td=""><td>DWI-506-20-08554</td></lor<>	DWI-506-20-08554
	Disinfection Residual	Chlorine (free)	mg/L	0.05	66	66	0	0.78	2.81	1.60	2.19	
	Disinfection Residual	Chlorine (total)	mg/L	0.05	66	66	0	0.78	2.85	1.80	2.51	
	рН	рН	pH Units	1	52	52	0	6.44	8.37	7.12	7.8	
	Turbidity	Turbidity	NTU	0.1	68	68	0	0.2	2.3	0.44	1.2	
Reticulation	Metals	Iron	mg/L	0.002	68	68	0	0.01	0.16	0.07	0.14	
Paluma Houses	Metals	Manganese	mg/L	0.0003	68	68	0	<lor< td=""><td>0.02</td><td>0.00</td><td>0.006</td><td></td></lor<>	0.02	0.00	0.006	
	Metals	Aluminium	mg/L	0.0003	68	68	0	<lor< td=""><td>0.05</td><td>0.02</td><td>0.04</td><td></td></lor<>	0.05	0.02	0.04	
	Metals	Lead	mg/L	0.0006	24	17	0	<lor< td=""><td>0.002</td><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	0.002	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	
	Fluoride	Fluoride (naturally occuring)	mg/L	0.02	24	24	0	0.04	0.20	0.09	0.15	
	Disinfection By-product	Chlorates	µg/L	50	12	12	0	122	512	362	502	
	Disinfection By-product	Trihalomethanes	µg/L	5	22	22	1	20	266	76	239	DWI-506-20-08733

			and a sta	Limit of		# of	# DW					
Scheme Component	Parameter Category	Parameter	Unit of Measure	(LOR)	Count	samples detected	Value	Min Value	Max Value	Avg Value	95th %tile	Comments
Source Water Ross River Dam	Thermotolerant Coliforms	Total Coliforms	org/100ml	1	285	0	0	144	56000	6899	29000	
	Thermotolerant Coliforms	E. coli	MPN/100ml	1	285	0	0	<lor< td=""><td>20</td><td>1</td><td>5</td><td></td></lor<>	20	1	5	
	Turbidity	Turbidity	NTU	0.1	1014	1014	0	2.4	653.00	10.30	16.04	
	рН	рН	pH Units	1	1030	1030	0	6.44	9.73	7.80	8.9	
	Metals	Iron, Total	mg/L	0.005	1009	1009	0	0.05	30	0.38	0.84	
	Metals	Manganese, Total	mg/L	0.001	1009	1009	0	0.01	1.7	0.08	0.25	
	Anions	Nitrate	mg/L	0.01	1009	116	0	<lor< td=""><td>0.16</td><td>0.003</td><td>0.03</td><td></td></lor<>	0.16	0.003	0.03	
	PFAS/PFOA	PFAS/PFOA	ug/L	<0.005/<0.01	455	0	0	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	
	Thermotolerant Coliforms	Thermotolerant Coliforms	org/100ml	1	169	169	0	50	49000	3601	13400	
	Thermotolerant Coliforms	E. coli	MPN/100ml	1	169	105	0	<lor< td=""><td>365</td><td>21</td><td>148</td><td></td></lor<>	365	21	148	
	Turbidity	Turbidity	NTU	0.1	181	181	0	1.10	35.7	3.08	7	
Source Water	рН	рН	pH Units	1	181	181	0	5.29	8.55	6.12	7	
Paluma Dam	Metals	Iron, Soluble	mg/L	0.005	169	169	0	0.27	2.9	0.91	2.2	
	Metals	Manganese, Soluble	mg/L	0.001	169	169	0	0.01	0.12	0.03	0.09	
	Anions	Nitrate	mg/L	0.01	181	64	0	<lor< td=""><td>0.28</td><td>0.016</td><td>0.09</td><td></td></lor<>	0.28	0.016	0.09	
	PFAS/PFOA	PFAS/PFOA	ug/L	<0.005/<0.01	108	0	0	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	
	Thermotolerant Coliforms	Total Coliforms	org/100ml	1	48	48	0	291	18400	5521	17300	
	Thermotolerant Coliforms	E. coli	MPN/100ml	1	52	17	0	0	9	1	6	
	Turbidity	Turbidity	NTU	0.1	365	365	0	2.19	21	5.55	9.73	
	рН	рН	pH Units	1	364	364	0	7.14	8.90	7.61	8.08	
	Anions	Sulphate	mg/L	0.5	12	11	0	0.00	1.30	1.01	1.25	
	Metals	Iron, Total	mg/L	0.005	107	107	0	0.05	0.64	0.18	0.34	
	Metals	Manganese, Total	mg/L	0.001	107	107	0	0.01	0.22	0.060	0.090	
	Geosmin/MIB	Geosmin	ng/L	2	9	9	0	3	8	5	8	
Douglas Water	Geosmin/MIB	MIB	ng/L	2	9	9	0	3	9	6	9	
Treatment Plant Raw Water	Fluoride	Fluoride (Naturally occuring)	mg/L	0.02	52	52	0	0.07	0.64	0.10	0.12	
	Metals	Arsenic	mg/L	0.001	4	3	0	<lor< td=""><td>0.0008</td><td>0.0006</td><td>0.0008</td><td></td></lor<>	0.0008	0.0006	0.0008	
	Metals	Selenium	mg/L	0.001	4	0	0	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	
	Metals	Mercury	mg/L	0.0006	4	0	0	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	
	Metals	Cadmium	mg/L	0.0001	4	0	0	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	
	Metals	Nickel	mg/L	0.001	4	0	0	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	
	Metals	Chromium	mg/L	0.001	4	0	0	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	
	Giardia	Giardia	cysts/100ml	1	4	0	0	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	
	Cryptosporidium	Cryptosporidium	oocysts/10L	1	4	0	0	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	

Scheme Component	Parameter Category	Parameter	Unit of Measure	Limit of Reporting (LOR)	Count	# of samples detected	# DW Guidelines Value	Min Value	Max Value	Avg Value	95th %tile	Comments
	Thermotolerant Coliforms	Total Coliforms	org/100ml	1	73	0	0	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	
	Thermotolerant Coliforms	E. coli	MPN/100ml	1	70	0	0	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	
	Disinfection Residual	Chlorine, free	mg/L	0.05	684	684	0	1	3.62	2.90	3.28	
	Turbidity	Turbidity	NTU	0.1	710	710	0	0.01	2.20	0.12	0.26	
	рН	рН	pH Units	1	710	710	0	7.31	7.70	7.54	7.63	
	Anions	Sulphate	mg/L	0.5	20	18	0	0.00	1.40	1.06	1.40	
	Anions	Nitrate	mg/L	0.01	20	20	0	0.01	0.08	0.05	0.08	
	Metals	Iron, Total	mg/L	0.005	171	29	0	<lor< td=""><td>0.16</td><td><lor< td=""><td>0.005</td><td></td></lor<></td></lor<>	0.16	<lor< td=""><td>0.005</td><td></td></lor<>	0.005	
	Metals	Manganese, Total	mg/L	0.001	94	61	0	<lor< td=""><td>0.19</td><td>0.010</td><td>0.060</td><td></td></lor<>	0.19	0.010	0.060	
Douglas Water	Metals	Aluminium	mg/L	0.005	579	491	0	<lor< td=""><td>0.14</td><td>0.02</td><td>0.04</td><td></td></lor<>	0.14	0.02	0.04	
Treated Water	Fluoride	Fluoride	mg/L	0.02	708	708	0	0.50	0.76	0.65	0.70	
	Metals	Copper	mg/L	0.002	21	0	0	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	
	Metals	Zinc	mg/L	0.001	21	6	0	<lor< td=""><td>0.010</td><td><lor< td=""><td>0.004</td><td></td></lor<></td></lor<>	0.010	<lor< td=""><td>0.004</td><td></td></lor<>	0.004	
	Metals	Arsenic	mg/L	0.001	7	0	0	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	
	Metals	Selenium	mg/L	0.001	7	0	0	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	
	Metals	Mercury	mg/L	0.0006	7	0	0	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	
	Metals	Cadmium	mg/L	0.0001	7	0	0	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	
	Metals	Nickel	mg/L	0.001	7	0	0	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	
	Metals	Chromium	mg/L	0.001	7	0	0	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	
	Disinfection By-product	Trihalomethanes	ug/L	5	80	77	0	<lor< td=""><td>140</td><td>30</td><td>59.8</td><td></td></lor<>	140	30	59.8	

			Unit of	Limit of Reporting		# of samples	# DW Guidelines					
Scheme Component	Parameter Category	Parameter	Measure	(LOR)	Count	detected	Value	Min Value	Max Value	Avg Value	95th %tile	Comments
	Thermotolerant Coliforms	Total Coliforms	org/100ml	1	33	30	0	0	365	46	245	
	Thermotolerant Coliforms	E. coli	MPN/100ml	1	37	25	0	0	126	7	20	
	Turbidity	Turbidity	NTU	0.1	255	255	0	0.53	17.6	1.30	2.40	
	рН	рН	pH Units	1	257	257	0	9.30	10.68	10.41	10.58	
	Anions	Sulphate	mg/L	0.5	8	7	0	0	1.50	1	1.47	
	Metals	Iron, Total	mg/L	0.005	37	37	0	0.02	0.33	0.11	0.26	
	Metals	Manganese, Total	mg/L	0.001	37	37	0	0.000	0.010	0.010	0.010	
	Geosmin/MIB	Geosmin	ng/L	1	6	2	0	0	11	3	10.25	
Northern Water	Geosmin/MIB	MIB	ng/L	1	6	1	0	0	15	2.50	11.25	
Raw Water	Fluoride	Fluoride	mg/L	0.02	37	33	0	0	0.23	0.06	0.17	
	Metals	Arsenic	mg/L	0.001	3	0	0	0	0	0	0	
	Metals	Selenium	mg/L	0.001	3	0	0	0	0	0	0	
	Metals	Mercury	mg/L	0.0006	3	0	0	0	0	0	0	
	Metals	Cadmium	mg/L	0.0001	3	0	0	0	0	0	0	
	Metals	Nickel	mg/L	0.001	3	0	0	0	0	0	0	
	Metals	Chromium	mg/L	0.001	3	0	0	0	0	0	0	
	Giardia	Giardia	cysts/100ml	1	3	0	0	0	0	0	0	
	Cryptosporidium	Cryptosporidium	oocysts/10L	1	3	0	0	0	0	0	0	
	Thermotolerant Coliforms	Total Coliforms	org/100ml	1	37	0	0	0	0	0	0	
	Thermotolerant Coliforms	E. coli	MPN/100ml	1	37	0	0	0	0	0	0	
	Disinfection Residual	Chlorine, free	mg/L	0.05	257	257	0	1.64	2.46	1.99	2.24	
	Turbidity	Turbidity	NTU	0.1	256	256	0	0.01	0.09	0.04	0.05	
	рН	рН	pH Units	1	256	256	0	7.44	7.63	7.54	7.6	
	Anions	Sulphate	mg/L	0.5	8	7	0	<lor< td=""><td>1.9</td><td>1.31</td><td>1.76</td><td></td></lor<>	1.9	1.31	1.76	
	Anions	Nitrate	mg/L	0.01	8	7	0	<lor< td=""><td>0.03</td><td>0.02</td><td>0.03</td><td></td></lor<>	0.03	0.02	0.03	
Northern Water	Metals	Manganese, Total	mg/L	0.001	37	37	0	0.001	0.003	0.000	0.002	
Treated Water	Metals	Iron, Total	mg/L	0.005	74	15	0	<lor< td=""><td>0.01</td><td><lor< td=""><td>0.01</td><td></td></lor<></td></lor<>	0.01	<lor< td=""><td>0.01</td><td></td></lor<>	0.01	
	Metals	Aluminium	mg/L	0.005	259	140	0	<lor< td=""><td>0.07</td><td>0.01</td><td>0.03</td><td></td></lor<>	0.07	0.01	0.03	
	Fluoride	Fluoride	mg/L	0.02	257	257	0	0.64	0.73	0.68	0.70	
	Metals	Copper	mg/L	0.002	8	0	0	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	
	Metals	Zinc	mg/L	0.001	8	4	0	<lor< td=""><td>0.002</td><td>0.001</td><td>0.002</td><td></td></lor<>	0.002	0.001	0.002	
	Metals	Arsenic	mg/L	0.001	3	0	0	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	
	Metals	Selenium	mg/L	0.001	3	0	0	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	
	Metals	Mercury	mg/L	0.0006	3	0	0	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	

			Unit of	Limit of Reporting		# of samples	# DW Guidelines					
Scheme Component	Parameter Category	Parameter	Measure	(LOR)	Count	detected	Value	Min Value	Max Value	Avg Value	95th %tile	Comments
Northern Water Treatment Plant Treated Water	Metals	Cadmium	mg/L	0.0001	3	0	0	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	
	Metals	Nickel	mg/L	0.001	3	0	0	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	
	Metals	Chromium	mg/L	0.001	3	0	0	<lor< td=""><td><lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	
	Disinfection By-product	Trihalomethanes	ug/L	5	35	27	0	<lor< td=""><td>91</td><td>17.11</td><td>36.9</td><td></td></lor<>	91	17.11	36.9	
	Thermotolerant Coliforms	Total Coliforms	org/100ml	1	972	34	0	<lor< td=""><td>200</td><td>0.54</td><td><lor< td=""><td></td></lor<></td></lor<>	200	0.54	<lor< td=""><td></td></lor<>	
	Thermotolerant Coliforms	E. coli	MPN/100ml	1	974	1	0	<lor< td=""><td>3</td><td><lor< td=""><td><lor< td=""><td>DWI-506-20-08510</td></lor<></td></lor<></td></lor<>	3	<lor< td=""><td><lor< td=""><td>DWI-506-20-08510</td></lor<></td></lor<>	<lor< td=""><td>DWI-506-20-08510</td></lor<>	DWI-506-20-08510
	Disinfection residual	Chlorine, free	mg/L	0.05	1077	1077	0	0.06	5.96	1.29	2.06	DWI-506-20-08504, DWI-506-21-09012
	Disinfection residual	Chlorine, total	mg/L	0.05	1081	1081	2	0.10	7.30	1.58	2.40	DWI-506-20-08504, DWI-506-21-09013
Transmission	Turbidity	Turbidity	NTU	0.1	1071	1053	0	0	1.7	0.22	0.5	
Reservoirs	рН	рН	pH Units	1	1078	1078	0	6.51	8.46	7.56	8.00	
	Metals	Iron, Total	mg/L	0.005	1067	614	0	<lor< td=""><td>0.09</td><td>0.005</td><td>0.02</td><td></td></lor<>	0.09	0.005	0.02	
	Metals	Manganese, Total	mg/L	0.001	1067	991	0	<lor< td=""><td>0.20</td><td><lor< td=""><td>0.02</td><td></td></lor<></td></lor<>	0.20	<lor< td=""><td>0.02</td><td></td></lor<>	0.02	
	Metals	Lead, Total	mg/L	0.0006	1067	35	0	<lor< td=""><td>0.003</td><td><lor< td=""><td><lor< td=""><td></td></lor<></td></lor<></td></lor<>	0.003	<lor< td=""><td><lor< td=""><td></td></lor<></td></lor<>	<lor< td=""><td></td></lor<>	
	Disinfection By-product	Trihalomethanes	µg/L	5	1017	978	1	<lor< td=""><td>275</td><td>62</td><td>122</td><td>DWI-506-21-08892</td></lor<>	275	62	122	DWI-506-21-08892
	Disinfection By-product	Chlorates	µg/L	50	275	257	15	<lor< td=""><td>975</td><td>351</td><td>804</td><td>DWI-506-21-08870</td></lor<>	975	351	804	DWI-506-21-08870
	Thermotolerant Coliforms	Total Coliforms	org/100ml	1	1795	29	0	<lor< td=""><td>200</td><td>1</td><td><lor< td=""><td></td></lor<></td></lor<>	200	1	<lor< td=""><td></td></lor<>	
	Thermotolerant Coliforms	E. coli	MPN/100ml	1	1795	4	4	<lor< td=""><td>2</td><td><lor< td=""><td><lor< td=""><td>DWI-506-20-08522, DWI-506-21-08835, DWI-506-21-08896, DWI-506-21-08926</td></lor<></td></lor<></td></lor<>	2	<lor< td=""><td><lor< td=""><td>DWI-506-20-08522, DWI-506-21-08835, DWI-506-21-08896, DWI-506-21-08926</td></lor<></td></lor<>	<lor< td=""><td>DWI-506-20-08522, DWI-506-21-08835, DWI-506-21-08896, DWI-506-21-08926</td></lor<>	DWI-506-20-08522, DWI-506-21-08835, DWI-506-21-08896, DWI-506-21-08926
	Disinfection residual	Chlorine, free	mg/L	0.05	1996	1972	3	<lor< td=""><td>2.80</td><td>1.07</td><td>1.82</td><td>DWI-506-20-08504, DWI-506-21-09013</td></lor<>	2.80	1.07	1.82	DWI-506-20-08504, DWI-506-21-09013
Reticulation	Disinfection residual	Chlorine, total	mg/L	0.05	2002	1987	3	<lor< td=""><td>7</td><td>1.36</td><td>2.23</td><td>DWI-506-20-08504, DWI-506-21-09013</td></lor<>	7	1.36	2.23	DWI-506-20-08504, DWI-506-21-09013
Houses	Turbidity	Turbidity	NTU	0.1	1971	1946	0	<lor< td=""><td>10.7</td><td>0.24</td><td>0.5</td><td></td></lor<>	10.7	0.24	0.5	
	рН	рН	pH Units	1	1990	1990	0	6.37	8.74	7.60	8.12	
	Metals	Iron, Total	mg/L	0.005	451	281	0	<lor< td=""><td>0.44</td><td>0.005</td><td>0.01</td><td></td></lor<>	0.44	0.005	0.01	
	Metals	Manganese, Total	mg/L	0.001	516	452	2	<lor< td=""><td>1.20</td><td>0.160</td><td>0.080</td><td>DWI-506-21-08878</td></lor<>	1.20	0.160	0.080	DWI-506-21-08878
	Metals	Lead, Total	mg/L	0.001	451	286	1	<lor< td=""><td>0.02</td><td>0.001</td><td>0.002</td><td>DWI-506-21-08898</td></lor<>	0.02	0.001	0.002	DWI-506-21-08898
	Fluoride	Fluoride	mg/L	0.02	451	451	0	0.54	0.8	0.68	0.72	
	Disinfection By-product	Trihalomethanes	µg/L	5	440	417	0	<lor< td=""><td>195</td><td>60</td><td>124</td><td></td></lor<>	195	60	124	
	Disinfection By-product	Chlorates	µg/L	50	156	142	3	<lor< td=""><td>844</td><td>264</td><td>674</td><td>DWI-506-21-08870</td></lor<>	844	264	674	DWI-506-21-08870

