Mareeba SHIRE COUNCIL

Drinking Water Quality Management Plan

Service Provider No:	557
Date Adopted:	7 July 2026
Revision Number:	10

DOCUMENT REVIEW HISTORY

Revision	Date	Change Summary
1	Jun 2015	Submitted to Water Supply Regulation DEWS.
2	May 2016	Re-submitted to Water Supply Regulation DEWS with requested changes.
3	Aug 2018	Re-submitted to Water Supply Regulation DEWS with: additional information written in main document; updated Tabulated Data; and revised Appendices.
4	May 2020	Re-submitted to Water Supply Regulation DNRME with: additional information written in main document; updated tabulated data and graphics; minor text formatting; and revised Appendices.
5	April 2022	Re-submitted to Water Supply Regulation DRDMW with: additional information written in main document; updated tabulated data and graphics; minor text formatting; and revised Appendices.
6	July 2022	Re-submitted to Water Supply Regulation DRDMW with: additional information written in main document; updated tabulated data and; revised Appendices.
7	May 2024	Re-submitted to Water Supply Regulator DRDMW alongside review document with amendments made to reflect 2 yearly review
8	September 2024	Approval received from Regulator on 26 September 2024
9	March 2025	Re-submitted to Water Supply Regulator DLGWV with amendments made to reflect 2 yearly review
10	March 2026	Re-submitted to Water Supply Regulator DLGWV with amendments made to reflect 2 yearly review

Contents

1. Introduction

The Mareeba Shire Council (MSC) has a total area of 53,679 km^2 (Figure 1). Mareeba Shire has an average daily temperature range of 18.7°C to 31.5°C, and a median annual rainfall range of 1,012 mm[1]. The estimated residential population of the shire, as of 30 June 2024, was 24,003 with an average annual growth rate of 1.1% over ten years. The population for the Shire is projected to increase to 28,684 persons by 30 Jun 2046 (at the current average annual growth rate of 0.9%)[2].

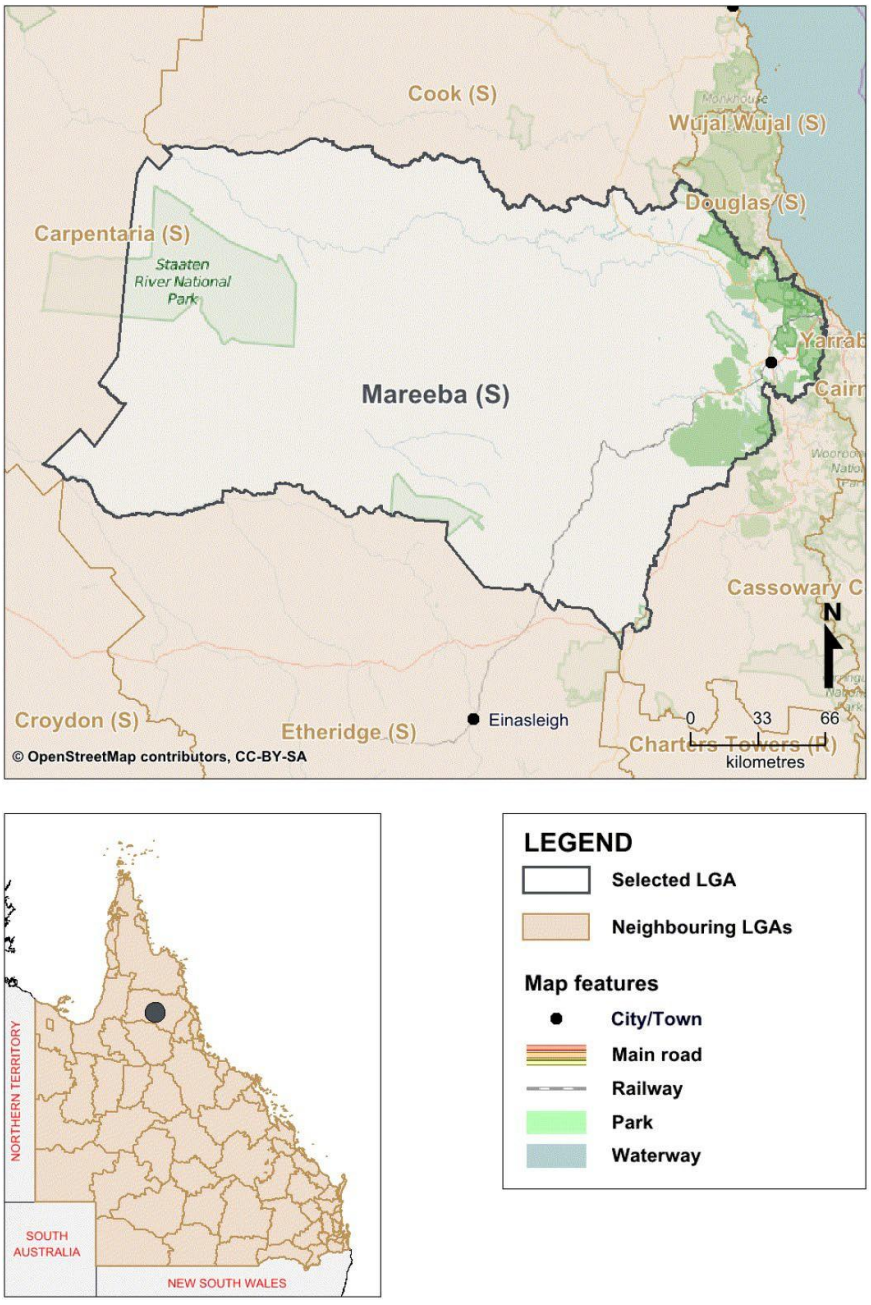

FIGURE 1: MAP OF MAREEBA SHIRE COUNCIL

[1] Sourced from Australian Bureau of Meteorology http://reg.bom.gov.au/climate/data/stations/
[2] Population data report was generated from Queensland Government Statistical Office (QGSO) http://statistics.qgso.qld.gov.au/qld-regional-profiles

2. Registered Services Details

2.1. Service Description

TABLE 1: SERVICE PROVIDER DETAILS

Service provider ID	557
Contact Person	Morris Hamill, Manager Water and Waste
Address	PO Box 154, Mareeba QLD 4880
Email	morrish@msc.qld.gov.au
Phone	1300 308 461
Mobile	0407 675 907

For each of the potable water schemes within MSC, the known and projected service details are provided in Table 2. The population data for each of the individual schemes (Towns) is obtained from the most recent Australian Bureau of Statistics Census data and applying a 1% annual growth rate. Projected connections are estimated using 2025 connections per person. The projected demand is estimated using 2025 demand per connection. The number of connections and water usage information is derived from Council rate records.

The declared service area maps are published on the MSC website: Declared Water Areas - Mareeba Shire Council (msc.qld.gov.au).

TABLE 2: SERVICE DETAILS BY SCHEME

				2025			2029 (Projected)		
Scheme	**Source Water**	**Production Capacity (ML/day)**	**Storage Capacity (ML/day)**	**Population**	**Connections[3]**	**Demand (ML/day)[4]**	**Population**	**Connections**	**Demand (ML/day)**
Chillagoe	Bore	0.5	0.5	223	133	0.230	231	137	0.336
Dimbulah	Channel	1.75	2	1008	248	0.403	1045	265	0.374
Mareeba	Barron River	19.9	20	12,220	4,270	7.531	12,666	4,466	8.058
Kuranda	Barron River	2.8	4	4,998	1,059	0.958	5,180	1,136	0.944
	TOTAL	**28.11**	**26.5**	**18,449**	**5,710**	**9.112**	**19,112**	**6,004**	**9.712**

3. Key Stakeholders

Dimbulah, Mareeba and Kuranda are supplied with raw water from the SunWater owned Mareeba Dimbulah Water Supply. Chillagoe sources its raw water from an underground aquifer.

SunWater, as the bulk water supplier, manages the Tinaroo Dam (which supplies the Barron River). SunWater manages a regional network of bulk water supply infrastructure that spans across Queensland to support around 5,000 customers across the mining, power generation, industrial, local government and irrigated agriculture sectors. SunWater's contact person for all matters relating to water quality on the Tablelands is the Operations Manager. SunWater is a key stakeholder (as the bulk water supplier) and notifies MSC in the event of any water quality changes. SunWater also notifies MSC of upcoming maintenance activities which may impact the water supply. Table 3 outlines the key stakeholders for MSC.

TABLE 3: KEY STAKEHOLDERS

Stakeholder	Role	Contact details
BASF	Polymer supplier	
IDEXX	Laboratory equipment and consumables	Customer Service Idexx-anz-customer-service@idexx.com
Cairns Regional Council (CRC) laboratory services	External NATA laboratory	Amanda Beecham (07) 4044 8344 laboratory@cairns.qld.gov.au
Cleaveland Bay Chemicals	Chemical supplier of Aluminimum Chlorohydrate (ACH) and Caustic	Nicholas Whebell P: (07) 47784500 M: 0400 784 973

[3] Total number of connections (including Residential & Non-Residential), as per the 2025 SWIM report.
[4] Average total treated water demand is based on the 2025 water year figures (includes losses) derived from the SWIM report (SWIM Code WA74).

Stakeholder	Role	Contact details
		nick@clevelandbaychemco.com.au
Westwater	Salt for Electro chlorination	Rhys Johnson P: (07) 38062900 M: 0458 600 323 rjohnson@westwater.com.au
TBC (xx)	Ferric Chloride Supplier	
TBC (xx)	Potassium Permanganate Supplier	
Coogee Chemicals	Sodium Hypochlorite Supplier	Steve Whelan 0413056255 Steven.whelan@coogee.com.au
SunWater	Bulk water supplier	Andrew Cooper – Operations Manager Far North P: 13 15 89 M: 0491 834 481 E: Andrew.Cooper@sunwater.com.au
FNQROC	Regional contract management	Amanda Hancock P: (07) 4044 3021 M: 0418 974214 E: a.hancock@fnqroc.qld.gov.au
Department of Regional Development, Manufacturing and Water (RDMW)	Water supply regulation	1300 596 709 drinkingwater.reporting@rdmw.qld.gov.au
Tropical Public Health Unit (Cairns) – Queensland Health	Public health regulation	(07) 4226 5555
Department of Environment, Science, and Innovation (DESI)	Environmental protection regulation	Pollution Hotline 1300 130 372 PollutionHotline@des.qld.gov.au
Baiada (Steggles Chicken)	Industrial customer	1 Moody St, Mareeba QLD 4880 (07) 4092 9500
Mareeba hospital	Vulnerable customer	21 Lloyd Street, Mareeba QLD 4880 (07) 4226 6000 chhhs_feedback@health.qld.gov.au
Chillagoe Primary Health Centre	Vulnerable customer	21 Hospital Ave, Chillagoe QLD 4871 (07) 4094 7500
Dimbulah Primary Health Centre	Vulnerable customer	1-5 Stephens St, Dimbulah QLD 4872 (07) 4094 5000
Blue Care Mareeba Aged Care Facility	Vulnerable customer	7 Macrae St, Mareeba QLD 4880 (07) 4030 3599
MSC Media Liaison Officer	Community notifications	65 Rankin St, Mareeba QLD 4880 1300 308 461 communications@msc.qld.gov.au

3.1. Chillagoe

Council owns and operates the Chillagoe water supply, delivering treated water to about 109 connected residential properties and 24 non-residential properties. Chillagoe is predominantly a mining town with a population that fluctuates with the Australian and world demand for minerals.

Chillagoe has a small hospital which provides general outpatient services, accident and emergency services, weekly doctor visits, mental health visits, and leads community health initiatives. Patients at this facility may be more sensitive to changes in water quality or be more greatly affected by a disruption in supply.

3.2. Dimbulah

Council owns and operates the Dimbulah water supply, delivering treated water to about 202 connected residential properties and 46 non-residential properties.

Dimbulah township has a number of retail facilities including: a bank post office; chemist; café; therapeutic massage facility; real estate agent; butcher; two salons; a clothing store; hardware store; community bank; grocery store; convenience store; and petrol station. Dimbulah also hosts many sporting clubs including: swimming; tennis; horse and pony club; lawn bowls; Rhee Tae Kwon Do; and soccer. Community groups include: the Dimbulah Community Centre; Lions Club; QCWA; Chamber of Commerce; Museum Association; library; and several faith-based groups.

Dimbulah has a small hospital which provides general outpatient services, accident and emergency services, weekly doctor visits, mental health visits, and leads community health initiatives. Patients at this facility may be more sensitive to changes in water quality or be more greatly affected by a disruption in supply.

3.3. Mareeba

Mareeba is the centre of administration, business and commerce of the MSC. Council owns and operates the Mareeba water supply, delivering treated water to about 3,882 connected residential properties and 388 non-residential properties.

Mareeba has a small (52 bed) hospital which provides general outpatient services, accident and emergency services, maternity, dental, women's health, mental health, and community health.

Blue care aged care facility also operates within the city limits. Patients and residents of these facilities may be more sensitive to changes in water quality or be more greatly affected by a disruption in supply.

3.4. Kuranda

Kuranda is a popular tourist destination with markets, cafes, restaurants and activities including wildlife sanctuaries, skyrail cableway and scenic railway.

Council owns and operates the Kuranda water supply, delivering treated water to about 879 connected residential properties and 180 non-residential properties.

There are no hospital or aged care facilities operating out of Kuranda.

4. Details of Infrastructure

4.1. Source Details

MSC Water and Waste maintain and operate 237.8 km of water mains, and four water treatment plants (WTP).

Infrastructure details and maintenance reminders are stored within council's asset management program; TechnologyOne.

Site visits are conducted by Water and Waste staff on a regular basis to ensure the functionality and security of infrastructure.

SunWater supplies untreated water for Mareeba and Kuranda via the Barron River and through its irrigation network to Dimbulah. SunWater operates in accordance with the Water Plan (Barron) 2023[5] which ensures that the Barron River is sustainably managed to provide for present and future needs while protecting social, economic, and environmental interests. Chillagoe sources its water from underground aquifers.

The graph below (Figure 2) illustrates the total clear water supplied to all four water treatment plants. As would be expected, the demand for drinking water increases in the dry season and decreases in the wet season.

[5] Water Act 2000: Water Plan (Barron) 2023

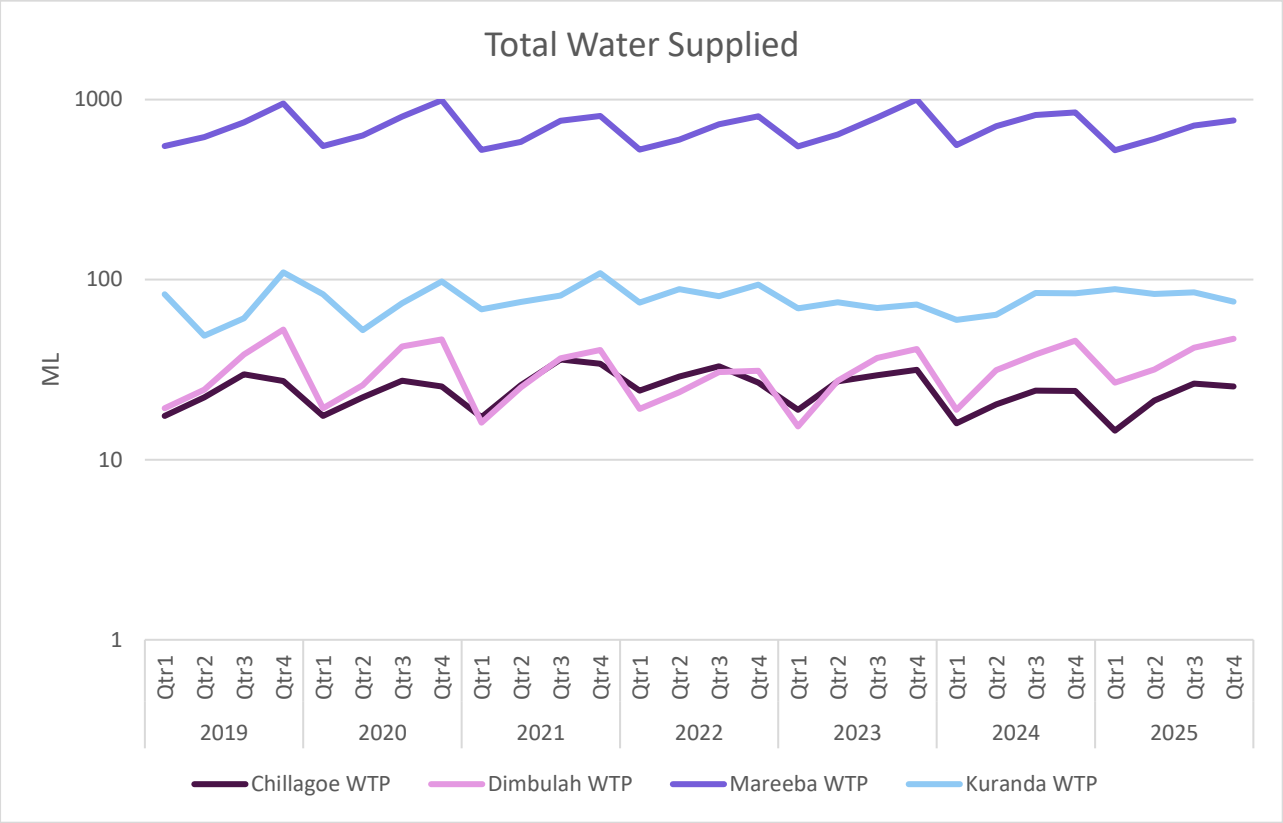

FIGURE 2: TOTAL WATER SUPPLIED, 2019-2023

4.1.1. Chillagoe

The town of Chillagoe is located approximately 140 km to the west of Mareeba. The raw water supply for Chillagoe is sourced from a bore field. The bore is referred to as "Bore 4" and is located approximately 4 km West of the town adjacent to the Burke development road[6]. A second bore "Bore 3", located off the North-Eastern End of Frew St[7], is not used to supply the treatment plant but is available for back-up supply.

FIGURE 3: CHILLAGOE WATER TREATMENT PLANT

[6] UTM Reference: Zone 55 K; Easting 232291.00 m E; Northing 8102156.00 m S
[7] UTM Reference: Zone 55 K; Easting 236597.00 m E; Northing 8102228.00 m S

The raw water parameters (listed in Table 4) are sampled at the discharge side of the bore water pumps.

TABLE 4: RAW WATER PARAMETERS SAMPLED AT BORE WATER PUMPS - CHILLAGOE

Parameter	Sampling Location	Laboratory	Frequency
Turbidity	Raw water intake line	Online analyser	Continuous
E. coli and Total Coliforms	Raw water tap	Internal	Monthly
pH/EC/ALK/TURB	Raw water tap	External NATA	Biannually
Ca/Mg/K/Na/Si/Hardness	Raw water tap	External NATA	Biannually
Cl/SO4	Raw water tap	External NATA	Biannually
OC/OP Pesticides	Raw water tap	External NATA	Biannually
Fluoride	Raw water tap	External NATA	Biannually
Colour	Raw water tap	External NATA	Biannually
Total dissolved solids (TDS)	Raw water tap	External NATA	Biannually
ICPMS (24 Metals)	Raw water tap	External NATA	Biannually
Mercury (Hg)	Raw water tap	External NATA	Biannually

Tabulated Results of these sampling events are displayed in Appendix D – Record of Testing Parameters.

4.1.2. Dimbulah

The township of Dimbulah is serviced by the SunWater owned Mareeba-Dimbulah Irrigation Scheme, which is supplied predominantly from Tinaroo Dam with a small portion periodically from the Walsh River via Collins Weir. Both Tinaroo Dam and the Walsh River are stable water supplies. SunWater manage the raw water supply. During times of maintenance to the channel distribution system SunWater release water from Collins Weir to the Walsh River.

Dimbulah Water Treatment Plant (Figure 4) is supplied with raw water sourced from a syphon (SunWater irrigation system) running along Ericson Road (Southern side of Dimbulah). The intake infrastructure consists of a sluice valve on the syphon connected to the WTP via 460m of DN150 gravity main.

FIGURE 4: DIMBULAH WATER TREATMENT PLANT

The raw water flow meter is located near the junction of Hambling St with Ericson Rd (adjacent to the SunWater syphon) and is connected to the supervisory control and data acquisition (SCADA) system. At the Dimbulah WTP, the raw water passes through a stainless steel screen filter prior to entering the 100 kL steel reservoir (elevated on a steel stand) from which it gravity feeds to two plastic tanks. Two multi-stage in-line pumps direct the water from the plastic tanks to the treatment plant.

The raw water parameters (listed in Table 5) are sampled at the discharge side of the raw water pumps.

TABLE 5: RAW WATER PARAMETERS AT DISCHARGE SIDE OF RAW WATER PUMPS - DIMBULAH

Parameter	Sampling Location	Laboratory	Frequency
Turbidity	Raw water intake line	Online analyser	Continuous
Alkalinity	Raw water intake	Internal	Three per week
Dissolved Oxygen	Raw water intake	Internal	Three per week
Conductivity	Raw water intake	Internal	Three per week
pH	Raw water intake	Internal	Three per week
Temperature	Raw water intake	Internal	Three per week
E. coli and Total Coliforms	Raw water tap	Internal	Weekly
pH/EC/ALK/TURB	Raw water tap	External NATA	Biannually
Ca/Mg/K/Na/Si/Hardness	Raw water tap	External NATA	Biannually
Cl/SO4	Raw water tap	External NATA	Biannually
OC/OP Pesticides	Raw water tap	External NATA	Biannually
Fluoride	Raw water tap	External NATA	Biannually
Colour	Raw water tap	External NATA	Biannually
Total dissolved solids (TDS)	Raw water tap	External NATA	Biannually
ICPMS (24 Metals)	Raw water tap	External NATA	Biannually
Mercury (Hg)	Raw water tap	External NATA	Biannually

Tabulated Results of these sampling events are displayed in Appendix D – Record of Testing Parameters.

SunWater conduct routine closure of the Dimbulah channel water supply. Prior to shut down raw water tanks and reservoirs are filled. To conserve water during this time public advertising in the form of erected public signs, Facebook notices and newspaper notices are published to advise residents. During the channel closure period the 2ML reservoir and raw water tanks are monitored for volume. In the unlikely occurrence of the reservoir becoming low, water trucks are available to cart raw water to the water treatment plant. Refer to Mareeba Shire Council *Dimbulah Water Scheme Channel Shut Down Procedure* for more information.

4.1.3. Mareeba

Mareeba's town water is sourced from Tinaroo Dam via releases to the Barron River. The Barron River, downstream from the dam to Kuranda, forms part of the regulated water supply controlled by SunWater. Due to the reasonably regular annual average rainfall within the Barron catchment it is considered to be a stable supply.

The raw water line at the Mareeba WTP (Figure 5) contains an online turbidity meter, pH analyser, and conductivity analyser. These instruments are connected to the SCADA system.

FIGURE 5: MAREEBA WATER TREATMENT PLANT

The raw water parameters listed in Table 6 are sampled at the discharge side of the raw water pumps.

TABLE 6: RAW WATER PARAMETERS SAMPLED AT THE DISCHARGE SIDE OF THE RAW WATER PUMPS – MAREEBA

Parameter	Sampling Location	Laboratory	Frequency
Turbidity	Raw water intake line	Online analyser	Continuous
Alkalinity	Raw water intake	Internal	Daily
Dissolved Oxygen	Raw water intake	Internal	Daily
Conductivity	Raw water intake	Internal	Daily
pH	Raw water intake	Internal	Daily
Temperature	Raw water intake	Internal	Daily
E. coli and Total Coliforms	Raw water tap	Internal	Weekly
pH/EC/ALK/TURB	Raw water tap	External NATA	Biannually
Ca/Mg/K/Na/Si/Hardness	Raw water tap	External NATA	Biannually
Cl/SO4	Raw water tap	External NATA	Biannually
OC/OP Pesticides	Raw water tap	External NATA	Biannually
Fluoride	Raw water tap	External NATA	Biannually
Colour	Raw water tap	External NATA	Biannually
TDS	Raw water tap	External NATA	Biannually
ICPMS (24 Metals)	Raw water tap	External NATA	Biannually
Mercury (Hg)	Raw water tap	External NATA	Biannually

Tabulated Results of these sampling events are displayed in Appendix D – Record of Testing Parameters.

4.1.4. Kuranda

Raw water supplying the Kuranda WTP (Figure 6) is extracted from the Barron River by a submersible pump located nearby on the riverbank in a dry well. A backup pump is also located near the riverbank andis used during times when the river has flooded the raw water dry well. Following Cyclone Jasper in December 2023, the Kuranda intake was permanently damaged. Funding for a new intake has been approved, with work expected to commence during the 2026-27 financial year.

Demand for potable water in Kuranda increased significantly in 2011 due to the completion of the Kuranda Aquatic Centre which boasts an 8-lane, 25 metre pool. Demand has settled since installation of the pool in 2011.

FIGURE 6: KURANDA WATER TREATMENT PLANT

The raw water line contains a magnetic flowmeter and a surface scatter type turbidity analyser. The data from the magnetic flow meter is automatically logged by the SCADA system, but the flow meter does not control any aspect of the plant. The raw water turbidity analyser data is also logged by SCADA, but in addition to this, will shut down the raw water pumps in the event of a high turbidity event in the Barron River.

The raw water parameters listed in Table 7 are sampled at the discharge side of the raw water pumps.

TABLE 7: RAW WATER PARAMETERS SAMPLED AT DISCHARGE SIDE OF RAW WATER PUMPS - KURANDA

Parameter	Sampling Location	Laboratory	Frequency
Turbidity	Raw water intake line	Online analyser	Continuous
Alkalinity	Raw water intake	Internal	Daily
Dissolved Oxygen	Raw water intake	Internal	Daily
Conductivity	Raw water intake	Internal	Daily
pH	Raw water intake	Internal	Daily
Temperature	Raw water intake	Internal	Daily
E. coli and Total Coliforms	Raw water tap	Internal	Weekly
pH/EC/ALK/TURB	Raw water tap	External NATA	Biannually
Ca/Mg/K/Na/Si/Hardness	Raw water tap	External NATA	Biannually
Cl/SO4	Raw water tap	External NATA	Biannually
OC/OP Pesticides	Raw water tap	External NATA	Biannually
Fluoride	Raw water tap	External NATA	Biannually
Colour	Raw water tap	External NATA	Biannually
TDS	Raw water tap	External NATA	Biannually
ICPMS (24 Metals)	Raw water tap	External NATA	Biannually
Mercury (Hg)	Raw water tap	External NATA	Biannually

4.2. Schematics

Each scheme has an overall schematic showing relationships and interactions from catchment to tap, and each plant has an Operational Standard Operating Procedure (section 7.2). Refer to Appendix A – Schematics for schematic details of scheme infrastructure and the appendices of each SOP for SCADA screen shots of each plants overview and detailed processes.

4.3. Treatment Process Details

4.3.1. Chillagoe

Water pumped from the bore is inline dosed with chlorine, passed through a WTP, then through approximately 590 m of dedicated main into a reservoir situated on a hill (elevated 33 m above the WTP). From the reservoir it is reticulated to the town.

The Chillagoe WTP comprises of:

- Pumps
- Electro chlorination system
- Inline chlorine dosing system
- Flow transmitter and ferric chloride dosing system
- DMI-65 media and cartridge filtration, and
- Booster pump

The sodium hypochlorite dosing system is flow paced dosed based on the Council's installed flow meter. The council has also installed a free chlorine analyser which provides a free chlorine reading to the Treatment plant. If the chlorine level falls below a certain setpoint the Treatment plant will shut down, as it is critical that chlorine is dosed at all times.

A flow transmitter located on the inlet line to the DMI-65 Media filters registers instantaneous and totalized flow, and provides a flow paced signal for the Ferric Chloride Dose Pumps. It will also instigate a plant shutdown in the event of low flow.

Arsenic can bond with iron salts in the water and with metal-based coagulants such as Ferric Chloride. Generally, the ratio of iron to arsenic required in the formation of complexes is in the range of 20:1 to 50:1 (this can vary greatly depending on pH, silica and other competing irons in the water). In Chillagoe, the levels of iron in bore water can range from less than 0.05 mg/L to 1 mg/L, therefore, to maintain sufficient levels of iron to achieve the iron: arsenic ratio Ferric Chloride is dosed.

With a sufficient reservoir of iron, arsenic can form precipitants with iron salts, via the chemical processes of precipitation, co-precipitation and adsorption (adsorption on to ferric hydroxide), which can then be filtered.

Liquid Ferric Chloride is flow paced dosed according to the Flow Transmitter FT-01. The dosage of Ferric Chloride is adjustable within the duty/standby dose pumps. The dose pumps will alarm if the solution tank level drops below the low level switch, and will alarm and shut down the plant if the solution drops below the low low level switch.

DMI-65 is a manganese dioxide (MnO_2) coated media whose surface acts as a good oxidant and is effective in removing both arsenite and arsenate, as well as iron/arsenic complexes. The DMI-65 Media Filter also acts to remove arsenic via mechanical filtration of the iron/arsenic precipitants.

The DMI-65 Media Filters are periodically backwashed/rinsed based on either pressure differential across the media filters or on time, whichever occurs first. The filter backwash cycle operates online, that is, the downstream product valve will close, and four media filters provide filtered water to backwash the fifth media filter; the cycle will rotate through each filter in this manner until all have been backwashed. The rinse cycle will follow discharging filtered water to waste before returning to the normal treatment mode.

A pressure relief valve is located on the inlet line to the media filter to release pressure in the event the feed pressure exceeds 6 bar - the media filter vessels and cartridge filter housings are rated to 6 bar working pressure. Each media filter vessel has an associated backwash valve that actuates during backwashing of that vessel. A flow control valve is located on the outlet of the backwash line to maintain the backwash design flow rate as too high a flow can result in the loss of DMI-65 media.

Pressure transmitters, located upstream and downstream of the media filters, enables monitoring of the media filter pressure differential and instigates a backwash / rinse cycle when the pressure exceeds the

recommended setpoint (normally 50 kPa). A level transmitter on the Backwash Tank will alarm if the water level reaches the high setpoint and then alarm and shut down the plant, if the water level reaches high high setpoint during a backwash cycle.

One micron cartridge filters have been installed to polish the produced water and provide a final barrier to the precipitated arsenic. The cartridge filters are periodically replaced based on pressure differential across the filters or on time.

A pH Transmitter registers the pH of the product water, and alarms if the pH fall outside the high and low setpoints. Inline Turbidity analysers are installed to monitor turbidity of the raw water coming into the WTP and the clear water post treatment.

The booster pump assists with the transfer of the filtered water to the town reservoir which is approximately half a kilometre away and 36 m above the elevation of the treatment plant. The booster pump operates on variable speed drive to ramp up or down to maintain the plant design flow rate. The Maximum Flow Limit setpoint (adjustable from 0 – 10 L/s), ensures that the Booster Pump will maintain and not exceed the maximum flow even though the inlet pressure setpoint is not reached. A flow switch on the discharge side of the pump will shut plant down in the event of low flow.

The WTP is capable of producing up to 10 L/s of product water. The plant was commissioned in April 2015. Weekly samples were taken for a period of six weeks with 0.003 mg/L the highest recorded concentration of arsenic in the treated water.

Should the WTP be offline for an extended period it is possible to bypass the WTP: this would only occur if each effected resident was previously notified and public notices were posted. For information in relation to bypassing the WTP please refer to Section 14.2 of the Chillagoe Water SOP.

4.3.2. Dimbulah

Raw water is gravity-fed from the channel through a flow meter located at the old water treatment plant. At the Dimbulah WTP, the raw water passes through a stainless steel screen filter prior to entering an elevated 100 kL steel Raw Water Reservoir and/or two HDPE 48 kL Raw Water Reservoirs. In normal operation, the elevated steel reservoir is used. The two smaller HDPE reservoirs are used for contingency purposes, when required.

From the Raw Water Reservoirs, two multi-stage in-line pumps direct the water to the filter shed. Prior to entering the filter shed, the raw water line is dosed with coagulant for turbidity removal and to aid filter performance. The Dimbulah WTP is fitted with a streaming current detector (SCD) to better control the dosing rate of coagulant.

The filter shed contains a cyclonic separator followed by five deep-bed multi-media filters. Primary separation is carried out by the cyclonic separator which allows sand and other coarse material to drop out and acts as a mixer for the chemicals added upstream.

The five deep-bed media filters each contain two media layers; the bottom layer is crushed basalt and the top layer is quartz sand. The filters are designed to remove the oxidized iron and manganese from the water through a slow filtration process. Raw water enters the top of each filter vessel through a distribution plate which disperses the water uniformly: allowing efficient backwash.

The filter contains a differential pressure sensor which signals the filter array to automatically backwash with filtered water when required. Backwash supply water is drawn from the other on-line filters. Backwash water collects in two Backwash Tanks, from which settled water is returned to the Raw Water Tanks. Residual waste is periodically drawn off the bottom of the tanks and transported to landfill.

Filtered water (from the deep bed media filters) flows through a SCADA monitored flow meter, onward through a sodium hypochlorite disinfection system, supplied by onsite salt electrolyser units, and thence into a 2 ML clear water reservoir. Caustic soda (sodium hydroxide) is also dosed on the outlet of the filters for pH and

alkalinity correction. From the clear water reservoir, the treated water is pumped into the town water reticulation by the Clearwater Booster Pumps. A residual chlorine analyser

monitors the disinfected water being pumped out of the Clearwater Reservoir into the town's water main.

4.3.3. Mareeba

The Mareeba WTP intake is a fixed-level type. The Mareeba raw water pump station contains two (2) high flow pumps (operating in duty/standby mode) rated at 250 L/s each. Raw water is drawn from the Barron River and enters a settling box before being chemically dosed and pumped to the Mareeba WTP.

The Mareeba WTP is a conventional-type treatment plant which utilises coagulation, sedimentation, and filtration. On average, the Mareeba WTP produces 4-6 million litres ML per day of drinking water in the wet season and 6-12 ML per day in the dry season. The WTP can produce up to 16.4 ML per day and has a combined storage of 20 ML.

Raw water is pre-dosed with hypochlorite chlorine to remove manganese and iron. Pre-dosing will oxidise any soluble manganese and iron in the raw water and to help to break down organics, which assists in coagulation. ACH/PolyDADMAC Blend, as supplied by Cleveland Bay Chemicals, is dosed next to assist in coagulation of the raw water and to improve the performance of the clarifiers. Although it is infrequently used, powdered activated carbon (PAC) can be dosed to the raw water to reduce the level of organics, pesticides, taste and odour.

The chemically dosed raw water flows through the static mixer to the clarifier splitter tower and then onto the two (2) up-flow clarifiers which allow for the coagulated particles to settle out. Polymer can be dosed when needed at the clarifier splitter tower or at the inlet to each clarifier flocculation zone to assist in coagulation.

Each clarifier is a circular concrete tank with a sludge scraper. Clarifier 1 includes mixers to aid in coagulation and flocculation. Raw water enters each clarifier through the central flocculation zone and then travels down and under the central ring and into the clarification zone. In Clarifier 2, clarified water flows over the outer weir and onto the filter splitter chamber. In Clarifier 1, the clarified water flows over the radial weir and on to the filter splitter chamber. In each case, the accumulated sludge is discharged when the pneumatically operated sludge blowdown valves are opened and sent to the settling pond. From the settling pond, the sludge is sent to one of three drying beds.

Once the water has been clarified, the water then gravitates to a filter distribution channel of the new Filter. The new Filter is a dual-media (sand and anthracite) gravity (down-flow) filter system, consisting of 6 No. cells. The inflow is split evenly between the cells via an inlet channel and the outflow measured so that each operates at a filtration rate of up to 10 m/h. Each cell has an inlet valve/penstock, so that it can be independently taken offline and backwashed. While one filter is offline, the other filters will operate at a filtration rate of up to 12 m/h. The new Filter is equipped with a Filter-to-waste sequence, which ensures that the turbidity limits can be achieved throughout the entire filter run to meet the required LRV target.

The new Filter is backwashed by using dedicated backwash pumps and air scour blowers. Back wash waste from the filter cells is directed to the Settling Pond. Filtered water from the new Filter then flows to the two (2) on-site treated water reservoirs, one reservoir is 5 ML capacity and the other reservoir is 15 ML capacity. Before entering the reservoirs, the filtered water is dosed with sodium hypochlorite (chlorine) for disinfection. The Mareeba WTP uses two (2) sodium hypochlorite pumps (Grundfos, 60 L/hr each) which operate in a duty/standby mode. The target residual is maintained between 0.5 mg/L to 5 mg/L. The sodium hypochlorite pumps start when the raw water pumps operate. The chlorine residual is measured daily, and the dose can be adjusted at the pump head by altering the speed and/or stroke of the pump.

The chlorine dosing system is skid mounted, which consists of a magnetic flow meter, and chlorine analyser. Combined these instruments are capable of automatically adjusting the chlorine dose in response to changes in flow and filter water quality. The output from the chlorine analyser is linked to the SCADA system and will alarm when the chlorine residual is outside the alert or critical limits.

The on-site treated water reservoirs are 5 ML and 15 ML and are roofed and vermin-proof. The Mareeba WTP contains a Booster Pump Station with five (5) pumps, which draw water from the treated water reservoirs and pumps the water directly into the Mareeba water reticulation system.

The Mareeba WTP contains an emergency generator that can operate the plant for 24 hours

4.3.4. Kuranda

The Kuranda Water Treatment Plant (WTP) utilises conventional treatment including coagulation, flocculation and sedimentation followed by dual media filtration. The plant operates seven days a week, twenty-four hours per day and treats on average 1 to 1.5 ML per day. Plant production is based on the amount of consumption in the town of Kuranda, or in other words, plant output is controlled by the level in the Clearwater Storage Reservoir.

Raw water is extracted from the Barron River by a submersible Raw Water Pump located near the riverbank in a dry well. A backup pump is also located near the riverbank and is used during times when the river has flooded the raw water dry well. The raw water line includes a magnetic flowmeter and a surface scatter type turbidity analyser. Raw water line is dosed with coagulant for turbidity removal and to aid filter performance. The WTP is fitted with a SCD to better control the dosing rate of coagulant.

The raw, chemically treated water enters the coagulation/flocculation chamber where it is slowly mixed by four mixers to allow the water to form floc. The flocculated water then passes through a submerged opening into the clarifier. In the clarifier, the water slowly travels from one end of the tank to the other allowing the coagulated particles to drop to the bottom. The coagulated particles collect on the floor of the clarifier and a scraper (guided by rails along the tank walls) slowly moves back and forth along the bottom of the tank to scrape the particles (or sludge) toward a deep well on the flocculation side of the tank. The clarified water is collected in a tube submerged near the water surface on the North end of the clarifier. From the collection tube, the clarified water flows to the media filters.

The clarifier sludge is cleaned out of the tank well by opening the sludge valves located on the West side of the clarifier. When the sludge valves are opened, the head pressure from the water in the tank pushes the sludge out and down to the sludge drying beds near the river.

The Kuranda WTP has three filters containing sand filter media. From the clarifier effluent tube, water enters the filters through each concrete filter launder. Filtration removes impurities from water by passing it through the filter media. The filtered water collects within the filter underdrain system below the filter media where it then flows to the filter outlet trough and on to the Clearwater tank.

The particles retained by the filter media are removed by periodic backwashing. A backwash is initiated manually by the operator. A backwash cycle begins with the filter level being drawn down and the water sent to waste at the sludge lagoons. Once the water level is drawn down, the filter air blowers start, and the air is forced up through the filter underdrains and into the filter media. The air agitates the filter media and causes the trapped particles to loosen from the media. After the backwash air period has finished, the blowers will stop, and the filter will fill with feed water and drain again (to the sludge lagoons) to rinse the filter clean. After the rinse cycle, the filter can resume operation.

Turbidity is measured at the filter outlet trough and sodium hypochlorite (chlorine) is dosed at the trough for disinfection.

From the filter outlet trough, the water flows down the hill and into the on-site Clearwater tank (500 kL). The outlet of the Clearwater Tank has a pH analyser and a Chlorine analyser installed. A flow meter records the amount of water pumped by the high lift pumps. Two high lift pumps transfer the treated water from the Clearwater tank to the Myola Road Reservoir (2 x 922.5 ML). From these reservoirs water is gravity fed through a reticulated network of underground pipes and pumped to two high lift areas of the township. Pumps, located on Masons Road, pressurise the Southern area of Kuranda and fill two balancing storage reservoirs

(636 kL and 500 kL) at the end of Platypus Close. Pumps are also located on Warril Drive which pressurises the South-Western area of Kuranda and fill a balancing storage Reservoir (500 kL) located at Hilltop Close.

4.4. Disinfection Process Details

4.4.1. Chillagoe

Arsenic occurs in soluble form as Arsenite As (III) under anaerobic conditions, predominantly in ground waters, and in soluble form as Arsenate As (V) under aerobic conditions more commonly in surface waters.

Chlorine is required, firstly, to oxidize arsenite to arsenate, as arsenate is more easily removed by coagulation and filtration than arsenite. In this case, oxidation does not remove arsenic however, prepares it for removal by other processes.

Secondly, chlorine acts as a catalyst for the downstream DMI-65 media filters and is required for regeneration. DMI-65 is periodically backwashed with chlorinated water to re-establish the oxidising environment on the surface of the DMI-65 media.

The sodium hypochlorite dosing system is flow paced dosed based on the Council's installed flow meter. The council has also installed a free chlorine analyser which provides a free chlorine reading to the Treatment plant. If the chlorine level falls below a certain setpoint the Treatment plant will shut down, as it is critical that chlorine is dosed at all times.

Another analyser checks residual levels prior to the distribution point. Where the residual of free chlorine is less than the operations target, the operator is alerted, and thereafter adjusts the chlorination dose.

4.4.1.1. Treated Water Quality

The WTP Operators sample the treated water for the parameters outlined in

Table 8. A summary of the treated water quality data has been included in Appendix D – Record of Testing Parameters.

TABLE 8: SAMPLING PARAMETERS – CHILLAGOE (TREATED WATER)

Parameter	Sampling Location	Laboratory	Frequency
Turbidity	Chillagoe WTP	Online analyser	Continuous
Chlorine (free and total)	Chillagoe WTP Chillagoe Reservoir	Online analyser	Continuous
pH	Chillagoe WTP	Online analyser	Recorded Weekly
Temperature	Chillagoe WTP	Online analyser	Continuous
Chlorine (free)	Chillagoe WTP	Online analyser	Recorded Weekly
E. coli and Total Coliforms	Chillagoe Town Hall	Internal	Monthly
Chlorine (free and total)	Chillagoe Town Hall Chillagoe Tennis Court Chillagoe Reservoir	Internal	Weekly
E. coli and Total Coliforms	Chillagoe Town Hall	External NATA	Biannually
Heterotrophic Plate Count (HPC)	Chillagoe Town Hall	External NATA	Biannually
pH/EC/ALK/TURB	Chillagoe Town Hall	External NATA	Biannually
Chlorine (free and total)	Chillagoe Town Hall	External NATA	Biannually
Ca/Mg/K/Na/Si/Hardness	Chillagoe Town Hall	External NATA	Biannually
Cl/SO4	Chillagoe Town Hall	External NATA	Biannually
OC/OP Pesticides	Chillagoe Town Hall	External NATA	Biannually
Fluoride	Chillagoe Town Hall	External NATA	Biannually
Colour	Chillagoe Town Hall	External NATA	Biannually
Total dissolved solids (TDS)	Chillagoe Town Hall	External NATA	Biannually
ICPMS (24 Metals)	Chillagoe Town Hall	External NATA	Biannually
Mercury (Hg)	Chillagoe Town Hall	External NATA	Biannually
THM's & Chlorates	Chillagoe WTP Chillagoe Town Hall	External NATA	Biannually
PFAS	Chillagoe WTP	External NATA	Every 2 years (2026, 2028, etc.)

4.4.1.2. Reticulation and Storage Infrastructure

Treated water is pumped from the treatment plant 600 m through a dedicated rising main to a 500 kL storage reservoir on a hill elevated 33 m above the township. The reservoir is fully enclosed and vermin-proof. From the reservoir the treated water is gravity reticulated to the township.

Refer to Figure A1 (Appendix A – Schematics) which displays a schematic of the Chillagoe WTP and reticulation system. MSC performs sampling within the reticulation system, as described in

Table 8.

The Chillagoe water reticulation system consists predominantly of PVC (approximately 64%) and asbestos cement (approximately 35.7%). There is a short length (30 m, 0.3%) of NB50 copper pipe connecting the reticulation to the Rodeo Grounds. The approximate ages of each type of pipe are summarised below.

- Asbestos cement (AC) piping: 25+ years;
- PVC piping: 25+ years; and
- Copper piping: 25+ years.

4.4.2. Dimbulah

Disinfection is achieved by filtered water flowing through a SCADA monitored flow meter, onward through a sodium hypochlorite disinfection system, supplied by onsite salt electrolyser units, and thence into a 2 ML clear water reservoir. From the Reservoir, the water is pumped by the Clearwater Pressure Booster Pumps to the mains throughout Dimbulah. Caustic soda (sodium hydroxide) is also dosed on the outlet of the filters for pH and alkalinity correction. From the clear water reservoir, the treated water is pumped into the town water reticulation by the Clearwater Booster Pumps. An inline SCADA monitored chlorine analyser, which monitors free and total chlorine (data is recorded on Council's Historian system), is installed after the pressure pumps.

4.4.2.1. Treated Water Quality

The WTP Operators sample the treated water (Clearwater tank outlet) for the parameters outlined in the table below. A summary of the treated water quality data has been included in Appendix D – Record of Testing Parameters.

TABLE 9: SAMPLING PARAMETERS - DIMBULAH (TREATED WATER)

Parameter	Sampling Location	Laboratory	Frequency
Turbidity	Dimbulah WTP	Online analyser	Continuous
Chlorine (free and total)	Dimbulah WTP	Online analyser	Continuous
pH	Dimbulah WTP	Online analyser	Continuous
Temperature	Dimbulah WTP	Online analyser	Continuous
Turbidity	Dimbulah WTP	Internal	Three times per week
pH	Dimbulah WTP	Internal	Three times per week
Alkalinity	Dimbulah WTP	Internal	Three times per week
Conductivity	Dimbulah WTP	Internal	Three times per week
Temperature	Dimbulah WTP	Internal	Three times per week
Chlorine (free and total)	Dimbulah WTP Dimbulah Hall Dimbulah Pool Park	Internal	Three times per week
E. coli and Total Coliforms	Dimbulah Hall Dimbulah Pool Park	Internal	Weekly
E. coli and Total Coliforms	Dimbulah WTP	External NATA	Biannually
Heterotrophic Plate Count (HPC)	Dimbulah WTP	External NATA	Biannually
pH/EC/ALK/TURB	Dimbulah WTP	External NATA	Biannually
Chlorine (free and total)	Dimbulah WTP	External NATA	Biannually
Ca/Mg/K/Na/Si/Hardness	Dimbulah WTP	External NATA	Biannually
Cl/SO4	Dimbulah WTP	External NATA	Biannually
OC/OP Pesticides	Dimbulah WTP	External NATA	Biannually
Fluoride	Dimbulah WTP	External NATA	Biannually
Colour	Dimbulah WTP	External NATA	Biannually
Total dissolved solids (TDS)	Dimbulah WTP	External NATA	Biannually

Parameter	Sampling Location	Laboratory	Frequency
ICPMS (24 Metals)	Dimbulah WTP	External NATA	Biannually
Mercury (Hg)	Dimbulah WTP	External NATA	Biannually
THM's & Chlorates	Dimbulah WTP Dimbulah Hall	External NATA	Biannually
PFAS	Dimbulah WTP	External NATA	Annually

4.4.2.2. Reticulation and Storage Infrastructure

Treated water is stored in the on-site Clearwater Reservoir (2 ML) and two Grundfos CRX-15 multi-stage pumps deliver the treated water to the reticulation system. The Clearwater pumps act as booster pump systems which turn on when the pressure in the reticulation mains drop below a setpoint level (usually 4.0 bar). This in turn lowers the level in the Clearwater tank and triggers the filter plant to turn off and on. The Clearwater tank is roofed and vermin-proof. MSC does not employ further booster pumping or top-up chlorination within the reticulation system at Dimbulah.

Refer to Figure A2 (Appendix A – Schematics) which displays the layout of the Dimbulah WTP reticulation system. MSC performs sampling within the reticulation system in accordance with Table 9.

The Dimbulah water reticulation system consists of asbestos cement (approximately 60%), PVC (approximately 30%), polythene (approximately 9%) and steel (approximately 1%) piping. The approximate ages of each type of pipe are summarised below.

- Asbestos cement (AC) piping: 25+ years;
- PVC piping: 1-5 years;
- Polythene piping: 1-5 years; and
- Steel piping: 10 years.

4.4.3. Mareeba

The Mareeba WTP disinfects the filtered water with sodium hypochlorite (chlorine) prior to storage in the on-site 5 ML and 15 ML treated water reservoirs. The Mareeba WTP uses two 60 L/h sodium hypochlorite pumps which operate in a duty/standby mode. The sodium hypochlorite pumps start when the low lift (raw water) pumps operate. The chlorine residual is monitored continuously by an online analyser and verified daily (excluding weekends). The dose can be adjusted at the pump head by altering the speed and/or stroke of the pump.

The chlorine dosing system is skid mounted, which consists of a magnetic flow meter, and chlorine analyser. Combined these instruments are capable of automatically adjusting the chlorine dose in response to changes in flow and filter water quality. The output from the chlorine analyser is linked to the SCADA system and will alarm when the chlorine residual is outside the alert or critical limits.

4.4.3.1. Treated Water Quality

Treatment Plant Operators sample the treated water for the parameters outlined in Table 10. A summary of the treated water quality data has been included in Appendix D – Record of Testing Parameters.

TABLE 10: SAMPLING PARAMETERS - MAREEBA WTP (TREATED WATER)

Parameter	Sampling Location	Laboratory	Frequency
Turbidity	High Lift Pump Discharge - Mareeba WTP	Online analyser	Continuous
Chlorine (free and total)	High Lift Pump Discharge - Mareeba WTP Wylandra Reservoir	Online analyser	Continuous
pH	High Lift Pump Discharge - Mareeba WTP	Online analyser	Continuous
Temperature	High Lift Pump Discharge - Mareeba WTP	Online analyser	Continuous
Turbidity	High Lift Pump Discharge - Mareeba WTP	Internal	Daily*
pH	High Lift Pump Discharge - Mareeba WTP	Internal	Daily*
Alkalinity	High Lift Pump Discharge - Mareeba WTP	Internal	Daily*
Conductivity	High Lift Pump Discharge - Mareeba WTP	Internal	Daily*
Temperature	High Lift Pump Discharge - Mareeba WTP	Internal	Daily*
Chlorine (free and total)	High Lift Pump Discharge - Mareeba WTP	Internal	Daily*

Parameter	Sampling Location	Laboratory	Frequency
Dissolved Oxygen	High Lift Pump Discharge - Mareeba WTP	Internal	Daily*
Chlorine (free and total)	Mareeba Airport Mareeba Mary Andrews	Internal	Three times per week
E. coli and Total Coliforms	Mareeba Airport Mareeba Mary Andrews	Internal	Weekly
E. coli and Total Coliforms	High Lift Pump Discharge - Mareeba WTP	External NATA	Biannually
Heterotrophic Plate Count (HPC)	High Lift Pump Discharge - Mareeba WTP	External NATA	Biannually
pH/EC/ALK/TURB	High Lift Pump Discharge - Mareeba WTP	External NATA	Biannually
Chlorine (free and total)	High Lift Pump Discharge - Mareeba WTP	External NATA	Biannually
Ca/Mg/K/Na/Si/Hardness	High Lift Pump Discharge - Mareeba WTP	External NATA	Biannually
Cl/SO4	High Lift Pump Discharge - Mareeba WTP	External NATA	Biannually
OC/OP Pesticides	High Lift Pump Discharge - Mareeba WTP	External NATA	Biannually
Fluoride	High Lift Pump Discharge - Mareeba WTP	External NATA	Biannually
Colour	High Lift Pump Discharge - Mareeba WTP	External NATA	Biannually
Total dissolved solids (TDS)	High Lift Pump Discharge - Mareeba WTP	External NATA	Biannually
ICPMS (24 Metals)	High Lift Pump Discharge - Mareeba WTP	External NATA	Biannually
Mercury (Hg)	High Lift Pump Discharge - Mareeba WTP	External NATA	Biannually
THM's & Chlorates	Mareeba WTP Mareeba Mary Andrews	External NATA	Biannually
PFAS	High Lift Pump Discharge - Mareeba WTP	External NATA	Annually

* Daily excludes weekends

4.4.3.2. Reticulation and Storage Infrastructure

The on-site treated water reservoirs are 5 ML and 15 ML and are roofed and vermin-proof. The Mareeba WTP contains a Booster Pump Station with five pumps, which draw water from the treated water reservoirs and pumps the water directly into the Mareeba water reticulation system.

The Mareeba WTP contains an emergency generator that can operate the plant for 24 hours.

Chlorine pumps at the Wylandra reservoir boost chlorine for the Wylandra Estate. The Wylandra Estate reservoir is roofed and vermin-proof. Refer to the schematic in Figure A3 (Appendix A – Schematics), which displays the layout of the Mareeba WTP distribution system.

MSC performs sampling within the reticulation system, as described in Table 10.

The Mareeba water reticulation system consists of asbestos cement (55%), PVC (20%), ductile iron (15%), and cast iron (10%) piping. The approximate ages of each type of piping are summarised below.

- Asbestos cement (AC) piping: 51 years;
- PVC piping: 10 years;
- Ductile iron piping: < 10 years; and
- Cast iron piping: 30 years.

4.4.4. Kuranda

The Kuranda WTP uses sodium hypochlorite to disinfect the filtered water prior to reticulation and storage. The Kuranda WTP contains two diaphragm-type chlorine pumps, which operate when the raw water pumps are running.

Both chlorine pumps operate at a fixed rate. The chlorine residual is monitored continuously by an online analyser at the outlet of the Clearwater Reservoir, chlorine residual is verified daily (excluding weekends) by the operator who adjusts the dose at each pump head accordingly.

4.4.4.1. Treated Water Quality

Plant Operators sample the treated water for the parameters outlined in Table 11. A summary of the treated water quality data has been included in Appendix D – Record of Testing Parameters.

TABLE 11: SAMPLING PARAMETERS - KURANDA WTP (TREATED WATER)

Parameter	Sampling Location	Laboratory	Frequency
Turbidity	Kuranda WTP	Online analyser	Continuous
Chlorine (free and total)	Kuranda WTP Myola Reservoirs Masons Road Reservoir	Online analyser	Continuous
pH	Kuranda WTP	Online analyser	Continuous
Temperature	Kuranda WTP	Online analyser	Continuous
Turbidity	Kuranda WTP	Internal	Daily*
pH	Kuranda WTP	Internal	Daily*
Alkalinity	Kuranda WTP	Internal	Daily*
Conductivity	Kuranda WTP	Internal	Daily*
Temperature	Kuranda WTP	Internal	Daily*
Chlorine (free and total)	Kuranda WTP	Internal	Daily*
Dissolved Oxygen	Kuranda WTP	Internal	Daily*
Chlorine (free and total)	Kuranda Gregory Terrace Kuranda Masons Road	Internal	Three times per week
E. coli and Total Coliforms	Kuranda Gregory Terrace Kuranda Masons Road	Internal	Weekly
E. coli and Total Coliforms	Kuranda WTP	External NATA	Biannually
Heterotrophic Plate Count (HPC)	Kuranda WTP	External NATA	Biannually
pH/EC/ALK/TURB	Kuranda WTP	External NATA	Biannually
Chlorine (free and total)	Kuranda WTP	External NATA	Biannually
Ca/Mg/K/Na/Si/Hardness	Kuranda WTP	External NATA	Biannually
Cl/SO4	Kuranda WTP	External NATA	Biannually
OC/OP Pesticides	Kuranda WTP	External NATA	Biannually
Fluoride	Kuranda WTP	External NATA	Biannually
Colour	Kuranda WTP	External NATA	Biannually
Total dissolved solids (TDS)	Kuranda WTP	External NATA	Biannually
ICPMS (24 Metals)	Kuranda WTP	External NATA	Biannually
Mercury (Hg)	Kuranda WTP	External NATA	Biannually
THM's & Chlorates	Kuranda WTP Kuranda Gregory Terrace	External NATA	Biannually
PFAS	Kuranda WTP	External NATA	Annually

* Daily excludes weekends

4.4.4.2. Reticulation and Storage Infrastructure

From the Clearwater trough, the treated water flows down a hill and into an on-site 500 kL Clearwater tank. The outlet of the Clearwater Reservoir has a pH analyser, chlorine analyser, and a turbidity analyser installed.

A flow meter records the amount of water pumped from the Clearwater Reservoir by the high lift pumps. The two high lift pumps transfer the treated water from the Clearwater tank to the Myola Road Reservoirs (2 x 1ML). The High Lift (Clearwater) pumps start and stop automatically when called to do so, depending on the level in the Myola Reservoirs. Pumps at the Myola Road Reservoirs transfer treated water to the Masons Road Reservoirs (636 kL & 500 kL) or the Warril Drive Reservoir (500 kL), as needed. All reservoirs are roofed and vermin-proof.

The Kuranda reticulation system does not utilise booster pumping, nor does it employ top-up chlorination within the system. Refer to Figure A4 (Appendix A – Schematics) for the layout of the Kuranda WTP distribution system.

MSC performs sampling within the reticulation system, as described in Table 11.

The Kuranda water reticulation system consists of asbestos cement (approximately 30%), PVC (approximately 30%), and ductile iron (approximately 10%) piping. The make-up of the remaining 30% of the reticulation system is unknown. The approximate ages of each type of piping are summarised below.

- Asbestos cement (AC) piping: 20+ years;
- PVC piping: 1-5 years; and

- Ductile iron piping: 1-5 years.

The Kuranda reticulation system does not normally experience long-detention times. The Operator samples for free chlorine in the reticulation at the Masons Road Pump Station and at Gregory Terrace Park, which represent the two furthest points in the reticulation system from the plant.

Because Kuranda's reservoirs are located in high areas, the town does not experience low water pressures and meeting firefighting pressures has not been an issue to-date.

4.5. Distribution and Reticulation Systems (including reservoirs and pump stations)

The following tables are an extraction from MSC GIS system. The abbreviations used to identify components of pipe material (used throughout each of the Towns reticulated water main networks) are as follows:

- AC: Asbestos Cement
- BB: Blue Brute
- CI: Cast Iron
- CICL: Cast Iron Cement Line
- CU: Copper
- DICL: Ductile Iron Cement Lined
- GI: Galvanised Iron
- PE: Polyethylene
- PVC: Polyvinylchloride
- MDPE: Medium Density Polyethylene

TABLE 12: DISTRIBUTION AND RETICULATION SYSTEM - CHILLAGOE

Scheme: Chillagoe

Distribution and Reticulation System	Pipe Material	Copper
	Approx. % of total length	0.31%
	Pipe Material	AC
	Approx. % of total length	39.04%
	Pipe Material	PVC
	Approx. % of total length	60.64%
Reservoirs	Name	Clearwater Tank
	Capacity	500 kL
	Roofed	Y
	Vermin Proof	Y
	Construction material	Concrete
	Alarms	Reservoir level, Low Chlorine

TABLE 13: DISTRIBUTION AND RETICULATION SYSTEM - DIMBULAH

Scheme: Dimbulah

Distribution and Reticulation System	Pipe Material	AC
	Approx. % of total length	83.05%
	Pipe Material	DICL
	Approx. % of total length	0.12%
	Pipe Material	PE
	Approx. % of total length	3.78%
	Pipe Material	PVC
	Approx. % of total length	12.64%
	Pipe Material	Steel
	Approx. % of total length	0.40%
Reservoirs	Name	Clearwater Tank
	Capacity	2 ML
	Roofed	Y
	Vermin Proof	Y
	Construction material	Concrete
	Alarms	Reservoir level, Chlorine

TABLE 14: DISTRIBUTION AND RETICULATION SYSTEM - MAREEBA

Scheme: Mareeba

Distribution and Reticulation System	Pipe Material	AC
	Approx. % of total length	35.84%
	Pipe Material	CI
	Approx. % of total length	5.91%
	Pipe Material	CICL
	Approx. % of total length	0.08%
	Pipe Material	CU
	Approx. % of total length	0.003%
	Pipe Material	DICL
	Approx. % of total length	0.84%
	Pipe Material	PE
	Approx. % of total length	3.49%
	Pipe Material	PVC
	Approx. % of total length	53.83%
Reservoirs	Name	Wylandra Estate
	Capacity	240 kL
	Roofed	Y
	Vermin Proof	Y
	Construction material	Steel
	Alarms	Reservoir levels, Chlorine

TABLE 15: DISTRIBUTION AND RETICULATION SYSTEM - KURANDA

Scheme: Kuranda

Distribution and Reticulation System	Pipe Material	Unidentified Pipe Type
	Approx. % of total length	13.01%
	Pipe Material	AC
	Approx. % of total length	37.32%
	Pipe Material	BB
	Approx. % of total length	0.11%
	Pipe Material	CI
	Approx. % of total length	0.56%
	Pipe Material	CICL
	Approx. % of total length	0.23%
	Pipe Material	CU
	Approx. % of total length	0.65%
	Pipe Material	DICL
	Approx. % of total length	2.24%
	Pipe Material	PE
	Approx. % of total length	0.53%
	Pipe Material	PVC
	Approx. % of total length	58.36%
Reservoirs	Name	Myola Rd (2)
	Capacity	922.5 kL (each)
	Roofed	Y
	Vermin Proof	Y
	Construction material	Concrete
	Alarms	Reservoir levels, Chlorine
	Name	Masons Rd (2)
	Capacity	636 kL & 500 kL
	Roofed	Y
	Vermin Proof	Y
	Construction material	Concrete
	Alarms	Reservoir levels, Chlorine
	Name	Warril Dr
	Capacity	500 kL
	Roofed	Y
	Vermin Proof	Y
	Construction material	Glass Fused to Steel
	Alarms	Reservoir levels, Chlorine

5. Identify Hazards and Hazardous Events

The Australian Drinking Water Guidelines 2011 explain that prevention and multiple barriers are essential features of effective drinking water quality management. Preventative measures are actions, activities and processes that prevent hazards from occurring or reduce their likelihood/consequence to acceptable levels.

The outcomes from the drinking water quality risk assessment workshops include a risk management strategy. As MSC advances, the maturity of the DWQMP critical control points for specific risks can be identified.

5.1. Water Quality Information and Complaints

MSC use TechnologyOne Enterprise Content Management (ECM) to capture, store, use and manage information relating to all aspects of Council business.

One of the uses of ECM is capturing customer complaint data in the customer request management (CRM) software. Customer complaints and other water quality data is entered into the Statewide Water Information Management (SWIM) system to assist better reporting, exceedance notifications and trending of data.

Currently, customer complaints are separated into quality complaints (colour, odour, taste, aeration) and service complaints (pressure, no water). This process is constantly being improved and expanded and used to track potential problem areas. The data suggests that service complaints are the main cause of customer complaints, mostly related to no water or low pressure.

TABLE 16: SUMMARY OF CUSTOMER COMPLAINTS

Financial Year	Chillagoe		Dimbulah		Mareeba		Kuranda	
	Quality	Service	Quality	Service	Quality	Service	Quality	Service
2019	0	0	0	3	11	12	5	5
2020	0	0	0	1	10	51	6	15
2021	1	3	0	2	9	60	3	12
2022	1	3	0	2	9	60	3	12
2023	0	5	0	7	4	93	0	19
2024	0	1	0	0	2	17	0	1
2025	0	1	0	0	19	22	0	0

5.1.1. Catchment Characterisation

A suitably qualified and experienced external contractor was engaged to assess each scheme, adapting methodology contained within the *Health Based Targets for Drinking Water Safety,* published by Water Services Association of Australia (WSAA).

The health-based targets (HBTs) is a methodology for quantifying microbial risk within a drinking water supply system. The HBTs process uses the concept of DALYs (disability adjusted life years) to quantify microbial risk to the community, where a DALY represents one year of lost healthy life, and considers the severity of disease, duration of and likelihood of illness. The goal of the HBTs process is to provide community protection against water-borne pathogens to a level of 1 µDALY.

The process is broken into four phases and considers risks in source water and the ability of the treatment system to reduce the pathogen load and identify improvements to the system to close shortfalls.

A sanitary survey informed a vulnerability assessment where each scheme was categorised into one of four categories:

- Category 1: Protected catchment
- Category 2: Moderately protected catchment
- Category 3: Poorly protected catchment
- Category 4: Unprotected catchment

A microbial indicator assessment is used to confirm the vulnerability assessment. By ensuring that raw water E. coli levels support the vulnerability assessment, greater confidence in the assessment can be achieved.

Source categories are assigned as per Table 17

TABLE 17: SOURCE WATER CATEGORISATION

	Microbial indicator concentration category Maximum E. coli per 100 mL			
Vulnerability assessment category	≤ 20 Category 1	> 20, ≤ 2,000 Category 2 & 3	> 2,000 ≤ 20,000 Category 4	> 20,000 Not suitable for drinking
1	Source = Cat 1	Source = Cat 2	Anomalous	Not suitable
2	Source = Cat 2	Source = Cat 2	Anomalous	Not suitable
3	Anomalous	Source = Cat 3	Source = Cat 4	Not suitable
4	Anomalous	Source = Cat 4	Source = Cat 4	Not suitable

With a source category assigned, the log reduction requirements for the plant can be determined in accordance with Table 18. The log reduction value (LRV) requirements are selected to provide 1 µDALY protection for the scheme based on pathogen challenge.

TABLE 18: LOG REDUCTION REQUIREMENTS AND TYPICAL TREATMENT

Category	Minimum LRV (Bacteria)	Minimum LRV (Bacteria)	Minimum LRV (Bacteria)	Typical Treatment Train
1	4.0	0.0	0.0	Chlorination
2	5.0	3.0	2.5	Direct filtration Chlorination
3	5.0	4.0	3.5	Conventional treatment Chlorination
4	6.0	6.0	5.5	Conventional treatment UV disinfection Chlorination

The results of the assessment are detailed by scheme in subsequent sections of this DWQMP.

5.1.1.1. Chillagoe

An overview of the HBT assessment for the Chillagoe scheme is shown in Table 19

TABLE 19: ASSESSMENT SNAPSHOT FOR CHILLAGOE

Source water category identified from sanitary survey	Category 1		
Confirmed with E. coli data	Yes	16 data points for Bore 4 are available. Data has been collected since June 2022, however data has only been collected consistently on a monthly basis since June 2023.	
Typical treatment to achieve LRV for Category 1	-	Chlorination	
Treatment train available at Chillagoe WTP	Direct filtration Secondary filtration	Chlorination	
Assessment	Treatment train appropriate		
LRV requirements as per HBT Manual	Bacteria: 4.0	Virus: 0.0	Protozoa: 0.0
LRV claim assessment form plant data	Bacteria: 4.0	Virus: 4.0	Protozoa: 0.0
Assessment	Appropriate Protection		

A new bore has been installed since the initial vulnerability assessment in 2018. It is assumed that the categorisation of the previously constructed bores applies to bore 4. It is identified in the risk management improvement program (RMIP) to include bore 4 in the vulnerability assessment, this will incorporate the recommendations made by the initial assessment to better support the categorisation. One recommendation is to confirm that surface water does not infiltrate. A turbidity analyser has been installed to analyse raw water quality, however at the time of updating this plan insufficient data (< 12 months) is available to make an assessment.

The vulnerability of the catchment is summarised in Table 20

TABLE 20: SUMMARY OF VULNERABILITY ASSESSMENT FOR CHILLAGOE

Item	Comments
Assessed vulnerability category	*Category 1 – Protected Catchment*
Hydrogeology	Recharge areas are not local to the scheme. Strata is homogenous, with groundwater significantly below surface. Low risk of surface water infiltration.
Bore Characteristics	Wellheads are sealed, with the bore screens and pumps located remote to the surface. Bores are fenced. Low risk of surface water infiltration.
Pathogen Source Challenge	Major pathogen risk source from the unsewered town adjacent to the bores. Stock is of low density only. Stock is of low density only

Monitoring of raw water from bore 4 for E. coli commenced in June 2022 for the scheme, however consistent monthly sampling is available only from June 2023. The data set shows no presence of E. coli, which is the expected result where surface water does not influence the groundwater supply.

5.1.1.2. Dimbulah

An overview of the HBT assessment for the Dimbulah scheme is shown in Table 21

TABLE 21: ASSESSMENT SNAPSHOT FOR DIMBULAH

Source water category identified from sanitary survey	Category 2		
Confirmed with E. coli data	Yes	270 data points are available. Data has been collected on a weekly basis since June 2018.	
Typical treatment to achieve LRV for Category 2	Direct filtration	Chlorination	
Treatment train available at Dimbulah WTP	Direct filtration	Chlorination	
Assessment	Treatment train appropriate		
LRV requirements as per HBT Manual	Bacteria: 5.0	Virus: 3.0	Protozoa: 2.5
LRV claim assessment form plant data	Bacteria: 5.0	Virus: 5.0	Protozoa: 2.5
Assessment	Appropriate Protection		

The vulnerability of the catchment is summarised in Table 22.

TABLE 22: SUMMARY OF VULNERABILITY ASSESSMENT FOR DIMBULAH

Item	Comments
Assessed vulnerability category	*Category 2 – Moderately Protected Catchment*
Supply source	Large reservoir and long irrigation channel provide extended detention periods and some protection against the transport of viable pathogens into the supply.
Permanent Human Source Challenge	Some small communities and a number of rural areas are located in the inner catchment of the dam. These communities are unsewered. Larger communities more distant to the dam drain directly into the Barron River. No STPs discharge into the dam's catchment.
Itinerant Human Source Challenge	Recreation in the inner catchment and the water body are permitted.
Stock Animal Source Challenge	Low-intensity pastoral lands are located within the dam catchment; however, the catchment is predominantly forested or plant-based agriculture. There is some pastoral and dairy challenge in the inner catchment of the dam, however long detention periods provide a storage barrier, decreasing the likelihood of viable pathogens entering the supply for the plant. Stock is generally fenced to prevent direct access to the dam or irrigation channel.
Catchment Protection	Limited active protection and fencing of the inner catchment at Tinaroo Dam, although the irrigation channel is fully fenced.

Monitoring of raw water for E. coli commenced in June 2018 for the scheme. Of the 285 data points seven are reported as > 200.5 MPN/100 mL. Testing methodology at the time could enumerate only to this limit. In May 2023 new methodology was introduced to allow enumeration up to 2419.6 MPN/100 mL. Since Feburary

2025the maximum E. coli result was 133.4 MPN/100 mL and for the past two years one data point was reported as > 200.5 MPN/100 mL.

5.1.1.3. Mareeba

An overview of the HBT assessment for the Mareeba scheme is shown in Table 23

TABLE 23: ASSESSMENT SNAPSHOT FOR MAREEBA

Source water category identified from sanitary survey	Category 3		
Confirmed with E. coli data	Yes	275 data points are available. Data has been collected on a weekly basis since June 2018.	
Typical treatment to achieve LRV for Category 3	Conventional treatment	Chlorination	
Treatment train available at Mareeba WTP	Conventional treatment	Chlorination	
Assessment	Treatment train appropriate		
LRV requirements as per HBT Manual	Bacteria: 5.0	Virus: 4.0	Protozoa: 3.5
LRV claim assessment form plant data	Bacteria: 6.0	Virus: 6.0	Protozoa: 4.0
Assessment	Appropriate Protection		

The vulnerability of the catchment is summarised in Table 24.

TABLE 24: SUMMARY OF VULNERABILITY ASSESSMENT FOR MAREEBA

Item	Comments
Assessed vulnerability category	*Category 3 – Poorly Protected Catchment*
Supply source	Large reservoir provides extended detention periods and some protection against the transport of viable pathogens into the supply, although most risk sources drain directly into Barron River.
Permanent Human Source Challenge	A number of medium and low-density communities and medium-density rural areas are located in the inner catchment of the river. A number of these communities are unsewered. Larger communities more distant to the dam drain directly into the Barron River. No STPs discharge into the catchment.
Itinerant Human Source Challenge	Recreation in the inner catchment and the water body are permitted.
Stock Animal Source Challenge	Low-intensity pastoral lands are located within the catchment; however, the catchment is predominantly forested or plant-based agriculture. There is some pastoral and dairy challenge in the inner catchment of the dam, however long detention periods provide a storage barrier, decreasing the likelihood of viable pathogens entering the supply for the plant. Stock is generally fenced to prevent direct access to water bodies.
Catchment Protection	Protection of the catchment enforced by planning regimes only.

Monitoring of raw water for E. coli commenced in June 2018 for the scheme. Of the 391 data points 35 are reported as > 200.5 MPN/100 mL. Testing methodology at the time could enumerate only to this limit. In May 2023 new methodology was introduced to allow enumeration up to 2419.6 MPN/100 mL. Since May 2023 the maximum E. coli result was 146.7 MPN/100 mL and for the past two years nine data points were reported as > 200.5 MPN/100 mL. More microbial data is required to confirm the assessment, this is documented in the RMIP.

5.1.1.4. Kuranda

An overview of the HBT assessment for the Kuranda scheme is shown in Table 25

TABLE 25: ASSESSMENT SNAPSHOT FOR KURANDA

Source water category identified from sanitary survey	Category 3	
Confirmed with E. coli data	Yes	282 data points are available. Data has been collected on a weekly basis since June 2018.
Typical treatment to achieve LRV for Category 3	Conventional treatment	Chlorination
Treatment train available at Mareeba WTP	Conventional treatment	Chlorination
Assessment	Treatment train appropriate	

LRV requirements as per HBT Manual	Bacteria: 5.0	Virus: 4.0	Protozoa: 3.5
LRV claim assessment form plant data	Bacteria: 6.0	Virus: 6.0	Protozoa: 3.5
Assessment	Appropriate Protection		

The vulnerability of the catchment is summarised in Table 26.

TABLE 26: SUMMARY OF VULNERABILITY ASSESSMENT FOR KURANDA

Item	Comments
Assessed vulnerability category	*Category 3 – Poorly Protected Catchment*
Supply source	Large reservoir provides extended detention periods and some protection against the transport of viable pathogens into the supply, although most risk sources drain directly into Barron River.
Permanent Human Source Challenge	A number of medium and low-density communities and medium-density rural areas are located in the inner catchment of the river. While larger communities are mostly sewered, most small communities are unsewered. Larger communities more distant to the dam drain directly into the Barron River. No STPs discharge into the catchment.
Itinerant Human Source Challenge	Recreation in the inner catchment and the water body are permitted.
Stock Animal Source Challenge	Low-intensity pastoral lands are located within the catchment; however, the catchment is predominantly forested or plant-based agriculture. There is some pastoral and dairy challenge in the inner catchment of the dam, however long detention periods provide a storage barrier, decreasing the likelihood of viable pathogens entering the supply for the plant. Stock is generally fenced to prevent direct access to water bodies.
Catchment Protection	Protection of the catchment enforced by planning regimes only.

Monitoring of raw water for E. coli commenced in June 2018 for the scheme. Of the 391 data points 36 are reported as > 200.5 MPN/100 mL and two are reported as > 2,000 MPN/100 mL. Testing methodology at the time could enumerate only to this limit. In May 2023 new methodology was introduced to allow enumeration up to 2419.6 MPN/100 mL. Since May 2023 the maximum E.coli result was > 2,419.6 MPN/100 mL and for the past two years 13 data points were reported as > 200.5 MPN/100 mL, one reported as 2419.6 MPN/100 mL and one reported as > 2,419.6 MPN/100 mL. All other results are < 2,000 MPN/100 mL. More microbial data is required to confirm the assessment.

5.2. Hazard Identification

A Risk Assessment Workshop was held in Mareeba on 19 September 2014 and has been regularly reviewed over the intervening years. Internal risk assessment workshops are conducted every two years to align with the scheduled review of the approved DWQMP. The workshops involve all personnel responsible for implementing and maintaining the DWQMP. The outcome of the workshop and reviews have been assembled in the Risk Assessment Matrix in Appendix B – Risk Assessments.

Hazards recognised and assessed are those associated with the:

- source water,
- processes,
- plant,
- storage and reticulation systems,
- system-wide hazards, and
- SCADA-related hazard items

5.2.1. Stakeholder Listing of Involvement in Hazard Identification

TABLE 27: STAKEHOLDERS INVOLVED IN HAZARD IDENTIFICATION

Role/Position	Experience	Reason for Inclusion
Director Infrastructure Services	15 years	Overall understanding of the W&W business
Manager Water & Waste	32 years	Overall understanding of the W&W business
Water & Waste Engineer	27 years	W&W Engineering
Supervisor Water Reticulation	23 years	Detailed reticulation operations knowledge
Supervisor Water & Waste Treatment	28 years	Detailed treatment plant operational knowledge
Water & Waste Reticulation Operators	3-28 years	Detailed reticulation operational knowledge
Water & Waste Treatment Plant Operators	3-28 years	Detailed treatment plant operational knowledge

6. Assessment of Risks

Residual risks rated 'moderate' or above were assigned an improvement measure, unless managed as, or subsequently managed as, a critical control point (CCP). The mitigated risks with the proposed improvement measures are summarised and presented in the table that forms part of the Risk Assessment (Appendix C – Risk Management Improvement Program (RMIP)).

6.1. Risk Assessment Methodology

The risk assessment was carried out using a methodology similar to the method outlined in the Australian Drinking Water Guidelines. In order to quantify the risk associated with each identified hazard, the workshop team agreed upon the matrix and descriptors in Figure 7.

		Consequence				
		Insignificant	Minor	Moderate	Major	Catastrophic
Likelihood	Likelihood Descriptor	1	2	3	4	5
E	Almost Certain	Moderate	High	Very High	Very High	Very High
D	Likely	Moderate	High	High	Very High	Very High
C	Possible	Low	Moderate	High	Very High	Very High
B	Unlikely	Low	Low	Moderate	High	Very High
A	Rare	Low	Low	Moderate	High	High

Likelihood	Descriptor	Definition
A	Rare	Occurs less than once every 5 years
B	Unlikely	Occurs more often than once every 5 years and up to once per year
C	Possible	Occurs more often than once per year and up to once a month
D	Likely	Occurs more often than once per month and up to once per week
E	Almost Certain	Occurs more often than once per week

Consequence	Descriptor	Definition
1	Insignificant	Little or no disruption to normal operation
2	Minor	Minor impact for a small percentage of the population, manageable operational disruption
3	Moderate	Minor impact for a large percentage of the population. Significant disruption in normal operation but manageable
4	Major	Major impact for a small percentage of the population, systems significantly compromised
5	Catastrophic	Major impact for a large percentage of the population, complete failure of systems

FIGURE 7: RISK MATRIX AND DESCRIPTORS

For each hazard identified, the unmitigated likelihood and consequence was determined through group discussion. The unmitigated risk considers the risk associated with the hazard assuming that there are no safeguards in place to prevent or mitigate it. Once the likelihood and consequence are agreed upon, the team used the Risk Matrix to determine the unmitigated risk for that hazard. Note that all risks which have been assigned a 'moderate' or higher were examined further in the risk assessment.

For the unmitigated risks which were deemed 'moderate' or higher, the Team discussed what safeguards, control measures, and barriers are currently in place at the Mareeba WTP in order to mitigate the risk. From this discussion, a residual likelihood and consequence was agreed upon which considered the existing control measures. Again, based on the Risk Matrix, the mitigated risk was assigned a descriptor and those which were determined to be 'moderate' or higher were further discussed.

The certainty of the Team's confidence in the mitigated risk descriptor (likelihood/consequence) was assigned using the certainty descriptors described in Table 28.

TABLE 28: CERTAINTY DESCRIPTORS

Level of uncertainty	Descriptor	Definition
1	Certain	There is 5 years of continuous monitoring data, which has been trended and assessed, with at least daily monitoring. The process involved is thoroughly understood.
2	Confident	There is 5 years of continuous monitoring data, which has been collated and assessed, with at least weekly monitoring or for the duration of seasonal events. There is a good understanding of the processes involved.
3	Reliable	There is at least a year of continuous monitoring of data available, which has been assessed, with at least monthly monitoring. There is a good understanding of the processes involved.
4	Estimate	There is limited monitoring data available and there is a reasonable understanding of the processes involved.
5	Uncertain	There is limited or no monitoring data available and the processes are not well understood.

7. Managing Risks

7.1. Risk Management Measures

Within the preventative risk management strategy, CCPs have been identified to confirm that the Risk Treatment measures are effective and maintain risk at an acceptable level.

7.2. Operation and Maintenance Procedures

Standard Operating Procedures (SOPs) were created for each treatment plant, E. coli sampling and Chlorine monitoring. The SOP's were initially developed by consultants in collaboration with operations and maintenance staff and have been continuously modified by staff since. All SOPs have been included in toolbox talks to ensure all staff are aware of these documents and are aware of any changes that have been made.

MSC Water and Waste will review all SOPs on a 12 monthly basis.

All of the SOPs associated with the operation, maintenance and management of Council's drinking water schemes are held in ECM. A listing of the title and document number is provided below in Table 29.

TABLE 29: OPERATIONAL SOPS

ECM Doc. No.	SOP short description
3646778	Water Treatment Plant Standard Operating Procedures for Chillagoe
3646779	Water Treatment Plant Standard Operating Procedures for Dimbulah
4613563	Water Treatment Plant Standard Operating Procedures for Mareeba
3209697	Water Treatment Plant Standard Operating Procedures for Kuranda
3237615	E. coli Sampling, Collection, Transportation, Data Entry and Analysis
3350122	Chlorination Management Procedures for Drinking Water
4402808	Dimbulah Water Scheme Channel Shut Down Procedure

7.3. Management of Incidents and Emergencies

TABLE 30: MANAGEMENT OF INCIDENTS AND EMERGENCIES

Alert level	Description of incident(s)[8]	Key management response(s)	Summary of actions	Responsible position(s)	Documented plans and procedures
1	Exceedance of operational limits, for example: • Free chlorine after disinfection. • Turbidity after filtration. • Any other incident that can be managed by the water service provider.	• Ensure all operational steps are identified in the DWQMP are functioning effectively. • Check and act upon operations and maintenance records and procedures. • Incident response and reporting protocols on standby.	• Notify Water and Waste (WW) Treatment Supervisor, and if a reticulation issue has been identified the WW Reticulation Supervisor. • Review operations and maintenance records for anomalies. • Commence investigation to determine cause, if not identifiable through operational records. • Instigate immediate remediation actions. • Ensure all control measures identified in the DWQM Plan are functioning effectively. • Increase operational monitoring frequency where required. • Ensure incident response and reporting protocols are on standby if the need arises.	• The WW Supervisor Treatment will be responsible for treatment issues. • WW Reticulation Supervisor will be responsible for reticulation issues. • The Manager WW and Quality & Compliance Officer WW are to be notified as soon as is practicable.	• Operations and maintenance procedures & SOPs. • DWQM Plan.
2	• Water quality criteria non-compliance (i.e., exceedance of the Australian Drinking Water Guidelines (ADWG) health guideline values, positive E. coli). • Presence of parameters with no water quality criteria. • An event (anything that has happened or is likely to happen, in relation to a drinking water service, which is beyond the ability of Council to control and may have an adverse effect on public health) such as: – the inability to operate system within acceptable operational limits, – contamination of source water, – contamination of treated water, – physical security incident (e.g., break in at WTP), – cyber security incident (e.g., 'hacking into SCADA network). *Refer to footnote[9]*	• Activate drinking water incident response and reporting protocols. • Ensure all control measures identified in the DWQM Plan are functioning effectively. • Local disaster management group (LDMG) on standby. Refer to the MSC Public Health & Environment Local disaster management sub plan. • The Council intranet and electronic file transfer system is password protected and has security protocols in place should the system be breached. • The SCADA network is operated by both the intranet/internet system and via Radio Transmission Units which communicate with the server. Should this be breached alarms will be sent to key personnel.	• Notify Manager WW and Quality & Compliance Officer WW. • Report incident to Water Supply Regulation (WSR) within the required timeframe, unless there is a reasonable excuse: 1300 596 709 Reporting drinking water incidents |Business Queensland • Ensure all control measures identified in the DWQM Plan are functioning effectively. • Commence investigation in accordance with WSR incident notification reporting form • Arrange for re-samples to be taken where required • Instigate immediate remediation actions, including isolation of affected area where possible • Review associated laboratory reports and operational records. • In case of customer complaints, coordinate investigation and resolution, including obtaining water samples where required • Ensure LDMG is on standby if the need arises. • Where necessary, ensure the community is effectively informed through appropriate channels, including social media, local radio, local newspapers and road signage. Vulnerable residents will be contacted via phone call. If required, targeted letter drops, and door knocking can be coordinated. Report cyber security incidents to Queensland Government Information Security Virtual Response Team (QGISVRT), 07 3215 3951, qgisvrt@qld.gov.au • Incidents and emergencies are debriefed through structured post-incident reviews involving all relevant stakeholders, and the findings are used to amend existing protocols to strengthen planning, improve response procedures, and enhance preparedness for future events.	• The Manager WW and is to be notified immediately. • If the Manager WW cannot be reached the Director Infrastructure Services (DIS) is to be contacted. • Notify the Quality & Compliance Officer WW to support coordination of the response.	• Incident response and reporting protocols. • MSC DWQM Plan. • Water sampling and testing SOPs. • Customer Service Standards.

[8] An incident is an issue which affects the quality (generally exceeds the Health Guideline Values as described in the ADWG) and/or delivery of drinking water to the consumer and does not include aesthetic guideline values as stated in the ADWG.
[9] Incident likely to be managed within the team responsible for drinking water operations and management in line with the DWQMP. However, in some cases it may require coordination across the provider departments (Council) and external resources and support, such as from Water Supply Regulation and Queensland Health. Customer complaints may occur.

Alert level	Description of incident(s)[8]	Key management response(s)	Summary of actions	Responsible position(s)	Documented plans and procedures
3	• Outbreak of waterborne disease • Government declared disaster or emergency. • Natural disaster (earthquake, flood, drought, bushfire, storm, cyclone, etc.). *Refer to footnote[10]*	Refer to MSC Local disaster management plan (LDMP).	• Notify CEO, DIS, Manager WW and Quality & Compliance Officer WW. • Coordinate notification, investigation and response of water related aspects (including community notifications) • Notify WSR within the required timeframe unless there is a reasonable excuse: 1300 596 709. • Ensure the community is effectively informed through appropriate channels, including social media, local radio, local newspapers and road signage. Vulnerable residents will be contacted via phone call. If required, targeted letter drops, and door knocking can be coordinated. • Incidents and emergencies are debriefed through structured post-incident reviews involving all relevant stakeholders, and the findings are used to amend existing protocols to strengthen planning, improve response procedures, and enhance preparedness for future events.	The following people are to be notified immediately: • Manager WW, • Director Infrastructure Services, and • CEO	• LDMP and sub plan • Communications protocols. • Alert templates i.e., boil water, do not drink notices (these are held by LDMG)

[10] Requires coordination across Council departments and is likely to require external resourcing and support from agencies, such as Water Supply Regulation, Queensland Health, local disaster management groups, emergency responders QFRS, Police, etc. Customers are likely to be adversely affected.

The Local Disaster Management Plan (LDMP) discusses the following disasters/emergencies:

- Storms, cyclones, and flooding;
- Epidemics and pandemics;
- Emergency animal disease;
- Bushfire;
- Earthquakes; and
- Major infrastructure failure.

A copy of the plan is kept current and made available through the MSCs website[11].

Storms and cyclones are the most likely form of disaster in the area, and so, MSC has developed a Cyclone Preparedness Check Sheet (ECM Doc. No. 3221213) which is used at the Water Treatment Plants to prepare for disasters.

7.3.1. Security of Water Supply

7.3.1.1. Responsibility

It is the responsibility of all MSC staff and contractors to practice safe work and security practices whilst working for or on behalf of the Council and to follow all protocols.

7.3.1.2. Physical Security

The water treatment plants, reservoirs and pumps stations are fenced and/or locked when not manned. Access to the Mareeba WTP is possible from the river side of the plant, this is captured in the RMIP (Appendix C – Risk Management Improvement Program (RMIP)).

7.3.1.3. Cyber Security

MSCs intranet is password protected with the latest security protocols and is constantly being revised. The physical SCADA infrastructure is being upgraded and will have the latest security protocols in place. These requirements have been addressed in the Risk Assessment and Risk Management Improvement Program (Appendix C – Risk Management Improvement Program (RMIP)).

7.3.2. Relationship Between SunWater and Mareeba Shire Council

MSC is situated within the SunWater owned and operated Mareeba-Dimbulah Water Supply Scheme (MDWSS). The MDWSS comprises of Tinaroo Dam, concrete and earth lined delivery channels, and designated reaches of the natural water drainage system (which includes the Barron River from Tinaroo Dam to the weir in Kuranda). Town water is sourced for Dimbulah, Mareeba and Kuranda from the MDWSS. SunWater notifies MSC well in advance to plan for WTP downtime prior to any shutdown or maintenance within the MDWSS.

SunWater developed procedures[12] associated with the supply, delivery and water usage in coordination with the Irrigator Advisory Committee (composed of customers and customer appointed nominees).

In summary:

- The SunWater contact person is the Operations Manager.
- SunWater, as the bulk water supplier, manages the Tinaroo Dam and delivery system.
- SunWater together with the Irrigation Advisory Committee developed rules associated with the delivery and usage of irrigation water.
- SunWater is a key stakeholder, as the bulk water supplier, and notifies MSC in the event of any water quality changes (such as Blue-Green algae events) and dam turnovers and notifies MSC of upcoming maintenance activities which may impact the water supply.

[11] Emergencies and Disasters - Mareeba Shire Council (msc.qld.gov.au)
[12] Water Supply Arrangements and Service Targets, Mareeba Dimbulah Water Supply Scheme: https://www.sunwater.com.au/customer/managing- your-account/scheme-rules-and-targets/

- Prior to any shutdown or maintenance on the Mareeba-Dimbulah irrigation channel SunWater notifies MSC well in advance to plan for WTP downtime.

Tinaroo Dam over the past six years has been a relatively reliable and stable water supply as Figure 8 shows.

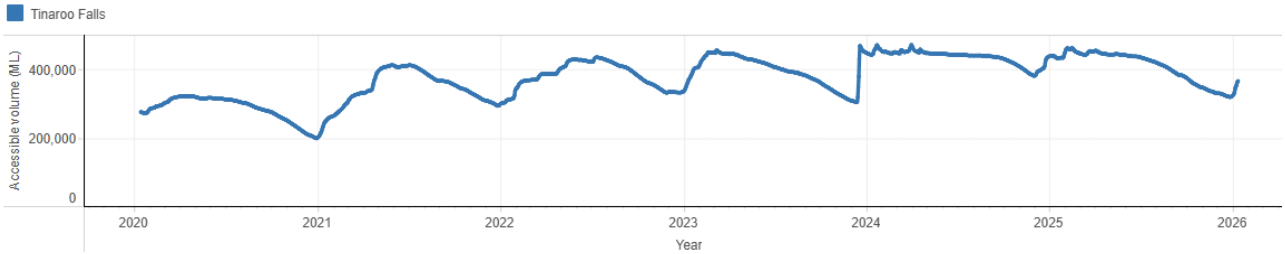

FIGURE 8: TINAROO DAM LEVELS, 2017-2022 (SOURCE: BOM[13])

7.4. Risk Management Improvement Program (RMIP)

MSC Water and Waste endeavour to work to these timelines wherever possible but there will be instances where projects are deferred due to finance and possible unforeseen priority and emergency projects needing funds instead. RMIP can be viewed in Appendix C – Risk Management Improvement Program (RMIP).

8. Operational and Verification Monitoring Programs

Monitoring is carried out by online instrumentation utilising the SCADA system, analysis by MSC operators in the field or at the MSC laboratory, and externally by CRC water and waste laboratory.

The CRC Laboratory are accredited by NATA (accreditation number 14206). Procedures for sampling, transporting (to both the MSC laboratory and CRC laboratory), recording results for both E. Coli and free chlorine data (collected by the MSC W&W Operators), are documented in ECM as SOPs.

The laboratory results are received by the Manager, Supervisors, Operators, and the Quality and Compliance Officer who review them.

Once made available the NATA laboratory results are imported by CRC directly in MSC SWIM local database. The laboratory reports any exceedances against water quality criteria in accordance with s 52 of the *Public Health Regulation 2018* (Qld) (PH Reg) and SWIM is set up with validation rules to highlight these and assist with annual reporting.

8.1. Operational Monitoring

Online monitoring (via the SCADA system) is in place throughout the MSC. It is operated predominantly by the MSC Treatment Plant Operators with the aid of key MSC Reticulation Staff members. MSC employs a specialist SCADA operator, engages the IT department and uses an external contractor to support the running of the system.

Intakes, reservoirs, chlorine residual, pH, chemical levels, turbidity, flow, generator run, valve position and environmental flow, Ibis dam level, rainfall and outflow are monitored continuously.

Council officers are paged if any alarms are triggered. The situation is escalated if the alarm has not been actioned in the designated time frame; dependent on the seriousness of the incident and likelihood of adverse effects on the water quality.

Operational monitoring programs have been designed based on the outcomes of the risk assessment (i.e. when establishing critical limits), expert advice, equipment operating parameters, operators knowledge and historical data (operational targets). The existing Operational Monitoring program at the WTP is detailed in the tables below. All SCADA monitoring is stored on MSC historian system. Any manual records, along with any SCADA data required for statutory reporting, are entered directly or transferred to the SWIM system.

[13] http://www.bom.gov.au/water/dashboards/#/water-storages/sites/state?storage=Tinaroo%20Falls

TABLE 31: OPERATIONAL MONITORING PROGRAM - CHILLAGOE

Parameter	Frequency	Location	Method	Sample Type	Operational Target	Critical Limit	Corrective Action
Turbidity	Continuous	Raw water	Online turbidimeter	Continuous	< 2.0 NTU	-	Check and calibrate equipment. Notify manager. Monitor filtered water turbidity.
pH	Biannually	Raw water	External - NATA	Grab	7.1 – 7.7	None for health	Review trends and operational data. Consider impacts on other parameters (chlorination). Notify the water service regulator if critical limits are breached.
Alkalinity	Biannually	Raw water	External - NATA	Grab	300 - 330 mg/L as $CaCO_3$	None for health	Review trends and operational data. Consider impacts on other parameters (refer to SOP)
Conductivity	Biannually	Raw water	External - NATA	Grab	-	-	Review trends and operational data for fluctuations. Investigate potential for surface water infiltration.
Turbidity	Continuous	Filtered water	Online turbidimeter	Continuous	< 0.3 NTU	< 0.5 mg/L	Check filters. Perform backwash. Notify manager.
Conductivity	Biannually	Clear water	External - NATA	Grab	-	-	Review trends and operational data for fluctuations. Investigate potential for surface water infiltration.
Alkalinity	Biannually	Clear water	External - NATA	Grab	300 - 330 mg/L as CaCO3	None for health	Review trends and operational data. Consider impacts on other parameters (refer to SOP)
Free chlorine	Continuous	Clear water	Online chlorine analyser	Continuous	0.5 - 2.5 mg/L	0.5 - 5 mg/L	Check and calibrate equipment. Increase chlorine dose. Retest within 1 hour. Sample and analyse the water for E.coli.
pH	Continuous	Clear water	Online pH meter	Continuous	6.8 – 8.0	6.5 - 8.5	Notify the water service regulator if critical limits are breached

TABLE 32: OPERATIONAL MONITORING PROGRAM - DIMBULAH

Parameter	Frequency	Location	Method	Sample Type	Operational Target	Critical Limit	Corrective Action
Turbidity	Continuous	Raw water	Online turbidimeter	Continuous	< 11.0 NTU	-	Check and calibrate equipment. Perform jar testing. Increase ACH/PolyDADMAC and/or Polymer dose.
pH	3 per week	Raw water	Handheld meter	Grab	-	6.5 - 8.5	Review trends and operational data. Consider impacts on other parameters (chlorination). Notify the water service regulator if critical limits are breached.
Alkalinity	3 per week	Raw water	Titration	Grab	16 - 52 mg/L as $CaCO_3$	None for health	Review trends and operational data. Consider impacts on other parameters (refer to SOP)
Conductivity	3 per week	Raw water	Handheld meter	Grab	-	-	Review trends and operational data for fluctuations. Investigate potential for surface water infiltration.
Turbidity	Continuous	Filtered water	Online turbidimeter	Continuous	0.1 – 0.15 NTU	< 0.5 NTU	Check filters. Perform backwash. Notify manager.
Conductivity	3 per week	Clear water	Handheld meter	Grab	-	-	Review trends and operational data for fluctuations. Investigate potential for surface water infiltration.
Alkalinity	3 per week	Clear water	Titration	Grab	16 - 52 mg/L as $CaCO_3$	None for health	Review trends and operational data. Consider impacts on other parameters (refer to SOP)
Free chlorine	Continuous	Clear water	Online chlorine analyser	Continuous	0.5 - 2.5 mg/L	0.5 - 5 mg/L	Check and calibrate equipment. Increase chlorine dose. Retest within 1 hour. Sample and analyse the water for E. coli.
pH	Continuous	Clear water	Online pH meter	Continuous	6.8 – 8.0	6.5 - 8.5	Notify the water service regulator if critical limits are breached

TABLE 33: OPERATIONAL MONITORING PROGRAM - MAREEBA

Parameter	Frequency[14]	Location	Method	Sample Type	Operational Target	Critical Limit	Corrective Action
Turbidity	Continuous	Raw water	Online turbidimeter	Continuous	< 10.0 NTU	-	Check and calibrate equipment. Perform jar testing. Increase ACH/PolyDADMAC and/or Polymer dose.
pH	Daily	Raw water	Handheld meter	Grab	-	6.5 - 8.5	Review trends and operational data. Consider impacts on other parameters (chlorination). Notify the water service regulator if critical limits are breached.
Alkalinity	Daily	Raw water	Titration	Grab	32 - 60 mg/L as $CaCO_3$	None for health	Review trends and operational data. Consider impacts on other parameters (refer to SOP)
Conductivity	Daily	Raw water	Handheld meter	Grab	-	-	Review trends and operational data for fluctuations. Investigate potential for surface water infiltration.
Turbidity	Continuous	Settled water	Online turbidimeter	Continuous	< 5.0 NTU	-	Check and calibrate equipment. Perform jar testing. Increase ACH/PolyDADMAC and/or Polymer dose.
Turbidity	Continuous	Filtered water	Online turbidimeter	Continuous	0.1 – 0.15 NTU	< 0.5 NTU	Check filters. Perform backwash. Notify manager.
Conductivity	Daily	Clear water	Handheld meter	Grab	-	-	Review trends and operational data for fluctuations. Investigate potential for surface water infiltration.
Alkalinity	Daily	Clear water	Titration	Grab	16 - 52 mg/L as $CaCO_3$	None for health	Review trends and operational data. Consider impacts on other parameters (refer to SOP)
Free chlorine	Continuous	Clear water	Online chlorine analyser	Continuous	0.5 - 2.5 mg/L	0.5 - 5 mg/L	Check and calibrate equipment. Increase chlorine dose. Retest within 1 hour. Sample and analyse the water for E. coli.
pH	Continuous	Clear water	Online pH meter	Continuous	6.8 – 8.0	6.5 - 8.5	Notify the water service regulator if critical limits are breached.

TABLE 34: OPERATIONAL MONITORING PROGRAM - KURANDA

Parameter	Frequency[14]	Location	Method	Sample Type	Operational Target	Critical Limit	Corrective Action
Turbidity	Continuous	Raw water	Online turbidimeter	Continuous	< 12.0 NTU	-	Check and calibrate equipment. Perform jar testing. Increase ACH/PolyDADMAC and/or Polymer dose.
pH	Daily	Raw water	Handheld meter	Grab	-	6.5 - 8.5	Review trends and operational data. Consider impacts on other parameters (chlorination). Notify the water service regulator if critical limits are breached.
Alkalinity	Daily	Raw water	Titration	Grab	26 - 32 mg/L as $CaCO_3$	None for health	Review trends and operational data. Consider impacts on other parameters (refer to SOP)
Conductivity	Daily	Raw water	Handheld meter	Grab	-	-	Review trends and operational data for fluctuations. Investigate potential for surface water infiltration.
Turbidity	Continuous	Settled water	Online turbidimeter	Continuous	< 5.0 NTU	-	Check and calibrate equipment. Perform jar testing. Increase ACH/PolyDADMAC and/or Polymer dose.
Turbidity	Continuous	Filtered water	Online turbidimeter	Continuous	0.1 – 0.15 NTU	< 0.5 NTU	Check filters. Perform backwash. Notify manager.
Conductivity	Daily	Clear water	Handheld meter	Grab	-	-	Review trends and operational data for fluctuations. Investigate potential for surface water infiltration.
Alkalinity	Daily	Clear water	Titration	Grab	26 - 32 mg/L as $CaCO_3$	None for health	Review trends and operational data. Consider impacts on other parameters (refer to SOP)
Free chlorine	Continuous	Clear water	Online chlorine analyser	Continuous	0.5 - 2.5 mg/L	0.5 - 5 mg/L	Check and calibrate equipment. Increase chlorine dose. Retest within 1 hour. Sample and analyse the water for E. coli.
pH	Continuous	Clear water	Online pH meter	Continuous	6.8 – 8.0	6.5 - 8.5	Notify the water service regulator if critical limits are breached.

[14] Daily monitoring excludes weekends

8.2. Verification Monitoring

The following tables describe the verification monitoring program by scheme.

TABLE 35: VERIFICATION MONITORING PROGRAM - CHILLAGOE

Parameter	Laboratory	Frequency	Location	Method	Sample Type	Critical Limit	Corrective Action
Turbidity	External - NATA	Biannually	Raw water tap	NATA	Grab	-	Review trends and operational data. Check and calibrate analytical equipment.
E.coli	Internal	Weekly	Raw water tap	E. coli monitoring SOP 3237615 (MPN)	Grab	< 20 MPN/100mL	Review trends, catchment categorisation and treatment train
Pesticides	External - NATA	Biannually	Raw water tap	NATA (Organochlorine/ Organophosphate ultra trace pesticide suite)	Grab	In accordance with ADWG	Notify water service regulator
Heavy metals	External - NATA	Biannually	Raw water tap	NATA (ICPMS (24 Metals))	Grab	In accordance with ADWG	Notify water service regulator
Fluoride	External - NATA	Biannually	Raw water tap	NATA	Grab	In accordance with ADWG	Notify water service regulator
Alkalinity	External - NATA	Biannually	Clearwater sample tap	NATA	Grab	None for health	Review trends and operational data. Consider impacts on other parameters (refer to SOP)
Turbidity	External - NATA	Biannually	Reticulation (Town Hall)	NATA	Grab	< 0.5 NTU	Review trends and operational data. Check and calibrate analytical equipment. Review backwash records and filter media quality.
Free Chlorine	Internal	Weekly	Reticulation (Town Hall and Tennis Courts)	Chlorine monitoring SOP 3350122	Grab	> 0.5 mg/L	Check and calibrate analytical equipment. Increase chlorine dose. Retest within 1 hour. Sample and analyse the water for E. coli.
Free Chlorine	External - NATA	Biannually	Reticulation (Town Hall)	Chlorine monitoring SOP 3350122	Grab	> 0.5 mg/L	Check and calibrate analytical equipment. Review trends and operational data. Re-test for chlorine. Increase chlorine dose if required. Retest within 1 hour. Sample and analyse the water for E. coli if chlorine does not meet critical limits.
E. coli	Internal	Monthly	Reticulation (Town Hall)	E. coli monitoring SOP 3237615 (MPN)	Grab	< 1 MPN/100 mL	Notify the water service regulator. Re-sample and test for 3 consecutive days.
E. coli	External - NATA	Biannually	Reticulation (Town Hall)	E. coli monitoring SOP 3237615 (NATA)	Grab	< 1 cfu/100 mL	Notify the water service regulator Review trends and operational data. Re-sample and test.
pH	External - NATA	Biannually	Reticulation (Town Hall)	NATA	Grab	6.5 - 8.5	Review trends and operational data. Re-sample and test.
Heavy metals	External - NATA	Biannually	Reticulation (Town Hall)	NATA (ICPMS (24 Metals))	Grab	In accordance with ADWG	Notify water service regulator
Pesticides	External - NATA	Biannually	Reticulation (Town Hall)	NATA (Organochlorine/ Organophosphate ultra trace pesticide suite)	Grab	In accordance with ADWG	Notify water service regulator
Fluoride	External - NATA	Biannually	Reticulation (Town Hall)	NATA	Grab	In accordance with ADWG	Notify water service regulator
THM's & Chlorates	External - NATA	Biannually	Clearwater sample tap Reticulation (Town Hall)	NATA	Grab	In accordance with ADWG	Notify water service regulator
PFAS	External - NATA	Every 2 years	Clearwater sample tap	NATA	Grab	In accordance with ADWG	Notify water service regulator

TABLE 36: VERIFICATION MONITORING PROGRAM - DIMBULAH

Parameter	Laboratory	Frequency	Location	Method	Sample Type	Critical Limit	Corrective Action
Turbidity	External - NATA	Biannually	Raw water intake	NATA	Grab	-	Review trends and operational data. Check and calibrate analytical equipment.
E. coli	Internal	Weekly	Raw water intake	E. coli monitoring SOP 3237615 (MPN)	Grab	< 2000 MPN/100mL	Review trends, catchment categorisation and treatment train
Pesticides	External - NATA	Biannually	Raw water intake	NATA (Organochlorine/ Organophosphate ultra trace pesticide suite)	Grab	In accordance with ADWG	Notify water service regulator
Heavy metals	External - NATA	Biannually	Raw water intake	NATA (ICPMS (24 Metals))	Grab	In accordance with ADWG	Notify water service regulator
pH	External - NATA	Biannually	Raw water intake	NATA	Grab	6.5 - 8.5	Review trends and operational data. Discuss with supplier of coagulation chemicals
Turbidity	External - NATA	Biannually	Dimbulah water treatment plant (clear water sample tap)	NATA	Grab	< 0.5 NTU	Review trends and operational data. Check and calibrate analytical equipment. Review backwash records and filter media quality.
Free Chlorine	Internal	3 per week	Reticulation (Dimbulah hall and Dimbulah pool)	Chlorine monitoring SOP 3350122	Grab	> 0.5 mg/L	Check and calibrate analytical equipment. Increase chlorine dose. Retest within 1 hour. Sample and analyse the water for E. coli.
Free Chlorine	External - NATA	Biannually	Dimbulah water treatment plant (clear water sample tap)	Chlorine monitoring SOP 3350122	Grab	> 0.5 mg/L	Check and calibrate analytical equipment. Review trends and operational data. Re-test for chlorine. Increase chlorine dose if required. Retest within 1 hour. Sample and analyse the water for E.coli if chlorine does not meet critical limits.
E. coli	Internal	Weekly	Reticulation (Dimbulah hall and Dimbulah pool)	E. coli monitoring SOP 3237615 (MPN)	Grab	< 1 MPN/100 mL	Notify the water service regulator. Re-sample and test for 3 consecutive days.
E. coli	External - NATA	Biannually	Dimbulah water treatment plant (clear water sample tap)	E. coli monitoring SOP 3237615 (NATA)	Grab	< 1 cfu/100 mL	Notify the water service regulator Review trends and operational data. Re-sample and test.
pH	Internal	3 per week	Dimbulah water treatment plant (clear water sample tap)	Handheld meter	Grab	6.5 - 8.5	Review trends and operational data. Re-sample and test.
pH	External - NATA	Biannually	Dimbulah water treatment plant (clear water sample tap)	NATA	Grab	6.5 - 8.5	Review trends and operational data. Re-sample and test.
Heavy metals	External - NATA	Biannually	Dimbulah water treatment plant (clear water sample tap)	NATA (ICPMS (24 Metals))	Grab	In accordance with ADWG	Notify water service regulator
Pesticides	External - NATA	Biannually	Dimbulah water treatment plant (clear water sample tap)	NATA (Organochlorine/ Organophosphate ultra trace pesticide suite)	Grab	In accordance with ADWG	Notify water service regulator
THM's & Chlorates	External - NATA	Biannually	Clearwater sample tap Reticulation (Town Hall)	NATA	Grab	In accordance with ADWG	Notify water service regulator
PFAS	External - NATA	Annually	Clearwater sample tap	NATA	Grab	In accordance with ADWG	Notify water service regulator

TABLE 37: VERIFICATION MONITORING PROGRAM - MAREEBA

Parameter	Laboratory	Frequency[15]	Location	Method	Sample Type	Critical Limit	Corrective Action
Turbidity	External - NATA	Biannually	Raw water intake	NATA	Grab		Review trends and operational data. Check and calibrate analytical equipment.
E. coli	Internal	Weekly	Raw water intake	E. coli monitoring SOP 3237615 (MPN)	Grab	< 2000 MPN/100mL	Review trends, catchment categorisation and treatment train
Pesticides	External - NATA	Biannually	Raw water intake	NATA (Organochlorine/ Organophosphate ultra trace pesticide suite)	Grab	In accordance with ADWG	Notify water service regulator
Heavy metals	External - NATA	Biannually	Raw water intake	NATA (ICPMS (24 Metals))	Grab	In accordance with ADWG	Notify water service regulator
pH	External - NATA	Biannually	Raw water intake	NATA	Grab	NA	Review trends and operational data. Discuss with supplier of coagulation chemicals
Turbidity	External - NATA	Biannually	High lift pump discharge	NATA	Grab	< 0.5 NTU	Review trends and operational data. Check and calibrate analytical equipment. Review backwash records and filter media quality.
Free Chlorine	Internal	Triweekly	Reticulation (Mareeba airport and Mary Andrews Park)	Chlorine monitoring SOP 3350122	Grab	> 0.5 mg/L	Check and calibrate analytical equipment. Increase chlorine dose. Retest within 1 hour. Sample and analyse the water for E. coli.
Free Chlorine	External - NATA	Biannually	High lift pump discharge	Chlorine monitoring SOP 3350122	Grab	> 0.5 mg/L	Check and calibrate analytical equipment. Review trends and operational data. Re-test for chlorine. Increase chlorine dose if required. Retest within 1 hour. Sample and analyse the water for E. coli if chlorine does not meet critical limits.
E. coli	Internal	Weekly	Reticulation (Mareeba airport and Mary Andrews Park)	E. coli monitoring SOP 3237615 (MPN)	Grab	< 1 MPN/100 mL	Notify the water service regulator. Re-sample and test for 3 consecutive days.
E. coli	External - NATA	Biannually	High lift pump discharge	E. coli monitoring SOP 3237615 (NATA)	Grab	< 1 cfu/100 mL	Notify the water service regulator Review trends and operational data. Re-sample and test.
pH	Internal	Daily*	High lift pump discharge	Handheld meter	Grab	6.5 - 8.5	Review trends and operational data. Re-sample and test.
pH	External - NATA	Biannually	High lift pump discharge	NATA	Grab	6.5 - 8.5	Review trends and operational data. Re-sample and test.
Heavy metals	External - NATA	Biannually	High lift pump discharge	NATA (ICPMS (24 Metals))	Grab	In accordance with ADWG	Notify water service regulator
Pesticides	External - NATA	Biannually	High lift Pump Discharge	NATA (Organochlorine/ Organophosphate ultra trace pesticide suite)	Grab	In accordance with ADWG	Notify water service regulator
THM's & Chlorates	External - NATA	Biannually	Clearwater sample tap Reticulation (Mary Andrews Park)	NATA	Grab	In accordance with ADWG	Notify water service regulator
PFAS	External - NATA	Annually	Clearwater sample tap	NATA	Grab	In accordance with ADWG	Notify water service regulator

[15] Daily monitoring excludes weekends

TABLE 38: VERIFICATION MONITORING PROGRAM - KURANDA

Parameter	Laboratory	Frequency[16]	Location	Method	Sample Type	Critical Limit	Corrective Action
Turbidity	External - NATA	Biannually	Raw water intake	NATA	Grab		Review trends and operational data. Check and calibrate analytical equipment.
E. coli	Internal	Weekly	Raw water intake	E. coli monitoring SOP 3237615 (MPN)	Grab	< 2000 MPN/100mL	Review trends, catchment categorisation and treatment train
Pesticides	External - NATA	Biannually	Raw water intake	NATA (Organochlorine/ Organophosphate ultra trace pesticide suite)	Grab	In accordance with ADWG	Notify water service regulator
Heavy metals	External - NATA	Biannually	Raw water intake	NATA (ICPMS (24 Metals))	Grab	In accordance with ADWG	Notify water service regulator
pH	External - NATA	Biannually	Raw water intake	NATA	Grab	6.5 - 8.5	Review trends and operational data. Discuss with supplier of coagulation chemicals
Turbidity	External - NATA	Biannually	Kuranda water treatment plant	NATA	Grab	< 0.5 NTU	Review trends and operational data. Check and calibrate analytical equipment. Review backwash records and filter media quality.
Free Chlorine	Internal	Triweekly	Reticulation (Gregory Terrace and Masons Rd)	Chlorine monitoring SOP 3350122	Grab	> 0.5 mg/L	Check and calibrate analytical equipment. Increase chlorine dose. Retest within 1 hour. Sample and analyse the water for E. coli.
Free Chlorine	External - NATA	Biannually	Kuranda water treatment plant	Chlorine monitoring SOP 3350122	Grab	> 0.5 mg/L	Check and calibrate analytical equipment. Review trends and operational data. Re-test for chlorine. Increase chlorine dose if required. Retest within 1 hour. Sample and analyse the water for E. coli if chlorine does not meet critical limits.
E. coli	Internal	Weekly	Reticulation (Gregory Terrace and Masons Rd)	E. coli monitoring SOP 3237615 (MPN)	Grab	< 1 MPN/100 mL	Notify the water service regulator. Re-sample and test for 3 consecutive days.
E. coli	External - NATA	Biannually	Kuranda water treatment plant	E. coli monitoring SOP 3237615 (NATA)	Grab	< 1 cfu/100 mL	Notify the water service regulator Review trends and operational data. Re-sample and test.
pH	Internal	Daily*	Kuranda water treatment plant	Handheld meter	Grab	6.5 - 8.5	Review trends and operational data. Re-sample and test.
pH	External - NATA	Biannually	Kuranda water treatment plant	NATA	Grab	6.5 - 8.5	Review trends and operational data. Re-sample and test.
Heavy metals	External - NATA	Biannually	Kuranda water treatment plant	NATA (ICPMS (24 Metals))	Grab	In accordance with ADWG	Notify water service regulator
Pesticides	External - NATA	Biannually	Kuranda water treatment plant	NATA (Organochlorine/ Organophosphate ultra trace pesticide suite)	Grab	In accordance with ADWG	Notify water service regulator
THM's & Chlorates	External - NATA	Biannually	Clearwater sample tap Reticulation (Gregory Terrace)	NATA	Grab	In accordance with ADWG	Notify water service regulator
PFAS	External - NATA	Annually	Clearwater sample tap	NATA	Grab	In accordance with ADWG	Notify water service regulator

[16] Daily monitoring excludes weekends

8.3. Baseline Monitoring Programs

Baseline monitoring of water quality should be carried out for all new water supplies being considered, poorly characterised existing systems and where significant changes to treatment processes are made. The results are used to inform the risk assessment process. According to the risk matrix the likelihood of a hazard is rare if it occurs less than once every five years. The tables below describe the current baseline monitoring programs.

TABLE 39: BASELINE MONITORING PROGRAM - CHILLAGOE

Parameter	Sample location	Laboratory	Guideline Values	Frequency	Rationale	Sampling period	Status	Outcome/ Response
Pesticides	Raw water	External - NATA	In accordance with ADWG	Biannually	There is some agricultural activity in the area and more data is required to better assess this risk.	5 years	Ongoing – 2025	Pesticides have not exceeded guideline values for any bore used to supply chillagoe water in the past 5 years. However, for bore 4 there are only 8 data points available for past 4 years and more data is required.
Heavy metals	Raw water	External – NATA	In accordance with ADWG	Biannually	Bore water is higher risk for heavy metals. More data is required to better assess the risk.	5 years	Ongoing - 2025	Heavy metals have exceeded guideline values for previous bores used in the past 5 years (arsenic and lead). Bore 4 has not exceeded guideline values for health, however there are only 8 data points available for past 4 years and more data is required. No treated water samples have exceeded threshold values in the past 5 years.
Fluoride	Raw water	External – NATA	< 1.5 mg/L (ADWG)	Biannually	More data is required to better assess the risk.	5 years	Ongoing - 2025	Fluoride in raw water has not exceeded guideline values for all bores used in the past 5 years. However, bore 4 has only 8 data points available for past 4 years and more data is required.
Aluminium	Clear water (reticulation)	External – NATA	< 0.2 mg/L (ADWG - aesthetic)	Biannually	More data is required to better assess the risk.	5 years	Ongoing - 2025	Aluminium has not been detected in treated water in the past 5 years. However, bore 4 has only 8 data points available for past 4 years and more data is required. Raw water from bore 4 exceeded aesthetic guideline values on one occasion in 2020.
Iron	Clear water (reticulation)	External – NATA	< 0.3 mg/L (ADWG - aesthetic)	Biannually	More data is required to better assess the risk.	5 years	Ongoing - 2025	Iron has not been detected in treated water in the past 5 years. Only 8 data points for past 4 years are available since commissioning bore 4 and more data is required. Raw water from bore 4 exceeded aesthetic guideline values on one occasion in 2020.
Manganese	Clear water (reticulation)	External – NATA	< 0.5 mg/L (ADWG)	Biannually	More data is required to better assess the risk.	5 years	Ongoing - 2025	Manganese has not exceeded guideline values in treated water in the past 5 years. Only 8 data points for past 4 years are available since commissioning bore 4 and more data is required. Raw water from bore 4 has not exceeded guideline values for manganese.
E. coli	Raw water	• External – NATA • Internal	<20 MPN/100mL (WSAA)	Monthly	More data is required to better assess the risk.	2 years	Ongoing – 2025	E. coli has not been detected in bore 4 samples (16 data points since June 2022). However, monthly raw water samples have only been analysed consistently since Jun 2023. It is recommended to run the baseline program for two years.
E. coli	Clear water (reticulation)	• External – NATA • Internal	< 1 cfu/100 mL (PH Reg)	Refer to verification program	No longer required in baseline program. E.coli is monitored in the verification program.	Ongoing	Complete	There have been no detections of E. coli in the past 5 years in clear water for Chillagoe. E. coli in clear water is included in the verification program, raw water has been included in the baseline program. Monthly raw water samples have been analysed consistently since Jun 2023. It is recommended to continue the baseline program for two years.
Turbidity	Filter effluent	• External – NATA • Internal	< 0.5 NTU (ADWG)	Refer to verification program	No longer required in baseline program. Turbidity of filtered water is monitored by operational monitoring and the verification program.	Ongoing	Complete	There is an online analyser in place for continuous monitoring turbidity of filtered water. Alarms are in place to alert the operator and shut the plant down if limits are exceeded.
Free Chlorine	Clear water (reticulation)	• External – NATA • Internal	0.5 – 5.0 mg/L (ADWG)	Refer to verification program	No longer required in baseline program. Chlorine in reticulated water is monitored by operational monitoring and the verification programs.	Ongoing	Complete	There is an online analyser for continuous monitoring of clear water. Alarms are in place to alert the operator and shut the plant down if requirements are not met. Corrective action for chlorine levels in reticulation is documented under verification monitoring.

Chlorates and THMs	Clear water	• External - NATA	THMs: < 250 µg/L (ADWG) Chlorates: 0.80 mg/L (QH interim)	Bi-annual	Baseline monitoring established in September 2024 as raw water primary disinfectant is Chlorine.	12 months	Current	Chlorate and THMs have not been detected in the baseline monitoring program. A reduced monitoring approach will occur on a bi-annual basis.
PFAS	Clear water	• External Nata	PFOA - 0.2 µg/L PFOS - 0.008 µg/L PFHxS – 0.03 µg/L PFBS – 1 µg/L	Annually	Baseline monitoring implemented in 2023	Ongoing	Current	There have been no detections of PFAS. PFAS is still monitored annually as part of the verification program.

TABLE 40: BASELINE MONITORING PROGRAM - DIMBULAH

Parameter	Sample location	Laboratory	Guideline Values	Frequency	Rationale	Sampling period	Status	Outcome/ Response
Pesticides	Raw water	External - NATA	In accordance with ADWG	Biannually	There is some agricultural activity in the area and more data is required to better assess this risk.	5 years	Complete	Pesticides have not exceeded guideline values in the past 5 years. Pesticides are still monitored biannually as part of the verification program.
Heavy metals	Raw water	External – NATA	In accordance with ADWG (Health)	Biannually	More data is required to better assess the risk.	5 years	Complete	Heavy metals have not exceeded guideline values in the past 5 years. Heavy metals are still monitored biannually as part of the verification program.
Fluoride	Raw water	External – NATA	< 1.5 mg/L (ADWG - health)	Biannually	More data is required to better assess the risk.	5 years	Complete	Fluoride has not exceeded guideline values in the past 5 years. Fluoride is still monitored biannually as part of the verification program.
Aluminium	Clear water	External – NATA	< 0.2 mg/L (ADWG - aesthetic)	Biannually	More data is required to better assess the risk.	5 years	Complete	Aluminium has not exceeded guideline values in the past 5 years. Raw water has exceeded aesthetic guideline values on two occasions in 2020 and 2021. Aluminium is still monitored biannually as part of the verification program.
Iron	Clear water	External – NATA	< 0.3 mg/L (ADWG - aesthetic)	Biannually	More data is required to better assess the risk.	5 years	Complete	Iron has not been detected in treated water in the past 5 years. Raw water has exceeded aesthetic guideline values on three occasions in 2019, 2020 and 2022. Iron is still monitored biannually as part of the verification program.
Manganese	Clear water	External – NATA	< 0.5 mg/L (ADWG - health)	Biannually	More data is required to better assess the risk.	5 years	Complete	Manganese has not exceeded guideline values in the past 5 years. Manganese is still monitored biannually as part of the verification program.
E. coli	Raw water	• External – NATA • Internal	< 2000 MPN/100 mL (WSAA)	Weekly	More data is required to better assess the risk.	2 years	Complete	E. coli has not exceeded guideline values in the past 5 years. E. coli is still monitored weekly as part of the verification program.
E. coli	Clear water (reticulation)	• External – NATA • Internal	< 1 cfu/100 mL (PH Reg)	Refer to verification program	No longer required in baseline program. E.coli is monitored in the verification program.	Ongoing	Complete	There have been no detections of E. coli in the past 5 years. E. coli is still monitored weekly as part of the verification program.
Turbidity	Filter effluent	• External – NATA • Internal	< 0.5 NTU (ADWG)	Refer to verification program	No longer required in baseline program. Turbidity of filtered water is monitored by operational monitoring and the verification program.	Ongoing	Complete	There is an online analyser in place for continuous monitoring turbidity of filtered water. Alarms are in place to alert the operator and shut the plant down if limits are exceeded. Corrective action for exceedances is documented under verification monitoring.
Free Chlorine	Clear water (reticulation)	• External – NATA • Internal	0.5 – 5.0 mg/L (ADWG)	Refer to verification program	No longer required in baseline program. Chlorine in reticulated water is monitored by operational monitoring and the verification programs.	Ongoing	Complete	There is an online analyser for continuous monitoring of clear water. Alarms are in place to alert the operator and shut the plant down if requirements are not met. Corrective action for chlorine levels in reticulation is documented under verification monitoring.

Chlorates and THMs	Clear water	• External - NATA	THMs: < 250 µg/L (ADWG) Chlorates: 0.80 mg/L (QH interim)	Bi-annual	Baseline monitoring established in September 2024 as raw water primary disinfectant is Chlorine.	Ongoing	Current	Chlorate and THMs have not been detected in the baseline monitoring program. A reduced monitoring approach will occur on a bi-annual basis.
PFAS	Clear water	• External Nata	PFOA - 0.2 µg/L PFOS - 0.008 µg/L PFHxS – 0.03 µg/L PFBS – 1 µg/L	Annually	Baseline monitoring implemented in 2023	Ongoing	Current	There have been no detections of PFAS. PFAS is still monitored annually as part of the verification program.

TABLE 41: BASELINE MONITORING PROGRAM - MAREEBA

Parameter	Sample location	Laboratory	Guideline Values	Frequency	Rationale	Sampling period	Status	Outcome/ Response
Pesticides	Raw water	External - NATA	In accordance with ADWG	Biannually	There is some agricultural activity in the area and more data is required to better assess this risk.	5 years	Complete	Pesticides have not exceeded guideline values in the past 5 years. Pesticides are still monitored biannually as part of the verification program.
Heavy metals	Raw water	External – NATA	In accordance with ADWG (Health)	Biannually	More data is required to better assess the risk.	5 years	Complete	Heavy metals have exceeded guideline values in the past 5 years on one occasion for manganese (27th Sept 2022). Treated water has not exceeded guideline values in the past 5 years. Heavy Metals are still monitored biannually as part of the verification program.
Fluoride	Raw water	External – NATA	< 1.5 mg/L (ADWG - health)	Biannually	More data is required to better assess the risk.	5 years	Complete	Fluoride has not exceeded guideline values in the past 5 years. Fluoride is still monitored biannually as part of the verification program.
Aluminium	Clear water	External – NATA	< 0.2 mg/L (ADWG - aesthetic)	Biannually	More data is required to better assess the risk.	5 years	Complete	Aluminium has not exceeded guideline values in the past 5 years. Raw water has exceeded aesthetic guideline values in 50% of samples taken in the past 5 years. Aluminium is still monitored biannually as part of the verification program.
Iron	Clear water	External – NATA	< 0.3 mg/L (ADWG - aesthetic)	Biannually	More data is required to better assess the risk.	5 years	Complete	Iron has not been detected in treated water in the past 5 years. Raw water has exceeded aesthetic guideline values on all analysis performed in the past 3 years. Iron is still monitored biannually as part of the verification program.
Manganese	Clear water	External – NATA	< 0.5 mg/L (ADWG - health)	Biannually	More data is required to better assess the risk.	5 years	Complete	Manganese has not exceeded guideline values in the past 5 years. Raw water exceeded guideline values on one occasion (27th Sept 2022) in the past 5 years. Manganese is still monitored biannually as part of the verification program.
E. coli	Raw water	• External – NATA • Internal	< 2000 MPN/100 mL (WSAA)	Weekly	More data is required to better assess the risk.	2 years	Ongoing - 2025	E. coli is routinely detected in raw water samples. Enumeration of weekly raw water samples up to 2,419.6 MPN/100 mL has only occurred since May 2023. Prior to this some results are reported as >200.5 MPN/100 mL (9 in the past 2 years). Since May 2023 no samples have exceeded 2000 MPN/100 mL. It is recommended to run the baseline program for two years.
E. coli	Clear water (reticulation)	• External – NATA • Internal	< 1 cfu/100 mL (PH Reg)	Refer to verification program	No longer required in baseline program. E.coli is monitored in the verification program.	Ongoing	Complete	There have been no detections of E. coli in the past 5 years. E. coli is still monitored weekly as part of the verification program.
Turbidity	Filter effluent	• External – NATA • Internal	< 0.5 NTU (ADWG)	Refer to verification program	No longer required in baseline program. Turbidity of filtered water is monitored by operational monitoring and the verification program.	Ongoing	Complete	There is an online analyser in place for continuous monitoring turbidity of filtered water. Alarms are in place to alert the operator and shut the plant down if limits are exceeded. Corrective action for exceedances is documented under verification monitoring.

Free Chlorine	Clear water (reticulation)	• External – NATA • Internal	0.5 – 5.0 mg/L (ADWG)	Refer to verification program	No longer required in baseline program. Chlorine in reticulated water is monitored by operational monitoring and the verification programs.	Ongoing	Complete	There is an online analyser for continuous monitoring of clear water. Alarms are in place to alert the operator and shut the plant down if requirements are not met. Corrective action for chlorine levels in reticulation is documented under verification monitoring.
Chlorates and THMs	Clear water	External - NATA	THMs: < 250 µg/L (ADWG) Chlorates: 0.80 mg/L (QH interim)	Bi-annual	Baseline monitoring established in July 2024 as raw water primary disinfectant is Chlorine.	Ongoing	Complete	Chlorate and THMs have not been detected in treated water since the completion of the baseline monitoring program in September 2024. As a result, routine sampling is no longer undertaken.
PFAS	Clear water	External Nata	PFOA - 0.2 µg/L PFOS - 0.008 µg/L PFHxS – 0.03 µg/L PFBS – 1 µg/L	Annually	Baseline monitoring implemented in 2023	Ongoing	Current	There have been no detections of PFAS. PFAS is still monitored annually as part of the verification program.

TABLE 42: BASELINE MONITORING PROGRAM - KURANDA

Parameter	Sample location	Laboratory	Guideline Values	Frequency	Rationale	Sampling period	Status	Outcome/ Response
Pesticides	Raw water	External - NATA	In accordance with ADWG	Biannually	There is some agricultural activity in the area and more data is required to better assess this risk.	5 years	Complete	Pesticides have not exceeded guideline values in the past 5 years. Pesticides are still monitored biannually as part of the verification program.
Heavy metals	Raw water	External – NATA	In accordance with ADWG (Health)	Biannually	More data is required to better assess the risk.	5 years	Complete	Heavy metals have not exceeded guideline values in the past 5 years. Heavy Metals are still monitored biannually as part of the verification program.
Fluoride	Raw water	External – NATA	< 1.5 mg/L (ADWG - health)	Biannually	More data is required to better assess the risk.	5 years	Complete	Fluoride has not exceeded guideline values in the past 5 years. Fluoride is still monitored biannually as part of the verification program.
Aluminium	Clear water	External – NATA	< 0.2 mg/L (ADWG - aesthetic)	Biannually	More data is required to better assess the risk.	5 years	Complete	Aluminium has not exceeded guideline values in the past 5 years. Raw water has exceeded aesthetic guideline values in 40% of samples taken in the past 5 years. Aluminium is still monitored biannually as part of the verification program.
Iron	Clear water	External – NATA	< 0.3 mg/L (ADWG - aesthetic)	Biannually	More data is required to better assess the risk.	5 years	Complete	Iron has not been detected in treated water in the past 5 years. Raw water has exceeded aesthetic guideline values on all analysis performed in the past 5 years. Iron is still monitored biannually as part of the verification program.
Manganese	Clear water	External – NATA	< 0.5 mg/L (ADWG - health)	Biannually	More data is required to better assess the risk.	5 years	Complete	Manganese has not exceeded guideline values in the past 5 years. Manganese is still monitored biannually as part of the verification program.
E. coli	Raw water	• External – NATA • Internal	< 2000 MPN/100 mL (WSAA)	Weekly	More data is required to better assess the risk.	2 years	Ongoing - 2025	E. coli is routinely detected in raw water samples. Enumeration of weekly raw water samples up to 2,419.6 MPN/100 mL has only occurred since May 2023. Prior to this some results are reported as >200.5 MPN/100 mL (13 in the past 2 years). Since May 2023 two sample s have exceeded 2000 MPN/100 mL. It is recommended to run the baseline program for two years.
E. coli	Clear water (reticulation)	• External – NATA • Internal	< 1 cfu/100 mL (PH Reg)	Refer to verification program	No longer required in baseline program. E.coli is monitored in the verification program.	Ongoing	Complete	There have been no detections of E. coli in the past 5 years. E. coli is still monitored weekly as part of the verification program.

Turbidity	Filter effluent	• External – NATA • Internal	< 0.5 NTU (ADWG)	Refer to verification program	No longer required in baseline program. Turbidity of filtered water is monitored by operational monitoring and the verification program.	Ongoing	Complete	There is an online analyser in place for continuous monitoring turbidity of filtered water. Alarms are in place to alert the operator and shut the plant down if limits are exceeded. Corrective action for exceedances is documented under verification monitoring.
Free Chlorine	Clear water (reticulation)	• External – NATA • Internal	0.5 – 5.0 mg/L (ADWG)	Refer to verification program	No longer required in baseline program. Chlorine in reticulated water is monitored by operational monitoring and the verification programs.	Ongoing	Complete	There is an online analyser for continuous monitoring of clear water. Alarms are in place to alert the operator and shut the plant down if requirements are not met. Corrective action for chlorine levels in reticulation is documented under verification monitoring.
Chlorates and THMs	Clear water	• External - NATA	THMs: < 250 µg/L (ADWG) Chlorates: 0.80 mg/L (QH interim)	Bi-annual	Baseline monitoring established in July 2024 as raw water primary disinfectant is Chlorine.	Ongoing	Complete	Chlorate and THMs have not been detected in the baseline monitoring program. A reduced monitoring approach will occur on a bi-annual basis.
PFAS	Clear water	• External Nata	PFOA - 0.2 µg/L PFOS - 0.008 µg/L PFHxS – 0.03 µg/L PFBS – 1 µg/L	Annually	Baseline monitoring implemented in 2023	Ongoing	Current	There have been no detections of PFAS. PFAS is still monitored annually as part of the verification program.

9. Critical Control Points

Critical Control Points (CCPs) have been identified through the risk assessment process as outlined in the ADWG. They occur at the following scheme components/subcomponents.

- Oxidation of Arsenite to Arsenate (Chillagoe only),
- ferric chloride dosing (arsenic precipitation) (Chillagoe only),
- filtration, and
- disinfection

The risk assessment lists CCPs, critical limits, operational targets, validation, monitoring and corrective actions.

The tables below provide a summary of CCPs applicable to each scheme. Refer to the risk assessment for further details specific to corrective actions, operational and verification monitoring.

TABLE 43: CRITICAL CONTROL POINT (CCP) SUMMARY - CHILLAGOE

Component /Subcomponent	Critical Limit	Validation	SCADA monitoring and response
Disinfection	Free chlorine 0.5 – 5 mg/L	ADWG fact sheet on chlorine suggests a free chlorine residual of > 0.2 mg/L through the distribution system is preferred. WHO recommends effective disinfection can generally be achieved maintaining a minimum free chlorine concentration 15 mg/L.min. Ct calculation for Chillagoe indicates minimum concentration at typical minimum reservoir storage levels of 90% of 0.20 mg/L to achieve 15 mg.min/L pH 6.5 - 8.5 (ADWG) Upper limit for aesthetics is 0.6 and 5 for health	Online, continuous chlorine residual analyser (Reservoirs to reticulation): • Low alarm set point < 1 mg/L. Alert sent to on call operator. • Low Low alarm set point < 0.85 mg/L. Alert sent to on call operator and plant shut down. Online, continuous pH monitoring: • High high set point 8.5 • High set point 8.0 • Low set point 6.8 • Low low set point 6.5
Oxidation of Arsenite to Arsenate	Free chlorine > 0.5 mg/L	Refer to SOP 3209688. Residual chlorine > 0.5 mg/L in filtered water confirms raw water chlorine dose is sufficient to meet oxidation demands.	Online, continuous chlorine residual analyser (Reservoirs to reticulation): • Low alarm set point < 1 mg/L. Alert sent to on call operator. • Low Low alarm set point < 0.85 mg/L. Alert sent to on call operator and plant shut down
Ferric chloride dosing (arsenic precipitation)	Ferric chloride dosing rate >112 mL/h (plant flow 14 L/s)	Refer to SOP 3209688. Dose rate based on upper ratio requirement iron: arsenic of 50:1 (iron requirement of 1.0 mg/L)	Online, continuous monitoring of Ferric chloride dose rate. Plant shutdown on no and low flow.
Filtration	Free chlorine > 0.5 mg/L	Refer to SOP 3209688. Residual chlorine >0.5 mg/L in filtered water confirms raw water chlorine dose is sufficient to ensure effective operation and regeneration of the DMI-65 catalytic media for arsenic removal. Turbidity is an indicator of the mechanical effectiveness of the filter (potential blinding and breakthrough)	Online, continuous chlorine residual analyser (Reservoirs to reticulation): • Low alarm set point < 1 mg/L. Alert sent to on call operator. • Low Low alarm set point < 0.85 mg/L. Alert sent to on call operator and plant shut down. Online, continuous monitoring of clear water turbidity: • High High set point 0.30 NTU • High set point 0.20 NTU

TABLE 44: CRITICAL CONTROL POINT (CCP) SUMMARY - DIMBULAH

Component /Subcomponent	Critical Limit	Validation	SCADA monitoring and response
Disinfection	Free chlorine 0.5 – 5 mg/L	ADWG fact sheet on chlorine suggests a free chlorine residual of > 0.2 mg/L through the distribution system is preferred. WHO recommends effective disinfection can generally be achieved maintaining a minimum free chlorine concentration 15 mg/L.min. Ct calculation for Mareeba indicates minimum concentration at typical minimum reservoir storage levels of 80% of 0.11 mg/L to achieve 15 mg.min/L pH 6.5 - 8.5 (ADWG) Upper limit for aesthetics is 0.6 and 5 for health	Online, continuous chlorine residual analyser (Reservoirs to reticulation): • Low alarm set point < 1 mg/L. Alert sent to on call operator. • Low Low alarm set point < 0.85 mg/L. Alert sent to on call operator and plant shut down. Online, continuous pH monitoring: • High high set point 8.5 • High set point 8.0 • Low set point 6.8 • Low low set point 6.5
Filtration	Turbidity < 0.5 NTU	ADWG fact sheet on Turbidity suggests the target should be < 0.2 NTU, and limit 0.5 NTU (post filtration). < 1 NTU is desirable at the time of disinfection with chlorine.	Online, continuous Turbidity analyser (Filter to reservoir) High alarm set point > 0.10 NTU. Alert sent to on call operator. Plant shut down set at > 0.15 NTU for > 5 minutes. Alert sent to on call operator.

TABLE 45: CRITICAL CONTROL POINT (CCP) SUMMARY - MAREEBA

Component /Subcomponent	Critical Limit	Validation	SCADA monitoring and response
Disinfection	Free chlorine 0.5 – 5 mg/L	ADWG fact sheet on chlorine suggests a free chlorine residual of > 0.2 mg/L through the distribution system is preferred. WHO recommends effective disinfection can generally be achieved maintaining a minimum free chlorine concentration 15 mg/L.min. Ct calculation for Mareeba indicates minimum concentration at typical minimum reservoir storage levels of 85% of 0.12 mg/L to achieve 15 mg.min/L pH 6.5 - 8.5 (ADWG) Upper limit for aesthetics is 0.6 and 5 for health	Online, continuous chlorine residual analyser (Reservoirs to reticulation): • Low alarm set point < 1 mg/L. Alert sent to on call operator. • Low Low alarm set point < 0.85 mg/L. Alert sent to on call operator and plant shut down. Online, continuous pH monitoring: • High high set point 8.5 • High set point 8.0 • Low set point 6.8 • Low low set point 6.5
Filtration	Turbidity < 0.5 NTU	ADWG fact sheet on Turbidity suggests the target should be < 0.2 NTU, and limit 0.5 NTU (post filtration). < 1 NTU is desirable at the time of disinfection with chlorine.	Online, continuous Turbidity analyser (Filter to reservoir) High alarm set point > 0.10 NTU. Alert sent to on call operator. Plant shut down set at > 0.15 NTU for > 5 minutes. Alert sent to on call operator.

TABLE 46: CRITICAL CONTROL POINT (CCP) SUMMARY - KURANDA

Component /Subcomponent	Critical Limit	Validation	SCADA monitoring and response
Disinfection	Free chlorine 0.5 – 5 mg/L	ADWG fact sheet on chlorine suggests a free chlorine residual of > 0.2 mg/L through the distribution system is preferred. WHO recommends effective disinfection can generally be achieved maintaining a minimum free chlorine concentration 15 mg/L.min. Ct calculation for Mareeba indicates minimum concentration at typical minimum reservoir storage levels of 80% of 0.39 mg/L to achieve 15 mg.min/L pH 6.5 - 8.5 (ADWG) Upper limit for aesthetics is 0.6 and 5 for health	Online, continuous chlorine residual analyser (Reservoirs to reticulation): • Low alarm set point < 1 mg/L. Alert sent to on call operator. • Low Low alarm set point < 0.85 mg/L. Alert sent to on call operator and plant shut down Online, continuous pH monitoring: • High high set point 8.5 • High set point 8.0 • Low set point 6.8 • Low low set point 6.5
Filtration	Turbidity < 0.5 NTU	ADWG fact sheet on Turbidity suggests the target should be < 0.2 NTU, and limit 0.5 NTU (post filtration). < 1 NTU is desirable at the time of disinfection with chlorine.	Online, continuous Turbidity analyser (Filter to reservoir) High alarm set point > 0.10 NTU. Alert sent to on call operator. Plant shut down set at > 0.15 NTU for > 5 minutes. Alert sent to on call operator.

Appendix A – Schematics

Chillagoe WTP - Catchment to Tap Schematic

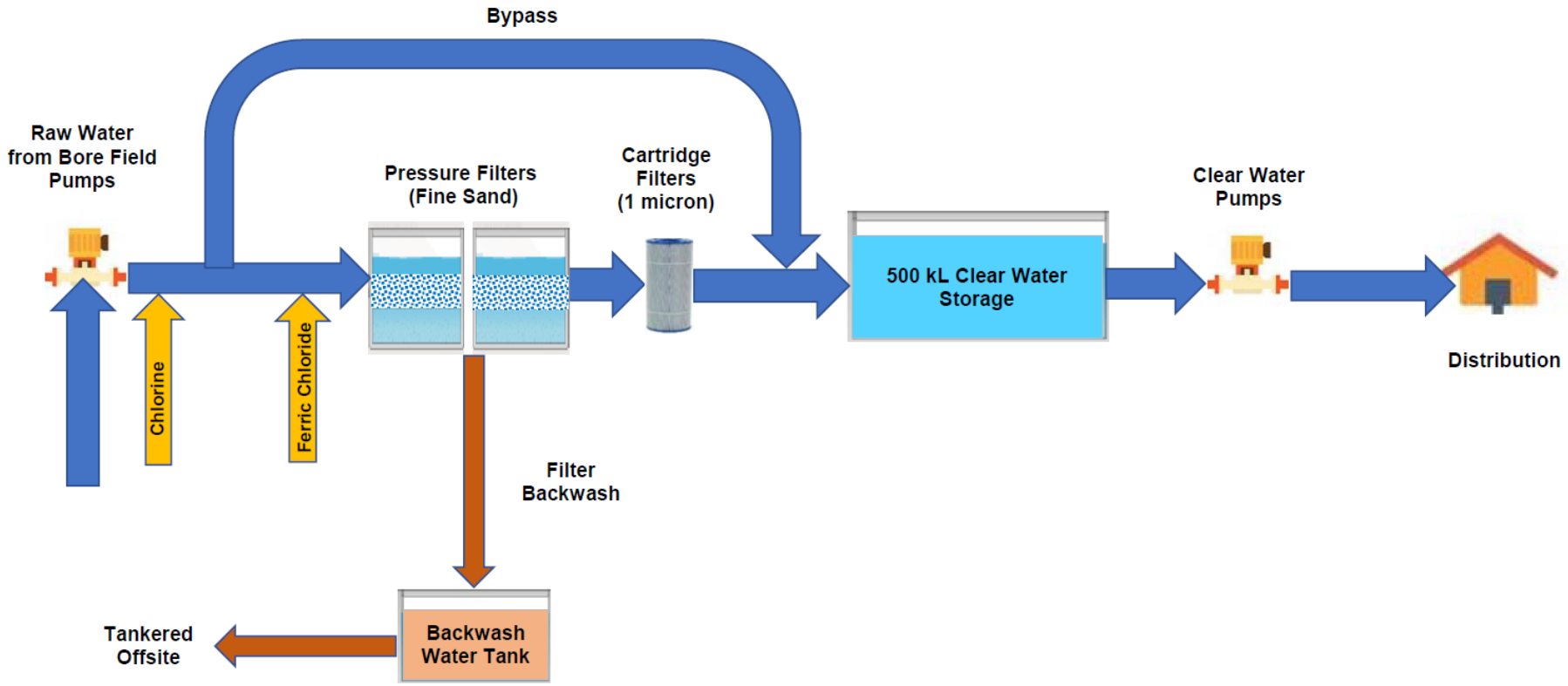

FIGURE A1: CHILLAGOE WTP SCHEMATIC

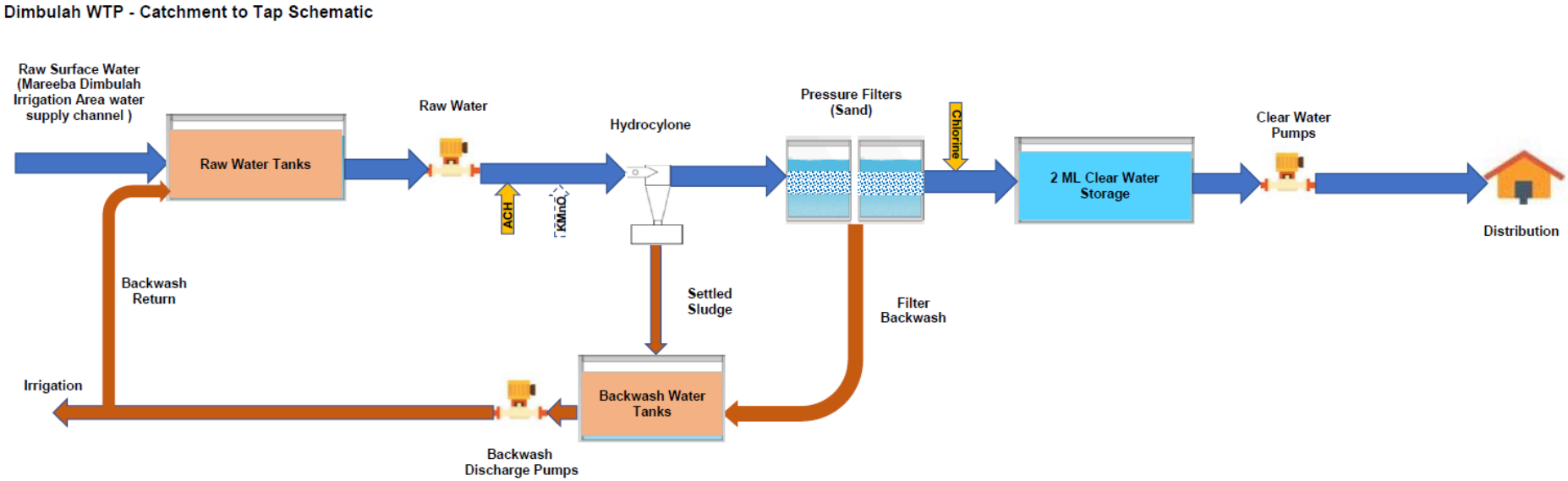

FIGURE A2: DIMBULAH WTP SCHEMATIC

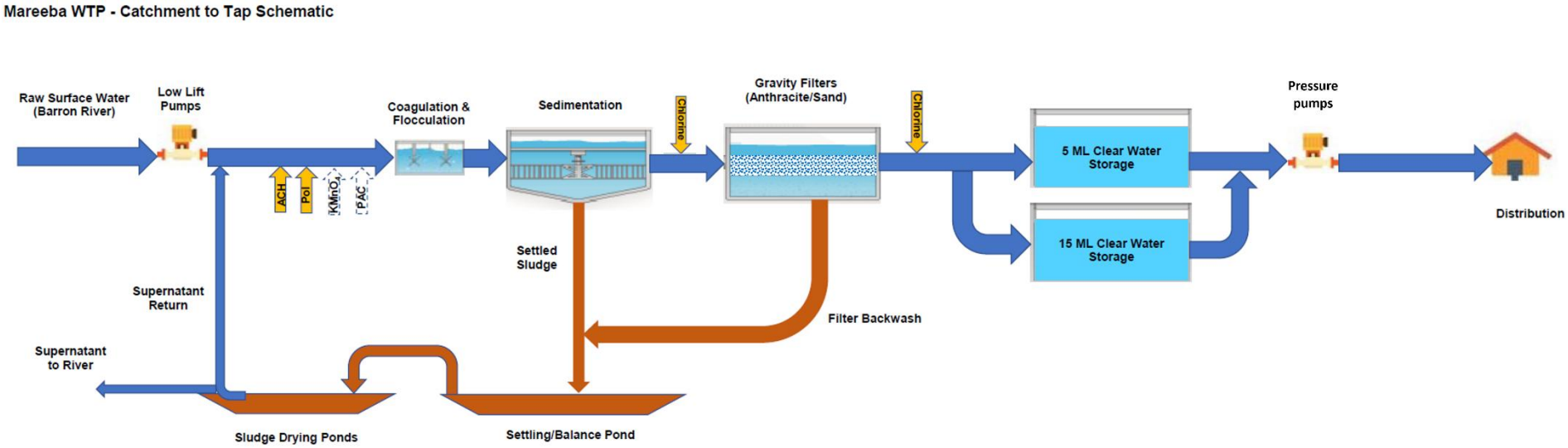

FIGURE A3: MAREEBA WTP SCHEMATIC

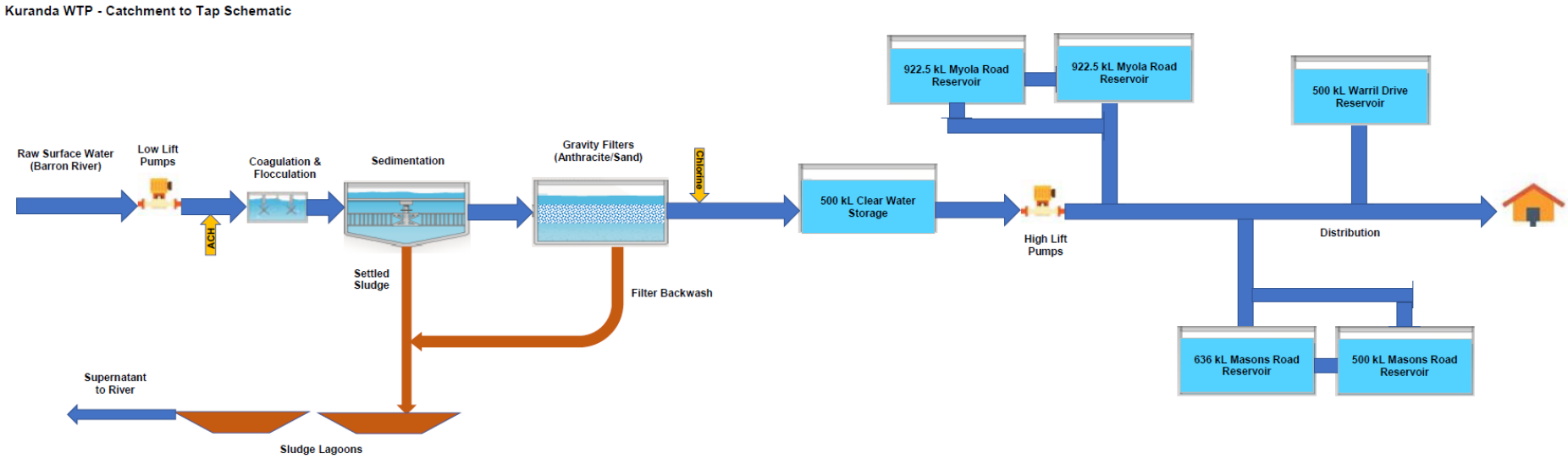

FIGURE A4: KURANDA WTP SCHEMATIC

Appendix B – Risk Assessments

TABLE B1: CHILLAGOE WATER TREATMENT PLANT RISK ASSESSMENT

RA ID#	Component / Subcomponent	Hazard	Hazardous Event/ Hazard Source	Inherent Risk Likelihood	Inherent Risk Consequence	Inherent Risk Rating	Preventative/ Control Measure	Residual Risk Likelihood	Residual Risk Consequence	Residual Risk Rating	Certainty	CCP	SCADA (continuous online)	Operational	Verification	Corresponding proposed measures
CHI01	Source Water	Turbidity	Naturally occurring (impact on disinfection effectiveness and formation of by products).	B	2	VERY HIGH	Direct filtration Secondary filtration	A	2	LOW	2	NO	YES	YES	YES	
CHI02	Source Water	Protozoa (Crypto/Giardia)	Agricultural run-off/ infiltration	D	5	VERY HIGH	Catchment categorisation	B	2	LOW	5	NO	NO	YES	YES	RMIP: Update vulnerability assessment to include bore 4
CHI03	Source Water	Pesticides	Agricultural run-off/ infiltration	E	5	VERY HIGH	Catchment categorisation	B	2	LOW	4	NO	NO	YES	YES	RMIP: Update vulnerability assessment to include bore 4
CHI04	Source Water	Heavy metals; iron, manganese, aluminium	Naturally present in source water	A	2	LOW		A	2	LOW	3	NO	NO	NO	YES	
CHI05	Source Water	Arsenic	Naturally present in groundwater	E	4	VERY HIGH	Ferric chloride injection followed by filtration (arsenic treatment plant).	A	2	LOW	3	NO	NO	NO	YES	Subsequent Steps: Oxidation of Arsenite to Arsenate, ferric chloride dosing and filtration to remove arsenic to an acceptable level are critical control points
CHI06	Source Water	Fluoride	Naturally present in groundwater	A	2	LOW		A	2	LOW	3	NO	NO	NO	YES	
CHI07	Source Water	Pathogenic bacteria and viruses	Naturally present in source water Agricultural run-off/ infiltration	B	4	HIGH	Catchment categorisation Treatment train - Direct filtration, Secondary filtration, Chlorination	B	2	LOW	2	NO	NO	YES	YES	RMIP: Update vulnerability assessment to include bore 4 Subsequent Step: Disinfection to reduce bacteria to an acceptable level is a critical control point Verification monitoring of source water
CHI08	Source Water	High alkalinity	Naturally present in source water	E	1	MODERATE		E	1	MODERATE	3	NO	NO	YES	YES	This risk has been accepted
CHI09	Source Water	Chemical or biological agents harmful to human health	Intentional Dumping/ Sabotage	A	5	HIGH	Site security and restricted access. Operator Observations.	A	2	LOW	5	NO	NO	NO	NO	
CHI10	Source Water Intake	Unable to treat or supply water	Pump failure	B	5	VERY HIGH	Standby bore & pump, backup large pump available to install. Operator visually monitors the level in the reservoirs daily.	B	2	LOW	3	NO	YES	NO	NO	
CHI11	Oxidation of Arsenite to Arsenate	Arsenic	Ineffective chlorine dosing to oxidise Arsenite to Arsenate	A	3	MODERATE	Setpoints installed on SCADA, alarms and plant shut down for Low chlorine levels.	A	3	MODERATE	3	YES	YES	YES	YES	Chlorine dosing to oxidise arsenic so that it can be precipitated and filtered for removal is a critical control point Raw water arsenic levels in bore 4 are lower than previous bores used. No results for have exceeded ADWG of < 0.01 mg/L (max. 0.0025 mg/L, mean. 0.0014 mg/L) (2024 review)
CHI12	Disinfection	Pathogenic bacteria	Mechanical chlorine dosing failure	B	4	HIGH	Maintenance, operator intervention (refer to SOP 3209688), residual testing, duty/standby pumps. flow paced/SCADA monitored.	B	2	LOW	3	YES	YES	YES	YES	Disinfection to reduce pathogenic bacteria to acceptable levels is a critical control point
CHI13	Disinfection	Pathogenic bacteria	Ineffective chlorine dosing rate for disinfection	B	4	HIGH	Maintenance, operator intervention (refer to SOP 3209688), residual testing, flow paced/SCADA monitored.	B	2	LOW	3	YES	YES	YES	YES	Disinfection to reduce pathogenic bacteria to acceptable levels is a critical control point

RA ID#	Component / Subcomponent	Hazard	Hazardous Event/ Hazard Source	Inherent Risk Likelihood	Inherent Risk Consequence	Inherent Risk Rating	Preventative/ Control Measure	Residual Risk Likelihood	Residual Risk Consequence	Residual Risk Rating	Certainty	CCP	SCADA (continuous online)	Operational	Verification	Corresponding proposed measures
CHI14	Disinfection	Inability to disinfect	Inability to produce sodium hypochlorite by electro chlorination	C	4	VERY HIGH	Back up supply of sodium hypochlorite used for other schemes	C	1	LOW	3	NO	YES	NO	NO	
CHI15	Disinfection	Pathogenic bacteria	Ineffective disinfection due to chlorine dosing contact time	B	4	HIGH	Minimum retention times in storage reservoirs Flow Rate	B	2	LOW	3	YES	YES	YES	YES	Disinfection to reduce pathogenic bacteria to acceptable levels is a critical control point
CHI16	Disinfection	Pathogenic bacteria	Ineffective disinfection due to pH	A	5	HIGH	pH monitoring and plant shutdown	A	1	LOW	3	NO	YES	YES	YES	
CHI17	Disinfection	Pathogenic bacteria	Ineffective chlorine dosing due to poor mixing	D	4	VERY HIGH	Retention times in storage reservoirs	B	2	LOW	3	YES	YES	YES	YES	Disinfection to reduce pathogenic bacteria to acceptable levels is a critical control point
CHI18	Disinfection	Disinfection by-products (Chlorates)	Contaminant formation due to storage conditions (temperature and time)	A	2	LOW	Sodium hypochlorite is produced by electro chlorination and produced as required to minimise storage.	A	2	LOW	3	NO	NO	NO	NO	Baseline monitoring program completed. Operational controls in place and bi-annual sampling.
CHI19	Disinfection	Disinfection by-products (Chlorates, THMs)	Disinfection by-products caused by high organic and inorganic load in raw water	A	2	LOW	Low load in source water	A	2	LOW	3	NO	NO	NO	NO	Baseline monitoring program completed. Operational controls in place and bi-annual sampling.
CHI20	Disinfection	Chlorine	Chlorine exceeding ADWG guideline values for health and aesthetic	B	2	LOW	Maintenance, operator intervention (refer to SOP 3209688), residual testing, installed online analysers integrated to SCADA & flow pacing. Dosed in accordance with ADWG	B	2	LOW	3	YES	YES	YES	YES	Disinfection to reduce pathogenic bacteria to acceptable levels is a critical control point
CHI21	Disinfection	Pathogenic bacteria	Poor disinfection due to high organic and inorganic load in raw water	A	2	LOW	Low load in source water	B	2	LOW	3	YES	YES	YES	YES	
CHI22	Ferric chloride dosing (arsenic precipitation)	Ineffective removal of arsenic	Injection system failure/ hose break	A	3	MODERATE	Operator checks, SCADA alarms	A	3	MODERATE	3	YES	YES	NO	YES	Ferric chloride dosing to precipitate arsenic so that it can be filtered is a critical control point. Raw water arsenic levels in bore 4 are lower than previous bores used. No results for have exceeded ADWG of < 0.01 mg/L (max. 0.0025 mg/L, mean. 0.0014 mg/L) (2024 review)
CHI23	Ferric chloride dosing (arsenic precipitation)	Ineffective removal of arsenic	Incorrect dosing	B	3	MODERATE	SCADA alarm on dosing pump	A	3	MODERATE	3	YES	YES	NO	YES	Ferric chloride dosing to precipitate arsenic so that it can be filtered is a critical control point. Raw water arsenic levels in bore 4 are lower than previous bores used. No results for have exceeded ADWG of < 0.01 mg/L (max. 0.0025 mg/L, mean. 0.0014 mg/L) (2024 review)
CHI24	Filtration	Breakthrough in filtered water (physical, chemical and microbiological contamination)	Backwash failure	B	3	MODERATE	Operator callout alarm - integrated into SCADA system.	A	3	MODERATE	3	YES	YES	YES	YES	Filtration to remove precipitated arsenic is a critical control point Raw water arsenic levels in bore 4 are lower than previous bores used. No results for have exceeded ADWG of < 0.01 mg/L (max. 0.0025 mg/L, mean. 0.0014 mg/L) (2024 review)
CHI25	Filtration	Breakthrough in filtered water (physical, chemical and microbiological contamination)	Ineffective filtration and breakthrough due to media blinding	B	3	MODERATE	Routine/ operator initiated backwash Backwash initiated by loss of head pressure. Media replacement	A	3	MODERATE	3	YES	YES	YES	YES	Filtration to remove precipitated arsenic is a critical control point Raw water arsenic levels in bore 4 are lower than previous bores used. No results for have exceeded ADWG of < 0.01 mg/L (max. 0.0025 mg/L, mean. 0.0014 mg/L) (2024 review)
CHI26	Clear water storage	Pathogenic bacteria	Growth/re-contamination with pathogenic bacteria	A	4	HIGH	Residual chlorine Reservoir holding times	B	2	LOW	3	NO	YES	YES	YES	

RA ID#	Component / Subcomponent	Hazard	Hazardous Event/ Hazard Source	Inherent Risk Likelihood	Inherent Risk Consequence	Inherent Risk Rating	Preventative/ Control Measure	Residual Risk Likelihood	Residual Risk Consequence	Residual Risk Rating	Certainty	CCP	SCADA (continuous online)	Operational	Verification	Corresponding proposed measures
CHI27	Clear water storage	Microbiological and physical contamination	Pest ingress	D	4	VERY HIGH	Covered, no inlets, inspection every 2 years.	B	2	LOW	3	NO	NO	NO	NO	
CHI28	Clear water storage	Chemical/ heavy metals (lead, asbestos)	Leaching from pipework and reservoirs	E	2	HIGH	Materials meet AS standard	A	1	LOW	3	NO	NO	NO	YES	
CHI29	Clear water storage	Microbiological, chemical and physical contamination	Contamination due to repairs and maintenance	B	5	VERY HIGH	Cleaning and inspections as per SOP 3209688 Residual chlorine	A	2	LOW	3	NO	NO	NO	YES	Disinfection (including residual chlorine) to reduce pathogenic bacteria to acceptable levels is a critical control point
CHI30	Clear water storage	Microbiological, chemical and physical contamination	Sedimentation	D	4	VERY HIGH	Monitoring & Inspection. Periodic cleaning.	B	2	LOW	3	NO	NO	NO	YES	
CHI31	Clear water storage	Microbiological, chemical and physical contamination	Sabotage	A	5	HIGH	Security patrol & restricted access.	A	2	LOW	3	NO	NO	NO	NO	
CHI32	Clear water storage	Unable to supply water	Empty reservoirs	B	4	HIGH	Operator alarm. Low tank level sensors installed on SCADA, back up float also sends alarm as secondary measure. Can supply directly from bores.	B	2	LOW	3	NO	YES	NO	NO	
CHI33	Reticulation	Pathogenic bacteria Physical contaminants	Contamination due to repairs, maintenance and cleaning (mains scouring)	C	4	VERY HIGH	Cleaning and inspections as per training and procedures. No sewer lines	B	2	LOW	3	NO	NO	NO	YES	
CHI34	Reticulation	Turbidity within reticulation	Contamination due to repairs, breaks etc	E	2	HIGH	Routine line flushing, line camera and repairs	C	1	LOW	3	NO	NO	NO	NO	
CHI35	Reticulation	Unable to supply water/ maintain pressure	Infrastructure failure (pumps, valves)	B	2	LOW		B	2	LOW	3	NO	NO	NO	NO	
CHI36	Reticulation	Pathogenic bacteria	Pathogenic bacteria growth due to no residual chlorine	C	2	MODERATE	Water quality in the bores is very consistent & does not see large fluctuations in water quality. Reticulation system monitoring, periodic flushing, scouring. Online analyser will alarm if set point is triggered.	B	2	LOW	3	NO	YES	YES	YES	
CHI37	Reticulation	Pathogenic bacteria Physical contaminants Chemicals/heavy metals	Contamination due to deteriorating pipework (leaks, leaching)	C	4	VERY HIGH	Replacement & maintenance program	C	2	MODERATE	3	NO	NO	NO	YES	RMIP: Install a pressure leakage management system on proposed lines.
CHI38	Reticulation	Microbiological, chemical and physical contamination	Backflow	D	5	VERY HIGH	Residual chlorine Backflow prevention devices, plumbing codes, backflow maintenance register.	A	2	LOW	3	NO	NO	NO	YES	

RA ID#	Component / Subcomponent	Hazard	Hazardous Event/ Hazard Source	Inherent Risk Likelihood	Inherent Risk Consequence	Inherent Risk Rating	Preventative/ Control Measure	Residual Risk Likelihood	Residual Risk Consequence	Residual Risk Rating	Certainty	CCP	SCADA (continuous online)	Operational	Verification	Corresponding proposed measures
CHI39	Plant-Wide	Unable to treat or supply water	Damage to infrastructure (including natural disasters)	C	5	VERY HIGH	Generator powering mains system, operator callout & diesel pump. Alternative bore. Paper-based monitoring Data-back up Disaster management	B	2	LOW	3	NO	NO	NO	NO	
CHI40	Plant-Wide	Unable to treat or supply water	Loss of power	C	5	VERY HIGH	Back up generator available.	B	2	LOW	3	NO	NO	NO	NO	
CHI41	Plant-Wide	Inability or ineffective treatment and/or supply of water	Insecure telemeter network. Online monitoring failure.	B	5	VERY HIGH	IT managed network, operator limitations.	A	2	LOW	3	NO	NO	NO	NO	
CHI42	Plant-Wide	Inability or ineffective treatment and/or supply of water	Inadequate maintenance supporting network	C	3	HIGH	IT managed network, operator limitations.	A	2	LOW	3	NO	NO	NO	NO	RMIP: Propose a review of councils network and potential backups
CHI43	Plant-Wide	Unable to treat or supply water	Breakdown of critical equipment (filters, pumps, flow meters, clarifiers, lines)	C	4	VERY HIGH	Asset management program SCADA and alarms Routine inspections and monitoring Spare parts and back up equipment (back up generator, diesel pump, duty & stand by pumps)	B	2	LOW	3	NO	NO	NO	NO	
CHI44	Plant-Wide	Unable to treat or supply water	Backwash settled water valve failure	A	4	HIGH	Level sensor alarms when level in backwash tank is high - SCADA monitored.	A	2	LOW	3	NO	NO	NO	NO	
CHI45	Plant-Wide	Unable to treat or supply water	PLC failure	C	3	HIGH	Generator and spares	B	1	LOW	3	NO	NO	NO	NO	
CHI46	Plant-Wide	Unable to treat or supply water	SCADA telemetry failure	B	3	MODERATE	Backup battery power, yearly maintenance schedule. Ability manually run	B	2	LOW	3	NO	NO	NO	NO	
CHI47	Plant-Wide	Unable to treat or supply water	Cyber attack	C	5	HIGH	Alignment with the ASD Essential Eight, enablement of 2FA, phishing awareness/training and the establishment of a formal relationship with a DFIR partner.	A	5	HIGH	3	NO	NO	NO	NO	RMIP: Future projects currently under consideration include the implementation of a SIEM solution, application control and performing a vulnerability/risk assessment. Council will continue to implement further cybersecurity measures from both a governance and practical solution perspective however, such work will be delivered in line with Council's resourcing/capacity to do so
CHI48	Plant-Wide	Ineffective treatment of water	Poor Work Practices, failure to act/inadequate training	C	5	VERY HIGH	SOP 3209688, Training program, Supervision.	A	2	LOW	3	NO	YES	YES	YES	
CHI49	Plant-wide	Ineffective treatment and/or supply of water	Inaccurate data from online monitoring systems	D	5	VERY HIGH	Operator knowledge, training and SOP 3209688 Monitoring Scheduled maintenance program	B	2	LOW	3	NO	NO	YES	YES	

RA ID#	Component / Subcomponent	Hazard	Hazardous Event/ Hazard Source	Inherent Risk Likelihood	Inherent Risk Consequence	Inherent Risk Rating	Preventative/ Control Measure	Residual Risk Likelihood	Residual Risk Consequence	Residual Risk Rating	Certainty	CCP	SCADA (continuous online)	Operational	Verification	Corresponding proposed measures
CHI50	Source Water	PFAS	Emerging contaminant	B	2	LOW	Baseline monitoring showed no detection of PFAS, ongoing monitoring to occur every 2 years	B	2	LOW	1	NO	NO	NO	YES	RMIP: PFAS testing to occur on treated water every 2 years to monitor any changes (2024, 2026, 2028, etc)

TABLE B2: DIMBULAH WATER TREATMENT PLANT RISK ASSESSMENT

RA ID#	Component / Subcomponent	Hazard	Hazardous Event/ Hazard Source	Inherent Risk Likelihood	Inherent Risk Consequence	Inherent Risk Rating	Preventative/ Control Measure	Residual Risk Likelihood	Residual Risk Consequence	Residual Risk Rating	Certainty	CCP	SCADA (continuous online)	Operational	Verification	Corresponding proposed measures
DIM01	Source Water	Turbidity	Naturally occurring (impact on disinfection effectiveness and formation of by products).	D	5	VERY HIGH	Coagulation and filtration	B	2	LOW	3	NO	YES	YES	YES	Subsequent Step: Filtration to reduce turbidity to acceptable level is a critical control point
DIM02	Source Water	Protozoa (Crypto/Giardia)	Agricultural run-off	D	5	VERY HIGH	Catchment categorisation Treatment train (filtration)	B	2	LOW	5	NO	NO	YES	YES	Subsequent Step: Filtration to reduce turbidity to acceptable level is a critical control point
DIM03	Source Water	Pesticides	Agricultural run-off	E	5	VERY HIGH	Catchment categorisation Treatment train (filtration)	B	2	LOW	4	NO	NO	YES	YES	
DIM04	Source Water	Heavy metals; iron, manganese	Naturally present in source water	E	3	VERY HIGH	Coagulation and filtration Capacity to dose potassium permanganate if required	A	2	LOW	3	NO	NO	NO	YES	
DIM05	Source Water	Harmful algal blooms	Long periods of hot, dry weather and low source water flows.	D	5	VERY HIGH	Channel is always flowing & not likely to experience HABs. SunWater notifies MSC when an outbreak occurs. Dimbulah WTP utilises coagulation & filtration.	A	2	LOW	3	NO	NO	NO	NO	RMIP: Harmful algal bloom management plan (SOP)
DIM06	Source Water	Pathogenic bacteria and viruses	Naturally present in source water Agricultural run-off Septic system discharges	E	5	VERY HIGH	Catchment categorisation Treatment train - Coagulation, filtration, and disinfection	A	2	LOW	3	NO	NO	NO	YES	Subsequent Step: Disinfection to reduce bacteria to an acceptable level is a critical control point Verification monitoring of source water
DIM07	Source Water	Acrolein (Herbicide)	Applied by sunwater to manage weeds in irrigation channels	A	5	HIGH	Planned channel shutdown managed by Sunwater. Publish notifications, conserve water notices, reservoir storage to manage supply during shutdowns.	A	2	LOW	4	NO	NO	NO	NO	
DIM08	Source Water	Pesticides, fuel/oil	Accidental spills in catchment	B	3	MODERATE	Operator observation. Plant shutdown & dilution. Coagulation removes some organic contaminants	B	2	LOW	5	NO	NO	NO	NO	
DIM09	Source Water	Fuel/oil, litter	Recreational use	A	1	LOW	It is not likely that boats etc will be in operation for recreational purposes nearby in an irrigation channel.	A	1	LOW	5	NO	NO	NO	NO	

RA ID#	Component / Subcomponent	Hazard	Hazardous Event/ Hazard Source	Inherent Risk Likelihood	Inherent Risk Consequence	Inherent Risk Rating	Preventative/ Control Measure	Residual Risk Likelihood	Residual Risk Consequence	Residual Risk Rating	Certainty	CCP	SCADA (continuous online)	Operational	Verification	Corresponding proposed measures
DIM10	Source Water	Chemical or biological agents harmful to human health	Intentional Dumping/ Sabotage	A	5	HIGH	Site security and restricted access. Operator Observations. Pipe located within the channel and underground. Coagulation removes some organic contaminants	A	2	LOW	5	NO	NO	NO	NO	
DIM11	Source Water Intake	Unable to treat or supply water	Pump failure	A	4	HIGH	Asset Management Critical spares Back up pumps Hire pump	A	2	LOW	3	NO	YES	NO	NO	
DIM12	Source Water Intake	Unable to treat or supply water	Valve failure	A	3	MODERATE	Security fencing & operator checks.	A	2	LOW	1	NO	YES	NO	NO	
DIM13	Source Water Intake	Unable to treat or supply water	Intake blockage	E	3	VERY HIGH	Standby operator intervention/maintenance (refer to SOP 3209691).	B	2	LOW	3	NO	YES	NO	NO	
DIM14	Source Water Storage	Unable to treat or supply water	Raw Water Tank Mechanical Failure (Leaks, Rupture)	A	5	HIGH	back up storage (additional tank), routine operator inspection.	A	2	LOW	3	NO	YES	NO	NO	
DIM15	Source Water Storage	Unable to treat or supply water	Raw water tank level sensor failure resulting in no flow to plant.	A	2	LOW	Bypass tank.	A	2	LOW	3	NO	YES	NO	NO	
DIM16	Coagulation	High turbidity in water to filters	Chemical dosing failure (pump, line break)	A	5	HIGH	Alarms, monitoring and inspection Maintenance program Standby pumps Backup system in place	A	2	LOW	3	NO	YES	YES	NO	
DIM17	Coagulation	High turbidity in water to filters	Incorrect chemical dose rate (operator over/under dosing)	D	3	HIGH	Online monitoring Routine monitoring and analysis (turbidity and jar tests) Operator training, SOP 3209691	A	2	LOW	3	NO	YES	YES	NO	
DIM18	Coagulation	By products (manganese, aluminium)	Chemical reactions with coagulants/flocculants	E	3	VERY HIGH	Controlled dosing. SOP 3209691.	C	1	LOW	3	NO	NO	NO	YES	
DIM19	Coagulation	High turbidity in water to filters	High turbidity in source water due to flooding, storms and natural disasters	C	4	VERY HIGH	Monitoring of source water and jar test to set chemical dose rates for coagulation, flocculation and sedimentation	B	4	HIGH	3	NO	YES	YES	NO	Subsequent Step: Filtration to reduce turbidity to acceptable level is a critical control point
DIM20	Coagulation	High turbidity in water to filters	Ineffective settlign of sludge in cyclone	B	3	MODERATE	Operator checks & SOP 3209691.	B	2	LOW	3	NO	YES	YES	NO	
DIM21	Filtration	High turbidity in filtered water (physical, chemical and microbiological contamination)	Ineffective filtration and breakthrough due to media blinding	C	4	VERY HIGH	Routine/ operator initiated backwash Backwash initiated by loss of head pressure. Media replacement	C	1	LOW	3	YES	YES	YES	YES	Filtration to reduce turbidity to acceptable level is a critical control point
DIM22	Filtration	High turbidity in filtered water (physical, chemical and microbiological contamination)	Unable to backwash filter due to level switch failure	A	2	LOW		A	2	LOW	3	YES	YES	YES	YES	Filtration to reduce turbidity to acceptable level is a critical control point
DIM23	Disinfection	Pathogenic bacteria	Mechanical chlorine dosing failure	D	5	VERY HIGH	Maintenance, operator intervention (refer to SOP	B	2	LOW	3	YES	YES	YES	YES	Disinfection to reduce pathogenic bacteria to acceptable levels is a critical control point

RA ID#	Component / Subcomponent	Hazard	Hazardous Event/ Hazard Source	Inherent Risk Likelihood	Inherent Risk Consequence	Inherent Risk Rating	Preventative/ Control Measure	Residual Risk Likelihood	Residual Risk Consequence	Residual Risk Rating	Certainty	CCP	SCADA (continuous online)	Operational	Verification	Corresponding proposed measures
							3209691), residual testing, duty/standby pumps. flow paced/SCADA monitored.									
DIM24	Disinfection	Pathogenic bacteria	Ineffective chlorine dosing due to degradation of chlorine in bulk storage	D	3	HIGH	Chlorine is produced as required by electro chlorination with minimal storage.	B	2	LOW	3	YES	YES	YES	YES	Disinfection to reduce pathogenic bacteria to acceptable levels is a critical control point
DIM25	Disinfection	Pathogenic bacteria	Ineffective chlorine dosing rate for disinfection	D	5	VERY HIGH	Maintenance, operator intervention (refer to SOP 3209691), residual testing, flow paced/SCADA monitored.	B	2	LOW	3	YES	YES	YES	YES	Disinfection to reduce pathogenic bacteria to acceptable levels is a critical control point
DIM26	Disinfection	Inability to disinfect	Inability to produce sodium hypochlorite by electro chlorination	C	4	VERY HIGH	Back up supply of sodium hypochlorite used for other schemes	C	1	LOW	3	NO	NO	NO	NO	
DIM27	Disinfection	Pathogenic bacteria	Ineffective disinfection due to chlorine dosing contact time	E	5	VERY HIGH	Minimum retention times in storage reservoirs Flow Rate	A	5	HIGH	3	YES	YES	YES	YES	Disinfection to reduce pathogenic bacteria to acceptable levels is a critical control point
DIM28	Disinfection	Pathogenic bacteria	Ineffective disinfection due to pH	A	5	HIGH	Managed by chemicals used for coagulation	A	1	LOW	3	NO	YES	YES	YES	
DIM29	Disinfection	Pathogenic bacteria	Ineffective chlorine dosing due to poor mixing	D	4	VERY HIGH	Retention times in storage reservoirs	B	2	LOW	3	YES	YES	YES	YES	Disinfection to reduce pathogenic bacteria to acceptable levels is a critical control point
DIM30	Disinfection	Disinfection by-products (Chlorates)	Contaminant formation due to storage conditions (temperature and time)	A	2	LOW	Sodium hypochlorite is produced by electro chlorination and produced as required to minimise storage.	A	2	LOW	3	NO	NO	NO	NO	Baseline monitoring program completed. Operational controls in place and bi-annual sampling.
DIM31	Disinfection	Disinfection by-products (Chlorates, THMs)	Disinfection by-products caused by high organic and inorganic load in filtered water	C	2	MODERATE	Coagulation and filtration. Standby operator intervention/maintenance (refer to SOP 3209691).	A	2	LOW	3	NO	NO	NO	NO	Baseline monitoring program completed. Operational controls in place and bi-annual sampling.
DIM32	Disinfection	Chlorine	Chlorine exceeding ADWG guideline values for health and aesthetic	E	2	HIGH	Maintenance, operator intervention (refer to SOP 3209691), residual testing, installed online analysers integrated to SCADA & flow pacing. Dosed in accordance with ADWG	B	2	LOW	3	YES	YES	YES	YES	Disinfection to reduce pathogenic bacteria to acceptable levels is a critical control point
DIM33	Disinfection	Pathogenic bacteria	Poor disinfection due to high organic and inorganic load in filtered water	D	4	VERY HIGH	Setpoints installed on Scada, alarms for HIGH/LOW chlorine levels. Operator monitors via Scada, 3 x weekly manual monitoring, chlorine analysers are on Scada for treatment plants.	B	2	LOW	3	YES	YES	YES	YES	Filtration to reduce turbidity to acceptable level is a critical control point
DIM34	Clear water storage	Pathogenic bacteria	Growth/re-contamination with pathogenic bacteria	B	5	HIGH	Cleaning and inspections as per SOP 3209693 Residual chlorine Reservoir holding times	A	2	LOW	3	NO	YES	YES	YES	Disinfection (including residual chlorine) to reduce pathogenic bacteria to acceptable levels is a critical control point
DIM35	Clear water storage	Microbiological and physical contamination	Pest ingress	D	4	VERY HIGH	Covered, no inlets, inspection every 2 years.	B	2	LOW	3	NO	NO	NO	NO	
DIM36	Clear water storage	Chemical/ heavy metals (lead, asbestos)	Leaching from pipework and reservoirs	E	2	HIGH	Materials meet AS standard	A	1	LOW	3	NO	NO	NO	YES	

RA ID#	Component / Subcomponent	Hazard	Hazardous Event/ Hazard Source	Inherent Risk Likelihood	Inherent Risk Consequence	Inherent Risk Rating	Preventative/ Control Measure	Residual Risk Likelihood	Residual Risk Consequence	Residual Risk Rating	Certainty	CCP	SCADA (continuous online)	Operational	Verification	Corresponding proposed measures
DIM37	Clear water storage	Microbiological, chemical and physical contamination	Contamination due to repairs and maintenance	D	2	VERY HIGH	Cleaning and inspections as per SOPs 3209691	A	2	LOW	3	NO	NO	NO	YES	
DIM38	Clear water storage	Microbiological, chemical and physical contamination	Sedimentation	C	2	MODERATE	Monitoring & Inspection. Periodic cleaning.	B	1	LOW	3	NO	NO	NO	YES	
DIM39	Clear water storage	Microbiological, chemical and physical contamination	Sabotage	A	5	HIGH	Security patrol & restricted access.	A	2	LOW	3	NO	NO	NO	NO	
DIM40	Clear water storage	Unable to supply water	Empty reservoirs	A	4	HIGH	Operator alarm. Low tank level sensors installed on SCADA, back up float also sends alarm as secondary measure. Clearwater pumps can be operated manually.	B	2	LOW	3	NO	YES	NO	NO	
DIM41	Reticulation	Pathogenic bacteria Physical contaminants	Contamination due to repairs, maintenance and cleaning (mains scouring)	D	2	HIGH	Cleaning and inspections as per training and procedures	B	2	LOW	3	NO	NO	NO	YES	
DIM42	Reticulation	Turbidity within reticulation	Contamination due to repairs, breaks etc	E	2	HIGH	Routine line flushing, line camera and repairs	C	1	LOW	3	NO	NO	NO	NO	
DIM43	Reticulation	Unable to supply water/ maintain pressure	Infrastructure failure (pumps, valves)	D	4	VERY HIGH	Asset management program Valve inspections and replacement program Duty and standby pumps	B	2	LOW	3	NO	NO	NO	NO	
DIM44	Reticulation	Chlorine	High residual chlorine	E	2	HIGH	Online analysing and controlled dosing	B	2	LOW	3	NO	YES	YES	YES	
DIM45	Reticulation	Pathogenic bacteria	Pathogenic bacteria growth due to no residual chlorine	B	5	VERY HIGH	Reticulation system monitoring, periodic flushing, scouring. Online analyser will alarm if set point is triggered.	A	2	LOW	3	NO	YES	YES	YES	
DIM46	Reticulation	Pathogenic bacteria Physical contaminants Chemicals/heavy metals	Contamination due to deteriorating pipework (leaks, leaching)	E	2	HIGH	Replacement & maintenance program	C	2	MODERATE	3	NO	NO	NO	YES	RMIP: Install a pressure leakage management system on proposed lines.
DIM47	Reticulation	Microbiological, chemical and physical contamination	Backflow	D	5	VERY HIGH	Residual chlorine Backflow prevention devices, plumbing codes, backflow maintenance register.	A	2	LOW	3	NO	NO	NO	YES	
DIM48	Plant-Wide	Unable to treat or supply water	Damage to infrastructure (including natural disasters)	C	5	VERY HIGH	Generator powering mains system, operator callout & diesel pump. Paper-based monitoring Data-back up Disaster management	B	2	LOW	3	NO	NO	NO	NO	
DIM49	Plant-Wide	Unable to treat or supply water	Loss of power	C	5	VERY HIGH	Generator powering mains system, operator callout &	B	2	LOW	3	NO	NO	NO	NO	

RA ID#	Component / Subcomponent	Hazard	Hazardous Event/ Hazard Source	Inherent Risk Likelihood	Inherent Risk Consequence	Inherent Risk Rating	Preventative/ Control Measure	Residual Risk Likelihood	Residual Risk Consequence	Residual Risk Rating	Certainty	CCP	SCADA (continuous online)	Operational	Verification	Corresponding proposed measures
							diesel pump. Booster pump generator.									
DIM50	Plant-Wide	Inability or ineffective treatment and/or supply of water	Insecure telemeter network. Online monitoring failure.	B	5	VERY HIGH	IT managed network, operator limitations.	A	2	LOW	3	NO	NO	NO	NO	
DIM51	Plant-Wide	Inability or ineffective treatment and/or supply of water	Inadequate maintenance supporting network	C	3	HIGH	IT managed network, operator limitations.	A	2	LOW	3	NO	NO	NO	NO	RMIP: Propose a review of councils network and potential backups
DIM52	Plant-Wide	Unable to treat or supply water	Breakdown of critical equipment (filters, pumps, flow meters, clarifiers, lines)	D	4	VERY HIGH	Asset management program SCADA and alarms Routine inspections and monitoring Spare parts and back up equipment (back up generator, diesel pump, duty & stand by pumps)	B	2	LOW	3	NO	NO	NO	NO	
DIM53	Plant-Wide	Unable to treat or supply water	Loss of access to site	A	5	VERY HIGH	No foreseen problems accessing site Remote access to HMI	B	1	LOW	3	NO	NO	NO	NO	
DIM54	Plant-Wide	Unable to treat or supply water	PLC failure	C	3	HIGH	Generator and spares	B	1	LOW	3	NO	NO	NO	NO	
DIM55	Plant-Wide	Unable to treat or supply water	SCADA telemetry failure	B	3	MODERATE	Backup battery power, yearly maintenance schedule. Ability manually run	B	2	LOW	3	NO	NO	NO	NO	
DIM56	Plant-Wide	Unable to treat or supply water	Cyber attack	C	5	HIGH	Alignment with the ASD Essential Eight, enablement of 2FA, phishing awareness/training and the establishment of a formal relationship with a DFIR partner.	A	5	HIGH	3	NO	NO	NO	NO	RMIP: Future projects currently under consideration include the implementation of a SIEM solution, application control and performing a vulnerability/risk assessment. Council will continue to implement further cybersecurity measures from both a governance and practical solution perspective however, such work will be delivered in line with Council's resourcing/capacity to do so
DIM57	Plant-Wide	Ineffective treatment of water	Poor Work Practices, failure to act/inadequate training	C	5	VERY HIGH	SOP 3209691, Training program, Supervision.	A	2	LOW	3	NO	YES	YES	YES	
DIM58	Plant-wide	Ineffective treatment and/or supply of water	Inaccurate data from online monitoring systems	D	5	VERY HIGH	Operator knowledge, training and SOP 3209691 Monitoring Scheduled maintenance program	B	2	LOW	3	NO	NO	YES	YES	
DIM59	Source Water	PFAS	Emerging contaminant	B	2	LOW	Baseline monitoring showed no detection of PFAS, ongoing annual monitoring	B	2	LOW	1	NO	NO	NO	YES	RMIP: Annual PFAS testing to occur on treated water to monitor any changes

TABLE B3: MAREEBA WATER TREATMENT PLANT RISK ASSESSMENT

RA ID#	Component/ Subcomponent	Hazard	Hazardous Event/ Hazard Source	Inherent Risk Likelihood	Inherent Risk Consequence	Inherent Risk Rating	Preventative/ Control Measure	Residual Risk Likelihood	Residual Risk Consequence	Residual Risk Rating	Certainty	CCP	SCADA (continuous online)	Operational	Verification	Corresponding proposed measures
MAR01	Source Water	Turbidity	Naturally occurring (impact on disinfection effectiveness and formation of by products).	E	5	VERY HIGH	Conventional treatment	B	2	LOW	1	NO	YES	YES	YES	Subsequent Step: Filtration to reduce turbidity to acceptable level is a critical control point
MAR02	Source Water	Protozoa (Crypto/Giardia)	Agricultural run-off	D	5	VERY HIGH	Catchment categorisation Treatment train (filtration)	B	2	LOW	4	NO	NO	YES	YES	RMIP: Confirm treatment train with microbial indicator assessment Subsequent Step: Filtration to reduce turbidity to acceptable level is a critical control point
MAR03	Source Water	Pesticides	Agricultural run-off	E	5	VERY HIGH	Catchment categorisation	B	2	LOW	4	NO	NO	YES	YES	RMIP: Confirm treatment train with microbial indicator assessment
MAR04	Source Water	Heavy metals; iron, manganese, aluminium	Naturally present in source water	E	3	VERY HIGH	Potassium permanganate dosing Conventional treatment	A	1	LOW	3	NO	NO	NO	YES	
MAR05	Source Water	Harmful algal blooms	Long periods of hot, dry weather and low source water flows.	B	5	VERY HIGH	Inspection of source water Conventional treatment Treatment with powdered Activated Carbon.	B	2	LOW	4	NO	NO	NO	NO	RMIP: Harmful algal bloom management plan (SOP)
MAR06	Source Water	Pathogenic bacteria and viruses	Naturally present in source water Agricultural run-off	E	5	VERY HIGH	Catchment categorisation Treatment train - Conventional treatment and Chlorination	A	2	LOW	3	NO	NO	YES	YES	RMIP: Confirm treatment train with microbial indicator assessment Subsequent Step: Disinfection to reduce bacteria to an acceptable level is a critical control point Verification monitoring of source water
MAR07	Source Water	Physical, chemical, and microbiological contamination	Sludge pond overflow/discharge to source water	D	4	VERY HIGH	Monitoring in accordance with environmental authority	B	2	LOW	3	NO	NO	NO	NO	Refer to EA for conditions
MAR08	Source Water	Physical, chemical, and microbiological contamination	Contaminated sludge pond supernatant returned as source water	D	4	VERY HIGH	Operator assessment	B	2	LOW	3	NO	NO	NO	NO	
MAR09	Source Water	acidic pH (soft water)	Naturally present in source water	A	5	HIGH	Managed by chemicals used for coagulation	A	1	LOW	3	NO	NO	YES	YES	
MAR10	Source Water	Pesticides, fuel/oil	Accidental spills in catchment	A	5	HIGH	Operator observation. Plant shutdown & dilution. Conventional treatment removes some organic contaminants	A	2	LOW	5	NO	NO	NO	NO	
MAR11	Source Water	Fuel/oil, litter	Recreational use	B	1	LOW		B	1	LOW	5	NO	NO	NO	NO	
MAR12	Source Water	Chemical or biological agents harmful to human health	Intentional Dumping/ Sabotage	A	5	HIGH	Site security and restricted access. Operator Observations. Conventional treatment	A	2	LOW	5	NO	NO	NO	NO	RMIP: long-term financial plan to improve security on the river side

RA ID#	Component/ Subcomponent	Hazard	Hazardous Event/ Hazard Source	Inherent Risk Likelihood	Inherent Risk Consequence	Inherent Risk Rating	Preventative/ Control Measure	Residual Risk Likelihood	Residual Risk Consequence	Residual Risk Rating	Certainty	CCP	SCADA (continuous online)	Operational	Verification	Corresponding proposed measures
							removes some organic contaminants									
MAR13	Source Water Intake	Unable to treat or supply water	Pump failure	E	3	VERY HIGH	Asset Management Critical spares Back up pumps	B	1	LOW	3	NO	YES	NO	NO	Raw water pump station upgraded in 2025
MAR14	Source Water Intake	Unable to treat or supply water	Intake damage	B	3	HIGH	Intake barrier	B	2	LOW	1	NO	YES	NO	NO	River intake upgraded in 2025
MAR15	Source Water Intake	Unable to treat or supply water	Intake blockage	A	2	LOW	Standby operator intervention/maintenance (refer to SOP).	A	1	LOW	3	NO	YES	NO	NO	
MAR16	Source Water Intake	Unable to treat or supply water	Pipe breakage	A	3	MODERATE	Standby operator intervention/maintenance (refer to SOP).	A	1	LOW	3	NO	YES	NO	NO	
MAR17	Source Water Intake	Unable to treat or supply water	Raw water flow meter failure	D	2	HIGH	Preventative maintenance	A	1	LOW	3	NO	YES	NO	NO	
MAR18	Coagulation, flocculation and sedimentation	High turbidity in settled water	Chemical dosing failure (pump, line break)	C	5	VERY HIGH	Alarms, monitoring and inspection Maintenance program Standby pumps	A	2	LOW	3	NO	YES	YES	NO	
MAR19	Coagulation, flocculation and sedimentation	High turbidity in settled water	Static mixer failure	C	3	HIGH	Standby operator intervention/maintenance (refer to SOP) - integrated into SCADA system.	C	1	LOW	3	NO	YES	YES	NO	
MAR20	Coagulation, flocculation and sedimentation	High turbidity in settled water	Incorrect chemical dose rate (operator over/under dosing)	D	3	HIGH	Online monitoring Routine monitoring and analysis (turbidity and jar tests) Operator training, SOPs	C	1	LOW	3	NO	YES	YES	NO	
MAR21	Coagulation, flocculation and sedimentation	By products (manganese, aluminium)	Chemical reactions with coagulants/flocculants	E	3	VERY HIGH	Controlled dosing. SOP 3209693.	E	1	LOW	3	NO	NO	NO	YES	Baseline monitoring program completed. Operational controls in place and bi-annual sampling.
MAR22	Coagulation, flocculation and sedimentation	High turbidity in settled water	High turbidity in source water due to flooding, storms and natural disasters	C	4	VERY HIGH	Monitoring of source water and jar test to set chemical dose rates for coagulation, flocculation and sedimentation	B	4	HIGH	3	NO	YES	YES	NO	Subsequent Step: Filtration to reduce turbidity to acceptable level is a critical control point
MAR23	Coagulation, flocculation and sedimentation	High turbidity in settled water	Equipment failure due to aging infrastructure (Clarifier)	A	3	MODERATE	Assets management program	A	1	LOW		NO	YES	YES	NO	Clarifier Infrastructure upgraded in 2025
MAR24	Coagulation, flocculation and sedimentation	High turbidity in settled water	Mechanical failure (clarifier)	B	4	HIGH	Standby operator intervention/maintenance (refer to SOP 3209693) - integrated into SCADA system.	B	2	LOW	3	NO	YES	YES	NO	Clarifier Infrastructure upgraded in 2025
MAR25	Filtration	High turbidity in filtered water (physical, chemical and microbiological contamination)	Insufficient backwash due to air scour failure	C	4	VERY HIGH	Operator callout alarm - integrated into SCADA system.	C	1	LOW	3	YES	YES	YES	YES	Filtration to reduce turbidity to acceptable level is a critical control point

RA ID#	Component/ Subcomponent	Hazard	Hazardous Event/ Hazard Source	Inherent Risk Likelihood	Inherent Risk Consequence	Inherent Risk Rating	Preventative/ Control Measure	Residual Risk Likelihood	Residual Risk Consequence	Residual Risk Rating	Certainty	CCP	SCADA (continuous online)	Operational	Verification	Corresponding proposed measures
MAR26	Filtration	High turbidity in filtered water (physical, chemical and microbiological contamination)	Ineffective filtration and breakthrough due to media blinding	C	4	VERY HIGH	Routine/ operator initiated backwash Backwash initiated by loss of head pressure. Media replacement	C	1	LOW	3	YES	YES	YES	YES	Filter upgraded in 2025
MAR27	Disinfection	Pathogenic bacteria	Mechanical chlorine dosing failure	D	5	VERY HIGH	Maintenance, operator intervention (refer to SOP 3209693), residual testing, duty/standby pumps. flow paced/SCADA monitored.	B	2	LOW	3	YES	YES	YES	YES	Disinfection to reduce pathogenic bacteria to acceptable levels is a critical control point
MAR28	Disinfection	Pathogenic bacteria	Ineffective chlorine dosing due to degradation of chlorine in bulk storage	D	2	HIGH	Only use QA supplied materials/sampling, covered hypo storage area integrated to SCADA Pumping out of bulk storage tanks on 6 monthly basis Manage volumes	B	2	LOW	3	YES	YES	YES	YES	Disinfection to reduce pathogenic bacteria to acceptable levels is a critical control point
MAR29	Disinfection	Pathogenic bacteria	Ineffective chlorine dosing rate for disinfection	D	5	VERY HIGH	Maintenance, operator intervention (refer to SOP 3209693), residual testing, flow paced/SCADA monitored.	B	2	LOW	3	YES	YES	YES	YES	Disinfection to reduce pathogenic bacteria to acceptable levels is a critical control point
MAR30	Disinfection	Inability to disinfect	Unavailability of sodium hypochlorite (including natural disasters)	C	4	VERY HIGH	Minimum 1 month of chemical storage, managing supplies. Disaster management	C	1	LOW	3	NO	NO	NO	NO	
MAR31	Disinfection	Pathogenic bacteria	Ineffective disinfection due to chlorine dosing contact time	E	5	VERY HIGH	Minimum retention times in storage reservoirs Flow Rate	A	5	HIGH	3	YES	YES	YES	YES	Disinfection to reduce pathogenic bacteria to acceptable levels is a critical control point
MAR32	Disinfection	Pathogenic bacteria	Ineffective disinfection due to pH	A	5	HIGH	Managed by chemicals used for coagulation	A	1	LOW	3	NO	YES	YES	YES	
MAR33	Disinfection	Pathogenic bacteria	Ineffective chlorine dosing due to poor mixing	D	4	VERY HIGH	Retention times in storage reservoirs	B	2	LOW	3	YES	YES	YES	YES	Disinfection to reduce pathogenic bacteria to acceptable levels is a critical control point
MAR34	Disinfection	Disinfection by-products (Chlorates)	Contaminant formation due to storage conditions (temperature and time)	D	3	HIGH	Only use QA supplied materials/sampling, covered hypo storage area & MSC manages supplies.	B	2	LOW	3	NO	NO	NO	NO	Baseline monitoring program completed. Operational controls in place and bi-annual sampling.
MAR35	Disinfection	Disinfection by-products (Chlorates, THMs)	Disinfection by-products caused by high organic and inorganic load in filtered water	C	5	VERY HIGH	Conventional treatment. Standby operator intervention/maintenance (refer to SOP 3209693).	B	2	LOW	3	NO	NO	NO	NO	Baseline monitoring program completed. Operational controls in place and bi-annual sampling. U Filtration to reduce turbidity to acceptable level is a critical control point

RA ID#	Component/ Subcomponent	Hazard	Hazardous Event/ Hazard Source	Inherent Risk Likelihood	Inherent Risk Consequence	Inherent Risk Rating	Preventative/ Control Measure	Residual Risk Likelihood	Residual Risk Consequence	Residual Risk Rating	Certainty	CCP	SCADA (continuous online)	Operational	Verification	Corresponding proposed measures
MAR36	Disinfection	Chlorine	Chlorine exceeding ADWG guideline values for health and aesthetic	D	2	HIGH	Maintenance, operator intervention (refer to SOP 3209693), residual testing, installed online analysers integrated to SCADA & flow pacing. Dosed in accordance with ADWG	B	2	LOW	3	YES	YES	YES	YES	Disinfection to reduce pathogenic bacteria to acceptable levels is a critical control point
MAR37	Disinfection	Pathogenic bacteria	Poor disinfection due to high organic and I organic load in filtered water	C	4	VERY HIGH	Setpoints installed on Scada, alarms for HIGH/LOW chlorine levels. Operator monitors via Scada, 3 x weekly manual monitoring, chlorine analysers are on Scada for treatment plants.	B	2	LOW	3	YES	YES	YES	YES	Filtration to reduce turbidity to acceptable level is a critical control point
MAR38	Clear water storage	Pathogenic bacteria	Growth/re-contamination with pathogenic bacteria	C	5	VERY HIGH	Residual chlorine Reservoir holding times	A	5	HIGH	3	NO	YES	YES	YES	Disinfection to reduce pathogenic bacteria to acceptable levels is a critical control point
MAR39	Clear water storage	Microbiological and physical contamination	Pest ingress	D	4	VERY HIGH	Covered, no inlets, inspection every 2 years.	B	2	LOW	3	NO	NO	NO	NO	
MAR40	Clear water storage	Chemical/ heavy metals (lead, asbestos)	Leaching from pipework and reservoirs	E	2	HIGH	Materials meet AS standard	A	1	LOW	3	NO	NO	NO	YES	
MAR41	Clear water storage	Microbiological, chemical and physical contamination	Contamination due to repairs and maintenance	B	5	VERY HIGH	Cleaning and inspections as per SOP 3209693 Residual Chlorine	A	2	LOW	3	NO	NO	NO	YES	Disinfection (including residual chlorine) to reduce pathogenic bacteria to acceptable levels is a critical control point
MAR42	Clear water storage	Microbiological, chemical and physical contamination	Sedimentation	C	2	MODERATE	Monitoring & Inspection. Periodic cleaning.	B	1	LOW	3	NO	NO	NO	YES	
MAR43	Clear water storage	Microbiological, chemical and physical contamination	Sabotage	A	5	HIGH	Security patrol & restricted access.	A	2	LOW	3	NO	NO	NO	NO	RMIP: long-term financial plan to improve security on the river side
MAR44	Clear water storage	Unable to supply water	Under spec reservoir	B	5	VERY HIGH		B	5	VERY HIGH	3	NO	NO	NO	NO	RMIP: Reservoir upgrade (5ML to 10ML)
MAR45	Clear water storage	Unable to supply water	Empty reservoirs	C	4	VERY HIGH	Operator alarm. LOW tank level sensors installed on SCADA, back up float also sends alarm as secondary measure.	B	2	LOW	3	NO	YES	NO	NO	
MAR46	Reticulation	Pathogenic bacteria Physical contaminants	Contamination due to repairs, maintenance and cleaning (mains scouring)	E	2	HIGH	Cleaning and inspections as per training and procedures.	B	2	LOW	3	NO	NO	NO	YES	
MAR47	Reticulation	Turbidity within reticulation	Contamination due to repairs, breaks etc	E	2	HIGH	Routine line flushing, line camera and repairs	C	1	LOW	3	NO	NO	NO	NO	
MAR48	Reticulation	Unable to supply water/ maintain pressure	Under spec infrastructure	E	4	VERY HIGH	Asset management program	B	2	LOW	3	NO	NO	NO	NO	Clear water booster pump station upgraded in 2025

RA ID#	Component/ Subcomponent	Hazard	Hazardous Event/ Hazard Source	Inherent Risk Likelihood	Inherent Risk Consequence	Inherent Risk Rating	Preventative/ Control Measure	Residual Risk Likelihood	Residual Risk Consequence	Residual Risk Rating	Certainty	CCP	SCADA (continuous online)	Operational	Verification	Corresponding proposed measures
MAR49	Reticulation	Unable to supply water/ maintain pressure	Aging infrastructure	E	5	VERY HIGH	Asset management program Valve replacement program Hydrant renewal program	E	5	VERY HIGH	3	NO	NO	NO	NO	RIMP: Annual valve and hydrant replacement program is a part of Council long term plan
MAR50	Reticulation	Chlorine	High residual chlorine	E	2	HIGH	Online analysing and controlled dosing	B	2	LOW	3	NO	YES	YES	YES	
MAR51	Reticulation	Pathogenic bacteria	Pathogenic bacteria growth due to long detention times in reticulation network	C	2	MODERATE	Residual chlorine Routine flushing	C	2	MODERATE	3	NO	YES	YES	YES	RMIP: Network modelling, pressure testing RMIP: Surge vessels installed as part of the booster pump station upgrade
MAR52	Reticulation	Pathogenic bacteria	Pathogenic bacteria growth due to no residual chlorine	B	5	VERY HIGH	Reticulation system monitoring, periodic flushing, scouring. Online analyser will alarm if set point is triggered.	A	1	LOW	3	NO	YES	YES	YES	
MAR53	Reticulation	Pathogenic bacteria Physical contaminants Chemicals/heavy metals	Contamination due to deteriorating pipework (leaks, leaching)	E	2	HIGH	Replacement & maintenance program	C	2	MODERATE	3	NO	NO	NO	YES	RMIP: Install a pressure leakage management system on proposed lines.
MAR54	Reticulation	Microbiological, chemical and physical contamination	Backflow	D	5	VERY HIGH	Residual chlorine Backflow prevention devices, plumbing codes, backflow maintenance register.	A	2	LOW	3	NO	NO	NO	YES	
MAR55	Plant-Wide	Unable to treat or supply water	Damage to infrastructure (including natural disasters)	C	5	VERY HIGH	Generator powering mains system, operator callout & diesel pump. Paper-based monitoring Data-back up Disaster management	B	2	LOW	3	NO	NO	NO	NO	
MAR56	Plant-Wide	Unable to treat or supply water	Loss of power	C	5	VERY HIGH	Generator powering mains system, operator callout & diesel pump.	B	2	LOW	3	NO	NO	NO	NO	
MAR57	Plant-Wide	Inability or ineffective treatment and/or supply of water	Insecure telemeter network. Online monitoring failure.	B	5	VERY HIGH	IT managed network, operator limitations.	A	2	LOW	3	NO	NO	NO	NO	
MAR58	Plant-Wide	Inability or ineffective treatment and/or supply of water	Inadequate maintenance supporting network	C	3	HIGH	IT managed network, operator limitations.	A	2	LOW	3	NO	NO	NO	NO	RMIP: Propose a review of councils network and potential backups
MAR59	Plant-Wide	Unable to treat or supply water	Breakdown of critical equipment (filters, pumps, flow meters, clarifiers, lines)	D	4	VERY HIGH	Asset management program SCADA and alarms Routine inspections and monitoring Spare parts and back up	B	2	LOW	3	NO	NO	NO	NO	

RA ID#	Component/ Subcomponent	Hazard	Hazardous Event/ Hazard Source	Inherent Risk Likelihood	Inherent Risk Consequence	Inherent Risk Rating	Preventative/ Control Measure	Residual Risk Likelihood	Residual Risk Consequence	Residual Risk Rating	Certainty	CCP	SCADA (continuous online)	Operational	Verification	Corresponding proposed measures
							equipment (back up generator, diesel pump, duty & stand by pumps)									
MAR60	Plant-Wide	Unable to treat or supply water	Loss of access to site	B	5	VERY HIGH	Alternative entrance Remote access to HMI	B	1	LOW	3	NO	NO	NO	NO	
MAR61	Plant-Wide	Unable to treat or supply water	PLC failure	C	3	HIGH	Generator and spares	B	1	LOW	3	NO	NO	NO	NO	
MAR62	Plant-Wide	Unable to treat or supply water	SCADA telemetry failure	B	3	MODERATE	Backup battery power, yearly maintenance schedule. Ability manually run	B	2	LOW	3	NO	NO	NO	NO	
MAR63	Plant-Wide	Unable to treat or supply water	Cyber attack	C	5	HIGH	Alignment with the ASD Essential Eight, enablement of 2FA, phishing awareness/training and the establishment of a formal relationship with a DFIR partner.	A	5	HIGH	3	NO	NO	NO	NO	RMIP: Future projects currently under consideration include the implementation of a SIEM solution, application control and performing a vulnerability/risk assessment. Council will continue to implement further cybersecurity measures from both a governance and practical solution perspective however, such work will be delivered in line with Council's resourcing/capacity to do so
MAR64	Plant-Wide	Ineffective treatment of water	Poor Work Practices, failure to act/inadequate training	C	5	VERY HIGH	SOP 3209693, Training program, Supervision.	A	2	LOW	3	NO	YES	YES	YES	
MAR65	Plant-wide	Ineffective treatment and/or supply of water	Inaccurate data from online monitoring systems	D	5	VERY HIGH	Operator knowledge, training and SOP 3209693 Monitoring Scheduled maintenance program	B	2	LOW	3	NO	NO	YES	YES	
MAR66	Source Water	PFAS	Emerging contaminant	C	2	LOW	Baseline monitoring showed no detection of PFAS, ongoing annual monitoring to occur	B	2	LOW	1	NO	NO	NO	YES	RMIP: Annual PFAS testing to occur on treated water to monitor any changes

TABLE B4: KURANDA WATER TREATMENT PLANT RISK ASSESSMENT

RA ID#	Component / Subcomponent	Hazard	Hazardous Event/ Hazard Source	Inherent Risk Likelihood	Inherent Risk Consequence	Inherent Risk Rating	Preventative/ Control Measure	Residual Risk Likelihood	Residual Risk Consequence	Residual Risk Rating	Certainty	CCP	SCADA (continuous online)	Operational	Verification	Corresponding proposed measures
KUR01	Source Water	Turbidity	Naturally occurring (impact on disinfection effectiveness and formation of by products).	E	5	VERY HIGH	Conventional treatment Filtration	B	2	LOW	1	NO	YES	YES	YES	RMIP: Confirm treatment train with microbial indicator assessment Subsequent Step: Filtration to reduce turbidity to acceptable level is a critical control point
KUR02	Source Water	Protozoa (Crypto/Giardia)	Agricultural run-off	D	5	VERY HIGH	Catchment categorisation Treatment train (filtration)	B	2	LOW	5	NO	NO	NO	YES	RMIP: Confirm treatment train with microbial indicator assessment Subsequent Step: Filtration to reduce turbidity to acceptable level is a critical control point

RA ID#	Component / Subcomponent	Hazard	Hazardous Event/ Hazard Source	Inherent Risk Likelihood	Inherent Risk Consequence	Inherent Risk Rating	Preventative/ Control Measure	Residual Risk Likelihood	Residual Risk Consequence	Residual Risk Rating	Certainty	CCP	SCADA (continuous online)	Operational	Verification	Corresponding proposed measures
KUR03	Source Water	Pesticides	Agricultural run-off	E	5	VERY HIGH	Catchment categorisation	B	2	LOW	4	NO	NO	NO	YES	RMIP: Confirm treatment train with microbial indicator assessment
KUR04	Source Water	Heavy metals; iron, manganese, aluminium	Naturally present in source water	E	3	VERY HIGH	Conventional treatment Filtration Capacity to dose potassium permanganate if required	A	2	LOW	3	NO	NO	NO	YES	
KUR05	Source Water	Harmful algal blooms	Long periods of hot, dry weather and low source water flows.	B	5	VERY HIGH	Inspection of source water Treatment with powdered Activated Carbon. Coagulation, flocculation, sedimentation, filtration	B	2	LOW	4	NO	NO	NO	NO	RMIP: Harmful algal bloom management plan (SOP)
KUR06	Source Water	Pathogenic bacteria and viruses	Naturally present in source water Agricultural run-off	E	5	VERY HIGH	Catchment categorisation Treatment train - Conventional treatment, chlorination	B	2	LOW	3	NO	NO	NO	YES	RMIP: Confirm treatment train with microbial indicator assessment Subsequent Step: Disinfection to reduce bacteria to an acceptable level is a critical control point Verification monitoring of source water
KUR07	Source Water	acidic pH (soft water)	Naturally present in source water	A	5	HIGH	Managed by chemicals used for coagulation	A	1	LOW	3	NO	NO	YES	YES	
KUR08	Source Water	Pesticides, fuel/oil	Accidental spills in catchment	B	3	MODERATE	Operator observation. Plant shutdown & dilution. Conventional treatment removes some organic contaminants	B	2	LOW	5	NO	NO	NO	NO	
KUR09	Source Water	Fuel/oil, litter	Recreational use	A	1	LOW	Intake is in a rocky area. It is not likely that boats etc will be in operation nearby.	A	1	LOW	5	NO	NO	NO	NO	
KUR10	Source Water	Chemical or biological agents harmful to human health	Intentional Dumping/ Sabotage	A	5	HIGH	Site security and restricted access. Operator Observations. Conventional treatment removes some organic contaminants	A	2	LOW	5	NO	NO	NO	NO	
KUR11	Source Water Intake	Unable to treat or supply water	Pump failure	E	3	VERY HIGH	Asset Management Critical spares Back up pumps Hire pump	B	1	LOW	3	NO	YES	NO	NO	
KUR12	Source Water Intake	Unable to treat or supply water	Intake damage	B	3	HIGH	Permanent back up pump. Ability to obtain back up pump if back up is damaged.	B	2	LOW	1	NO	YES	NO	NO	RMIP: Upgrade river intake (need to add)
KUR13	Source Water Intake	Unable to treat or supply water	Intake blockage	A	2	LOW	Standby operator intervention/ maintenance (refer to SOP 3209692). Backup pump/intake	A	1	LOW	3	NO	YES	NO	NO	
KUR14	Coagulation, flocculation and sedimentation	Ineffective coagulation, flocculation and sedimentation	Clarifier overflow	A	4	HIGH	SCADA alarms for out-of-spec flows.	A	2	LOW	3	NO	YES	NO	NO	
KUR15	Coagulation, flocculation and sedimentation	High turbidity in settled water	Chemical dosing failure (pump, line break)	B	4	VERY HIGH	Alarms, monitoring and inspection Maintenance program Standby pumps Backup system in place	B	2	LOW	3	NO	YES	YES	NO	

RA ID#	Component / Subcomponent	Hazard	Hazardous Event/ Hazard Source	Inherent Risk Likelihood	Inherent Risk Consequence	Inherent Risk Rating	Preventative/ Control Measure	Residual Risk Likelihood	Residual Risk Consequence	Residual Risk Rating	Certainty	CCP	SCADA (continuous online)	Operational	Verification	Corresponding proposed measures
KUR16	Coagulation, flocculation and sedimentation	High turbidity in settled water	Floc mixer failure	A	4	HIGH	4 mixers, if one fails 3 remaining can operate reasonably well.	A	2	LOW	3	NO	YES	YES	NO	
KUR17	Coagulation, flocculation and sedimentation	High turbidity in settled water	Incorrect chemical dose rate (operator over/under dosing)	D	3	HIGH	Online monitoring Routine monitoring and analysis (turbidity and jar tests) Operator training, SOP 3209692	C	1	LOW	3	NO	YES	YES	NO	
KUR18	Coagulation, flocculation and sedimentation	By products (manganese, aluminium)	Chemical reactions with coagulants/flocculants	E	3	VERY HIGH	Controlled dosing. SOP 3209692.	E	1	LOW	3	NO	NO	NO	YES	Baseline monitoring program completed. Operational controls in place and bi-annual sampling.
KUR19	Coagulation, flocculation and sedimentation	High turbidity in settled water	High turbidity in source water due to flooding, storms and natural disasters	C	4	VERY HIGH	Monitoring of source water and jar test to set chemical dose rates for coagulation, flocculation and sedimentation	B	4	HIGH	3	NO	YES	YES	NO	Subsequent Step: Filtration to reduce turbidity to acceptable level is a critical control point
KUR20	Coagulation, flocculation and sedimentation	High turbidity in settled water	Equipment failure (Clarifier scraper)	B	3	MODERATE	Operator checks operation of scraper daily; would take over a day for flocculation carry-over to occur.	A	2	LOW	3	NO	YES	YES	NO	
KUR21	Coagulation, flocculation and sedimentation	High turbidity in settled water	Ineffective frequency of sludge draw off	B	3	MODERATE	Operator checks & SOP 3209692.	B	2	LOW	3	NO	YES	YES	NO	
KUR22	Filtration	High turbidity in filtered water (physical, chemical and microbiological contamination)	Insufficient backwash due to air scour failure	B	4	HIGH	Operator callout alarm - integrated into SCADA system.	B	2	LOW	3	YES	YES	YES	YES	Filtration to reduce turbidity to acceptable level is a critical control point
KUR23	Filtration	High turbidity in filtered water (physical, chemical and microbiological contamination)	Ineffective filtration and breakthrough due to media blinding	C	4	VERY HIGH	Routine/ operator initiated backwash Backwash initiated by loss of head pressure. Media replacement	C	1	LOW	3	YES	YES	YES	YES	Filtration to reduce turbidity to acceptable level is a critical control point Individual turbidity meters installed to verify log reduction value (LRV) credits claimed for protozoa.
KUR24	Filtration	High turbidity in filtered water (physical, chemical and microbiological contamination)	Unable to backwash due to filter valve failure	A	4	HIGH	Filter valves can be manually overridden to backwash the filters. Operator checks or air system.	A	2	LOW	3	YES	YES	YES	YES	Filtration to reduce turbidity to acceptable level is a critical control point
KUR25	Filtration	High turbidity in filtered water (physical, chemical and microbiological contamination)	Unable to backwash due filter level switch failure	A	5	HIGH	The filter has 3 independent cells (2 can operate while one is down), can take the level switch offline and manually drain down the filter.	A	2	LOW	3	YES	YES	YES	YES	Filtration to reduce turbidity to acceptable level is a critical control point
KUR26	Filtration	High turbidity in filtered water (physical,	Unable to backwash due to clarifier level senor failure	A	5	HIGH	Level sensor can be manually overridden in	A	2	LOW	3	YES	YES	YES	YES	Filtration to reduce turbidity to acceptable level is a critical control point

RA ID#	Component / Subcomponent	Hazard	Hazardous Event/ Hazard Source	Inherent Risk Likelihood	Inherent Risk Consequence	Inherent Risk Rating	Preventative/ Control Measure	Residual Risk Likelihood	Residual Risk Consequence	Residual Risk Rating	Certainty	CCP	SCADA (continuous online)	Operational	Verification	Corresponding proposed measures
		chemical and microbiological contamination)					order to backwash the filters if needed.									
KUR27	Disinfection	Pathogenic bacteria	Mechanical chlorine dosing failure	D	5	VERY HIGH	Maintenance, operator intervention (refer to SOP 3209692), residual testing, duty/standby pumps. flow paced/SCADA monitored.	B	2	LOW	3	YES	YES	YES	YES	Disinfection to reduce pathogenic bacteria to acceptable levels is a critical control point
KUR28	Disinfection	Pathogenic bacteria	Ineffective chlorine dosing due to degradation of chlorine in bulk storage	D	3	HIGH	Only use QA supplied materials/sampling, covered hypo storage area integrated to SCADA Pumping out of bulk storage tanks on 6 monthly basis Manage volumes	B	2	LOW	3	YES	YES	YES	YES	Disinfection to reduce pathogenic bacteria to acceptable levels is a critical control point
KUR29	Disinfection	Pathogenic bacteria	Ineffective chlorine dosing rate for disinfection	D	5	VERY HIGH	Maintenance, operator intervention (refer to SOP 3209692), residual testing, flow paced/SCADA monitored.	B	2	LOW	3	YES	YES	YES	YES	Disinfection to reduce pathogenic bacteria to acceptable levels is a critical control point
KUR30	Disinfection	Inability to disinfect	Unavailability of sodium hypochlorite (including natural disasters)	C	4	VERY HIGH	Minimum 1 month of chemical storage, managing supplies. Disaster management	C	1	LOW	3	NO	NO	NO	NO	
KUR31	Disinfection	Pathogenic bacteria	Ineffective disinfection due to chlorine dosing contact time	E	5	VERY HIGH	Minimum retention times in storage reservoirs Flow Rate	A	5	HIGH	3	YES	YES	YES	YES	Disinfection to reduce pathogenic bacteria to acceptable levels is a critical control point
KUR32	Disinfection	Pathogenic bacteria	Ineffective disinfection due to pH	A	5	HIGH	Managed by chemicals used for coagulation	A	1	LOW	3	NO	YES	YES	YES	
KUR33	Disinfection	Pathogenic bacteria	Ineffective chlorine dosing due to poor mixing	D	4	VERY HIGH	Retention times in storage reservoirs	B	2	LOW	3	YES	YES	YES	YES	Disinfection to reduce pathogenic bacteria to acceptable levels is a critical control point
KUR34	Disinfection	Disinfection by-products (Chlorates)	Contaminant formation due to storage conditions (temperature and time)	D	3	HIGH	Only use QA supplied materials/sampling, covered hypo storage area & MSC manages supplies.	B	2	LOW	3	NO	NO	NO	NO	Baseline monitoring program completed. Operational controls in place and bi-annual sampling.
KUR35	Disinfection	Disinfection by-products (Chlorates, THMs)	Disinfection by-products caused by high organic and inorganic load in filtered water	C	3	HIGH	Conventional treatment Standby operator intervention/maintenance (refer to SOP 3209692).	B	2	LOW	3	NO	NO	NO	NO	Baseline monitoring program completed. Operational controls in place and bi-annual sampling.
KUR36	Disinfection	Chlorine	Chlorine exceeding ADWG guideline values for health and aesthetic	E	2	HIGH	Maintenance, operator intervention (refer to SOP 3209692), residual testing, installed online analysers integrated to SCADA & flow pacing. Dosed in accordance with ADWG	B	2	LOW	3	YES	YES	YES	YES	Disinfection to reduce pathogenic bacteria to acceptable levels is a critical control point
KUR37	Disinfection	Pathogenic bacteria	Poor disinfection due to high organic and	D	4	VERY HIGH	Setpoints installed on Scada, alarms for HIGH/LOW chlorine	B	2	LOW	3	YES	YES	YES	YES	Filtration to reduce turbidity to acceptable level is a critical control point

RA ID#	Component / Subcomponent	Hazard	Hazardous Event/ Hazard Source	Inherent Risk Likelihood	Inherent Risk Consequence	Inherent Risk Rating	Preventative/ Control Measure	Residual Risk Likelihood	Residual Risk Consequence	Residual Risk Rating	Certainty	CCP	SCADA (continuous online)	Operational	Verification	Corresponding proposed measures
			inorganic load in filtered water				levels. Operator monitors via Scada, 3 x weekly manual monitoring, chlorine analysers are on Scada for treatment plants.									
KUR38	Clear water storage	Pathogenic bacteria	Growth/re-contamination with pathogenic bacteria	C	5	VERY HIGH	Residual chlorine Reservoir holding times	A	2	LOW	3	NO	YES	YES	YES	Disinfection (including residual chlorine) to reduce pathogenic bacteria to acceptable levels is a critical control point
KUR39	Clear water storage	Microbiological and physical contamination	Pest ingress	D	4	VERY HIGH	Covered, no inlets, inspection every 2 years.	B	2	LOW	3	NO	NO	NO	NO	
KUR40	Clear water storage	Chemical/ heavy metals (lead, asbestos)	Leaching from pipework and reservoirs	E	2	HIGH	Materials meet AS standard	A	1	LOW	3	NO	NO	NO	YES	
KUR41	Clear water storage	Microbiological, chemical and physical contamination	Contamination due to repairs and maintenance	B	5	VERY HIGH	Cleaning and inspections as per SOPs 3209692 Residual chlorine	A	2	LOW	3	NO	NO	NO	YES	Disinfection (including residual chlorine) to reduce pathogenic bacteria to acceptable levels is a critical control point
KUR42	Clear water storage	Microbiological, chemical and physical contamination	Sedimentation	C	2	MODERATE	Monitoring & Inspection. Periodic cleaning.	B	1	LOW	3	NO	NO	NO	YES	
KUR43	Clear water storage	Microbiological, chemical and physical contamination	Sabotage	A	5	HIGH	Security patrol & restricted access.	A	2	LOW	3	NO	NO	NO	NO	
KUR44	Clear water storage	Unable to supply water	Empty reservoirs	C	4	VERY HIGH	Operator alarm. LOW tank level sensors installed on SCADA, back up float also sends alarm as secondary measure.	B	2	LOW	3	NO	YES	NO	NO	
KUR45	Reticulation	Pathogenic bacteria Physical contaminants	Contamination due to repairs, maintenance and cleaning (mains scouring)	E	2	HIGH	Cleaning and inspections as per training and procedures	B	2	LOW	3	NO	NO	NO	YES	
KUR46	Reticulation	Turbidity within reticulation	Contamination due to repairs, breaks etc	E	2	HIGH	Routine line flushing, line camera and repairs	C	1	LOW	3	NO	NO	NO	NO	
KUR47	Reticulation	Unable to supply water/ maintain pressure	Infrastructure failure (pumps, valves)	D	4	VERY HIGH	Asset management program Valve inspections and replacement program Duty and standby pumps	B	2	LOW	3	NO	NO	NO	NO	
KUR48	Reticulation	Chlorine	High residual chlorine	E	2	HIGH	Online analysing and controlled dosing	B	2	LOW	3	NO	YES	YES	YES	
KUR49	Reticulation	Pathogenic bacteria	Pathogenic bacteria growth due to no residual chlorine	B	5	VERY HIGH	Reticulation system monitoring, periodic flushing, scouring. Online analyser will alarm if set point is triggered.	A	1	LOW	3	NO	YES	YES	YES	
KUR50	Reticulation	Pathogenic bacteria Physical contaminants Chemicals/heavy metals	Contamination due to deteriorating pipework (leaks, leaching)	E	2	HIGH	Replacement & maintenance program	C	2	MODERATE	3	NO	NO	NO	YES	RMIP: Install a pressure leakage management system on proposed lines.

RA ID#	Component / Subcomponent	Hazard	Hazardous Event/ Hazard Source	Inherent Risk Likelihood	Inherent Risk Consequence	Inherent Risk Rating	Preventative/ Control Measure	Residual Risk Likelihood	Residual Risk Consequence	Residual Risk Rating	Certainty	CCP	SCADA (continuous online)	Operational	Verification	Corresponding proposed measures
KUR51	Reticulation	Microbiological, chemical and physical contamination	Backflow	D	5	VERY HIGH	Residual chlorine Backflow prevention devices, plumbing codes, backflow maintenance register.	A	2	LOW	3	NO	NO	NO	YES	
KUR52	Plant-Wide	Unable to treat or supply water	Damage to infrastructure (including natural disasters)	C	5	VERY HIGH	Generator powering mains system, operator callout & diesel pump. Paper-based monitoring Data-back up Disaster management	B	2	LOW	3	NO	NO	NO	NO	
KUR53	Plant-Wide	Unable to treat or supply water	Loss of power	C	5	VERY HIGH	Generator powering mains system, operator callout & diesel pump. Booster pump generator.	B	2	LOW	3	NO	NO	NO	NO	
KUR54	Plant-Wide	Inability or ineffective treatment and/or supply of water	Insecure telemeter network. Online monitoring failure.	B	5	VERY HIGH	IT managed network, operator limitations.	A	2	LOW	3	NO	NO	NO	NO	
KUR55	Plant-Wide	Inability or ineffective treatment and/or supply of water	Inadequate maintenance supporting network	C	3	HIGH	IT managed network, operator limitations.	A	2	LOW	3	NO	NO	NO	NO	RMIP: Propose a review of councils network and potential backups
KUR56	Plant-Wide	Unable to treat or supply water	Breakdown of critical equipment (filters, pumps, flow meters, clarifiers, lines)	D	4	VERY HIGH	Asset management program SCADA and alarms Routine inspections and monitoring Spare parts and back up equipment (back up generator, diesel pump, duty & stand by pumps)	B	2	LOW	3	NO	NO	NO	NO	
KUR57	Plant-Wide	Unable to treat or supply water	Loss of access to site	A	5	VERY HIGH	No foreseen problems accessing site Remote access to HMI	B	1	LOW	3	NO	NO	NO	NO	
KUR58	Plant-Wide	Unable to treat or supply water	PLC failure	C	3	HIGH	Generator and spares	B	1	LOW	3	NO	NO	NO	NO	
KUR59	Plant-Wide	Unable to treat or supply water	SCADA telemetry failure	B	3	MODERATE	Backup battery power, yearly maintenance schedule. Ability manually run	B	2	LOW	3	NO	NO	NO	NO	
KUR60	Plant-Wide	Unable to treat or supply water	Cyber attack	C	5	HIGH	Alignment with the ASD Essential Eight, enablement of 2FA, phishing awareness/training and the establishment of a formal relationship with a DFIR partner.	A	5	HIGH	3	NO	NO	NO	NO	RMIP: Future projects currently under consideration include the implementation of a SIEM solution, application control and performing a vulnerability/risk assessment. Council will continue to implement further cybersecurity measures from both a governance and practical solution perspective however, such work will be delivered in line with Council's resourcing/capacity to do so
KUR61	Plant-Wide	Ineffective treatment of water	Poor Work Practices, failure to act/inadequate training	C	5	VERY HIGH	SOP 3209692, Training program, Supervision.	A	2	LOW	3	NO	YES	YES	YES	

RA ID#	Component / Subcomponent	Hazard	Hazardous Event/ Hazard Source	Inherent Risk Likelihood	Inherent Risk Consequence	Inherent Risk Rating	Preventative/ Control Measure	Residual Risk Likelihood	Residual Risk Consequence	Residual Risk Rating	Certainty	CCP	SCADA (continuous online)	Operational	Verification	Corresponding proposed measures
KUR62	Plant-wide	Ineffective treatment and/or supply of water	Inaccurate data from online monitoring systems	D	5	VERY HIGH	Operator knowledge, training and SOP 3209692 Monitoring Scheduled maintenance program	B	2	LOW	3	NO	NO	YES	YES	
KUR63	Source Water	PFAS	Emerging contaminant	B	2	LOW	Baseline monitoring showed no detection of PFAS, ongoing annual monitoring to occur	B	2	LOW	1	NO	NO	NO	YES	RMIP: Annual PFAS testing to occur on treated water to monitor any changes

Appendix C – Risk Management Improvement Program (RMIP)

TABLE C1: CHILLAGOE RISK MANAGEMENT IMPROVEMENT PROGRAM

RA ID#	Component / Sub-component	Hazard	Hazardous Event/ Hazard Source	Risk Rating	Proposed Measures	Estimated Costs	Estimated Completion	Status
CHI02	Source Water	Protozoa (Crypto/Giardia)	Agricultural run-off/ infiltration	LOW	Include bore 4 in vulnerability assessment	Operational	2026-2028	not started
CHI03	Source Water	Pesticides	Agricultural run-off/ infiltration	LOW	Include bore 4 in vulnerability assessment	Operational	2026-2028	not started
CHI07	Source Water	Pathogenic bacteria and viruses	Naturally present in source water Agricultural run-off/ infiltration	LOW	Include bore 4 in vulnerability assessment	Operational	2026-2028	not started
CHI37	Reticulation	Pathogenic bacteria Physical contaminants Chemicals/heavy metals	Contamination due to deteriorating pipework (leaks, leaching)	MODERATE	Installing a pressure leakage management system on proposed lines.	Operational	2026-2028	not started
CHI42	Plant-Wide	Inability or ineffective treatment and/or supply of water	Inadequate maintenance supporting network	LOW	Propose a review of council's network and potential backups	TBC	TBC	IT is reviewing improvements to communication systems and business continuity. This includes strengthening disaster recovery capability
CHI47	Plant-Wide	Unable to treat or supply water	Cyber attack	HIGH	Future projects currently under consideration include the implementation of a SIEM solution, application control and performing a vulnerability/risk assessment.	TBC	TBC	IT is reviewing improvements to communication systems and business continuity. This includes strengthening disaster recovery capability
CHI50	Source Water	PFAS	Emerging contaminant	LOW	Low risk water supply. Testing to occur every 2 years to monitor any changes	Operational	ongoing	commenced

TABLE C2: DIMBULAH RISK MANAGEMENT IMPROVEMENT PROGRAM

RA ID#	Component / Sub-component	Hazard	Hazardous Event/ Hazard Source	Risk Rating	Proposed Measures	Estimated Costs	Estimated Completion	Status
DIM05	Source Water	Harmful algal blooms	Long periods of hot, dry weather and low source water flows.	LOW	Harmful algal bloom management plan (SOP)	Operational	2026-2028	not started
DIM46	Reticulation	Pathogenic bacteria Physical contaminants Chemicals/heavy metals	Contamination due to deteriorating pipework (leaks, leaching)	MODERATE	Installing a pressure leakage management system on proposed lines.	TBC	TBC	not started
DIM51	Plant-Wide	Inability or ineffective treatment and/or supply of water	Inadequate maintenance supporting network	LOW	Propose a review of council's network and potential backups	TBC	TBC	IT is reviewing improvements to communication systems and business continuity. This includes strengthening disaster recovery capability
DIM56	Plant-Wide	Unable to treat or supply water	Cyber attack	HIGH	Future projects currently under consideration include the implementation of a SIEM solution, application control and performing a vulnerability/risk assessment.	TBC	TBC	IT is reviewing improvements to communication systems and business continuity. This includes strengthening disaster recovery capability
DIM59	Source Water	PFAS	Emerging contaminant	LOW	Low risk water supply. Annual testing to monitor any changes	Operational	ongoing	commenced

TABLE C3: MAREEBA RISK MANAGEMENT IMPROVEMENT PROGRAM

RA ID#	Component / Sub-component	Hazard	Hazardous Event/ Hazard Source	Risk Rating	Proposed Measures	Estimated Costs	Estimated Completion	Status
MAR02	Source Water	Protozoa (Crypto/Giardia)	Agricultural run-off	LOW	Confirm treatment train with microbial indicator assessment	Operational	2026-2028	not started
MAR03	Source Water	Pesticides	Agricultural run-off	LOW	Update vulnerability assessment	Operational	2026-2028	not started
MAR05	Source Water	Harmful algal blooms	Long periods of hot, dry weather and low source water flows.	LOW	Harmful algal bloom management plan (SOP	Operational	2026-2028	not started
MAR06	Source Water	Pathogenic bacteria and viruses	Naturally present in source water Agricultural run-off	LOW	Confirm treatment train with microbial indicator assessment	Operational	2026-2028	not started
MAR12	Source Water	Chemical or biological agents harmful to human health	Intentional Dumping/ Sabotage	LOW	Long-term financial plan to improve security on the river side	$ 45,100.00	2026-2028	not started
MAR43	Clear water storage	Microbiological, chemical and physical contamination	Sabotage	LOW	Long-term financial plan to improve security on the river side	Operational	2026-2028	not started
MAR44	Clear water storage	Unable to supply water	Under spec reservoir	VERY HIGH	Reservoir upgrade (5ML to 10ML).	$ 8,292,058.00	2027-2028	not started
MAR49	Reticulation	Unable to supply water/ maintain pressure	Aging infrastructure	VERY HIGH	Annual valve and hydrant replacement program is a part of Council long term plan	Capital	ongoing	ongoing
MAR51	Reticulation	Pathogenic bacteria	Pathogenic bacteria growth due to long detention times in reticulation network	MODERATE	Install a pressure leakage management system on proposed lines. Surge vessels installed as part of the booster pump station upgrade.	Operational	2026	in progress
MAR53	Reticulation	Pathogenic bacteria Physical contaminants Chemicals/heavy metals	Contamination due to deteriorating pipework (leaks, leaching)	MODERATE	Installing a pressure leakage management system on proposed lines.	Capital	ongoing	ongoing
MAR58	Plant-Wide	Inability or ineffective treatment and/or supply of water	Inadequate maintenance supporting network	LOW	Propose a review of Council's network and potential backups.	TBC	2027	IT is reviewing improvements to communication systems and business continuity. This includes strengthening disaster recovery capability
MAR63	Plant-Wide	Unable to treat or supply water	Cyber attack	HIGH	Future projects currently under consideration include the implementation of a SIEM solution, application control and performing a vulnerability/risk assessment.	Operational	2029	IT is reviewing improvements to communication systems and business continuity. This includes strengthening disaster recovery capability
MAR66	Source Water	PFAS	Emerging contaminant	LOW	Low risk water supply. Annual testing to monitor any changes	Operational	ongoing	commenced

TABLE C4: KURANDA RISK MANAGEMENT IMPROVEMENT PROGRAM

RA ID#	Component / Sub-component	Hazard	Hazardous Event/ Hazard Source	Risk Rating	Proposed Measures	Estimated Costs	Estimated Completion	Status
KUR01	Source Water	Turbidity	Naturally occurring (impact on disinfection effectiveness and formation of by products).	LOW	Confirm treatment train with microbial indicator assessment. Subsequent Step: Filtration to reduce turbidity to acceptable level is a critical control point	Operational	2026-2028	design
KUR02	Source Water	Protozoa (Crypto/Giardia)	Agricultural run-off	LOW	Confirm treatment train with microbial indicator assessment	Operational	2026-2028	not started
KUR03	Source Water	Pesticides	Agricultural run-off	LOW	Confirm treatment train with microbial indicator assessment	Operational	2026-2028	not started
KUR05	Source Water	Harmful algal blooms	Long periods of hot, dry weather and low source water flows.	LOW	Harmful algal bloom management plan (SOP)	Operational	2026-2028	not started
KUR06	Source Water	Pathogenic bacteria and viruses	Naturally present in source water Agricultural run-off	LOW	Confirm treatment train with microbial indicator assessment	Operational	2026-2028	not started
KUR12	Source Water Intake	Unable to treat or supply water	Intake damage	LOW	Upgrade river intake	$19,000,000	2026-2028	Funding conformed. Primary design and bank stabilisation have commenced.
KUR50	Reticulation	Pathogenic bacteria Physical contaminants Chemicals/heavy metals	Contamination due to deteriorating pipework (leaks, leaching)	MODERATE	Installing a pressure leakage management system on proposed lines.	Operational	2026	In progress
KUR55	Plant-Wide	Inability or ineffective treatment and/or supply of water	Inadequate maintenance supporting network	LOW	Propose a review of councils network and potential backups	TBC	TBC	IT is reviewing improvements to communication systems and business continuity. This includes strengthening disaster recovery capability
KUR60	Plant-Wide	Unable to treat or supply water	Cyber attack	HIGH	Future projects currently under consideration include the implementation of a SIEM solution, application control and performing a vulnerability/risk assessment.	TBC	TBC	IT is reviewing improvements to communication systems and business continuity. This includes strengthening disaster recovery capability
KUR63	Source Water	PFAS	Emerging contaminant	LOW	Low risk water supply. Annual testing to monitor any changes	Operational	ongoing	commenced

Appendix D – Record of Testing Parameters

TABLE D1: UNTREATED ADWG PARAMETER TESTING RESULTS – CHILLAGOE (2021 – FEBRUARY 2026)

Parameter	Frequency of Sampling	No. of Samples Taken	Minimum	Maximum	ADWG Value	No. of Exceedances	Units	LOR
4.4`-DDD	Biannual	11	<0.01	<0.01			µg/L	
4.4`-DDE	Biannual	11	<0.01	<0.01			µg/L	
4.4`-DDT	Biannual	11	<0.01	<0.01			µg/L	
Acephate	Biannual	11	<0.5	<0.5	8.00	0	µg/L	0
Aldrin	Biannual	11	<0.01	<0.01	0.15	0	µg/L	
alpha-BHC	Biannual	11	<0.01	<0.01			µg/L	
alpha-Endosulfan	Biannual	11	<0.01	<0.01			µg/L	
Apparent Colour	Biannual	11	<1	2.00			Pt/Co units	0
Azinphos-ethyl	Biannual	11	<0.02	<0.02			µg/L	
Azinphos-methyl	Biannual	11	<0.02	<0.02	30.00	0	µg/L	<0.02
Bensulide	Biannual	11	<0.1	<0.1			µg/L	
beta-BHC	Biannual	11	<0.01	<0.01			µg/L	
beta-Endosulfan	Biannual	11	<0.01	<0.01			µg/L	
Bromophos-ethyl	Biannual	11	<0.10	<0.10	10.00	0	µg/L	<0.10
Calcium	Biannual	11	4	150.00			mg/L	0
Carbofenothion	Biannual	11	<0.02	<0.02			µg/L	
Chlorfenvinphos	Biannual	11	<0.02	<0.02	2.00	0	µg/L	<0.02
Chloride	Biannual	11	3	24.00			mg/L	<1
Chlorpyrifos	Biannual	11	<0.02	<0.02	10.00	0	µg/L	<0.02
Chlorpyrifos-methyl	Biannual	11	<0.20	<0.20			µg/L	
cis-Chlordane	Biannual	11	<0.01	<0.01			µg/L	
Coumaphos	Biannual	11	<0.01	<0.01			µg/L	
delta-BHC	Biannual	11	<0.01	<0.01			µg/L	
Demeton-O	Biannual	11	<0.02	<0.02			µg/L	
Demeton-O & Demeton-S	Biannual	11	<0.02	<0.02			µg/L	
Demeton-S	Biannual	11	<0.02	<0.02			µg/L	
Demeton-S-methyl	Biannual	11	<0.02	<0.02			µg/L	
Diazinon	Biannual	11	<0.01	<0.01	4.00	0	µg/L	<0.01

Dichlorvos	Biannual	11	<0.20	<0.20	5.00	0	µg/L	<0.2
Dieldrin	Biannual	11	<0.01	<0.01	0.15	0	µg/L	
Dimethoate	Biannual	11	<0.02	<0.02	7.00	0	µg/L	<0.02
Disulfoton	Biannual	11	<0.05	<0.05	4.00	0	µg/L	<0.05
E. coli (IH)	Monthly	35	<1	<1			MPN/100mL	0
Electrical Conductance	Biannual	11	590	740.00			µS/cm	0
Endosulfan (sum)	Biannual	11	<0.01	<0.01			µg/L	
Endosulfan sulfate	Biannual	11	<0.01	<0.01			µg/L	
Endrin	Biannual	11	<0.01	<0.01			µg/L	
Endrin aldehyde	Biannual	11	<0.01	<0.01			µg/L	
Endrin ketone	Biannual	11	<0.010	<0.010			µg/L	
EPN	Biannual	11	<0.05	<0.05			µg/L	
Ethion	Biannual	11	<0.02	<0.02	4.00	0	µg/L	<0.02
Ethoprophos	Biannual	11	<0.01	<0.01	1.00	0	µg/L	<0.01
Fenamiphos	Biannual	11	<0.01	<0.01	0.50	0	µg/L	<0.01
Fenchlorphos (Ronnel)	Biannual	11	<10.0	<10.0			µg/L	
Fenitrothion	Biannual	11	<2.0	<2.0	7.00	0	µg/L	<2
Fensulfothion	Biannual	11	<0.01	<0.01	10.00	0	µg/L	<0.01
Fenthion	Biannual	11	<0.05	<0.05	7.00	0	µg/L	<0.05
Fluoride	Biannual	11	<0.03	0.16	1500.00	0	mg/L	<0.02
Formothion	Biannual	11	<20.0	<20.0	50.00	0	µg/L	
Fosetyl Aluminium	Biannual	11	<10.0	<10.0			µg/L	
gamma-BHC	Biannual	8	<0.01	<0.01			µg/L	
Heptachlor	Biannual	11	<0.005	<0.005			µg/L	
Heptachlor epoxide	Biannual	11	<0.01	<0.01			µg/L	
Hexachlorobenzene (HCB)	Biannual	11	<0.01	<0.01			µg/L	
ICPMS Aluminium	Biannual	12	<0.008	0.01			mg/L	
ICPMS Antimony	Biannual	11	<0.000	<0.001			mg/L	
ICPMS Arsenic	Biannual	20	0	0.59			mg/L	
ICPMS Barium	Biannual	11	0	0.04			mg/L	
ICPMS Beryllium	Biannual	11	<0.0001	<0.0010			mg/L	
ICPMS Boron	Biannual	11	<0.05	<0.05			mg/L	
ICPMS Cadmium	Biannual	11	<0.0001	0.00			mg/L	
ICPMS Chromium	Biannual	11	<0.0005	<0.0010			mg/L	
ICPMS Cobalt	Biannual	11	<0.0001	<0.0010			mg/L	

ICPMS Copper	Biannual	11	0	0.01			mg/L	
ICPMS Iron	Biannual	11	<0.015	<0.050			mg/L	
ICPMS Lead	Biannual	11	0	0.00			mg/L	
ICPMS Manganese	Biannual	11	<0.0002	0.02			mg/L	
ICPMS Molybdenum	Biannual	11	<0.0005	<0.0010			mg/L	
ICPMS Nickel	Biannual	11	<0.0002	<0.0010			mg/L	
ICPMS Selenium	Biannual	11	<0.002	<0.010			mg/L	
ICPMS Silver	Biannual	11	<0.0002	<0.0010			mg/L	
ICPMS Thallium	Biannual	11	<0.0001	<0.0010			mg/L	
ICPMS Thorium	Biannual	11	<0.000	<0.002			mg/L	
ICPMS Tin	Biannual	11	<0.000	<0.005			mg/L	
ICPMS Titanium	Biannual	11	<0.000	<0.010			mg/L	
ICPMS Uranium	Biannual	11	0	0.00			mg/L	
ICPMS Vanadium	Biannual	11	0	<0.0100			mg/L	
ICPMS Zinc	Biannual	11	<0.008	0.02			mg/L	
ICPOES Silicon	Biannual	11	11	28.00			mg/ L SiO2	
Langliers Index	Biannual	11	-1	0.99				
Magnesium	Biannual	11	2	3.60			mg/L	0
Malathion	Biannual	11	<0.02	<0.02			µg/L	
Mercury	Biannual	11	<0.06	<0.06	1.00	0	µg/L	<0.06
Methidathion	Biannual	11	<0.1	<0.1	6.00	0	µg/L	<0.1
Methoxychlor	Biannual	11	<0.01	<0.01	0.30	0	µg/L	<0.01
Mevinphos	Biannual	11	<0.02	<0.02	5.00	0	µg/L	<0.02
Monocrotophos	Biannual	11	<0.02	<0.02	2.00	0	µg/L	<0.02
Naftalofos	Biannual	11	<1.0	<1.0			µg/L	
Omethoate	Biannual	11	<0.01	<0.01	1.00	0	µg/L	<0.01
Oxychlordane	Biannual	11	<0.01	<0.01			µg/L	
Parathion	Biannual	11	<0.20	<0.20	20.00	0	µg/L	<0.2
Parathion-methyl	Biannual	11	<0.50	<0.50	0.70	0	µg/L	<0.5
pH	Biannual	11	7	7.80				<0.1
pH @ 25 deg C	Biannual	11	7	8.20				
Phorate	Biannual	11	<0.1	<0.1			µg/L	
Pirimiphos-ethyl	Biannual	11	<0.01	<0.01	0.50	0	µg/L	<0.01
Pirimiphos-methyl	Biannual	11	<0.01	<0.01			µg/L	
Potassium	Biannual	11	0	6.00			mg/L	0

Profenofos	Biannual	11	<0.01	<0.01	0.30	0	µg/L	<0.01
Prothiofos	Biannual	11	<0.10	<0.10			µg/L	
Pyrazophos	Biannual	11	<0.1	<0.1	20.00	0	µg/L	<0.1
Salinity (psu)	Biannual	11	0	0.36			psu	
SAR_CALC	Biannual	11	0	3.80			Units	
Sodium	Biannual	11	3	34.00			mg/L	<0.15
Sulfotep	Biannual	11	<0.005	<0.005			µg/L	
Sulphate	Biannual	11	2	17.00			mg/L	
Sulprofos	Biannual	11	<0.05	<0.05	10.00	0	µg/L	<0.05
Sum of DDD + DDE + DDT	Biannual	11	<0.01	<0.01			µg/L	
Temephos	Biannual	11	<0.02	<0.02	400.00	0	µg/L	<0.020
Terbufos	Biannual	11	<0.01	<0.01	0.90	0	µg/L	<0.01
Tetrachlorvinphos	Biannual	11	<0.01	<0.01	100.00	0	µg/L	<0.01
Thiometon	Biannual	11	<0.5	<0.5	0.00	0	µg/L	<0.5
Total Alkalinity	Biannual	11	310	400.00			mg CaCO3 / L	
Total Chlordane (sum)	Biannual	11	<0.01	<0.01			µg/L	
Total Coliforms (IH)	Monthly	37	0	3.00			MPN/100mL	0
Total Dissolved Solids	Biannual	11	350	430.00			mg/L	<10
Total Hardness	Biannual	11	15	390.00			mg CaCO3 / L	
trans-Chlordane	Biannual	11	<0.01	<0.01			µg/L	
Triazophos	Biannual	11	<0.005	<0.005			µg/L	
Trichlorfon	Biannual	11	<0.02	<0.02	7.00	0	µg/L	<0.02
Trichloronate	Biannual	11	<0.5	<0.5			µg/L	
Turbidity	Biannual	11	<0.100	0.60			NTU	<0.1

TABLE D2: TREATED ADWG PARAMETER TESTING RESULTS – CHILLAGOE (2021 TO FEBRUARY 2026)

Parameter	Frequency of Sampling	No. of Samples Taken	Minimum	Maximum	ADWG Value	No. of Exceedances	Units	LOR
(EtFOSA)	Biannual	1	<0.005	<0.005			µg/L	
(EtFOSAA)	Biannual	1	<0.002	<0.002			µg/L	
(EtFOSE)	Biannual	1	<0.005	<0.005			µg/L	
(MeFOSA)	Biannual	1	<0.005	<0.005			µg/L	
(MeFOSAA)	Biannual	1	<0.002	<0.002			µg/L	
(MeFOSE)	Biannual	1	<0.005	<0.005			µg/L	
4.4`-DDD	Biannual	11	<0.01	<0.01			µg/L	
4.4`-DDE	Biannual	11	<0.01	<0.01			µg/L	
4.4`-DDT	Biannual	11	<0.01	<0.01			µg/L	
Acephate	Biannual	11	<0.5	<0.5	8	0	µg/L	0
Aldrin	Biannual	11	<0.01	<0.01	0.15	0	µg/L	
alpha-BHC	Biannual	11	<0.01	<0.01			µg/L	
alpha-Endosulfan	Biannual	11	<0.01	<0.01			µg/L	
Apparent Colour	Biannual	12	<1	<1			Pt/Co units	0
Azinphos-ethyl	Biannual	11	<0.02	<0.02			µg/L	
Azinphos-methyl	Biannual	11	<0.02	<0.02	30	0	µg/L	<0.02
Bensulide	Biannual	11	<0.1	<0.1			µg/L	
beta-BHC	Biannual	11	<0.01	<0.01			µg/L	
beta-Endosulfan	Biannual	11	<0.01	<0.01			µg/L	
Bromodichloromethane	Biannual	1	<5.0	<5.0			µg/L	
Bromoform	Biannual	1	<5.0	<5.0			µg/L	
Bromophos-ethyl	Biannual	11	<0.10	<0.10	10	0	µg/L	<0.10
Calcium	Biannual	14	<0.1	150			mg/L	0
Carbofenothion	Biannual	11	<0.02	<0.02			µg/L	
Chlorate	Biannual	1	0.082	0.082			mg/L	
Chlorfenvinphos	Biannual	11	<0.02	<0.02	2	0	µg/L	<0.02
Chloride	Biannual	11	6.4	24			mg/L	<1
Chloroform	Biannual	1	<5.0	<5.0			µg/L	
Chlorpyrifos	Biannual	11	<0.02	<0.02	10	0	µg/L	<0.02
Chlorpyrifos-methyl	Biannual	11	<0.20	<0.20			µg/L	
cis-Chlordane	Biannual	11	<0.01	<0.01			µg/L	
Coumaphos	Biannual	11	<0.01	<0.01			µg/L	
delta-BHC	Biannual	11	<0.01	<0.01			µg/L	
Demeton-O	Biannual	11	<0.02	<0.02			µg/L	
Demeton-O & Demeton-S	Biannual	11	<0.02	<0.02			µg/L	

Demeton-S	Biannual	11	<0.02	<0.02			µg/L	
Demeton-S-methyl	Biannual	11	<0.02	<0.02			µg/L	
Diazinon	Biannual	11	<0.01	<0.01	4	0	µg/L	<0.01
Dibromochloromethane	Biannual	1	<5.0	<5.0			µg/L	
Dichlorvos	Biannual	11	<0.20	<0.20	5	0	µg/L	<0.2
Dieldrin	Biannual	11	<0.01	<0.01	0.15	0	µg/L	
Dimethoate	Biannual	11	<0.02	<0.02	7	0	µg/L	<0.02
Disulfoton	Biannual	11	<0.05	<0.05	4	0	µg/L	<0.05
E coli	Biannual	12	<1	<1			CFU/100mL	
E. coli (IH)	Monthly	134	0	<1			MPN/100mL	0
Electrical Conductance	Biannual	14	640	750			µS/cm	0
Endosulfan (sum)	Biannual	11	<0.01	<0.01			µg/L	
Endosulfan sulfate	Biannual	11	<0.01	<0.01			µg/L	
Endrin	Biannual	11	<0.01	<0.01			µg/L	
Endrin aldehyde	Biannual	11	<0.01	<0.01			µg/L	
Endrin ketone	Biannual	11	<0.010	<0.010			µg/L	
EPN	Biannual	11	<0.05	<0.05			µg/L	
Ethion	Biannual	11	<0.02	<0.02	4	0	µg/L	<0.02
Ethoprophos	Biannual	11	<0.01	<0.01	1	0	µg/L	<0.01
Fenamiphos	Biannual	11	<0.01	<0.01	0.5	0	µg/L	<0.01
Fenchlorphos (Ronnel)	Biannual	11	<10.0	<10.0			µg/L	
Fenitrothion	Biannual	11	<2.0	<2.0	7	0	µg/L	<2
Fensulfothion	Biannual	11	<0.01	<0.01	10	0	µg/L	<0.01
Fenthion	Biannual	11	<0.05	<0.05	7	0	µg/L	<0.05
Fluoride	Biannual	11	<0.03	0.14	1500	0	mg/L	<0.02
Fluorotelomer sulfonic acid (10:2 FTS)	Biannual	1	<0.005	<0.005			µg/L	
Fluorotelomer sulfonic acid (4:2 FTS)	Biannual	1	<0.005	<0.005			µg/L	
Fluorotelomer sulfonic acid (6:2 FTS)	Biannual	1	<0.005	<0.005			µg/L	
Fluorotelomer sulfonic acid (8:2 FTS)	Biannual	1	<0.005	<0.005			µg/L	
Formothion	Biannual	11	<20.0	<20.0	50	0	µg/L	
Fosetyl Aluminium	Biannual	11	<10.0	<10.0			µg/L	
Free Chlorine	Biannual	12	0.97	1.3			mg/L	
Free Chlorine (IH)	Weekly	1130	<1.00	1.91			mg/L	0
Free Chlorine (Instr.)	Weekly	287	0.34	2			mg/L	
gamma-BHC	Biannual	8	<0.01	<0.01			µg/L	
Heptachlor	Biannual	11	<0.005	<0.005			µg/L	
Heptachlor epoxide	Biannual	11	<0.01	<0.01			µg/L	
Heterotrophic Plate Count	Biannual	12	<10	20			CFU/mL	0
Hexachlorobenzene (HCB)	Biannual	11	<0.01	<0.01			µg/L	
ICPMS Aluminium	Biannual	11	<0.008	<0.015			mg/L	
ICPMS Antimony	Biannual	11	<0.000	<0.001			mg/L	

ICPMS Arsenic	Biannual	11	0.0002	0.0033			mg/L	
ICPMS Barium	Biannual	11	0.037	0.065			mg/L	
ICPMS Beryllium	Biannual	11	<0.0001	<0.0010			mg/L	
ICPMS Boron	Biannual	11	<0.05	<0.05			mg/L	
ICPMS Cadmium	Biannual	11	<0.0001	0.0001			mg/L	
ICPMS Chromium	Biannual	11	<0.0005	0.0005			mg/L	
ICPMS Cobalt	Biannual	11	<0.0001	<0.0010			mg/L	
ICPMS Copper	Biannual	11	0.006	0.057			mg/L	
ICPMS Iron	Biannual	11	<0.015	<0.050			mg/L	
ICPMS Lead	Biannual	11	<0.0005	0.0052			mg/L	
ICPMS Manganese	Biannual	11	<0.0002	0.0065			mg/L	
ICPMS Molybdenum	Biannual	11	<0.0005	<0.0010			mg/L	
ICPMS Nickel	Biannual	11	0.0002	<0.0010			mg/L	
ICPMS Selenium	Biannual	11	<0.002	<0.010			mg/L	
ICPMS Silver	Biannual	11	<0.0002	0.0011			mg/L	
ICPMS Thallium	Biannual	11	<0.0001	<0.0010			mg/L	
ICPMS Thorium	Biannual	11	<0.000	<0.002			mg/L	
ICPMS Tin	Biannual	11	<0.000	<0.005			mg/L	
ICPMS Titanium	Biannual	11	<0.000	<0.010			mg/L	
ICPMS Uranium	Biannual	11	0.0004	0.0012			mg/L	
ICPMS Vanadium	Biannual	11	0.0005	<0.0100			mg/L	
ICPMS Zinc	Biannual	11	0.009	0.031			mg/L	
ICPOES Silicon	Biannual	12	19	36			mg/ L SiO2	
Langliers Index	Biannual	12	0.39	0.98				
Magnesium	Biannual	14	<0.1	4.4			mg/L	0
Malathion	Biannual	11	<0.02	<0.02			µg/L	
Mercury	Biannual	11	<0.06	<0.06	1	0	µg/L	<0.06
Methidathion	Biannual	11	<0.1	<0.1	6	0	µg/L	<0.1
Methoxychlor	Biannual	11	<0.01	<0.01	0.3	0	µg/L	<0.01
Mevinphos	Biannual	11	<0.02	<0.02	5	0	µg/L	<0.02
Monocrotophos	Biannual	11	<0.02	<0.02	2	0	µg/L	<0.02
Naftalofos	Biannual	11	<1.0	<1.0			µg/L	
Omethoate	Biannual	11	<0.01	<0.01	1	0	µg/L	<0.01
Oxychlordane	Biannual	11	<0.01	<0.01			µg/L	
Parathion	Biannual	11	<0.20	<0.20	20	0	µg/L	<0.2
Parathion-methyl	Biannual	11	<0.50	<0.50	0.7	0	µg/L	<0.5
Perfluorobutane sulfonic acid (PFBS)	Biannual	1	<0.002	<0.002	0.03	0	µg/L	
Perfluorobutanoic acid (PFBA)	Biannual	1	<0.010	<0.010			µg/L	
Perfluorodecane sulfonic acid (PFDS)	Biannual	1	<0.002	<0.002			µg/L	
Perfluorodecanoic acid (PFDA)	Biannual	1	<0.002	<0.002			µg/L	
Perfluorododecanoic acid (PFDoDA)	Biannual	1	<0.002	<0.002			µg/L	

Perfluoroheptane sulfonic acid (PFHpS)	Biannual	1	<0.002	<0.002			µg/L	
Perfluoroheptanoic acid (PFHpA)	Biannual	1	<0.002	<0.002			µg/L	
Perfluorohexane sulfonic acid (PFHxS)	Biannual	1	<0.002	<0.002	0.008	0	µg/L	
Perfluorohexanoic acid (PFHxA)	Biannual	1	<0.002	<0.002			µg/L	
Perfluorononanoic acid (PFNA)	Biannual	1	<0.002	<0.002			µg/L	
Perfluorooctane sulfonamide (FOSA)	Biannual	1	<0.002	<0.002			µg/L	
Perfluorooctane sulfonic acid (PFOS)	Biannual	1	<0.002	<0.002	0.2	0	µg/L	
Perfluorooctanoic acid (PFOA)	Biannual	1	<0.002	<0.002	0.2	0	µg/L	
Perfluoropentane sulfonic acid (PFPeS)	Biannual	1	<0.002	<0.002			µg/L	
Perfluoropentanoic acid (PFPeA)	Biannual	1	<0.002	<0.002			µg/L	
Perfluorotetradecanoic acid (PFTeDA)	Biannual	1	<0.005	<0.005			µg/L	
Perfluorotridecanoic acid (PFTrDA)	Biannual	1	<0.002	<0.002			µg/L	
Perfluoroundecanoic acid (PFUnDA)	Biannual	1	<0.002	<0.002			µg/L	
pH	Biannual	14	7	7.8				<0.1
pH (Instr.)	Weekly	287	6.6	7.1				
pH @ 25 deg C	Biannual	12	6.6	6.8				
Phorate	Biannual	11	<0.1	<0.1			µg/L	
Pirimiphos-ethyl	Biannual	11	<0.01	<0.01	0.5	0	µg/L	<0.01
Pirimiphos-methyl	Biannual	11	<0.01	<0.01			µg/L	
Potassium	Biannual	12	0.51	1.7			mg/L	0
Profenofos	Biannual	11	<0.01	<0.01	0.3	0	µg/L	<0.01
Prothiofos	Biannual	11	<0.10	<0.10			µg/L	
Pyrazophos	Biannual	11	<0.1	<0.1	20	0	µg/L	<0.1
Salinity (psu)	Biannual	12	0.31	0.367			psu	
SAR_CALC	Biannual	12	0.09	0.28			Units	
Sodium	Biannual	12	3.9	11			mg/L	<0.15
Sulfotep	Biannual	11	<0.005	<0.005			µg/L	
Sulphate	Biannual	11	2.4	7.8			mg/L	
Sulprofos	Biannual	11	<0.05	<0.05	10	0	µg/L	<0.05
Sum of DDD + DDE + DDT	Biannual	11	<0.01	<0.01			µg/L	
SUM of PFAS	Biannual	1	<0.002	<0.002			µg/L	
Sum of PFAS (WA DER List)	Biannual	1	<0.00	<0.00			µg/L	
SUM of PFHxS and PFOS	Biannual	1	<0.002	<0.002			µg/L	
Temephos	Biannual	11	<0.02	<0.02	400	0	µg/L	<0.020
Temperature (IH)	Continuous	55	22.4	32.6			deg C	0
Terbufos	Biannual	11	<0.01	<0.01	0.9	0	µg/L	<0.01
Tetrachlorvinphos	Biannual	11	<0.01	<0.01	100	0	µg/L	<0.01
Thiometon	Biannual	11	<0.5	<0.5	0.004	0	µg/L	<0.5
Total Alkalinity	Biannual	12	300	390			mg CaCO3 / L	
Total Chlordane (sum)	Biannual	11	<0.01	<0.01			µg/L	
Total Chlorine	Biannual	12	0.97	1.3			mg/L	0

Total Chlorine (IH)	Weekly	979	0.09	2			mg/L	0
Total Chlorine (Instr.)	Weekly	52	1.21	2.21			mg/L	
Total coliforms	Biannual	12	<1	1			CFU/100mL	0
Total Coliforms (IH)	Monthly	134	0	<1			MPN/100mL	0
Total Dissolved Solids	Biannual	12	390	430			mg/L	<10
Total Hardness	Biannual	14	<1.0	390			mg CaCO3 / L	
Total Trihalomethanes	Biannual	1	<5.0	<5.0			µg/L	
trans-Chlordane	Biannual	11	<0.01	<0.01			µg/L	
Triazophos	Biannual	11	<0.005	<0.005			µg/L	
Trichlorfon	Biannual	11	<0.02	<0.02	7	0	µg/L	<0.02
Trichloronate	Biannual	11	<0.5	<0.5			µg/L	
Turbidity	Continuous	64	0.000	0.5			NTU	<0.1

TABLE D3: UNTREATED ADWG PARAMETER TESTING RESULTS – DIMBULAH (2021 – FEBRUARY 2026)

Parameter	Frequency of Sampling	No. of Samples Taken	Minimum	Maximum	ADWG Value	No. of Exceedances	Units	LOR
4.4`-DDD	Biannual	10	<0.01	<0.01			µg/L	
4.4`-DDE	Biannual	10	<0.01	<0.01			µg/L	
4.4`-DDT	Biannual	10	<0.01	<0.01			µg/L	
Acephate	Biannual	10	<0.5	<0.5	8	0	µg/L	0
Aldrin	Biannual	10	<0.01	<0.01	0.15	0	µg/L	
Alkalinity (IH)	3 times per week	390	17	33			mg/100mL	0
alpha-BHC	Biannual	10	<0.01	<0.01			µg/L	
alpha-Endosulfan	Biannual	10	<0.01	<0.01			µg/L	
Apparent Colour	Biannual	10	10	78			Pt/Co units	0

Azinphos-ethyl	Biannual	10	<0.02	<0.02			µg/L	
Azinphos-methyl	Biannual	10	<0.02	<0.02	30	0	µg/L	<0.02
Bensulide	Biannual	10	<0.1	<0.1			µg/L	
beta-BHC	Biannual	10	<0.01	<0.01			µg/L	
beta-Endosulfan	Biannual	10	<0.01	<0.01			µg/L	
Bromophos-ethyl	Biannual	10	<0.10	<0.10	10	0	µg/L	<0.10
Calcium	Biannual	10	1.7	3.2			mg/L	0
Carbofenothion	Biannual	10	<0.02	<0.02			µg/L	
Chlorfenvinphos	Biannual	10	<0.02	<0.02	2	0	µg/L	<0.02
Chloride	Biannual	10	6.4	9			mg/L	<1
Chlorpyrifos	Biannual	10	<0.02	<0.02	10	0	µg/L	<0.02
Chlorpyrifos-methyl	Biannual	10	<0.20	<0.20			µg/L	
cis-Chlordane	Biannual	10	<0.01	<0.01			µg/L	
Coumaphos	Biannual	10	<0.01	<0.01			µg/L	
delta-BHC	Biannual	10	<0.01	<0.01			µg/L	
Demeton-O	Biannual	10	<0.02	<0.02			µg/L	
Demeton-O & Demeton-S	Biannual	10	<0.02	<0.02			µg/L	
Demeton-S	Biannual	10	<0.02	<0.02			µg/L	
Demeton-S-methyl	Biannual	10	<0.02	<0.02			µg/L	
Diazinon	Biannual	10	<0.01	<0.01	4	0	µg/L	<0.01
Dichlorvos	Biannual	10	<0.20	0.41	5	0	µg/L	<0.2
Dieldrin	Biannual	10	<0.01	<0.01	0.15	0	µg/L	
Dimethoate	Biannual	10	<0.02	<0.02	7	0	µg/L	<0.02
Disulfoton	Biannual	10	<0.05	<0.05	4	0	µg/L	<0.05
DO (mg/L) (IH)	Biannual	391	2.45	9.01			mg/L	
E. coli (IH)	Weekly	248	0	1300			MPN/100mL	0
Electrical Conductance	Biannual	10	63	79			µS/cm	0
Electrical Conductance (IH)	3 times per week	391	7	96			µS/cm	0
Endosulfan (sum)	Biannual	10	<0.01	<0.01			µg/L	
Endosulfan sulfate	Biannual	10	<0.01	<0.01			µg/L	

Endrin	Biannual	10	<0.01	<0.01			µg/L	
Endrin aldehyde	Biannual	10	<0.01	<0.01			µg/L	
Endrin ketone	Biannual	10	<0.010	<0.010			µg/L	
EPN	Biannual	10	<0.05	<0.05			µg/L	
Ethion	Biannual	10	<0.02	<0.02	4	0	µg/L	<0.02
Ethoprophos	Biannual	10	<0.01	<0.01	1	0	µg/L	<0.01
Fenamiphos	Biannual	10	<0.01	<0.01	0.5	0	µg/L	<0.01
Fenchlorphos (Ronnel)	Biannual	10	<10.0	<10.0			µg/L	
Fenitrothion	Biannual	10	<2.0	<2.0	7	0	µg/L	<2
Fensulfothion	Biannual	10	<0.01	<0.01	10	0	µg/L	<0.01
Fenthion	Biannual	10	<0.05	<0.05	7	0	µg/L	<0.05
Fluoride	Biannual	10	<0.03	0.13	1500	0	mg/L	<0.02
Formothion	Biannual	10	<20.0	<20.0	50	0	µg/L	
Fosetyl Aluminium	Biannual	10	<10.0	<10.0			µg/L	
gamma-BHC	Biannual	7	<0.01	<0.01			µg/L	
Heptachlor	Biannual	10	<0.005	<0.005			µg/L	
Heptachlor epoxide	Biannual	10	<0.01	<0.01			µg/L	
Hexachlorobenzene (HCB)	Biannual	10	<0.01	<0.01			µg/L	
ICPMS Aluminium	Biannual	10	0.034	0.651			mg/L	
ICPMS Antimony	Biannual	10	<0.000	<0.002			mg/L	
ICPMS Arsenic	Biannual	10	<0.0010	0.0059			mg/L	
ICPMS Barium	Biannual	10	0.01	0.02			mg/L	
ICPMS Beryllium	Biannual	10	<0.0001	<0.0010			mg/L	
ICPMS Boron	Biannual	10	<0.05	<0.10			mg/L	
ICPMS Cadmium	Biannual	10	<0.0001	<0.0002			mg/L	
ICPMS Chromium	Biannual	10	<0.0005	0.001			mg/L	
ICPMS Cobalt	Biannual	10	0.0001	<0.0010			mg/L	
ICPMS Copper	Biannual	10	0.002	0.041			mg/L	
ICPMS Iron	Biannual	10	0.098	1.09			mg/L	
ICPMS Lead	Biannual	10	0.0001	0.0028			mg/L	

ICPMS Manganese	Biannual	10	0.008	0.0683			mg/L	
ICPMS Molybdenum	Biannual	10	<0.0005	0.0005			mg/L	
ICPMS Nickel	Biannual	10	<0.0005	0.0016			mg/L	
ICPMS Selenium	Biannual	10	<0.002	<0.010			mg/L	
ICPMS Silver	Biannual	10	<0.0002	<0.0010			mg/L	
ICPMS Thallium	Biannual	10	<0.0001	<0.0010			mg/L	
ICPMS Thorium	Biannual	10	<0.000	<0.004			mg/L	
ICPMS Tin	Biannual	10	<0.000	<0.002			mg/L	
ICPMS Titanium	Biannual	10	0.001	0.016			mg/L	
ICPMS Uranium	Biannual	10	<0.0000	<0.0010			mg/L	
ICPMS Vanadium	Biannual	10	0.0003	<0.0100			mg/L	
ICPMS Zinc	Biannual	10	<0.003	0.014			mg/L	
ICPOES Silicon	Biannual	10	11	16			mg/ L SiO2	
Langliers Index	Biannual	10	-2.4	-0.87				
Magnesium	Biannual	10	1.4	3.2			mg/L	0
Malathion	Biannual	10	<0.02	<0.02			µg/L	
Mercury	Biannual	10	<0.06	<0.06	1	0	µg/L	<0.06
Methidathion	Biannual	10	<0.1	<0.1	6	0	µg/L	<0.1
Methoxychlor	Biannual	10	<0.01	<0.01	0.3	0	µg/L	<0.01
Mevinphos	Biannual	10	<0.02	<0.02	5	0	µg/L	<0.02
Monocrotophos	Biannual	10	<0.02	<0.02	2	0	µg/L	<0.02
Naftalofos	Biannual	10	<1.0	<1.0			µg/L	
Omethoate	Biannual	10	<0.01	<0.01	1	0	µg/L	<0.01
Oxychlordane	Biannual	10	<0.01	<0.01			µg/L	
Parathion	Biannual	10	<0.20	<0.20	20	0	µg/L	<0.2
Parathion-methyl	Biannual	10	<0.50	<0.50	0.7	0	µg/L	<0.5
pH	Biannual	10	7.2	8.8				<0.1
pH (IH)	3 times per week	391	6.26	8.89				0
pH @ 25 deg C	Biannual	10	9.4	9.8				
Phorate	Biannual	10	<0.1	<0.1			µg/L	

Pirimiphos-ethyl	Biannual	10	<0.01	<0.01	0.5	0	µg/L	<0.01
Pirimiphos-methyl	Biannual	10	<0.01	<0.01			µg/L	
Potassium	Biannual	10	1.5	1.9			mg/L	0
Profenofos	Biannual	10	<0.01	<0.01	0.3	0	µg/L	<0.01
Prothiofos	Biannual	10	<0.10	<0.10			µg/L	
Pyrazophos	Biannual	10	<0.1	<0.1	20	0	µg/L	<0.1
Salinity (psu)	Biannual	10	0.0353	0.042			psu	
SAR_CALC	Biannual	10	0.56	1			Units	
Sodium	Biannual	10	5.7	8			mg/L	<0.15
Sulfotep	Biannual	10	<0.005	<0.005			µg/L	
Sulphate	Biannual	10	0.79	2.4			mg/L	
Sulprofos	Biannual	10	<0.05	<0.05	10	0	µg/L	<0.05
Sum of DDD + DDE + DDT	Biannual	10	<0.01	<0.01			µg/L	
Temephos	Biannual	10	<0.02	<0.02	400	0	µg/L	<0.020
Temperature (IH)	3 times per week	391	18.4	32.4			deg C	0
Terbufos	Biannual	10	<0.01	<0.01	0.9	0	µg/L	<0.01
Tetrachlorvinphos	Biannual	10	<0.01	<0.01	100	0	µg/L	<0.01
Thiometon	Biannual	10	<0.5	<0.5	0.004	0	µg/L	<0.5
Total Alkalinity	Biannual	10	15	24			mg CaCO3 / L	
Total Chlordane (sum)	Biannual	10	<0.01	<0.01			µg/L	
Total Coliforms (IH)	weekly	338	5	>2430			MPN/100mL	0
Total Dissolved Solids	Biannual	10	48	60			mg/L	<10
Total Hardness	Biannual	10	10	20			mg CaCO3 / L	
trans-Chlordane	Biannual	10	<0.01	<0.01			µg/L	
Triazophos	Biannual	10	<0.005	<0.005			µg/L	
Trichlorfon	Biannual	10	<0.02	<0.02	7	0	µg/L	<0.02
Trichloronate	Biannual	10	<0.5	<0.5			µg/L	
Turbidity	Biannual	10	1.1	16			NTU	<0.1
Turbidity (IH)	3 times per week	390	0.02	41			NTU	0

TABLE D4: TREATED ADWG PARAMETER TESTING RESULTS – DIMBULAH (2021 TO FEBRUARY 2026)

Parameter	Frequency of Sampling	No. of Samples Taken	Minimum	Maximum	ADWG Value	No. of Exceedances	Units	LOR
(EtFOSA)	Biannual	3	<0.005	<0.005			µg/L	
(EtFOSAA)	Biannual	3	<0.002	<0.002			µg/L	
(EtFOSE)	Biannual	3	<0.005	<0.005			µg/L	
(MeFOSA)	Biannual	3	<0.005	<0.005			µg/L	
(MeFOSAA)	Biannual	3	<0.002	<0.002			µg/L	
(MeFOSE)	Biannual	3	<0.005	<0.005			µg/L	
4.4`-DDD	Biannual	10	<0.01	<0.01			µg/L	
4.4`-DDE	Biannual	10	<0.01	<0.01			µg/L	
4.4`-DDT	Biannual	10	<0.01	<0.01			µg/L	
Acephate	Biannual	10	<0.5	<0.5	8	0	µg/L	0
Aldrin	Biannual	10	<0.01	<0.01	0.15	0	µg/L	
Alkalinity (IH)	3 times per week	392	15	34			mg/100mL	0
alpha-BHC	Biannual	10	<0.01	<0.01			µg/L	
alpha-Endosulfan	Biannual	10	<0.01	<0.01			µg/L	
Apparent Colour	Biannual	10	<1	<1			Pt/Co units	0
Azinphos-ethyl	Biannual	10	<0.02	<0.02			µg/L	
Azinphos-methyl	Biannual	10	<0.02	<0.02	30	0	µg/L	<0.02
Bensulide	Biannual	10	<0.1	<0.1			µg/L	
beta-BHC	Biannual	10	<0.01	<0.01			µg/L	
beta-Endosulfan	Biannual	10	<0.01	<0.01			µg/L	
Bromodichloromethane	Biannual	2	8	15			µg/L	
Bromoform	Biannual	2	<5.0	<5.0			µg/L	
Bromophos-ethyl	Biannual	10	<0.10	<0.10	10	0	µg/L	<0.10
Calcium	Biannual	12	2	3			mg/L	0
Carbofenothion	Biannual	10	<0.02	<0.02			µg/L	
Chlorate	Biannual	2	0.133	0.225			mg/L	
Chlorfenvinphos	Biannual	10	<0.02	<0.02	2	0	µg/L	<0.02
Chloride	Biannual	10	11	17			mg/L	<1
Chloroform	Biannual	2	22	43			µg/L	
Chlorpyrifos	Biannual	10	<0.02	<0.02	10	0	µg/L	<0.02
Chlorpyrifos-methyl	Biannual	10	<0.20	<0.20			µg/L	
cis-Chlordane	Biannual	10	<0.01	<0.01			µg/L	
Coumaphos	Biannual	10	<0.01	<0.01			µg/L	
delta-BHC	Biannual	10	<0.01	<0.01			µg/L	
Demeton-O	Biannual	10	<0.02	<0.02			µg/L	

Demeton-O & Demeton-S	Biannual	10	<0.02	<0.02			µg/L	
Demeton-S	Biannual	10	<0.02	<0.02			µg/L	
Demeton-S-methyl	Biannual	10	<0.02	<0.02			µg/L	
Diazinon	Biannual	10	<0.01	<0.01	4	0	µg/L	<0.01
Dibromochloromethane	Biannual	2	<5.0	<5.0			µg/L	
Dichlorvos	Biannual	10	<0.20	<0.20	5	0	µg/L	<0.2
Dieldrin	Biannual	10	<0.01	<0.01	0.15	0	µg/L	
Dimethoate	Biannual	10	<0.02	<0.02	7	0	µg/L	<0.02
Disulfoton	Biannual	10	<0.05	<0.05	4	0	µg/L	<0.05
DO (mg/L) (IH)	3 times per week	393	5.05	92.4			mg/L	
E coli	Biannual	10	<1	<1			CFU/100mL	
E. coli (IH)	Biannual	419	0	<1			MPN/100mL	0
Electrical Conductance	Biannual	12	71	110			µS/cm	0
Electrical Conductance (IH)	3 times per week	393	29	120			µS/cm	0
Endosulfan (sum)	Biannual	10	<0.01	<0.01			µg/L	
Endosulfan sulfate	Biannual	10	<0.01	<0.01			µg/L	
Endrin	Biannual	10	<0.01	<0.01			µg/L	
Endrin aldehyde	Biannual	10	<0.01	<0.01			µg/L	
Endrin ketone	Biannual	10	<0.010	<0.010			µg/L	
EPN	Biannual	10	<0.05	<0.05			µg/L	
Ethion	Biannual	10	<0.02	<0.02	4	0	µg/L	<0.02
Ethoprophos	Biannual	10	<0.01	<0.01	1	0	µg/L	<0.01
Fenamiphos	Biannual	10	<0.01	<0.01	0.5	0	µg/L	<0.01
Fenchlorphos (Ronnel)	Biannual	10	<10.0	<10.0			µg/L	
Fenitrothion	Biannual	10	<2.0	<2.0	7	0	µg/L	<2
Fensulfothion	Biannual	10	<0.01	<0.01	10	0	µg/L	<0.01
Fenthion	Biannual	10	<0.05	<0.05	7	0	µg/L	<0.05
Fluoride	Biannual	10	<0.03	0.16	1500	0	mg/L	<0.02
Fluorotelomer sulfonic acid (10:2 FTS)	Biannual	3	<0.005	<0.005			µg/L	
Fluorotelomer sulfonic acid (4:2 FTS)	Biannual	3	<0.005	<0.005			µg/L	
Fluorotelomer sulfonic acid (6:2 FTS)	Biannual	3	<0.005	<0.005			µg/L	
Fluorotelomer sulfonic acid (8:2 FTS)	Biannual	3	<0.005	<0.005			µg/L	
Formothion	Biannual	10	<20.0	<20.0	50	0	µg/L	
Fosetyl Aluminium	Biannual	10	<10.0	<10.0			µg/L	
Free Chlorine	Biannual	10	1.1	1.5			mg/L	
Free Chlorine (IH)	3 times per week	1935	0.07	2			mg/L	0
gamma-BHC	Biannual	7	<0.01	<0.01			µg/L	
Heptachlor	Biannual	10	<0.005	<0.005			µg/L	
Heptachlor epoxide	Biannual	10	<0.01	<0.01			µg/L	
Heterotrophic Plate Count	Biannual	10	<10	<10			CFU/mL	0
Hexachlorobenzene (HCB)	Biannual	10	<0.01	<0.01			µg/L	

ICPMS Aluminium	Biannual	10	<0.015	0.037			mg/L	
ICPMS Antimony	Biannual	10	<0.000	<0.001			mg/L	
ICPMS Arsenic	Biannual	10	0.0005	0.001			mg/L	
ICPMS Barium	Biannual	10	0.009	0.016			mg/L	
ICPMS Beryllium	Biannual	10	<0.0001	<0.0010			mg/L	
ICPMS Boron	Biannual	10	<0.05	<0.05			mg/L	
ICPMS Cadmium	Biannual	10	<0.0001	<0.0001			mg/L	
ICPMS Chromium	Biannual	10	<0.0005	<0.0010			mg/L	
ICPMS Cobalt	Biannual	10	<0.0001	<0.0010			mg/L	
ICPMS Copper	Biannual	10	0.001	0.005			mg/L	
ICPMS Iron	Biannual	10	<0.015	<0.050			mg/L	
ICPMS Lead	Biannual	10	<0.0001	0.0005			mg/L	
ICPMS Manganese	Biannual	10	<0.0002	0.0014			mg/L	
ICPMS Molybdenum	Biannual	10	<0.0005	<0.0010			mg/L	
ICPMS Nickel	Biannual	10	<0.0002	0.0006			mg/L	
ICPMS Selenium	Biannual	10	<0.002	<0.010			mg/L	
ICPMS Silver	Biannual	10	<0.0002	<0.0010			mg/L	
ICPMS Thallium	Biannual	10	<0.0001	<0.0010			mg/L	
ICPMS Thorium	Biannual	10	<0.000	<0.002			mg/L	
ICPMS Tin	Biannual	10	<0.000	<0.005			mg/L	
ICPMS Titanium	Biannual	10	<0.000	<0.010			mg/L	
ICPMS Uranium	Biannual	10	<0.0000	<0.0010			mg/L	
ICPMS Vanadium	Biannual	10	0.0002	<0.0100			mg/L	
ICPMS Zinc	Biannual	10	<0.003	<0.008			mg/L	
ICPOES Silicon	Biannual	10	11	15			mg/ L SiO2	
Langliers Index	Biannual	10	-3	-1.7				
Magnesium	Biannual	12	1.4	3.1			mg/L	0
Malathion	Biannual	10	<0.02	<0.02			µg/L	
Mercury	Biannual	10	<0.06	<0.06	1	0	µg/L	<0.06
Methidathion	Biannual	10	<0.1	<0.1	6	0	µg/L	<0.1
Methoxychlor	Biannual	10	<0.01	<0.01	0.3	0	µg/L	<0.01
Mevinphos	Biannual	10	<0.02	<0.02	5	0	µg/L	<0.02
Monocrotophos	Biannual	10	<0.02	<0.02	2	0	µg/L	<0.02
Naftalofos	Biannual	10	<1.0	<1.0			µg/L	
Omethoate	Biannual	10	<0.01	<0.01	1	0	µg/L	<0.01
Oxychlordane	Biannual	10	<0.01	<0.01			µg/L	
Parathion	Biannual	10	<0.20	<0.20	20	0	µg/L	<0.2
Parathion-methyl	Biannual	10	<0.50	<0.50	0.7	0	µg/L	<0.5
Perfluorobutane sulfonic acid (PFBS)	Biannual	3	<0.002	<0.002	0.03	0	µg/L	
Perfluorobutanoic acid (PFBA)	Biannual	3	<0.010	<0.010			µg/L	
Perfluorodecane sulfonic acid (PFDS)	Biannual	3	<0.002	<0.002			µg/L	

Perfluorodecanoic acid (PFDA)	Biannual	3	<0.002	<0.002			µg/L	
Perfluorododecanoic acid (PFDoDA)	Biannual	3	<0.002	<0.002			µg/L	
Perfluoroheptane sulfonic acid (PFHpS)	Biannual	3	<0.002	<0.002			µg/L	
Perfluoroheptanoic acid (PFHpA)	Biannual	3	<0.002	<0.002			µg/L	
Perfluorohexane sulfonic acid (PFHxS)	Biannual	3	<0.002	<0.002	0.008	0	µg/L	
Perfluorohexanoic acid (PFHxA)	Biannual	3	<0.002	<0.002			µg/L	
Perfluorononanoic acid (PFNA)	Biannual	3	<0.002	<0.002			µg/L	
Perfluorooctane sulfonamide (FOSA)	Biannual	3	<0.002	<0.002			µg/L	
Perfluorooctane sulfonic acid (PFOS)	Biannual	3	<0.002	<0.002	0.2	0	µg/L	
Perfluorooctanoic acid (PFOA)	Biannual	3	<0.002	<0.002	0.2	0	µg/L	
Perfluoropentane sulfonic acid (PFPeS)	Biannual	3	<0.002	<0.002			µg/L	
Perfluoropentanoic acid (PFPeA)	Biannual	3	<0.002	<0.002			µg/L	
Perfluorotetradecanoic acid (PFTeDA)	Biannual	3	<0.005	<0.005			µg/L	
Perfluorotridecanoic acid (PFTrDA)	Biannual	3	<0.002	<0.002			µg/L	
Perfluoroundecanoic acid (PFUnDA)	Biannual	3	<0.002	<0.002			µg/L	
pH	Biannual	12	7	7.8				<0.1
pH (IH)	3 times per week	393	6.5	8.42				0
pH @ 25 deg C	Biannual	10	9.4	10				
Phorate	Biannual	10	<0.1	<0.1			µg/L	
Pirimiphos-ethyl	Biannual	10	<0.01	<0.01	0.5	0	µg/L	<0.01
Pirimiphos-methyl	Biannual	10	<0.01	<0.01			µg/L	
Potassium	Biannual	10	1.4	2.2			mg/L	0
Profenofos	Biannual	10	<0.01	<0.01	0.3	0	µg/L	<0.01
Prothiofos	Biannual	10	<0.10	<0.10			µg/L	
Pyrazophos	Biannual	10	<0.1	<0.1	20	0	µg/L	<0.1
Salinity (psu)	Biannual	10	0.0387	0.0542			psu	
SAR_CALC	Biannual	10	0.74	1.2			Units	
Sodium	Biannual	10	7.1	12			mg/L	<0.15
Sulfotep	Biannual	10	<0.005	<0.005			µg/L	
Sulphate	Biannual	10	0.82	3.6			mg/L	
Sulprofos	Biannual	10	<0.05	<0.05	10	0	µg/L	<0.05
Sum of DDD + DDE + DDT	Biannual	10	<0.01	<0.01			µg/L	
SUM of PFAS	Biannual	3	<0.002	<0.002			µg/L	
Sum of PFAS (WA DER List)	Biannual	3	<0.00	<0.00			µg/L	
SUM of PFHxS and PFOS	Biannual	3	<0.002	<0.002			µg/L	
Temephos	Biannual	10	<0.02	<0.02	400	0	µg/L	<0.020
Temperature (IH)	3 times per week	393	8	92.4			deg C	0
Terbufos	Biannual	10	<0.01	<0.01	0.9	0	µg/L	<0.01
Tetrachlorvinphos	Biannual	10	<0.01	<0.01	100	0	µg/L	<0.01
Thiometon	Biannual	10	<0.5	<0.5	0.004	0	µg/L	<0.5
Total Alkalinity	Biannual	10	9.1	23			mg CaCO3 / L	

Total Chlordane (sum)	Biannual	10	<0.01	<0.01			µg/L	
Total Chlorine	Biannual	10	1.1	1.7			mg/L	0
Total Chlorine (IH)	3 times per week	1931	0.24	2.16			mg/L	0
Total coliforms	Biannual	10	<1	<1			CFU/100mL	0
Total Coliforms (IH)	3 times per week	518	0	<1			MPN/100mL	0
Total Dissolved Solids	Biannual	10	48	65			mg/L	<10
Total Hardness	Biannual	12	11	19			mg CaCO3 / L	
Total Trihalomethanes	Biannual	2	30	58			µg/L	
trans-Chlordane	Biannual	10	<0.01	<0.01			µg/L	
Triazophos	Biannual	10	<0.005	<0.005			µg/L	
Trichlorfon	Biannual	10	<0.02	<0.02	7	0	µg/L	<0.02
Trichloronate	Biannual	10	<0.5	<0.5			µg/L	
Turbidity	Biannual	10	<0.100	0.3			NTU	<0.1
Turbidity (IH)	3 times per week	392	0.00	0.17			NTU	0

TABLE D5: UNTREATED ADWG PARAMETER TESTING RESULTS – KURANDA (2021- FEBRUARY 2026)

Parameter	Frequency of Sampling	No. of Samples Taken	Minimum	Maximum	ADWG Value	No. of Exceedances	Units	LOR
4.4`-DDD	Biannual	10	<0.01	<0.01			µg/L	
4.4`-DDE	Biannual	10	<0.01	<0.01			µg/L	
4.4`-DDT	Biannual	10	<0.01	<0.01			µg/L	
Acephate	Biannual	10	<0.5	<0.5	8	0	µg/L	0
Aldrin	Biannual	10	<0.01	<0.01	0.15	0	µg/L	
Alkalinity (IH)	Daily	622	7	109			µg/L	0
alpha-BHC	Biannual	10	<0.01	<0.01			µg/L	
alpha-Endosulfan	Biannual	10	<0.01	<0.01			Pt/Co units	
Apparent Colour	Biannual	10	20	>150			µg/L	0
Azinphos-ethyl	Biannual	10	<0.02	<0.02			µg/L	
Azinphos-methyl	Biannual	10	<0.02	<0.02	30	0	µg/L	<0.02
Bensulide	Biannual	10	<0.1	<0.1			µg/L	
beta-BHC	Biannual	10	<0.01	<0.01			µg/L	
beta-Endosulfan	Biannual	10	<0.01	<0.01			µg/L	
Bromophos-ethyl	Biannual	10	<0.10	<0.10	10	0	mg/L	<0.10
Calcium	Biannual	10	1.6	5.9			µg/L	0
Carbofenothion	Biannual	10	<0.02	<0.02			µg/L	

Chlorfenvinphos	Biannual	10	<0.02	<0.02	2	0	mg/L	<0.02
Chloride	Biannual	10	6.8	18			µg/L	<1
Chlorpyrifos	Biannual	10	<0.02	<0.02	10	0	µg/L	<0.02
Chlorpyrifos-methyl	Biannual	10	<0.20	<0.20			µg/L	
cis-Chlordane	Biannual	10	<0.01	<0.01			µg/L	
Coumaphos	Biannual	10	<0.01	<0.01			µg/L	
delta-BHC	Biannual	10	<0.01	<0.01			µg/L	
Demeton-O	Biannual	10	<0.02	<0.02			µg/L	
Demeton-O & Demeton-S	Biannual	10	<0.02	<0.02			µg/L	
Demeton-S	Biannual	10	<0.02	<0.02			µg/L	
Demeton-S-methyl	Biannual	10	<0.02	<0.02			µg/L	
Diazinon	Biannual	10	<0.01	<0.01	4	0	µg/L	<0.01
Dichlorvos	Biannual	10	<0.20	<0.20	5	0	µg/L	<0.2
Dieldrin	Biannual	10	<0.01	<0.01	0.15	0	µg/L	
Dimethoate	Biannual	10	<0.02	<0.02	7	0	µg/L	<0.02
Disulfoton	Weekly	10	<0.05	<0.05	4	0	MPN/100mL	<0.05
DO (mg/L) (IH)	Daily	622	6.6	9.6			µS/cm	
E. coli (IH)	Weekly	261	1	>2420			µg/L	0
Electrical Conductance	Biannual	10	49	150			µg/L	0
Electrical Conductance (IH)	weekly	622	48	189			µg/L	0
Endosulfan (sum)	Biannual	10	<0.01	<0.01			µg/L	
Endosulfan sulfate	Biannual	10	<0.01	<0.01			µg/L	
Endrin	Biannual	10	<0.01	<0.01			µg/L	
Endrin aldehyde	Biannual	10	<0.01	<0.01			µg/L	
Endrin ketone	Biannual	10	<0.010	<0.010			µg/L	
EPN	Biannual	10	<0.05	<0.05			µg/L	
Ethion	Biannual	10	<0.02	<0.02	4	0	µg/L	<0.02
Ethoprophos	Biannual	10	<0.01	<0.01	1	0	µg/L	<0.01
Fenamiphos	Biannual	10	<0.01	<0.01	0.5	0	µg/L	<0.01
Fenchlorphos (Ronnel)	Biannual	10	<10.0	<10.0			µg/L	
Fenitrothion	Biannual	10	<2.0	<2.0	7	0	mg/L	<2
Fensulfothion	Biannual	10	<0.01	<0.01	10	0	µg/L	<0.01
Fenthion	Biannual	10	<0.05	<0.05	7	0	µg/L	<0.05
Fluoride	Biannual	10	0.04	0.06	1500	0	µg/L	<0.02
Formothion	Biannual	10	<20.0	<20.0	50	0	µg/L	
Fosetyl Aluminium	Biannual	10	<10.0	<10.0			µg/L	
gamma-BHC	Biannual	7	<0.01	<0.01			µg/L	
Heptachlor	Biannual	10	<0.005	<0.005			mg/L	
Heptachlor epoxide	Biannual	10	<0.01	<0.01			mg/L	
Hexachlorobenzene (HCB)	Biannual	10	<0.01	<0.01			mg/L	
ICPMS Aluminium	Biannual	10	0.128	3.9			mg/L	

ICPMS Antimony	Biannual	10	<0.000	<0.002			mg/L	
ICPMS Arsenic	Biannual	10	<0.0010	0.002			mg/L	
ICPMS Barium	Biannual	10	0.011	0.034			mg/L	
ICPMS Beryllium	Biannual	10	<0.0001	<0.0010			mg/L	
ICPMS Boron	Biannual	10	<0.05	<0.10			mg/L	
ICPMS Cadmium	Biannual	10	<0.0001	<0.0002			mg/L	
ICPMS Chromium	Biannual	10	<0.0005	0.004			mg/L	
ICPMS Cobalt	Biannual	10	0.0002	0.0022			mg/L	
ICPMS Copper	Biannual	10	<0.001	0.058			mg/L	
ICPMS Iron	Biannual	10	0.435	3.41			mg/L	
ICPMS Lead	Biannual	10	0.0001	0.004			mg/L	
ICPMS Manganese	Biannual	10	0.0346	0.148			mg/L	
ICPMS Molybdenum	Biannual	10	<0.0005	<0.0010			mg/L	
ICPMS Nickel	Biannual	10	0.0005	0.0028			mg/L	
ICPMS Selenium	Biannual	10	<0.002	<0.010			mg/L	
ICPMS Silver	Biannual	10	<0.0002	<0.0010			mg/L	
ICPMS Thallium	Biannual	10	<0.0001	<0.0010			mg/L	
ICPMS Thorium	Biannual	10	<0.000	<0.004			mg/L	
ICPMS Tin	Biannual	10	<0.000	<0.005			mg/L	
ICPMS Titanium	Biannual	10	0.005	0.043			mg/L	
ICPMS Uranium	Biannual	10	<0.0000	<0.0010			mg/ L SiO2	
ICPMS Vanadium	Biannual	10	0.001	<0.0100				
ICPMS Zinc	Biannual	10	<0.003	0.042			mg/L	
ICPOES Silicon	Biannual	10	10	23			µg/L	
Langliers Index	Biannual	10	-3	-1.2			µg/L	
Magnesium	Biannual	10	1.3	5.4			µg/L	0
Malathion	Biannual	10	<0.02	<0.02			µg/L	
Mercury	Biannual	10	<0.06	<0.06	1	0	µg/L	<0.06
Methidathion	Biannual	10	<0.1	<0.1	6	0	µg/L	<0.1
Methoxychlor	Biannual	10	<0.01	<0.01	0.3	0	µg/L	<0.01
Mevinphos	Biannual	10	<0.02	<0.02	5	0	µg/L	<0.02
Monocrotophos	Biannual	10	<0.02	<0.02	2	0	µg/L	<0.02
Naftalofos	Biannual	10	<1.0	<1.0			µg/L	
Omethoate	Biannual	10	<0.01	<0.01	1	0	µg/L	<0.01
Oxychlordane	Biannual	10	<0.01	<0.01			µg/L	
Parathion	Biannual	10	<0.20	<0.20	20	0	µg/L	<0.2
Parathion-methyl	Biannual	10	<0.50	<0.50	0.7	0	µg/L	<0.5
pH	Biannual	10	6.9	7.8			µg/L	<0.1
pH (IH)	Daily	622	6.6	28			µg/L	0
pH @ 25 deg C	Biannual	10	8.9	10			mg/L	
Phorate	Biannual	10	<0.1	<0.1			µg/L	

Pirimiphos-ethyl	Biannual	10	<0.01	<0.01	0.5	0	µg/L	<0.01
Pirimiphos-methyl	Biannual	10	<0.01	<0.01			µg/L	
Potassium	Biannual	10	1.5	1.8			psu	0
Profenofos	Biannual	10	<0.01	<0.01	0.3	0	Units	<0.01
Prothiofos	Biannual	10	<0.10	<0.10			mg/L	
Pyrazophos	Biannual	10	<0.1	<0.1	20	0	µg/L	<0.1
Salinity (psu)	Biannual	10	0.029	0.074			mg/L	
SAR_CALC	Biannual	10	0.73	1.1			µg/L	
Sodium	Biannual	10	5.3	13			µg/L	<0.15
Sulfotep	Biannual	10	<0.005	<0.005			µg/L	
Sulphate	Biannual	10	1.1	1.8			µg/L	
Sulprofos	Biannual	10	<0.05	<0.05	10	0	µg/L	<0.05
Sum of DDD + DDE + DDT	Biannual	10	<0.01	<0.01			µg/L	
Temephos	Biannual	10	<0.02	<0.02	400	0	mg CaCO3 / L	<0.020
Temperature (IH)	Daily	622	17.6	157			µg/L	0
Terbufos	Weekly	10	<0.01	<0.01	0.9	0	MPN/100mL	<0.01
Tetrachlorvinphos	Biannual	10	<0.01	<0.01	100	0	mg/L	<0.01
Thiometon	Biannual	10	<0.5	<0.5	0.004	0	mg CaCO3 / L	<0.5
Total Alkalinity	Biannual	10	11	38			µg/L	
Total Chlordane (sum)	Biannual	10	<0.01	<0.01			µg/L	
Total Coliforms (IH)	Weekly	361	0	>2420			µg/L	0
Total Dissolved Solids	Biannual	10	55	97			µg/L	<10
Total Hardness	Biannual	10	9.3	37			NTU	
trans-Chlordane	Biannual	10	<0.01	<0.01				
Triazophos	Biannual	10	<0.005	<0.005				
Trichlorfon	Biannual	10	<0.02	<0.02	7	0		<0.02
Trichloronate	Biannual	10	<0.5	<0.5				
Turbidity	Biannual	10	3.6	150				<0.1
Turbidity (IH)	Weekly	619	1.15	374				0

TABLE D6: TREATED ADWG PARAMETER TESTING RESULTS – KURANDA (2021 – FEBRUARY 2026)

Parameter	Frequency of Sampling	No. of Samples Taken	Minimum	Maximum	ADWG Value	No. of Exceedances	Units	LOR
(EtFOSA)	Biannual	1	<0.005	<0.005			µg/L	
(EtFOSAA)	Biannual	1	<0.002	<0.002			µg/L	
(EtFOSE)	Biannual	1	<0.005	<0.005			µg/L	
(MeFOSA)	Biannual	1	<0.005	<0.005			µg/L	
(MeFOSAA)	Biannual	1	<0.002	<0.002			µg/L	
(MeFOSE)	Biannual	1	<0.005	<0.005			µg/L	

4.4`-DDD	Biannual	10	<0.01	<0.01			µg/L	
4.4`-DDE	Biannual	10	<0.01	<0.01			µg/L	
4.4`-DDT	Biannual	10	<0.01	<0.01			µg/L	
Acephate	Biannual	10	<0.5	<0.5	8	0	µg/L	0
Aldrin	Biannual	10	<0.01	<0.01	0.15	0	µg/L	
Alkalinity (IH)	Daily	623	15	50			mg/100mL	0
alpha-BHC	Biannual	10	<0.01	<0.01			µg/L	
alpha-Endosulfan	Biannual	10	<0.01	<0.01			µg/L	
Apparent Colour	Biannual	10	<1	4			Pt/Co units	0
Azinphos-ethyl	Biannual	10	<0.02	<0.02			µg/L	
Azinphos-methyl	Biannual	10	<0.02	<0.02	30	0	µg/L	<0.02
Bensulide	Biannual	10	<0.1	<0.1			µg/L	
beta-BHC	Biannual	10	<0.01	<0.01			µg/L	
beta-Endosulfan	Biannual	10	<0.01	<0.01			µg/L	
Bromodichloromethane	Biannual	7	7	18			µg/L	
Bromoform	Biannual	7	<5.0	<5.0			µg/L	
Bromophos-ethyl	Biannual	10	<0.10	<0.10	10	0	µg/L	<0.10
Calcium	Biannual	10	2.1	6			mg/L	0
Carbofenothion	Biannual	10	<0.02	<0.02			µg/L	
Chlorate	Biannual	7	0.122	0.412			mg/L	
Chlorfenvinphos	Biannual	10	<0.02	<0.02	2	0	µg/L	<0.02
Chloride	Biannual	10	12	21			mg/L	<1
Chloroform	Biannual	7	7	94			µg/L	
Chlorpyrifos	Biannual	10	<0.02	<0.02	10	0	µg/L	<0.02
Chlorpyrifos-methyl	Biannual	10	<0.20	<0.20			µg/L	
cis-Chlordane	Biannual	10	<0.01	<0.01			µg/L	
Coumaphos	Biannual	10	<0.01	<0.01			µg/L	
delta-BHC	Biannual	10	<0.01	<0.01			µg/L	
Demeton-O	Biannual	10	<0.02	<0.02			µg/L	
Demeton-O & Demeton-S	Biannual	10	<0.02	<0.02			µg/L	
Demeton-S	Biannual	10	<0.02	<0.02			µg/L	
Demeton-S-methyl	Biannual	10	<0.02	<0.02			µg/L	
Diazinon	Biannual	10	<0.01	<0.01	4	0	µg/L	<0.01
Dibromochloromethane	Biannual	7	<5.0	9			µg/L	
Dichlorvos	Biannual	10	<0.20	<0.20	5	0	µg/L	<0.2
Dieldrin	Biannual	10	<0.01	<0.01	0.15	0	µg/L	
Dimethoate	Biannual	10	<0.02	<0.02	7	0	µg/L	<0.02
Disulfoton	Biannual	10	<0.05	<0.05	4	0	µg/L	<0.05
DO (mg/L) (IH)	Daily	623	6.7	75			mg/L	
E coli	Biannual	10	<1	<1			CFU/100mL	
E. coli (IH)	Weekly	507	0	<1			MPN/100mL	0

Electrical Conductance	Biannual	10	73	160			µS/cm	0
Electrical Conductance (IH)	Daily	623	2	179			µS/cm	0
Endosulfan (sum)	Biannual	10	<0.01	<0.01			µg/L	
Endosulfan sulfate	Biannual	10	<0.01	<0.01			µg/L	
Endrin	Biannual	10	<0.01	<0.01			µg/L	
Endrin aldehyde	Biannual	10	<0.01	<0.01			µg/L	
Endrin ketone	Biannual	10	<0.010	<0.010			µg/L	
EPN	Biannual	10	<0.05	<0.05			µg/L	
Ethion	Biannual	10	<0.02	<0.02	4	0	µg/L	<0.02
Ethoprophos	Biannual	10	<0.01	<0.01	1	0	µg/L	<0.01
Fenamiphos	Biannual	10	<0.01	<0.01	0.5	0	µg/L	<0.01
Fenchlorphos (Ronnel)	Biannual	10	<10.0	<10.0			µg/L	
Fenitrothion	Biannual	10	<2.0	<2.0	7	0	µg/L	<2
Fensulfothion	Biannual	10	<0.01	<0.01	10	0	µg/L	<0.01
Fenthion	Biannual	10	<0.05	<0.05	7	0	µg/L	<0.05
Fluoride	Biannual	10	<0.03	0.06	1500	0	mg/L	<0.02
Fluorotelomer sulfonic acid (10:2 FTS)	Biannual	1	<0.005	<0.005			µg/L	
Fluorotelomer sulfonic acid (4:2 FTS)	Biannual	1	<0.005	<0.005			µg/L	
Fluorotelomer sulfonic acid (6:2 FTS)	Biannual	1	<0.005	<0.005			µg/L	
Fluorotelomer sulfonic acid (8:2 FTS)	Biannual	1	<0.005	<0.005			µg/L	
Formothion	Biannual	10	<20.0	<20.0	50	0	µg/L	
Fosetyl Aluminium	Biannual	10	<10.0	<10.0			µg/L	
Free Chlorine	Biannual	10	1.1	3.5			mg/L	
Free Chlorine (IH)	3 times per week	1987	0.32	3.3			mg/L	0
gamma-BHC	Biannual	7	<0.01	<0.01			µg/L	
Heptachlor	Biannual	10	<0.005	<0.005			µg/L	
Heptachlor epoxide	Biannual	10	<0.01	<0.01			µg/L	
Heterotrophic Plate Count	Biannual	10	<10	<10			CFU/mL	0
Hexachlorobenzene (HCB)	Biannual	10	<0.01	<0.01			µg/L	
ICPMS Aluminium	Biannual	10	<0.008	0.024			mg/L	
ICPMS Antimony	Biannual	10	<0.000	<0.001			mg/L	
ICPMS Arsenic	Biannual	10	0.0003	0.0005			mg/L	
ICPMS Barium	Biannual	10	0.008	0.015			mg/L	
ICPMS Beryllium	Biannual	10	<0.0001	<0.0010			mg/L	
ICPMS Boron	Biannual	10	<0.05	<0.05			mg/L	
ICPMS Cadmium	Biannual	10	<0.0001	<0.0001			mg/L	
ICPMS Chromium	Biannual	10	<0.0005	<0.0010			mg/L	
ICPMS Cobalt	Biannual	10	<0.0001	<0.0010			mg/L	
ICPMS Copper	Biannual	10	0.006	0.019			mg/L	
ICPMS Iron	Biannual	10	<0.015	<0.050			mg/L	
ICPMS Lead	Biannual	10	0.0001	<0.0010			mg/L	

ICPMS Manganese	Biannual	10	0.0042	0.0204			mg/L	
ICPMS Molybdenum	Biannual	10	<0.0005	<0.0010			mg/L	
ICPMS Nickel	Biannual	10	<0.0002	0.0006			mg/L	
ICPMS Selenium	Biannual	10	<0.002	<0.010			mg/L	
ICPMS Silver	Biannual	10	<0.0002	<0.0010			mg/L	
ICPMS Thallium	Biannual	10	<0.0001	<0.0010			mg/L	
ICPMS Thorium	Biannual	10	<0.000	<0.002			mg/L	
ICPMS Tin	Biannual	10	<0.000	<0.005			mg/L	
ICPMS Titanium	Biannual	10	<0.000	<0.010			mg/L	
ICPMS Uranium	Biannual	10	<0.0000	<0.0010			mg/L	
ICPMS Vanadium	Biannual	10	0.0003	<0.0100			mg/L	
ICPMS Zinc	Biannual	10	<0.003	0.01			mg/L	
ICPOES Silicon	Biannual	10	10	22			mg/ L SiO2	
Langliers Index	Biannual	10	-2.5	-1				
Magnesium	Biannual	10	1.7	5.4			mg/L	0
Malathion	Biannual	10	<0.02	<0.02			µg/L	
Mercury	Biannual	10	<0.06	<0.06	1	0	µg/L	<0.06
Methidathion	Biannual	10	<0.1	<0.1	6	0	µg/L	<0.1
Methoxychlor	Biannual	10	<0.01	<0.01	0.3	0	µg/L	<0.01
Mevinphos	Biannual	10	<0.02	<0.02	5	0	µg/L	<0.02
Monocrotophos	Biannual	10	<0.02	<0.02	2	0	µg/L	<0.02
Naftalofos	Biannual	10	<1.0	<1.0			µg/L	
Omethoate	Biannual	10	<0.01	<0.01	1	0	µg/L	<0.01
Oxychlordane	Biannual	10	<0.01	<0.01			µg/L	
Parathion	Biannual	10	<0.20	<0.20	20	0	µg/L	<0.2
Parathion-methyl	Biannual	10	<0.50	<0.50	0.7	0	µg/L	<0.5
Perfluorobutane sulfonic acid (PFBS)	Biannual	1	<0.002	<0.002	0.03	0	µg/L	
Perfluorobutanoic acid (PFBA)	Biannual	1	<0.010	<0.010			µg/L	
Perfluorodecane sulfonic acid (PFDS)	Biannual	1	<0.002	<0.002			µg/L	
Perfluorodecanoic acid (PFDA)	Biannual	1	<0.002	<0.002			µg/L	
Perfluorododecanoic acid (PFDoDA)	Biannual	1	<0.002	<0.002			µg/L	
Perfluoroheptane sulfonic acid (PFHpS)	Biannual	1	<0.002	<0.002			µg/L	
Perfluoroheptanoic acid (PFHpA)	Biannual	1	<0.002	<0.002			µg/L	
Perfluorohexane sulfonic acid (PFHxS)	Biannual	1	<0.002	<0.002	0.008	0	µg/L	
Perfluorohexanoic acid (PFHxA)	Biannual	1	<0.002	<0.002			µg/L	
Perfluorononanoic acid (PFNA)	Biannual	1	<0.002	<0.002			µg/L	
Perfluorooctane sulfonamide (FOSA)	Biannual	1	<0.002	<0.002			µg/L	
Perfluorooctane sulfonic acid (PFOS)	Biannual	1	<0.002	<0.002	0.2	0	µg/L	
Perfluorooctanoic acid (PFOA)	Biannual	1	<0.002	<0.002	0.2	0	µg/L	
Perfluoropentane sulfonic acid (PFPeS)	Biannual	1	<0.002	<0.002			µg/L	
Perfluoropentanoic acid (PFPeA)	Biannual	1	<0.002	<0.002			µg/L	

Perfluorotetradecanoic acid (PFTeDA)	Biannual	1	<0.005	<0.005			µg/L	
Perfluorotridecanoic acid (PFTrDA)	Biannual	1	<0.002	<0.002			µg/L	
Perfluoroundecanoic acid (PFUnDA)	Biannual	1	<0.002	<0.002			µg/L	
pH	Biannual	10	7.3	7.9				<0.1
pH (IH)	Daily	623	6.5	7.9				0
pH @ 25 deg C	Biannual	10	8.9	9.8				
Phorate	Biannual	10	<0.1	<0.1			µg/L	
Pirimiphos-ethyl	Biannual	10	<0.01	<0.01	0.5	0	µg/L	<0.01
Pirimiphos-methyl	Biannual	10	<0.01	<0.01			µg/L	
Potassium	Biannual	10	1.5	1.8			mg/L	0
Profenofos	Biannual	10	<0.01	<0.01	0.3	0	µg/L	<0.01
Prothiofos	Biannual	10	<0.10	<0.10			µg/L	
Pyrazophos	Biannual	10	<0.1	<0.1	20	0	µg/L	<0.1
Salinity (psu)	Biannual	10	0.0392	0.079			psu	
SAR_CALC	Biannual	10	0.93	1.4			Units	
Sodium	Biannual	10	8.6	16			mg/L	<0.15
Sulfotep	Biannual	10	<0.005	<0.005			µg/L	
Sulphate	Biannual	10	<1.00	1.7			mg/L	
Sulprofos	Biannual	10	<0.05	<0.05	10	0	µg/L	<0.05
Sum of DDD + DDE + DDT	Biannual	10	<0.01	<0.01			µg/L	
SUM of PFAS	Biannual	1	<0.002	<0.002			µg/L	
Sum of PFAS (WA DER List)	Biannual	1	<0.00	<0.00			µg/L	
SUM of PFHxS and PFOS	Biannual	1	<0.002	<0.002			µg/L	
Temephos	Biannual	10	<0.02	<0.02	400	0	µg/L	<0.020
Temperature (IH)	Daily	623	19.7	30			deg C	0
Terbufos	Biannual	10	<0.01	<0.01	0.9	0	µg/L	<0.01
Tetrachlorvinphos	Biannual	10	<0.01	<0.01	100	0	µg/L	<0.01
Thiometon	Biannual	10	<0.5	<0.5	0.004	0	µg/L	<0.5
Total Alkalinity	Biannual	10	14	39			mg CaCO3 / L	
Total Chlordane (sum)	Biannual	10	<0.01	<0.01			µg/L	
Total Chlorine	Biannual	10	1.2	3.5			mg/L	0
Total Chlorine (IH)	3 times per week	1972	0.54	145			mg/L	0
Total coliforms	Biannual	10	<1	<1			CFU/100mL	0
Total Coliforms (IH)	Weekly	744	0	<1			MPN/100mL	0
Total Dissolved Solids	Biannual	10	46	96			mg/L	<10
Total Hardness	Biannual	10	12	37			mg CaCO3 / L	
Total Trihalomethanes	Biannual	7	22	110			µg/L	
trans-Chlordane	Biannual	10	<0.01	<0.01			µg/L	
Triazophos	Biannual	10	<0.005	<0.005			µg/L	
Trichlorfon	Biannual	10	<0.02	<0.02	7	0	µg/L	<0.02
Trichloronate	Biannual	10	<0.5	<0.5			µg/L	

Turbidity	Biannual	10	0.1	0.3			NTU	<0.1
Turbidity (IH)	Daily	622	0.01	2			NTU	0

TABLE D7: UNTREATED ADWG PARAMETER TESTING RESULTS – MAREEBA (2021 – FEBRUARY 2026)

Parameter	Frequency of Sampling	No. of Samples Taken	Minimum	Maximum	ADWG Value	No. of Exceedances	Units	LOR
(EtFOSA)	Biannual	1	<0.005	<0.005			µg/L	
(EtFOSAA)	Biannual	1	<0.002	<0.002			µg/L	
(EtFOSE)	Biannual	1	<0.005	<0.005			µg/L	
(MeFOSA)	Biannual	1	<0.005	<0.005			µg/L	
(MeFOSAA)	Biannual	1	<0.002	<0.002			µg/L	
(MeFOSE)	Biannual	1	<0.005	<0.005			µg/L	
4.4`-DDD	Biannual	10	<0.01	<0.01			µg/L	
4.4`-DDE	Biannual	10	<0.01	<0.01			µg/L	
4.4`-DDT	Biannual	10	<0.01	<0.01			µg/L	
Acephate	Biannual	10	<0.5	<0.5	8	0	µg/L	0
Aldrin	Biannual	10	<0.01	<0.01	0.15	0	µg/L	
Alkalinity (IH)	Daily	680	8	70			mg/100mL	0
alpha-BHC	Biannual	10	<0.01	<0.01			µg/L	
alpha-Endosulfan	Biannual	10	<0.01	<0.01			µg/L	
Apparent Colour	Biannual	10	7	76			Pt/Co units	0
Azinphos-ethyl	Biannual	10	<0.02	<0.02			µg/L	
Azinphos-methyl	Biannual	10	<0.02	<0.02	30	0	µg/L	<0.02
Bensulide	Biannual	10	<0.1	<0.1			µg/L	
beta-BHC	Biannual	10	<0.01	<0.01			µg/L	
beta-Endosulfan	Biannual	10	<0.01	<0.01			µg/L	
Bromophos-ethyl	Biannual	10	<0.10	<0.10	10	0	µg/L	<0.10
Calcium	Biannual	10	2.8	7.6			mg/L	0
Carbofenothion	Biannual	10	<0.02	<0.02			µg/L	
Chlorfenvinphos	Biannual	10	<0.02	<0.02	2	0	µg/L	<0.02
Chloride	Biannual	10	7.6	11			mg/L	<1
Chlorpyrifos	Biannual	10	<0.02	<0.02	10	0	µg/L	<0.02
Chlorpyrifos-methyl	Biannual	10	<0.20	<0.20			µg/L	
cis-Chlordane	Biannual	10	<0.01	<0.01			µg/L	
Coumaphos	Biannual	10	<0.01	<0.01			µg/L	
delta-BHC	Biannual	10	<0.01	<0.01			µg/L	
Demeton-O	Biannual	10	<0.02	<0.02			µg/L	
Demeton-O & Demeton-S	Biannual	10	<0.02	<0.02			µg/L	
Demeton-S	Biannual	10	<0.02	<0.02			µg/L	

Demeton-S-methyl	Biannual	10	<0.02	<0.02			µg/L	
Diazinon	Biannual	10	<0.01	<0.01	4	0	µg/L	<0.01
Dichlorvos	Biannual	10	<0.20	<0.20	5	0	µg/L	<0.2
Dieldrin	Biannual	10	<0.01	<0.01	0.15	0	µg/L	
Dimethoate	Biannual	10	<0.02	<0.02	7	0	µg/L	<0.02
Disulfoton	Biannual	10	<0.05	<0.05	4	0	µg/L	<0.05
DO (mg/L) (IH)	Daily	683	5.2	70.03			mg/L	
E. coli (IH)	Weekly	257	<1	>2420			MPN/100mL	0
Electrical Conductance	Biannual	10	74	140			µS/cm	0
Electrical Conductance (IH)	Daily	683	7	184			µS/cm	0
Endosulfan (sum)	Biannual	10	<0.01	<0.01			µg/L	
Endosulfan sulfate	Biannual	10	<0.01	<0.01			µg/L	
Endrin	Biannual	10	<0.01	<0.01			µg/L	
Endrin aldehyde	Biannual	10	<0.01	<0.01			µg/L	
Endrin ketone	Biannual	10	<0.010	<0.010			µg/L	
EPN	Biannual	10	<0.05	<0.05			µg/L	
Ethion	Biannual	10	<0.02	<0.02	4	0	µg/L	<0.02
Ethoprophos	Biannual	10	<0.01	<0.01	1	0	µg/L	<0.01
Fenamiphos	Biannual	10	<0.01	<0.01	0.5	0	µg/L	<0.01
Fenchlorphos (Ronnel)	Biannual	10	<10.0	<10.0			µg/L	
Fenitrothion	Biannual	10	<2.0	<2.0	7	0	µg/L	<2
Fensulfothion	Biannual	10	<0.01	<0.01	10	0	µg/L	<0.01
Fenthion	Biannual	10	<0.05	<0.05	7	0	µg/L	<0.05
Fluoride	Biannual	10	<0.03	0.07	1500	0	mg/L	<0.02
Fluorotelomer sulfonic acid (10:2 FTS)	Biannual	1	<0.005	<0.005			µg/L	
Fluorotelomer sulfonic acid (4:2 FTS)	Biannual	1	<0.005	<0.005			µg/L	
Fluorotelomer sulfonic acid (6:2 FTS)	Biannual	1	<0.005	<0.005			µg/L	
Fluorotelomer sulfonic acid (8:2 FTS)	Biannual	1	<0.005	<0.005			µg/L	
Formothion	Biannual	10	<20.0	<20.0	50	0	µg/L	
Fosetyl Aluminium	Biannual	10	<10.0	<10.0			µg/L	
gamma-BHC	Biannual	7	<0.01	<0.01			µg/L	
Heptachlor	Biannual	10	<0.005	<0.005			µg/L	
Heptachlor epoxide	Biannual	10	<0.01	<0.01			µg/L	
Hexachlorobenzene (HCB)	Biannual	10	<0.01	<0.01			µg/L	
ICPMS Aluminium	Biannual	10	0.109	9.77			mg/L	
ICPMS Antimony	Biannual	10	<0.000	<0.002			mg/L	
ICPMS Arsenic	Biannual	10	0.0005	0.0037			mg/L	
ICPMS Barium	Biannual	10	0.01	0.09			mg/L	
ICPMS Beryllium	Biannual	10	<0.0001	<0.0010			mg/L	
ICPMS Boron	Biannual	10	<0.05	<0.10			mg/L	
ICPMS Cadmium	Biannual	10	<0.0001	<0.0002			mg/L	

ICPMS Chromium	Biannual	10	<0.0005	0.0105			mg/L	
ICPMS Cobalt	Biannual	10	<0.0005	0.0099			mg/L	
ICPMS Copper	Biannual	10	<0.001	0.007			mg/L	
ICPMS Iron	Biannual	10	0.11	7.47			mg/L	
ICPMS Lead	Biannual	10	0.0001	0.0027			mg/L	
ICPMS Manganese	Biannual	10	0.025	3.6			mg/L	
ICPMS Molybdenum	Biannual	10	<0.0005	<0.0010			mg/L	
ICPMS Nickel	Biannual	10	0.0005	0.0092			mg/L	
ICPMS Selenium	Biannual	10	<0.002	<0.010			mg/L	
ICPMS Silver	Biannual	10	<0.0002	<0.0010			mg/L	
ICPMS Thallium	Biannual	10	<0.0001	<0.0010			mg/L	
ICPMS Thorium	Biannual	10	<0.000	<0.004			mg/L	
ICPMS Tin	Biannual	10	<0.000	<0.005			mg/L	
ICPMS Titanium	Biannual	10	0.004	0.186			mg/L	
ICPMS Uranium	Biannual	10	<0.0000	0.0005			mg/L	
ICPMS Vanadium	Biannual	10	0.0011	0.0156			mg/L	
ICPMS Zinc	Biannual	10	<0.003	0.018			mg/L	
ICPOES Silicon	Biannual	10	16	30			mg/ L SiO2	
Langliers Index	Biannual	10	-2	-1.1				
Magnesium	Biannual	10	2.9	6.3			mg/L	0
Malathion	Biannual	10	<0.02	<0.02			µg/L	
Mercury	Biannual	10	<0.06	<0.06	1	0	µg/L	<0.06
Methidathion	Biannual	10	<0.1	<0.1	6	0	µg/L	<0.1
Methoxychlor	Biannual	10	<0.01	<0.01	0.3	0	µg/L	<0.01
Mevinphos	Biannual	10	<0.02	<0.02	5	0	µg/L	<0.02
Monocrotophos	Biannual	10	<0.02	<0.02	2	0	µg/L	<0.02
Naftalofos	Biannual	10	<1.0	<1.0			µg/L	
Omethoate	Biannual	10	<0.01	<0.01	1	0	µg/L	<0.01
Oxychlordane	Biannual	10	<0.01	<0.01			µg/L	
Parathion	Biannual	10	<0.20	<0.20	20	0	µg/L	<0.2
Parathion-methyl	Biannual	10	<0.50	<0.50	0.7	0	µg/L	<0.5
Perfluorobutane sulfonic acid (PFBS)	Biannual	1	<0.002	<0.002	0.03	0	µg/L	
Perfluorobutanoic acid (PFBA)	Biannual	1	<0.010	<0.010			µg/L	
Perfluorodecane sulfonic acid (PFDS)	Biannual	1	<0.002	<0.002			µg/L	
Perfluorodecanoic acid (PFDA)	Biannual	1	<0.002	<0.002			µg/L	
Perfluorododecanoic acid (PFDoDA)	Biannual	1	<0.002	<0.002			µg/L	
Perfluoroheptane sulfonic acid (PFHpS)	Biannual	1	<0.002	<0.002			µg/L	
Perfluoroheptanoic acid (PFHpA)	Biannual	1	<0.002	<0.002			µg/L	
Perfluorohexane sulfonic acid (PFHxS)	Biannual	1	<0.002	<0.002	0.008	0	µg/L	
Perfluorohexanoic acid (PFHxA)	Biannual	1	<0.002	<0.002			µg/L	
Perfluorononanoic acid (PFNA)	Biannual	1	<0.002	<0.002			µg/L	

Perfluorooctane sulfonamide (FOSA)	Biannual	1	<0.002	<0.002			µg/L	
Perfluorooctane sulfonic acid (PFOS)	Biannual	1	<0.002	<0.002	0.2	0	µg/L	
Perfluorooctanoic acid (PFOA)	Biannual	1	<0.002	<0.002	0.2	0	µg/L	
Perfluoropentane sulfonic acid (PFPeS)	Biannual	1	<0.002	<0.002			µg/L	
Perfluoropentanoic acid (PFPeA)	Biannual	1	<0.002	<0.002			µg/L	
Perfluorotetradecanoic acid (PFTeDA)	Biannual	1	<0.005	<0.005			µg/L	
Perfluorotridecanoic acid (PFTrDA)	Biannual	1	<0.002	<0.002			µg/L	
Perfluoroundecanoic acid (PFUnDA)	Biannual	1	<0.002	<0.002			µg/L	
pH	Biannual	10	7.4	7.7				<0.1
pH (IH)	Daily	683	6.5	7.75				0
pH @ 25 deg C	Biannual	10	8.7	9.4				
Phorate	Biannual	10	<0.1	<0.1			µg/L	
Pirimiphos-ethyl	Biannual	10	<0.01	<0.01	0.5	0	µg/L	<0.01
Pirimiphos-methyl	Biannual	10	<0.01	<0.01			µg/L	
Potassium	Biannual	10	1.5	2.1			mg/L	0
Profenofos	Biannual	10	<0.01	<0.01	0.3	0	µg/L	<0.01
Prothiofos	Biannual	10	<0.10	<0.10			µg/L	
Pyrazophos	Biannual	10	<0.1	<0.1	20	0	µg/L	<0.1
Salinity (psu)	Biannual	10	0.0401	0.0716			psu	
SAR_CALC	Biannual	10	0.6	0.84			Units	
Sodium	Biannual	10	6.9	11			mg/L	<0.15
Sulfotep	Biannual	10	<0.005	<0.005			µg/L	
Sulphate	Biannual	10	<1.00	1.8			mg/L	
Sulprofos	Biannual	10	<0.05	<0.05	10	0	µg/L	<0.05
Sum of DDD + DDE + DDT	Biannual	10	<0.01	<0.01			µg/L	
SUM of PFAS	Biannual	1	<0.002	<0.002			µg/L	
Sum of PFAS (WA DER List)	Biannual	1	<0.00	<0.00			µg/L	
SUM of PFHxS and PFOS	Biannual	1	<0.002	<0.002			µg/L	
Temephos	Biannual	10	<0.02	<0.02	400	0	µg/L	<0.020
Temperature (IH)	Daily	683	16.9	126.5			deg C	0
Terbufos	Biannual	10	<0.01	<0.01	0.9	0	µg/L	<0.01
Tetrachlorvinphos	Biannual	10	<0.01	<0.01	100	0	µg/L	<0.01
Thiometon	Biannual	10	<0.5	<0.5	0.004	0	µg/L	<0.5
Total Alkalinity	Biannual	10	23	48			mg CaCO3 / L	
Total Chlordane (sum)	Biannual	10	<0.01	<0.01			µg/L	
Total Coliforms (IH)	Weekly	352	1	>2420			MPN/100mL	0
Total Dissolved Solids	Biannual	10	56	110			mg/L	<10
Total Hardness	Biannual	10	19	45			mg CaCO3 / L	
trans-Chlordane	Biannual	10	<0.01	<0.01			µg/L	
Triazophos	Biannual	10	<0.005	<0.005			µg/L	
Trichlorfon	Biannual	10	<0.02	<0.02	7	0	µg/L	<0.02

Trichloronate	Biannual	10	<0.5	<0.5			µg/L	
Turbidity	Biannual	10	1.1	19			NTU	<0.1
Turbidity (IH)	Weekly	682	0.06	194.52			NTU	0

TABLE D8: TREATED ADWG PARAMETER TESTING RESULTS – MAREEBA (2021- FEBRUARY 2026)

Parameter	Frequency of Sampling	No. of Samples Taken	Minimum	Maximum	ADWG Value	No. of Exceedances	Units	LOR
(EtFOSA)	Biannual	1	<0.005	<0.005			µg/L	
(EtFOSAA)	Biannual	1	<0.002	<0.002			µg/L	
(EtFOSE)	Biannual	1	<0.005	<0.005			µg/L	
(MeFOSA)	Biannual	1	<0.005	<0.005			µg/L	
(MeFOSAA)	Biannual	1	<0.002	<0.002			µg/L	
(MeFOSE)	Biannual	1	<0.005	<0.005			µg/L	
4.4`-DDD	Biannual	10	<0.01	<0.01			µg/L	
4.4`-DDE	Biannual	10	<0.01	<0.01			µg/L	
4.4`-DDT	Biannual	10	<0.01	<0.01			µg/L	
Acephate	Biannual	10	<0.5	<0.5	8	0	µg/L	0
Aldrin	Biannual	10	<0.01	<0.01	0.15	0	µg/L	
Alkalinity (IH)	Daily	678	7	69			mg/100mL	0
alpha-BHC	Biannual	10	<0.01	<0.01			µg/L	
alpha-Endosulfan	Biannual	10	<0.01	<0.01			µg/L	
Apparent Colour	Biannual	10	<1	5			Pt/Co units	0
Azinphos-ethyl	Biannual	10	<0.02	<0.02			µg/L	
Azinphos-methyl	Biannual	10	<0.02	<0.02	30	0	µg/L	<0.02
Bensulide	Biannual	10	<0.1	<0.1			µg/L	
beta-BHC	Biannual	10	<0.01	<0.01			µg/L	
beta-Endosulfan	Biannual	10	<0.01	<0.01			µg/L	
Bromodichloromethane	Biannual	24	7	22			µg/L	
Bromoform	Biannual	24	<5.0	<5.0			µg/L	
Bromophos-ethyl	Biannual	10	<0.10	<0.10	10	0	µg/L	<0.10
Calcium	Biannual	10	3.3	7.5			mg/L	0
Carbofenothion	Biannual	10	<0.02	<0.02			µg/L	
Chlorate	Biannual	24	0.077	0.414			mg/L	
Chlorfenvinphos	Biannual	10	<0.02	<0.02	2	0	µg/L	<0.02
Chloride	Biannual	10	12	16			mg/L	<1
Chloroform	Biannual	24	10	122			µg/L	
Chlorpyrifos	Biannual	10	<0.02	<0.02	10	0	µg/L	<0.02
Chlorpyrifos-methyl	Biannual	10	<0.20	<0.20			µg/L	
cis-Chlordane	Biannual	10	<0.01	<0.01			µg/L	

Coumaphos	Biannual	10	<0.01	<0.01			µg/L	
delta-BHC	Biannual	10	<0.01	<0.01			µg/L	
Demeton-O	Biannual	10	<0.02	<0.02			µg/L	
Demeton-O & Demeton-S	Biannual	10	<0.02	<0.02			µg/L	
Demeton-S	Biannual	10	<0.02	<0.02			µg/L	
Demeton-S-methyl	Biannual	10	<0.02	<0.02			µg/L	
Diazinon	Biannual	10	<0.01	<0.01	4	0	µg/L	<0.01
Dibromochloromethane	Biannual	24	<5.0	7			µg/L	
Dichlorvos	Biannual	10	<0.20	<0.20	5	0	µg/L	<0.2
Dieldrin	Biannual	10	<0.01	<0.01	0.15	0	µg/L	
Dimethoate	Biannual	10	<0.02	<0.02	7	0	µg/L	<0.02
Disulfoton	Biannual	10	<0.05	<0.05	4	0	µg/L	<0.05
DO (mg/L) (IH)	Daily	680	6.94	103			mg/L	
E coli	Biannual	10	<1	<1			CFU/100mL	
E. coli (IH)	Weekly	509	0	<1			MPN/100mL	0
Electrical Conductance	Biannual	10	93	150			µS/cm	0
Electrical Conductance (IH)	Daily	680	8	210			µS/cm	0
Endosulfan (sum)	Biannual	10	<0.01	<0.01			µg/L	
Endosulfan sulfate	Biannual	10	<0.01	<0.01			µg/L	
Endrin	Biannual	10	<0.01	<0.01			µg/L	
Endrin aldehyde	Biannual	10	<0.01	<0.01			µg/L	
Endrin ketone	Biannual	10	<0.010	<0.010			µg/L	
EPN	Biannual	10	<0.05	<0.05			µg/L	
Ethion	Biannual	10	<0.02	<0.02	4	0	µg/L	<0.02
Ethoprophos	Biannual	10	<0.01	<0.01	1	0	µg/L	<0.01
Fenamiphos	Biannual	10	<0.01	<0.01	0.5	0	µg/L	<0.01
Fenchlorphos (Ronnel)	Biannual	10	<10.0	<10.0			µg/L	
Fenitrothion	Biannual	10	<2.0	<2.0	7	0	µg/L	<2
Fensulfothion	Biannual	10	<0.01	<0.01	10	0	µg/L	<0.01
Fenthion	Biannual	10	<0.05	<0.05	7	0	µg/L	<0.05
Fluoride	Biannual	10	<0.03	0.07	1500	0	mg/L	<0.02
Fluorotelomer sulfonic acid (10:2 FTS)	Biannual	1	<0.005	<0.005			µg/L	
Fluorotelomer sulfonic acid (4:2 FTS)	Biannual	1	<0.005	<0.005			µg/L	
Fluorotelomer sulfonic acid (6:2 FTS)	Biannual	1	<0.005	<0.005			µg/L	
Fluorotelomer sulfonic acid (8:2 FTS)	Biannual	1	<0.005	<0.005			µg/L	
Formothion	Biannual	10	<20.0	<20.0	50	0	µg/L	
Fosetyl Aluminium	Biannual	10	<10.0	<10.0			µg/L	
Free Chlorine	Biannual	10	0.4	1.6			mg/L	
Free Chlorine (IH)	Daily	2207	0.04	2.6			mg/L	0
gamma-BHC	Biannual	7	<0.01	<0.01			µg/L	
Heptachlor	Biannual	10	<0.005	<0.005			µg/L	

Heptachlor epoxide	Biannual	10	<0.01	<0.01			µg/L	
Heterotrophic Plate Count	Biannual	10	<10	<10			CFU/mL	0
Hexachlorobenzene (HCB)	Biannual	10	<0.01	<0.01			µg/L	
ICPMS Aluminium	Biannual	10	<0.008	0.033			mg/L	
ICPMS Antimony	Biannual	10	<0.000	<0.001			mg/L	
ICPMS Arsenic	Biannual	10	0.0003	0.0005			mg/L	
ICPMS Barium	Biannual	10	0.007	0.011			mg/L	
ICPMS Beryllium	Biannual	10	<0.0001	<0.0010			mg/L	
ICPMS Boron	Biannual	10	<0.05	<0.05			mg/L	
ICPMS Cadmium	Biannual	10	<0.0001	<0.0001			mg/L	
ICPMS Chromium	Biannual	10	<0.0005	<0.0010			mg/L	
ICPMS Cobalt	Biannual	10	<0.0001	<0.0010			mg/L	
ICPMS Copper	Biannual	10	0.001	0.049			mg/L	
ICPMS Iron	Biannual	10	<0.015	<0.050			mg/L	
ICPMS Lead	Biannual	10	<0.0001	<0.0010			mg/L	
ICPMS Manganese	Biannual	10	<0.0002	0.0017			mg/L	
ICPMS Molybdenum	Biannual	10	<0.0005	<0.0010			mg/L	
ICPMS Nickel	Biannual	10	<0.0002	0.0005			mg/L	
ICPMS Selenium	Biannual	10	<0.002	<0.010			mg/L	
ICPMS Silver	Biannual	10	<0.0002	<0.0010			mg/L	
ICPMS Thallium	Biannual	10	<0.0001	<0.0010			mg/L	
ICPMS Thorium	Biannual	10	<0.000	<0.002			mg/L	
ICPMS Tin	Biannual	10	<0.000	<0.005			mg/L	
ICPMS Titanium	Biannual	10	<0.000	<0.010			mg/L	
ICPMS Uranium	Biannual	10	<0.0000	<0.0010			mg/L	
ICPMS Vanadium	Biannual	10	0.0005	<0.0100			mg/L	
ICPMS Zinc	Biannual	10	<0.003	0.023			mg/L	
ICPOES Silicon	Biannual	10	15	27			mg/ L SiO2	
Langliers Index	Biannual	10	-1.7	-0.84				
Magnesium	Biannual	10	3.2	6.2			mg/L	0
Malathion	Biannual	10	<0.02	<0.02			µg/L	
Mercury	Biannual	10	<0.06	<0.06	1	0	µg/L	<0.06
Methidathion	Biannual	10	<0.1	<0.1	6	0	µg/L	<0.1
Methoxychlor	Biannual	10	<0.01	<0.01	0.3	0	µg/L	<0.01
Mevinphos	Biannual	10	<0.02	<0.02	5	0	µg/L	<0.02
Monocrotophos	Biannual	10	<0.02	<0.02	2	0	µg/L	<0.02
Naftalofos	Biannual	10	<1.0	<1.0			µg/L	
Omethoate	Biannual	10	<0.01	<0.01	1	0	µg/L	<0.01
Oxychlordane	Biannual	10	<0.01	<0.01			µg/L	
Parathion	Biannual	10	<0.20	<0.20	20	0	µg/L	<0.2
Parathion-methyl	Biannual	10	<0.50	<0.50	0.7	0	µg/L	<0.5

Perfluorobutane sulfonic acid (PFBS)	Biannual	1	<0.002	<0.002	0.03	0	µg/L	
Perfluorobutanoic acid (PFBA)	Biannual	1	<0.010	<0.010			µg/L	
Perfluorodecane sulfonic acid (PFDS)	Biannual	1	<0.002	<0.002			µg/L	
Perfluorodecanoic acid (PFDA)	Biannual	1	<0.002	<0.002			µg/L	
Perfluorododecanoic acid (PFDoDA)	Biannual	1	<0.002	<0.002			µg/L	
Perfluoroheptane sulfonic acid (PFHpS)	Biannual	1	<0.002	<0.002			µg/L	
Perfluoroheptanoic acid (PFHpA)	Biannual	1	<0.002	<0.002			µg/L	
Perfluorohexane sulfonic acid (PFHxS)	Biannual	1	<0.002	<0.002	0.008	0	µg/L	
Perfluorohexanoic acid (PFHxA)	Biannual	1	<0.002	<0.002			µg/L	
Perfluorononanoic acid (PFNA)	Biannual	1	<0.002	<0.002			µg/L	
Perfluorooctane sulfonamide (FOSA)	Biannual	1	<0.002	<0.002			µg/L	
Perfluorooctane sulfonic acid (PFOS)	Biannual	1	<0.002	<0.002	0.2	0	µg/L	
Perfluorooctanoic acid (PFOA)	Biannual	1	<0.002	<0.002	0.2	0	µg/L	
Perfluoropentane sulfonic acid (PFPeS)	Biannual	1	<0.002	<0.002			µg/L	
Perfluoropentanoic acid (PFPeA)	Biannual	1	<0.002	<0.002			µg/L	
Perfluorotetradecanoic acid (PFTeDA)	Biannual	1	<0.005	<0.005			µg/L	
Perfluorotridecanoic acid (PFTrDA)	Biannual	1	<0.002	<0.002			µg/L	
Perfluoroundecanoic acid (PFUnDA)	Biannual	1	<0.002	<0.002			µg/L	
pH	Biannual	10	7.6	7.9				<0.1
pH (IH)	Daily	680	7.09	8.04				0
pH @ 25 deg C	Biannual	10	8.7	9.3				
Phorate	Biannual	10	<0.1	<0.1			µg/L	
Pirimiphos-ethyl	Biannual	10	<0.01	<0.01	0.5	0	µg/L	<0.01
Pirimiphos-methyl	Biannual	10	<0.01	<0.01			µg/L	
Potassium	Biannual	10	1.5	1.9			mg/L	0
Profenofos	Biannual	10	<0.01	<0.01	0.3	0	µg/L	<0.01
Prothiofos	Biannual	10	<0.10	<0.10			µg/L	
Pyrazophos	Biannual	10	<0.1	<0.1	20	0	µg/L	<0.1
Salinity (psu)	Biannual	10	0.0482	0.0734			psu	
SAR_CALC	Biannual	10	0.71	1.2			Units	
Sodium	Biannual	10	9.6	14			mg/L	<0.15
Sulfotep	Biannual	10	<0.005	<0.005			µg/L	
Sulphate	Biannual	10	<1.00	1.2			mg/L	
Sulprofos	Biannual	10	<0.05	<0.05	10	0	µg/L	<0.05
Sum of DDD + DDE + DDT	Biannual	10	<0.01	<0.01			µg/L	
SUM of PFAS	Biannual	1	<0.002	<0.002			µg/L	
Sum of PFAS (WA DER List)	Biannual	1	<0.00	<0.00			µg/L	
SUM of PFHxS and PFOS	Biannual	1	<0.002	<0.002			µg/L	
Temephos	Biannual	10	<0.02	<0.02	400	0	µg/L	<0.020
Temperature (IH)	Daily	680	18.7	123			deg C	0
Terbufos	Biannual	10	<0.01	<0.01	0.9	0	µg/L	<0.01

Tetrachlorvinphos	Biannual	10	<0.01	<0.01	100	0	µg/L	<0.01
Thiometon	Biannual	10	<0.5	<0.5	0.004	0	µg/L	<0.5
Total Alkalinity	Biannual	10	25	48			mg CaCO3 / L	
Total Chlordane (sum)	Biannual	10	<0.01	<0.01			µg/L	
Total Chlorine	Biannual	10	0.47	1.7			mg/L	0
Total Chlorine (IH)	3 times per week	2205	0.28	129			mg/L	0
Total coliforms	Biannual	10	<1	<1			CFU/100mL	0
Total Coliforms (IH)	Weekly	581	0	<1			MPN/100mL	0
Total Dissolved Solids	Biannual	10	58	92			mg/L	<10
Total Hardness	Biannual	10	22	44			mg CaCO3 / L	
Total Trihalomethanes	Biannual	24	17	144			µg/L	
trans-Chlordane	Biannual	10	<0.01	<0.01			µg/L	
Triazophos	Biannual	10	<0.005	<0.005			µg/L	
Trichlorfon	Biannual	10	<0.02	<0.02	7	0	µg/L	<0.02
Trichloronate	Biannual	10	<0.5	<0.5			µg/L	
Turbidity	Biannual	10	<0.100	0.4			NTU	<0.1
Turbidity (IH)	Daily	679	0.03	0.9			NTU	0

TABLE D9: SUMMARY OF E. COLI SAMPLING (2019 – 2023)

	Chillagoe		Dimbulah		Mareeba		Kuranda	
Year	Samples Collected	E. coli detections	Samples Collected	E. coli detections	Samples Collected	E. coli detections	Samples Collected	E. coli detections
2019	14	0	54	0	109	0	105	0
2020	14	0	55	0	108	0	105	0
2021	14	0	54	0	106	0	106	0
2022	18	0	62	0	106	0	105	0
2023	14	0	108	0	106	0	103	0
2024	12	0	56	0	101	0	102	0
2025	12	0	96	0	99	0	101	0

Samples frequency has been established to meet the requirements under s 52(2) of the PH Reg as described in Table D10.

TABLE D10: E. COLI SAMPLING FREQUENCY

Scheme	Population	Samples Required	Current Regime
Chillagoe	223	1 per month	1 per month
Dimbulah	1008	1 per month	2 per week
Mareeba	12,220	1 per week, and an additional 1 per month	2 per week
Kuranda	4,998	1 per week	2 per week