Water Safety Plan

Wairoa and Frasertown Drinking Water Supply

Document Details:

Date: November 2022

Status: Issue 9

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1. Revision Details

Version No	Description	Approved	Revision Date
Issue 1	WSP for WDC review	GSp	30/07/14
Issue 2	Water Safety Plan (WSP) for submission	GSp	21/08/14
Issue 3	Minor client change	GSp	05/09/14
Issue 4	Amendment of Section 12, and corrective measures in risk tables	GSp	24/11/14
Issue 5	WSP Updated	LG/MG	26/06/15
Issue 6	WSP updated following Hawke's Bay District Health Board's (HBDHB) audit issues	SH	Early November 2018
Issue 7	WSP updated and approved by Council to submit to Drinking Water Assessors	SH	20 November 2018
Issue 8	WSP finalised and approved by Council's Group Manager Community Assets and Services following Drinking Water Assessors approval in December 2018	SH	March 2019
Issues 9	WSP updated to reflect the Guidance on Drinking Water Safety Planning and Water Safety Plan requirements published by Taumata Arowai	SH	November 2022

Responsibility of the Plan

The Utilities Manager is responsible for implementation of the Improvement Schedule within the timeframes indicated, subject to community and Council approvals, funding constraints and availability of resources. The Utilities Manager is responsible for ongoing review and updating of the WSP.

Assessment and Reporting of Performance

An assessment of the performance of the plan will be undertaken annually by the Utilities Manager who will produce a brief report on the performance of the plan which is to be supplied to the Group Manager Community Assets and Services.

The report shall be an evaluation of progress towards the improvements within the WSP and adjustments made to the plan on information provided by the assessment. A template for the annual review report is provided in Appendix B and includes:

- Improvements that have been completed
- Modifications or differences between the improvement plan recommendations and the work undertaken along with reasons for these differences

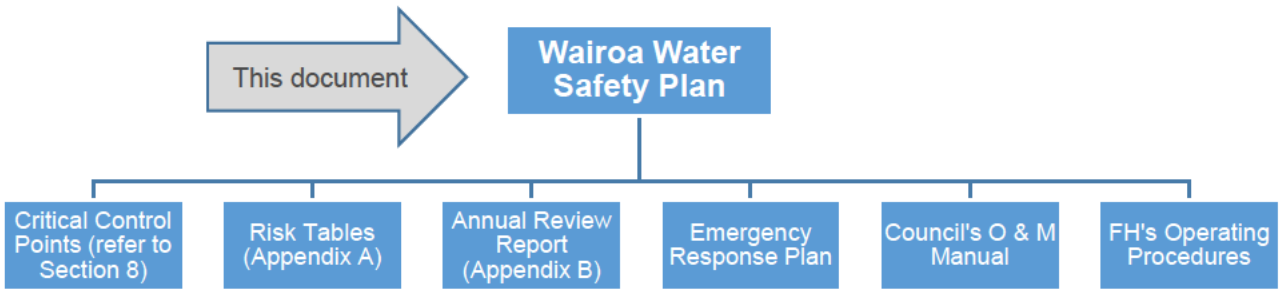
- Improvements which have not been undertaken within the allocated timeframe, and the reason for not being actioned
- Progress towards improvements which are underway but are not yet completed
- Events or non-compliances that have occurred
- Changes to any of the supply elements.

Links to other quality systems

This Water Safety Plan (WSP) is a controlled document of Council. An official master copy will be kept by the Group Manager Community Assets and Services and will be reviewed and updated at least three yearly by the Utilities Manager. This WSP must be revised as and when new information becomes available.

This plan is linked to the Long-Term Plan, Water Services Asset Management Plan and Assessment of Water and Sanitary Services.

This plan has been simplified and consists of manageable subdocuments that are more focused for the correct audience. The layout of this plan, supporting appendices and documents are shown below including Fulton Hogan's (FH) Operating Procedures.



2. Introduction

2.1. Overview

Wairoa District Council (WDC) has committed to the preparation of a WSP for the Wairoa and Frasertown water supply to identify potential events that present public health risks to the consumers of the drinking water supply. A principal purpose of this plan is to identify potential events that present public health risks to the water supply system.

2.2. Key regulation changes

This WSP was prepared consistent with the approaches recommended by the Ministry of Health and was guided by the Drinking Water Standard New Zealand (DWSNZ). The plan has been updated with this revision to meet the new requirements set by Taumata Arowai. It is recognised that this will take time, so an improvement programme has been developed to capture the required changes for completeness and a new table of contents for the future WSP.

The three waters activities in local government are in the process of major reform. The Taumata Arowai Water Services Regulator Act has been passed as well as the complementary Water Services Act. The standalone Crown entity Taumata Arowai has been created to regulate drinking water. It is noted that the existing DWSNZ 2005 (revised 2018) will remain in effect until 14 November 2022 as revised by the Water Services Act. A new set of standards along with the Drinking Water Quality Assurance Rules and Aesthetic Values published by Taumata Arowai will replace the existing standards.

The content of this WSP will continue to evolve as influenced by national drivers and future legislation changes. The next version of the WSP will be updated in accordance with the requirement and guidance notes published by Taumata Arowai. Council has also undertaken a gap analysis of the WSP recently against the World Health Organisation guidelines. The outputs of the gap analysis are shown in Appendix C along with the proposed table of content for the next WSP update.

2.3. Commitment to drinking water quality management

Council is committed to the provision of safe and secure drinking water for its consumers. Council has established a comprehensive organisational and operational framework that refer to drinking water management. The framework contains management practices and processes that are endorsed by the Chief Executive, senior leadership of Council and councillors.

2.4. Roles and responsibilities

To achieve our commitment, Council works in partnership with stakeholders and relevant agencies to:

- Embrace a high standard of care to manage water quality at all points along the delivery chain from source water to the consumer to provide a continuous supply of safe drinking water

- Ensure there are multiple barriers that prevent contamination and protect consumers from harm
- Use a preventive risk-based approach in which potential threats to water quality and quantity are identified and managed
- Integrate the needs and expectations of our consumers, stakeholders, regulators and employees into our planning
- Acknowledge that protection of source water is of paramount importance in protecting consumers against drinking-water contamination and illness
- Acknowledge that contamination is almost always preceded by some kind of change (including changes to processes and hazardous events), and we will monitor and always respond to change
- Develop appropriate contingency planning and incident response capability
- Monitor the quality of our drinking water and provide timely information to stakeholders to promote confidence in the water supply and its management
- Participate in appropriate investigative activities to ensure continued understanding of drinking-water quality issues and performance
- Continually improve our practices by assessing performance against corporate commitments, stakeholder expectations and regulatory requirements.

Key roles and responsibilities:

- Individual responsibilities – All employees involved in the supply of drinking water shall support the delivery of safe water consistent with the stated commitments and principles.
- Managers responsibilities – All managers and employees involved in the supply of drinking-water are responsible for understanding, implementing, maintaining and continually improving the drinking-water quality management system.
- Chief Executive – Responsible for:
  - Providing support and training to the managers and staff involved in the supply of drinking water
  - Providing regular reporting to Council on the implementation of the drinking water quality management system and the escalation of any significant incidences / events including the corrective actions taken.
- Councillors – The Council ensures management undertakes the above actions for achieving safe drinking water for Wairoa community and to regularly assess the compliance towards achieving this.

2.5. Verification monitoring programme

Monitoring the quality of drinking water and consumer complaints is a vital part of Council's operation. Council undertakes a comprehensive network sampling programme as required by the DWSNZ. Council also complies with the non-financial performance measures rules for drinking water and evaluate its performance measures annually. This is discussed in the Annual Report.

Customer complaints are recorded on Council's database as a service request. Information on actions taken to resolve complaints and the outcomes of these actions are also recorded on the database. Council undertakes a review of this information regularly to determine what can be done better or differently to reduce customer problems and complaints.

2.6. About this plan

This WSP includes the following key sections:

Description of Water Supply Scheme

The detail for this has been put together from information gathered during the site investigation and discussions with key Council staff who manage the supply.

1. Risk Tables
   A series of risk tables have been used to record the potential public health risks that may occur within each process area of the water supply system. For each identified risk in the table, the following related information is recorded.
   - Description of the risk event
   - Current measures in place to control risk
   - Additional measures which could be taken to control risk
   - Risk rating levels
2. Improvement Plan
   The improvement plan includes measures which need to be put in place to manage the risks identified in the risk tables. The new WSP requirements published by Taumata Arowai will now require Council to prepare and implement a Source Water Risk Management Plan. The improvement schedule shows the actions completed to date and the key actions to complete over the next two years. (refer to Appendix C)
3. Contingency Plan
   This is a collated list of actions for public health risk management, should any risk event actually occur.

3. Supply Details

Table 1. Summary of Wairoa and Frasertown Water Supply Details

Supply Details		
Supply Name	Wairoa	
WINZ Community Code	S00063	
Supply Owner	Wairoa District Council	
Supply Manager	Stephen Heath (Group Manager Community Assets and Services)	
Supply Operators	Morgan Goldsmith (Plant Manager), Karen Akuhata (Utilities Manager), Victor Minter (Environmental Health Officer)	
Population Served by Supply	4,920 (2013 Census data)	
Source Details		
Source Name	Waiau River, Wairoa	
Source WINZ Code	S00063	
Type of Source	River	
Consent Number	WP110405T	
Consent Expires	2032	
Maximum Consented water take:	200L/sec, 112,000m^3/7-day period	
Grid Reference of Source (NZTM)	**Easting** : 1980305	**Northing** : 5678408
Treatment		
Plant Name	Wairoa	
Plant WINZ Code	TP00100	
Location	Frasertown	
Treatment Processes	Coagulation, sedimentation, sand filtration, chlorination, U.V.	
Average Daily Volume	7,000 m^3/day	
Peak Daily Volume	16,000 m^3/day	
Distribution		
Distribution Zone Name	Frasertown	
Distribution Zone WINZ Code	WAI006FR	
Distribution Zone Population	360	
Distribution Zone Name	Wairoa	
Distribution Zone WINZ Code	WAI006WA	
Distribution Zone Population	4,560	

4. Description of the Wairoa and Frasertown Water Supply

4.1. General

The drinking water supply is a small urban supply providing water to a population of approximately 4,920 people in Wairoa and Frasertown. The supply provides water to the usual facilities of a town of this size including medical facilities, schools and educational facilities, commercial buildings and households. The supply also provides water for the AFFCO freezing works which uses a large proportion of the supplied water.

The water is sourced from the Waiau River before it undergoes treatment at the Frasertown water treatment plant (WTP). It is then pumped from the treatment plant to the Frasertown distribution zone, and to the “Boundary Reservoirs” where the water is pumped to the Wairoa Township and the AFFCO freezing works. The scheme is administered and managed at the main council offices in Queen Street, Wairoa, but the day-to-day management of the WTP is carried out at the treatment plant.

Located at the water treatment plant is an IANZ registered level 2 laboratory run by the staff at the water treatment plant. The management, maintenance and operation of the Wairoa and Frasertown water supply are the responsibility of:

- Group Manager Community Assets and Services – Stephen Heath
- Water Treatment Plant Manager – Morgan Goldsmith
- Utilities Manager – Patrick Knerlich (in acting role).

4.2. History

The Wairoa water supply scheme and the tanks (known as the boundary tanks) were installed in the 1940s. During this period until the 1950s, the supply was untreated however the boundary tanks were used as a sedimentation process prior to reticulation. In the mid-1960s the Frasertown treatment plant was commissioned. At this time the intake, pipeline to the treatment plant, boundary tanks and pump station, and the reticulation network throughout Frasertown were installed. The function of the boundary tanks then changed from sedimentation to treated water storage.

By the 1970s the treatment plant had reached capacity, and a sand filter was installed in 1972. Further expansion occurred in 1983 with the installation of another sand filter and an additional clarifier.

During the 1970s and 1980s significant extensions to the Wairoa reticulation zone were made. At the time of expansion during the 1980s, a joint deal with AFFCO's predecessors was made where the meat processor contributed to the capital cost of the upgrade, and in return were supplied water at cost. This agreement has expired. WDC and AFFCO are currently in negotiation with regards to ongoing supply agreements. In addition to the AFFCO freezing works, Wairoa Sawmill (Clyde Lumber) is the second largest consumer of water connected to the water supply. In addition to the treatment clarifier and sand filter, the upgrades included new intake structures, modifications to the WTP including updated control and dosing systems, modification to flow paths to increase chlorine contact time, and replacement of the boundary pump station.

A significant number of capital improvements have been made in 2010, most notably the automation of control valves and monitoring of individual sand filters, and the installation of UV treatment in 2011. The filter component was upgraded in 2012 followed by the installation of a new chemical dosing plant in 2013.

The supply has achieved compliance with the DWSNZ during the last annual monitoring period.

4.3. Water Source and Catchment

The water originates from Te Urewera National Park and Lake Waikaremoana as shown in Figure 1. This catchment area consists of native bush. Between the National Park and the abstraction point near Frasertown many smaller tributary streams flow into the Waiau River from surrounding low intensity mixed grazing farmland. The catchment risk category approach of the T3 Protozoal Rules section of the Drinking Water Quality Assurance Rules (4.10.2) identifies that bacterial treatment and a protozoal removal requirement of log 4 is appropriate for this supply.

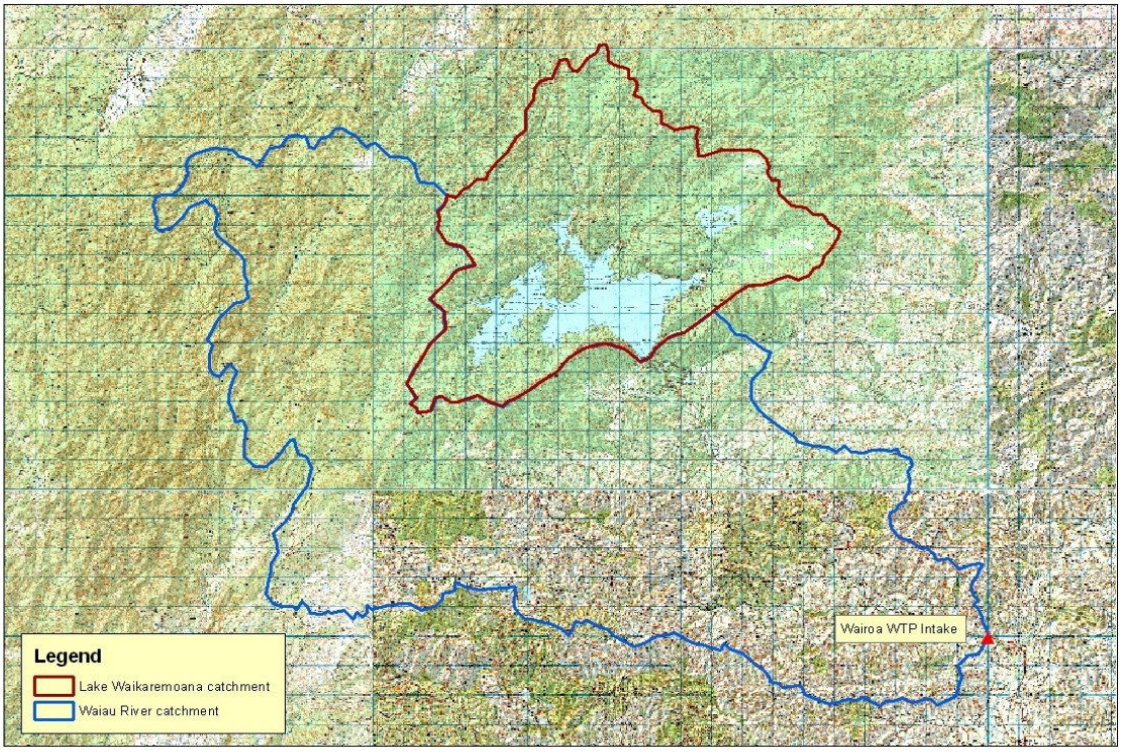


Figure 1 Extended Catchment Area

4.4. Source Water Quality

Water quality from the river is quite variable and is sensitive to rainfall and storm events throughout the year. The volume of water within the river also varies depending on the time of the year. Turbidity can range from 3 NTU to 6,000 NTU depending on time of year and weather conditions.

Regular samples are taken of the source water. No P2 determinants have been allocated to this source due to sample levels being well under maximum acceptable values (MAVs).

4.5. Abstraction

The Wairoa/Frasertown water supply scheme supplies water to the Wairoa and Frasertown townships from the Waiau River. The intake is located adjacent to State Highway 38 approximately 2 kilometres north west of Frasertown.

The abstraction point consists of a pump room in which 2 x 132kw surface pumps and a sump pump are housed. The pump room is located at the water level of the Waiau River and is fully contained enabling any flood event to flow directly over the pump room without causing damage to the room or the equipment inside. The pump room is partially built into the river bank with sheet piles providing protection from the river and debris, additional sheet piles were added in 2018 to stabilise the lower pump room. The pumps have a coarse screen located in the river to prevent abstraction of debris, which are cleaned bi-annually by certified divers from Gisborne.

The pump control room is located adjacent to State Highway 38 and provides access to the concrete corridor which in turn provides access to the pump room, 10 metres below. The corridor also houses the control cables and the raw watermain. When required these pumps can be raised to up to road level via the concrete corridor for maintenance and servicing requirements.

In addition to controls, located under the control room is a surge tank to prevent surges and water hammer within the raw watermain.

From the control room, water is delivered via a 375mm diameter AC pipeline to the Water Treatment Plant located on Stout Street, in Frasertown.

The Taumata Arowai Public Register (Hinekōrako) currently records both the Wairoa & Frasertown water distribution zones and treatment plant as networked supply.

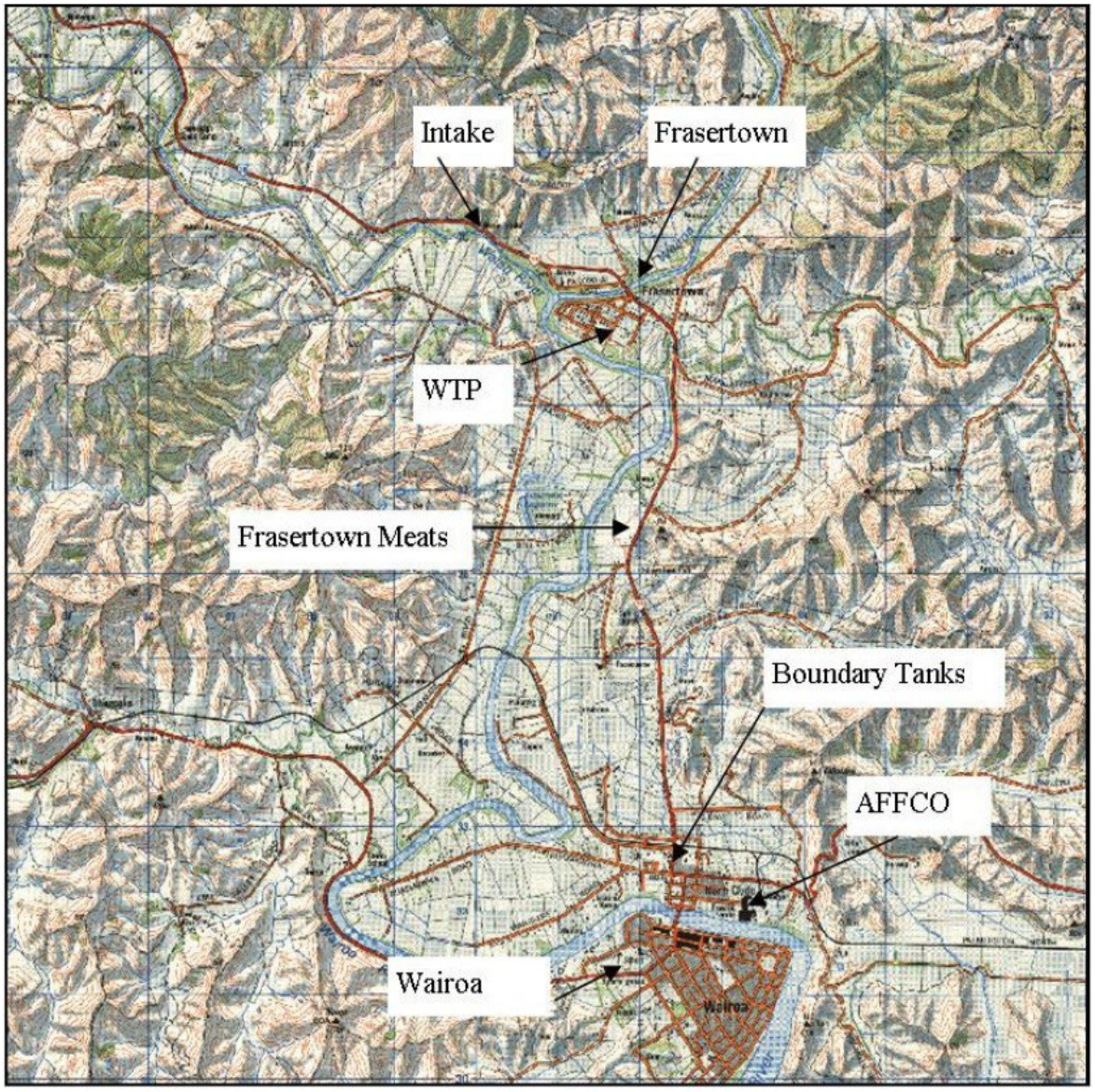


Figure 2 Scheme Location

4.6. Treatment

The treatment processes provide a bacterial and protozoal barrier to the supply. The raw water is subject to pre-settlement followed by coagulation, flocculation, chlorination, rapid sand filtration and UV disinfection. The treatment plant is configured to demonstrate compliance through enhanced individual filtration. Contact time is achieved by chlorine dosing prior to filtration to ensure a minimum of 30 minutes prior to the first consumer. Annual testing for THM (Trihalomethanes) produced results well below the MAV. The current capacity of the treatment plant is 13,000m^3 per day, although the average flow rate is around 7,000m^3 per day. During processing, the AFFCO meat works consumes approximately 60% of the water produced by the treatment plant.

The water from the intake is delivered into a mixing column. When raw water turbidity reaches 2,500 NTU the treatment plant is shutdown to ensure that the treatment plant is not overloaded. Warning alarms are triggered at 800 NTU to inform staff that the turbidity is high. Treatment plant staff then monitor turbidity levels and shut down the plant if it continues to rise above 3,500 NTU. The plant is then started when turbidity drops below 3,500 NTU. The plant can now treat high turbidity water for longer since the chemical dosing plant upgrade in 2013 and the new 3.5 ML reservoir which was commissioned in 2017.

Kibbled alum is added to the water at a variable rate based on turbidity. Polyaluminum chloride (PACL) has been installed and commissioned, which is dosed in conjunction with alum. Compared to alum, PACL has demonstrated improved control of the pH range and resulted in the total removal of hydrated lime altogether. It also provides improved treatment of colour which increases the effectiveness of UV treatment. It is also overall showing good results, whilst minimising input costs at higher turbidity levels. Caustic soda at 50% has replaced hydrated lime for final water pH buffering.

After pre-settlement, a flow splitter channel is used to split the flow between four up-flow clarifiers. Prior to sand filtration the water has chlorine gas injected. Free available chlorine (FAC) high and low alarm levels are set at 1.40 ppm and 0.45ppm respectively. Chlorine gas is controlled at the treatment plant control room by a Wallace and Tiernan vacuum regulator. The chlorine storage consists of a 920kg chlorine gas drum with an additional 920kg as back up. A Wallace and Tiernan leak detection device is located within the chlorine room and is connected to the treatment plant SCADA system as well the 24-hour monitored fire alarm to alert operators of a fault.

After clarification and prior to sand filtration the turbidity of the water reduces to between 0.1-0.3NTU and monitored. A high-level alarm is set at 0.5NTU to inform operator of declining clarification performance. The five sand filters have a media depth of approximately 1.2m.

The filtered water is also monitored for turbidity, and usually operates at 0.03 NTU. Each filter has an individual turbidity unit with a high turbidity alarm triggered should turbidity reach 0.1 NTU for more than a 1 hour, should it then reach 0.3 NTU the plant is automatically shut down. Each filter has a flow meter and automatic actuating valves added to enable the balance of flow rate, filtration NTU management, and to manage the water level in each of the five sand filters.

Filtered water is collected by a fully enclosed box collection channel (within the treatment plant building) which delivers water into a wet well underneath the plant room.

A backwash pump provides water from the treated water storage to the sand filters for backwashing. A series of actuated valves on each filter are adjusted to enable back washing to occur and diverts backwash water to waste. Directly after backwashing, the turbidity can range between 0.5 NTU and 1.0 NTU, however water is run to waste until the turbidity drops below 0.1 NTU before the filter is bought back on line.

Backwash water is collected and stored in a sludge tank at the WTP site where the slurry is put through a plate press and disposed of at the land fill. The remaining water is discharged under permit back into the Waiau River.

For pH correction, automatic dosing of caustic soda occurs within the contact tank. Other benefits of caustic soda include health improvements and less maintenance costs for man hours, dust and cleaning (lime does build up on the UV quartz sleeves and in reservoirs).

The WDC's Environmental Health Officer issues public notices to households and in the local paper every 6 months advising water users to flush there taps when first used after a prolonged to achieve compliance with DWSNZ for plumbosolvency (priority 2c) as although the treatment contains pH correction, it hasn't been demonstrated that water from the supply is not plumbosolvent.

A UV treatment system was installed in 2011. This provides a disinfection barrier improving the overall bacterial and protozoal removal for all water leaving the plant. The UV treatment provides additional certainty to the community regarding the quality of water. It also minimises the risk of loss of supply in the event of a failure of another treatment barrier.

All online analytical measurements are logged by the SCADA, and any anomalies are also recorded manually in a log diary.

The treatment processes have been upgraded to treat high turbidity water as noted above. This is in response to changing storm events impacting the river banks as well as the release of the upstream dam water.

4.7. Reticulation Network

A pump set at the treatment plant, consisting of 2 x 90kW pumps in a duty standby configuration, delivers treated water through a class B 375mm AC pipeline to the 'Boundary Tanks' located at Kaimoana Road, Wairoa (refer to Figure 11). During 2012 a slip occurred near Frasertown which resulted in a section of the pipeline falling into the Waiau River cutting off the supply to Wairoa for a number of days.

Since then a 3.5km section of new pipe was installed and located on the northern side of the highway to lessen the chance of this occurring again and also to by-pass Silver Fern Farms livestock processing plant as the previous pipe travelled through the property of the plant in proximity to their effluent plant.

The boundary tanks have a combined storage volume of approximately 2,850 m^3. From the Boundary Tanks 2 x 110kW duty & standby pump sets delivers water to the Tawhara tanks (total storage capacity of 5,700m^3) where water is then fed by gravity to the Wairoa Township. At the Boundary pump station 22kW duty and standby pumps are installed which provides water to the AFFCO meat works.

A second pump set at the treatment plant pumps water to the Frasertown reticulation and reservoirs. This pump set is also a duty standby configuration consisting of pumps with 9.5kW motors. When these reservoirs have been filled, the pumps turn off and the Frasertown reticulation zone relies on gravity to supply to residents. The Frasertown reservoirs have a combined volume of 100m^3.

The condition of the existing Tawhara and Boundary reservoirs need to be assessed. This future initiative has been added to the Improvement Schedule (refer to Table 3).

The reticulation network age is relatively uniform as the initial installation occurred during the 1940s when the supply was established. More recent pipes are found in extensions to the system installed the 1970s and 1980s. The network consists predominantly of PVC, AC, spiral welded steel (concrete lined) and spiral riveted steel (some concrete lined).

The high leakage areas were identified in the Wairoa and Frasertown reticulation with an acoustic survey in 2012. Council's asset management improvement programme includes the project to check these high leakage areas initially then develop a suitable leakage management programme based on benefits and costs.

4.8. Water Pressure

Reticulation pressure within the Wairoa Township itself is moderate, with most of the properties within the supply area being provided with continuous pressure ranging consistently between 400 to 500 kPa. Water pressure has reduced to moderate levels since the installation of the new reservoir in 2017 resulting in less pipe failures. Two new pump stations, Fraser Street and Awatere, were installed in 2017 to address potential low-pressure issues for elevated properties (refer to Figure 8 and Figure 9).

The pressure within the Frasertown reticulation averages 300kPa to most properties.

4.9. Operations and Maintenance

Staff from the WDC operate and manage the water supply under the direction of the Group Manager Community Assets and Services.

The O&M Manual for the treatment plant is currently being finalised to include the additions and amendments with the various upgrades.

Regular sampling of the water leaving the treatment plant is carried out in the IANZ accredited laboratory located within the treatment plant building. Fully qualified treatment plant staff are IANZ certified. The laboratory operation is currently under review as it needs to be level 1 IANZ accredited under the new rules published by Taumata Arowai.

Operational procedures within the treatment plant include the active management of the treatment facilities and equipment, calibration of equipment, repairs and programmed maintenance, monitoring of the raw water quality and manual adjustment of the treatment settings, sampling of treated water, vibration monitoring and regular maintenance of pumps. These procedures are governed by the draft O&M manual and the experience / knowledge of the staff located at the treatment plant. Calibration of equipment is carried out as per their respective maintenance schedules by the water treatment plant staff. A reputable third-party contractor also undertakes an annual calibration validation of all analytical equipment.

A Chlorine Management Plan was completed in 2005/2006 to meet the requirements of the HSNO Act 2004. Morgan Goldsmith has HSNO certification. A hazard register is located at the WTP. The Chlorine Management Plan is part of the O&M Manual.

Maintenance of the reticulation network is carried out by FH under a maintenance contract. Should a break or other event occur which requires remediation by the contracting company a customer service request is raised which records the event and enables the council to ensure the remedial action is completed. Renewal / replacement of mains is determined by condition testing but there is not a formal mains replacement works programme.

Potable water samples are taken from various points within the reticulation system by the staff. These samples are tested by WTP staff with IANZ certification in the treatment plant laboratory.

5. Photographs of Wairoa and Frasertown Water Supply

Figure 3 Intake

Figure 4 Intake Pump Station

Figure 5 View inside concrete corridor

Figure 6 Clarifier

Figure 7 Gravity sand filters

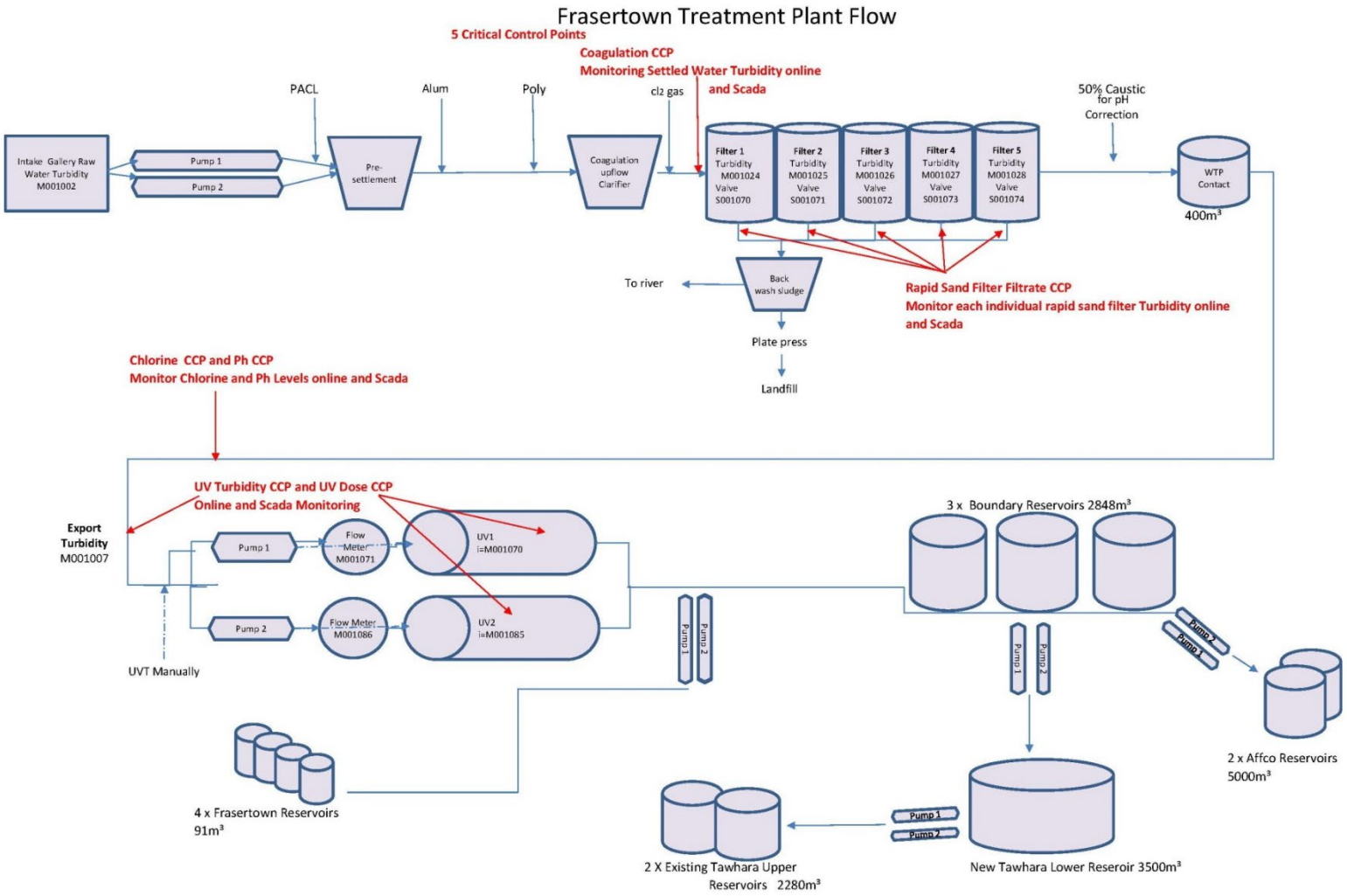
Figure 8 UV disinfection

Figure 9 Fraser Street Booster Pump Station

Figure 10 Awatere Booster Pump Station

6. Flow Chart/Schematic of the Supply

Figure 11 Supply schematic



7. Barriers to Contamination

Table 2 Critical Points

Critical points where hazards can be eliminated, minimised or isolated include:

No.	Critical Point	Description
1.	Abstraction Point	Intake
2.	Coagulant/Flocculation	Discharge point of supply pipeline into treatment plant
3.	**Critical Control Point 1** Clarifier	4 Clarifiers located at WTP
4.	**Critical Control Point 2** Chlorine dosing	Injection of chlorine gas after clarifiers
5.	**Critical Control Point 3** Sand Filters	5 Gravity acting sand filters
6.	Contact tank	The contact tank is located under building
7.	Caustic Dosing	pH adjustment of treated water
8.	**Critical Control Point 4** UV treatment	Disinfection of the water
9.	Treated Water Storage	Multiple storage sites at Wairoa
10.	Distribution system connections	Connection points to consumers
11.	Pumps	Multiple pumps within scheme

Existing barriers to contamination include:

1. Coagulation and Sedimentation

The treatment plant uses the addition of coagulants to stabilise and flocculate contaminants to enable settling and filtration of the water removing microbiological organisms, organic material and suspended solids. This process **provides a barrier to protozoan and particulate contamination.**

2. Filtration

The treatment plant uses gravity sand filters to remove remaining filterable material such as organic matter, suspended solids and protozoan organisms after coagulation and sedimentation. This process step employs enhanced individual filtration and provides a particle removal **barrier to contamination**.

3. Chlorination

The treatment plant uses chlorination to disinfect the water of non-protozoan microbiological organisms. As there is at least 30 minutes contact period before the chlorinated water is distributed to consumers, this provides **a barrier** to bacterial and viral **contamination**.

4. UV disinfection

A UV disinfection plant has been added to the end of the treatment process to provide additional certainty to the system. This provides a **barrier to microbiological contamination.**

5. Prevention of contamination of treated water in storage

The reservoirs are covered to prevent unauthorised access, ingress of rainwater, contaminants, birds and vermin. The following measures contribute to provision of a **partial barrier against recontamination** of water following treatment.

6. Prevention of contamination of treated water while it is in the network reticulation

The following measures contribute to provision of a **partial barrier against recontamination** of water following treatment:

- Chlorine dosing is done at a level to ensure it is available to protect the water against microbiological contamination throughout the storage and reticulation.
- Operators are trained and experienced. Only fully qualified operators allowed to be “On Call” or in sole charge.
- Ongoing leak detection programme has been implemented
- Contractors are to comply with disinfection WDC processes during distribution network repairs.

8. Critical Control Point Process Control

A Critical Control Point (CCP) is defined as an activity, procedure or process at which control can be applied, and that is essential to prevent a hazard or reduce it to an acceptable level. For each CCP, a critical limit for operational performance is established to represent a complete loss of control of the process and the existence of an unacceptable health risk. The operator shall notify the Water Production Manager immediately if any of these critical limits cannot be met.

The Wairoa and Frasertown water supply have four critical control points over which process control can be made. These critical control points are established around the following processes:

- CCP 1 – Coagulation and flocculation processes to remove suspended and colloidal solids
- CCP 2 – Filtration process to provide a barrier to particulate and protozoan contamination
- CCP 3 – Chlorine disinfection process to maintain integrity of water and reticulation hygiene
- CCP 4 – UV disinfection process to provide a barrier to pathogenic microbiological organisms including bacteria, viruses and protozoa.

8.1. Coagulation and Flocculation Critical Control Point

8.1.1. Process objectives

To provide removal of suspended and colloidal solids such as clays. A CCP confirms that the coagulant dose, pH correction, flocculation and clarifier operations are optimised when changes occur to raw water quality or operating conditions.

Operational day-to-day monitoring of control processes		
What	Turbidity	
When	Continuously online	
Where	Turbidity at the outlet of clarifier, prior to sand filtration	
How	Turbidity monitored online via SCADA	
Who	Telemetry system	
Records	All data to be recorded in SCADA	
Process performance criteria at the operational monitoring point		***Correction required if performance criteria are not met***
Target Range	Water turbidity exits clarifier is <0.3 NTU	No action
Action Limits	Water turbidity exits clarifier is >0.3 NTU but <0.5 NTU	SCADA system notifies operator of increase. Operator to check coagulation /flocculation dose rates.
Critical Limits	Water turbidity exits clarifier is > 0.5 NTU (May go to this level or higher during extreme raw water turbidity fresh events exceeding 3,500 NTU)	Plant automatically shuts down. Operator in full control to diagnose causes and make adjustments immediately. Operator to notify the Water Production Manager if high level of turbidity persists.

8.2. Chlorine Disinfection Critical Control Point

8.2.1. Process objectives

1. Provide another **primary disinfection Critical Control Point** to inactivate bacterial, viral and most protozoan pathogens that may have entered upstream of dosing point.
2. Provide a minimum **residual disinfection** to help inactivate pathogens entering the reticulation of the supply downstream of the dosing point.

Operational day-to-day monitoring of control processes		
What	Free available chlorine (FAC); pH	
When	Continuously online	
Where	At the outlet of contact tank prior to the booster pumps	
How	Both monitored online via SCADA	
Who	Telemetry system	
Records	All data to be recorded in SCADA	
Process performance criteria at the operational monitoring point		***Correction required if performance criteria are not met***
Target Range	FAC: 0.7> and <1.2 mg/L pH: 7.6> and <7.9 pH	No action
Action Limits	FAC: < 0.7mg/L (> 30 m) or > 1.2 but < 1.4 mg/L (> 30m) pH: < 7.6 (> 30m) or > 7.9 but < 8.2(> 30m)	Operator to monitor trend and make appropriate adjustments if required. Operator to monitor trend and make appropriate adjustments if required.
Critical Limits	FAC: < 0.45 mg/L (> 15 m) or > 1.4 mg/L pH: >8.2. (> 5m)	SCADA automatically shuts down plant if FAC <0.45 or >1.4 mg/L and pages operator Operator to isolate the supply and run off storage until rectified. Operator to diagnose causes and make adjustments immediately. Operator to notify the Water Production Manager if high or low levels persist.

8.3. Filtration Critical Control Point

8.3.1. Process objectives

To provide removal of particulate material. A filtration CCP ensures that the UV disinfection process can operate at expected levels of efficiency.

Operational day-to-day monitoring of control processes		
What	Turbidity; flow	
When	Turbidity – continuously online	
Where	Turbidity at the outlet of each filter housing Flow measured from each filter water meter continuously online.	
How	Turbidity monitored online via SCADA Flow from flow meters on filter outlet Filter Headloss - visual inspection	
Who	Combination of WDC plant Manager / Operator and telemetry system	
Records	All electronic data is recorded digitally to the SCADA historian, and all manual data is transferred to a spreadsheet and held by Council.	
Process performance criteria at the operational monitoring point		***Correction required if performance criteria are not met***
Target Range	Filtered water turbidity <0.1 NTU	No action
	Filter Headloss <0-500> mm	
Action Limits	Filtered water turbidity >0.1 but < 0.3 for 1 hour	SCADA system notifies Manager/Operator if NTU is constant between these two set points for after an hour. Operator to diagnose causes and make adjustments immediately.
	Filter Headloss >500 but <1,000 mm	
Critical Limits	Filtered water turbidity is >0.3 NTU	SCADA system will shut down filters and plant and notify Operator thus keeping plant fully compliant with DWSNZ. Operator to investigate cause and back wash filter. If problem cannot be solved take filter off line and notify Plant Manager/ DWA
	Filter headloss >1,000 mm	

8.4. UV Disinfection Critical Control Point

8.4.1. Process objectives

To provide a primary disinfection CCP to inactivate bacterial, viral and protozoan pathogens that may have entered the water supply system upstream of the UV Reactor. This CCP is developed for a validated UV reactor.

Operational day-to-day monitoring of control processes	
What	UV turbidity; UV intensity (fluence); UV transmittance; flow
When	Flow, UV intensity, and UV turbidity – continuously online UV transmittance – twice weekly
Where	UV turbidity at inlet of UV reactor UV intensity inside UV reactor UV Transmittance measured by Laboratory benchtop meter in a 10ml cell
How	Flow, UV intensity, and UV turbidity from online instrumentation and PLC controls UV transmittance by handheld analyser This system is fully PLC automated which has been programmed to stay within the UV reactor's operating parameters at all times as per its O'Norm certificate.
Who	Combination of WDC plant operator and telemetry system
Records	All electronic data is recorded digitally to the SCADA historian, and all manual data is transferred to a spreadsheet and held by Council.

Process performance criteria at the operational monitoring point.		***Correction required if performance criteria are not met.***
Target Range	Water turbidity exits contact tank is less than 0.10 NTU	No action required
	Turbidity does not exceed 1.0 NTU for more than 5% of the compliance monitoring period.	
	UV – The water entering the UV reactor has turbidity not greater than 2.0 NTU for any three-minute period	
	UV intensity not allowed to drop below the validated performance curve for more than 2.5 % of the monitoring period.	
	UV intensity not less than 100% of the validated performance curve for any three-minute period (10ml cell)	
	Flow monitored continuously every minute	
Action Limits	Water turbidity exits contact tank is > 0.10 NTU but < 0.30 NTU	Operator to monitor turbidity trend and seek further guidance if it does not drop. Check filtration and coagulation.
	UV intensity not allowed to drop below the validated performance curve for more than 3% of the monitoring period	Operator to perform a clean of the UV lamps, sleeves and intensity sensor.
	Water turbidity exists contact tank >0.30 BUT <0.50 NTU	Operator to monitor trend and investigate cause of increase and make corrective action.
	UV intensity not less than 95% of the validated performance curve for any three-minute period (10ml cell)	Operator to monitor transmittance trend and seek further guidance if it continues to fall. Inform Plant Manager

Critical Limits	Water turbidity exits contact tank > 0.5 NTU	SCADA shuts down treatment plant, operator investigates and resolves issues, and operates. Supply from storage until parameters return within critical limits. The Operator notifies the Water Production Manager. The Water Production Manager notifies DWA if inadequately treated water needs to be supplied or has been supplied to the community and considers with DWA the need to issue a boil water notice.
	UV intensity not allowed to drop below the validated performance curve for more than 5 % of the monitoring period	
	UV intensity not less than 90% of the validated performance curve for any three-minute period (10ml cell)	
	UV intensity not less than 80% of the validated performance curve for any three-minute period (#)	
	Flow not more than 100% of the rated flow	

9. Improvement Schedule

All proposed new works and operational improvements have been extracted from the relevant risk tables to help address public health risks with the water supply.

These projects have been ranked in order of priority. By prioritising the risks and order of improvements then generally the greatest benefits in terms of addressing public health risks can be made first. The improvement schedule includes improvements where risks identified we rated as wither Moderate, High, Very High, or Extreme, using the WDC risk Matrix. In this case no risks rated as Extreme were identified.

Operational improvements often have little cost implication and can collectively contribute to providing and maintaining effective barriers to contamination which can often be undertaken within existing operational budgets.

The improvement table includes risks identified with a risk level of Moderate or above. It is recognised that other improvements have been captured within the risk tables but are of a lower priority. These lower priority improvements can be undertaken when appropriate with other improvements if it is logical to sequence improvements at the same time, otherwise can be address once the higher priority risks are addressed.

Responsibility

Responsibility for implementation of specific improvement items have been identified as:

GM = Group Manager Community Assets and Services (Stephen Heath)

WPM = Water Production Manager (Morgan Goldsmith)

EHO = Environmental Health Officer (Victor Minter)

UM = Utilities Manager (Karen Akuhata)

Cost Estimates

Cost estimates presented in this Improvement Schedule are intended to provide an indication of the typical cost associated with the item. The improvements cost estimates presented here may be +/- 30%. Additional work is required to adequately scope and cost these works. Implementation of the Improvement Schedule is ultimately subject to Council funding approval. In some instances, there is no direct cost other than Council staff time.

Timeframes

Although these improvements are prioritised on the basis of the risk level identified. The proposed timeframe for implementation has been determined by Council Staff taking into account the level of risks, anticipated Council funding arrangements and budgets and availability of resources, and ease of implementation. Some lower priority, low-cost improvements may be completed at an earlier date where staff resources are available.

Table 3 Wairoa Frasertown Water Supply Improvement Schedule

Wairoa Frasertown Water Supply Improvement Schedule							
Priority	**Water Supply Area and Reference**	**Risk Level**	**Details of Proposed Works**	**Person Responsible**	**Expected Cost**	**Status**	**Completion date (actual / planned)**
1	S6	Very High	Install sealed marine hatches over all tank hatches	UM	Staff time+5k	Completed	2017
1	UV1	Very High	Review and amend the O&M manual to bring it up to date after completion of all new major projects directly affecting the operation of the plant and ensure it becomes an official working document.	WPM	Staff time	Completed	Dec 2018
2	A2	High	Repair or replace bent sheet piles protecting intake screens	UM GM	Staff time+$30k Staff time +	Underway (with design approved; capital budget of $150k)	Dec 2018
2	A5, A1	High	Condition assessment indicated mainline replacement in 2021. Carryout condition assessment of pipe and if required plan and prepare for future pipeline replacement. Undertake test from piece of broken trunk main if laid around the same time as the Intake pipeline	UM	Staff time=$5k	Underway with section cut out planned. part of trunk main renewal programme	Dec 2019
2	A9	High	Investigate secondary sources of water supply as a back up to primary source. Suitable bores located either side of the Wairoa Bridge	UM	Staff time-$10k	Partially completed with alternative water sources report (Opus)	June 2019
1		High	Replace collapsed Intake sheet pile wall downstream of intake pump room and reinstate major riverbank slip	UM	$400-$500k	Completed	Apr 2019

Wairoa Frasertown Water Supply Improvement Schedule							
Priority	**Water Supply Area and Reference**	**Risk Level**	**Details of Proposed Works**	**Person Responsible**	**Expected Cost**	**Status**	**Completion date (actual / planned)**
2	Cl2	High	Ensure that the Chlorine Management Plan procedures are followed, and the document is referenced to in the O & M manual. Make system duty /standby operation allowing easy safe changeover for standby qualified operator.	WPM	Staff time	Completed (now part of O & M Manual)	2017
2	CL11, T11, T4	High	Confirm back up chemical suppliers and add names and purchase procedures to O&M *manual*	WPM	Staff time	Completed (now part of O & M Manual)	2017
2	F2	High	Undertake core sampling of media determine volume and condition. Replace media when required	WPM	Staff time+$5k +$20k	Completed (filters are OK)	2016
2	pH2	High	Ensure staff are trained to carry out calibration of pH probes and is documented in their individual staff training Records	WPM	Staff time	Completed (now part of O & M Manual)	2017
2	R3	High	Ensure O & M procedures have disinfection procedures for materials that have undergone maintenance and have risk of exposure to a contaminant.	WPM	Staff time	Completed (now part of O & M Manual)	2017
	Added in		Assess the condition of the Wairoa storage tanks and Boundary Tanks 1 & 2.	UM	Staff time + $15k	To start as new project added in	2019/20
2	Added in	Moderate	Develop Source Water Risk Management Plan as required by Taumata Arowai.	GM	$50k	To be started	2024
2	Added in	Moderate	Update WSP with new content as identified in Appendix C. Review WSP risk assessment tables. Establish review frequency once the plan is updated.	GM	$20k	To be started	2025

10. Benefits of Proposed Improvements

The proposed actions will provide public health benefits by reducing the risk of adverse health outcomes associated with poor drinking water quality.

In addition to development of a WSP in accordance with the Taumata Arowai requirements, Wairoa District Council used the opportunity to gain a number of additional benefits. These benefits are listed below and were achieved by Council actively managing the process to ensure that:

- The plan was prepared with the involvement of key WDC water supply staff to ensure ownership of the document and its implementation. Staff at all levels including operations, maintenance management, and senior engineering personnel responsible for service delivery were involved in the assessment of risks and identification of preventative measures.
- Risk identification and operational and treatment processes were discussed with staff members which encouraged communication and collaboration between operations and management staff of Council. This enabled transfer of collective knowledge between participants and identification of systemic issues.
- This WSP document is developed as a standalone document so that the document relevant to each scheme can be kept at a suitable location i.e. treatment plant, Council offices or abstraction point for ready reference and updating by as things change over time.

11. Methodology

This WSP was prepared consistent with the approaches recommended by the Ministry of Health. Supporting documents include the WSP Guides and A Framework on How to Prepare and Develop Water Safety Plans for Drinking-water Supplies, Ministry of Health 2014. It is noted that a new set of WSP requirements along with the Drinking Water Quality Assurance Rules and Aesthetic Values published by Taumata Arowai will replace the existing guidelines. The next version of the WSP will be updated in accordance with the new requirements as stated in Appendix C.

A qualitative risk assessment approach has been taken following the guidance notes in Appendix 2 of the “Framework” allowing the prioritisation of improvement needs and development of the Improvement Schedule.

The objectives of this WSP are to:

1. Identify what can go wrong with the supply (hazard)
2. Identify what might cause things to go wrong and how these problems would be identified (indicators).
3. Identify the barriers that are in place and those that need to be put in place to protect the quality of the water (to minimise, remove or inactivate hazards).

4. Identify the capital upgrade requirements that need to be put in place to ensure provision of safe drinking-water.
5. Identify the list of operational improvements that can be put in place to improve the drinking water supply and reduce risks to public health.
6. Provide an improvement plan which prioritises the most urgently required preventative measures (barriers) and monitoring requirements.
7. Provide contingency actions required to be taken if any of the potential risk events occur.

The plan also includes additional items recommended by the Government Inquiry into Havelock North Drinking-Water such as critical control points. Council has chosen to adopt the following six fundamental principles outlined by the inquiry as guiding principles for its water supplies:

- A high standard of care must be embraced
- Protection of source water is of paramount importance
- Maintain multiple barriers against contamination
- Change precedes contamination
- Suppliers must own the safety of drinking water
- Apply a preventive risk management approach.

Contingency Plans have been prepared to provide guidance in the event that control measures fail to prevent the occurrence of a risk event that may present acute risk to public health. The Group Manager Community Assets and Services and Water Treatment Plant Operator are responsible for implementation of the Contingency Plans when monitoring has identified the occurrence of a risk event.

Separate risk tables have been prepared for:

- Catchment
- Abstraction and Raw Water Pipeline
- Coagulation, Flocculation, and Sedimentation
- Chlorination Treatment
- UV Disinfection
- Filtration
- pH Adjustment
- Pumps
- Reticulation
- Storage Reservoirs
- Other.

12. Risk Ranking Procedure

Potential public health risks have been evaluated using the Likelihood and Consequence scales tabulated below to determine a risk level and match existing Wairoa District Council Risk management framework. The assessed risk level allows prioritisation of the associated improvement measures.

Table 4 Likelihood Scale

	Consequence Description	Probability	Frequency	Description
Threat	**Likely**	>50%	Greater than once per year	The threat can be expected to occur, or a very poor state of knowledge has been established on the threat
	Quite Common	20 - 50%	Once per 1-5 years	The threat will quite commonly occur, or a poor state of knowledge has been established on the threat
	Possible	10 - 20%	Once per 5-10 years	The threat may occur occasionally, or a moderate state of knowledge has been established on the threat
	Unusual	2 - 10%	Once per 10-50 years	The threat could infrequently occur, or a good state of knowledge has been established on the threat
	Rare	<2%	Less than once per 50 years	The threat may occur in exceptional circumstances, or a very good state of knowledge has been established on the threat

Table 5 Consequence Scale

Impact Description		SERVICE DELIVERY	SOCIAL / CULTURAL	
		Level of Service (LOS)/Loss of Supply	Public Health, & Safety	Community / Social
Threat	Extreme	Complete failure to deliver services	Single fatality & Permanent Disability	Significant unplanned disruption to essential/significant community services
			Widespread severe illness	Significant damage to multiple public properties
			50% increase of infection rate	
	Major	Failure to meet 100% of LOSs	Temporary disability	Formal complaint by key stakeholder
		Failure to meet multiple significant LOSs	Illness to one person or more	
		LOS exceeded by 50% - implying overspend		
	Medium	Failure to meet 75% of LOSs	Serious injuries	Simultaneous unplanned disruption to multiple households or commercial premises or community services and/or structures
		Failure to meet significant LOS		Formal complaint by member of the public or ratepayer
		LOS exceeded by 40% - implying overspend		Formal complaint by key stakeholder with reasonable defence
	Minor	Failure to meet 50% of LOSs	Minor injuries	Community complaints
		LOS exceeded by 30% - implying overspend		
	Negligible	Failure to meet 25% of LOSs	Slight injuries	Unplanned disruption to single household or commercial premises or community services and/or structures
		LOS exceeded by 20% - implying overspend		

Table 6 Risk Level Allocation Table

RISK MATRIX							
			CONSEQUENCE				
			Negligible	Minor	Medium	Major	Extreme
Threat	LIKELIHOOD	Likely	Low	Moderate	Very High	Extreme	Extreme
		Quite Common	Low	Moderate	Very High	Very High	Extreme
		Possible	Negligible	Moderate	High	Very High	Very High
		Unusual	Negligible	Low	High	High	Very High
		Rare	Negligible	Low	Moderate	High	High

13. Drinking Water Standards Compliance

At the time this WSP was prepared, the water supply fully complies with DWSNZ 2005 (Revised 2008). The table below shows a summary of the compliance with the standards to date. The treatment plant and distribution zone are not currently graded.

Table 7 Summary of Compliance with DWSNZ 2005 (Revised 2008)

Standards compliance assessed against	DWSNZ 2005 (R2008)
Bacterial compliance criteria used for water leaving the treatment plant	Criterion 2A or Criterion 5
Protozoa log removal requirement required for the supply	4-log
Protozoa treatment process	Coagulation, disinfection, filtration, chlorination and UV
Compliance criteria 6A or 6B is used for water in the distribution zone	Criterion 6B
Bacterial compliance for water leaving the treatment plant has been achieved for the last four quarters	Yes
Protozoa compliance for water leaving the treatment plant has been achieved for the last four quarters	Yes
Bacteria compliance for water in the distribution zone has been achieved for the last four quarters	Yes
P2 determinands allocated to supply	None
Chemical compliance achieved for the last four quarters	Yes
Cyanobacteria identified in the supply	No
Cyanobacterial compliance has been achieved for the last four quarters.	Yes

14. Consultation and Site Visit

In June 2014 Opus carried out a site visit of the Wairoa and Frasertown water supply with Morgan Goldsmith. The site visit included an inspection of the water treatment plant, pump stations, intake and inspection and assessment of the risks within the Frasertown and Wairoa distribution zones to determine any zone-specific risks.

Risks to the supply, preventative measures that are in place, or could be put in place, critical points and the barriers to contamination were identified and discussed. Subsequent to this consultation, telephone discussions and email contact occurred including provision of additional information with the above staff along with Don Smith. This information along with that gathered during the site visit was used to prepare this WSP. During this site visit it was determined that no distribution zone specific risks were significant enough to create a risk table for each distribution zone and are combined into a reticulation risk table.

15. Contingency Plan

The Contingency Plan outlines processes and actions required should a significant event occur. The Contingency Plan identifies the Type of event and indicators to help WDC staff manage events. The ownership and responsibility of the contingency plan actions lies with the Group Manager Community Assets and Services.

Wairoa and Frasertown Water Supply Contingency Plan	
Type of Event	***Required Contingency Action***
Severe microbiological contamination of source water (such that treatment is ineffective) Indicators: A contamination event in the catchment may come from a positive test result but may also be indicated by reported illness among consumers.	• Shut down supply • Undertake additional sampling to confirm security of supply • Advise AFFCO Meats of problem and shut down the supply • Issue "Boil Water' notice and advise consumers to conserve water • Advise Drinking Water Assessor (DWA). Respond to storm warnings to ensure water quality is suitable.
Chemical contamination of source water Indicators: A contamination event in the catchment may be indicated by reported water quality concerns from consumers (taste, odour, colour) or illness among consumers. Chemical tests may indicate chemical contamination.	• Shut down supply • Advise Drinking Water Assessor (DWA) • Assess situation and advise customers regarding use/treatment/disposal of contaminated water. Undertake additional sampling to confirm security of supply. • Arrange emergency water supply (tankers) if necessary. Inspect catchment and spring and abstraction point to identify source of contamination and rectify problem as quickly as possible. • If normal treatment and supply cannot be resumed within 48 hours, then make arrangements for provision of emergency treatment or alternate sources. • Keep customers informed and advise once regular service is restored.

Wairoa and Frasertown Water Supply Contingency Plan	
Type of Event	***Required Contingency Action***
Insufficient water available for abstraction and treatment, and loss of supply Indicators: Observed or reported low spring flows, consumers reporting a loss of water	• Implement demand management strategies as required. • Advise customers to conserve water. • Shutdown AFFCO processing plant. • Ensure Diver is on standby where possible in case there is a blockage of the screens. • Inspect spring and abstraction point to identify cause of problem and rectify as quickly as possible. Identify alternative water sources. • If due to pipe failure, repair, and sterilise following council procedures. • Be prepared to use an alternative supply. • Keep customers informed and advise once regular service is restored. • Notify Taumata Arowai if outage is > 8 hours.
Cyanobacterial/Cyanotoxin contamination of source water Indicators: Unusual animal deaths (particularly dogs) near water bodies. Blooms in waterway, and changes in water colour or slimes forming on rocks. Notification from regional council	• Advise Drinking Water Assessor (DWA) Monitor source water for cyanobacteria. • Monitor water leaving the treatment plant for cyanotoxins. • If cyanotoxins in water leaving the treatment plant exceed 50% of the MAV prepare to supply drinking water from tankers to the community. • Keep customers informed and advise once regular service is restored. • Investigate activated carbon filtration for supply
E. coli transgression of water leaving the treatment plant or in the distribution network. Indicators: E. coli transgression reported following routine monitoring. Illness within the community.	• Follow transgression response procedure in Figure 12 or Figure 13. • Advise DWA. • Commence daily E. coli testing. • Send sample to Linnaeus Laboratory Gisborne for an enumeration test. • Sample in distribution system. • Investigate cause, inspect plant and source. • Take remedial action. • If E. coli < 10 per 100mL consult DWA, resample distribution zone and enumerate for E. coli for three days, continue investigation of fault. • If E. coli > 10 per 100mL consult DWA, consider 'Boil Water' notice, intensify investigation of cause, increase disinfection, and consider flushing contaminated water to waste, intensify action, and consider providing an alternative supply. • Continue until fault is corrected and E. coli is absent for three consecutive days and DWA is satisfied that there is no remaining contamination.

Wairoa and Frasertown Water Supply Contingency Plan	
Type of Event	***Required Contingency Action***
Backflow contamination Indicators: Sudden unexplained drop in pressure. Consumer complaint. Discolouration/taste odour in water.	• Shut down water supply, and isolate contaminated regions where known. • Investigate cause and take remedial action. • Advise Drinking Water Assessor (DWA). • Talk to people from contaminant source to identify potential chemicals and biological contaminants. • Flush contaminants. • Undertake additional sampling to confirm security of supply. • Issue boil water notice
Earthquake, flood or other natural disaster	• Refer to Council's Emergency Response Plan

Figure 12 Response to a transgression in drinking-water leaving the treatment plant

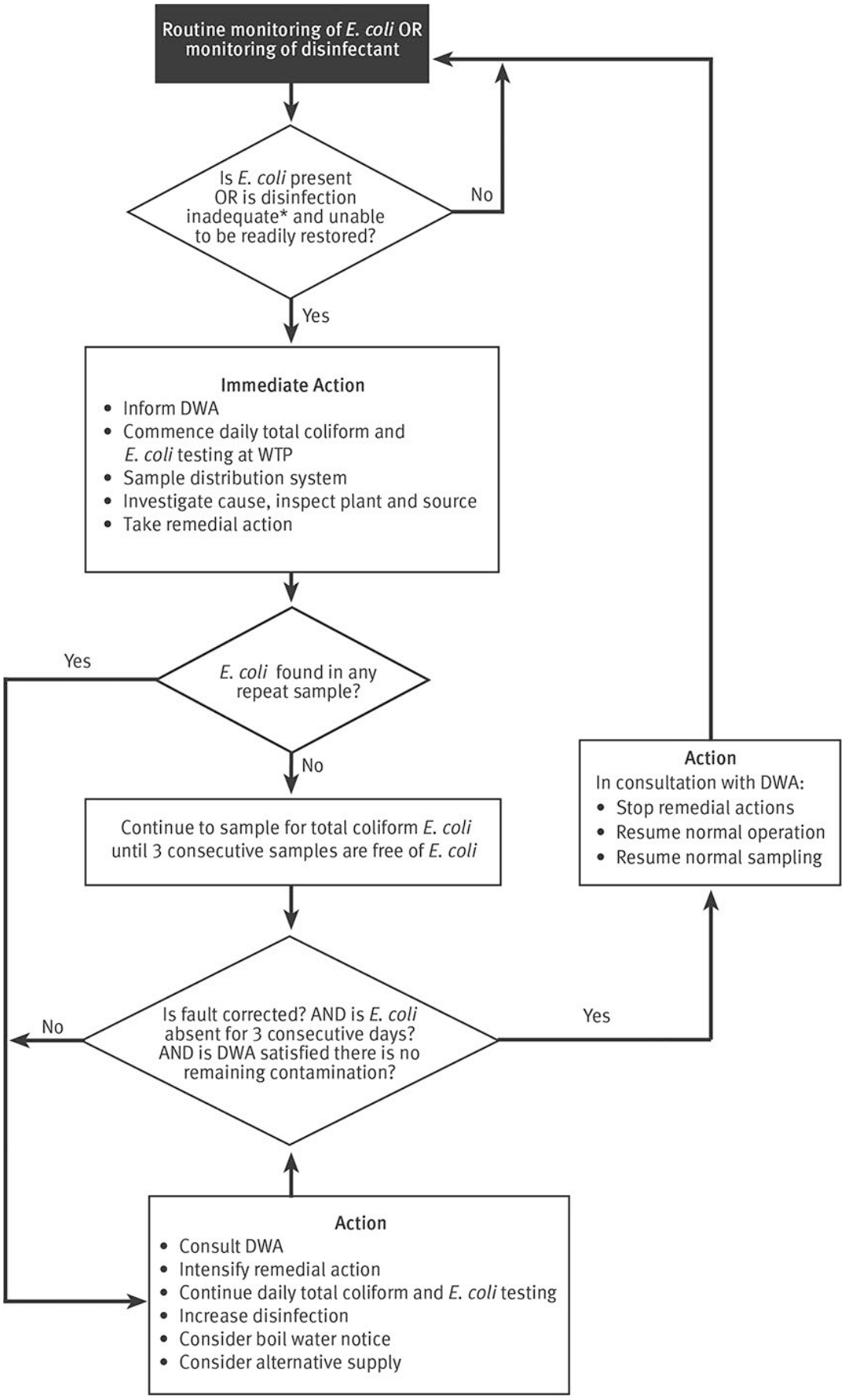
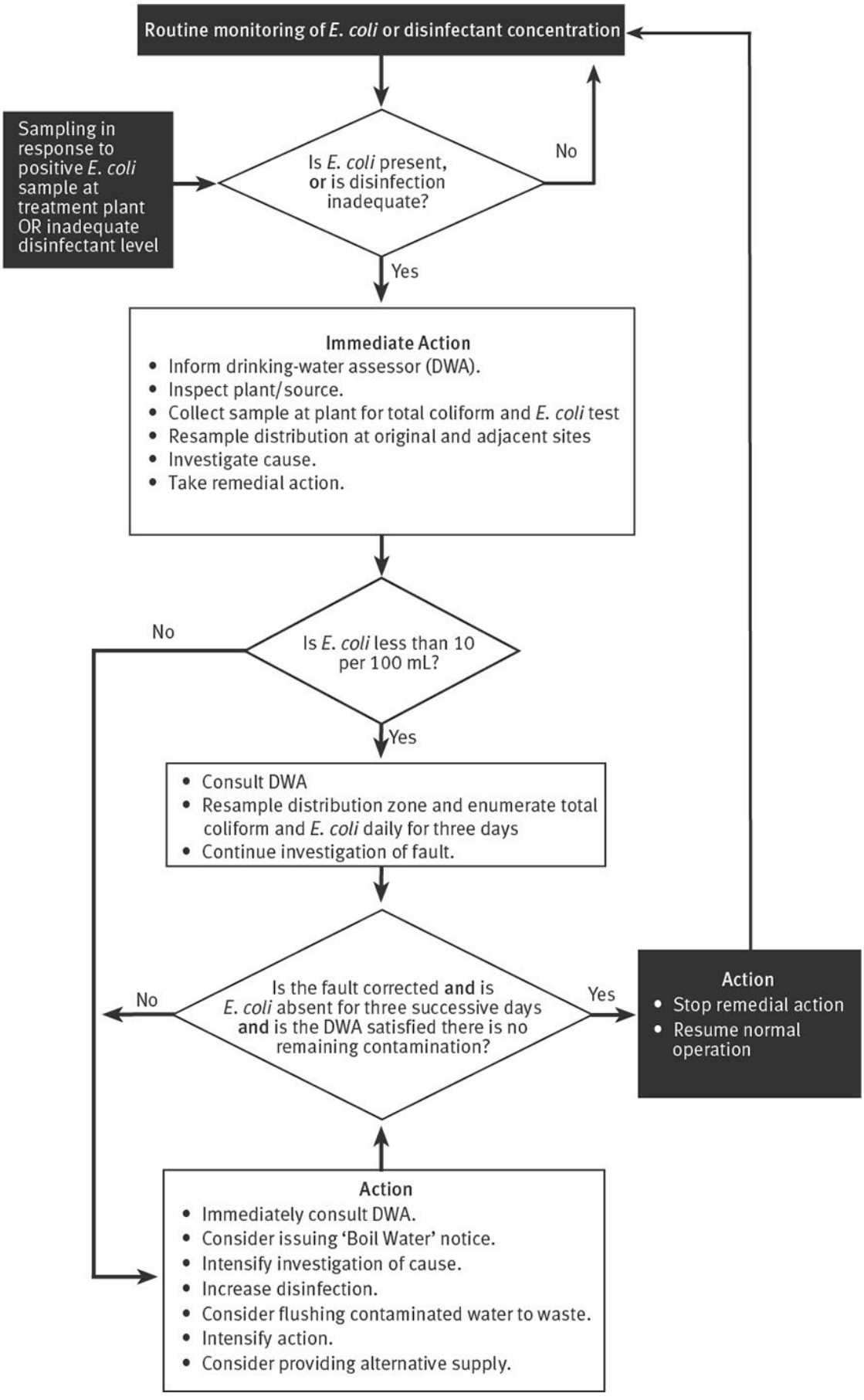


Figure 13 Response to a transgression in drinking-water supply distribution zone



16. Appendix A - Risk Assessment Tables

Catchment

List what could happen that may cause drinking-water to become unsafe			*Risk without Measures*			*Is this under control?*		*Residual Risk*			*What could be done to improve?*
Risk Event	**Ref**	**Potential Cause of Risk Event**	**Likelihood of Risk Event**	**Consequence of Risk Event**	**Risk Level,**	**Measures in Place to Control Risk**	**Controlled? Yes / No/ Partial**	**Likelihood of Risk Event**	**Consequence of Risk Event**	**Risk Level,**	**Additional Measures to Control Risk Event**
Microbiological Contamination	C1	Unprotected catchment causing contamination from humans, livestock, septic tanks, agricultural activities, surface runoff, etc	Unusual	Major	High	Coagulation filtration chlorination, UV disinfection, analytical monitoring equipment, liaison with DOC, lake authorities, and land owners. UV treatment on Tuai WwTP, which is maintained regularly and monitored by telemetry.	Yes	Rare	Minor	Low	Confirm log credit rating with DWA
	C2	Land use changes & discharges from Agricultural Activities, i.e. dairy effluent disposal	Rare	Medium	Moderate	Large section of protective forests in catchment Coagulation filtration chlorination, UV disinfection, analytical monitoring equipment, liaison with DOC, lake authorities, regional council and land owners.	Yes	Rare	Minor	Low	
Chemical Contamination	C3	Unprotected catchment causing contamination from humans, 1080 drops animals, surface runoff,	Unusual	Major	High	Large area of catchment is protect and in natural bush. Coagulation filtration chlorination, recent chemical sampling regime, liaison with DOC, lake authorities, and land owners, UV treatment on Tuai WwTP. National Environmental and chemical controls.	Yes	Unusual	Minor	Low	Carry out chemical sampling to determine P2 Determinads. Use the steps and decision making guide, and procedures outlined in the ESR Priority 2 Determinand Identification Guide.
	C4	Land use changes & chemical discharges from Agricultural Activities, i e. fertiliser, poisons, petroleum	Rare	Major	High	Coagulation filtration chlorination, analytical monitoring equipment, liaison with land owners, national environmental controls for chemical application to farm land. Protected catchment for large portion of the catchment. Regular contact with regional council	Yes	rare	medium	Moderate	Carry out chemical sampling to determine P2 Determinads. Use the steps and decision making guide, and procedures outlined in the ESR Priority 2 Determinand Identification Guide.
	C5	Accidental Discharge due to spill near intake	Rare	Medium	Moderate	Suitable storage to enable flushing of intake/pipeline & plant during contamination, monitoring equipment for some chemicals. Sign with emergency phone numbers located at intake	Yes	Rare	Minor	Low	New Signage put in place 2012. If event occurs, stop abstraction until contaminant has been confirmed as past intake.
Loss of supply	C6	Risk of source supply failure due to inadequate water within river	Rare	Extreme	High	Agreement with AFFCO meat works to shutdown during supply issues, Alternative supplies options considered.	Partially	Rare	Medium	Moderate	Confirm secondary sources which can be quickly and easily connected to, or obtained (i.e. tankered water) Ensure emergency procedures remain up-to-date, and account for any learnings from 2012 slip.
	C7	Risk of source supply failure due to a landside collapse of river bank or earthquake damage	Rare	Extreme	High	Agreement with AFFCO meat works to shutdown during supply issues, water tankered to boundary tanks, reviews undertaken for secondary supply	Partially	Rare	Medium	Moderate	Confirm secondary sources which can be quickly and easily connected to, or obtained (i e. tankered water) Ensure Contingency Plan and emergency procedures remain up-to-date, and account from learnings from the 2012 slip.
Cyanobacteria contamination	C8	Risk of contamination from toxins produced by algae in source water	Rare	Extreme	High	Regular testing regime put in place, showing cyanotxins are not present, inspections for blue green algae during summer, investigation of alternative sources underway	Yes	Rare	Medium	Moderate	

Abstraction and Raw Water Pipe

List what could happen that may cause drinking-water to become unsafe			*Risk without Measures*			*Is this under control?*		*Residual Risk*			*What could be done to improve?*
Risk Event	**Ref**	**Potential Cause of Risk Event**	**Likelihood of Risk Event**	**Consequence of Risk Event**	**Risk Level,**	**Measures in Place to Control Risk**	**Controlled? Yes / No/ Partial**	**Likelihood of Risk Event**	**Consequence of Risk Event**	**Risk Level,**	**Additional Measures to Control Risk Event**
Microbiological Contamination	A1	Failure of raw water pipeline due to deterioration of materials	Possible	Medium	High	Condition Assessments undertaken in 2006. pipeline is prior to treatment. Monthly maintenance checks of surge tank	Partially	Possible	Medium	High	Condition assessment indicated mainline replacement in 2021. carryout condition assessment of pipe and if required plan and prepare for future pipeline replacement. If event occurs, repair pipeline or install temporary over ground pipe.
	A2	Failure of intake structure due to deterioration of materials, and inadequate maintenance	Possible	Major	Very High	visual inspection of intake, including after periods of high flow. Movement of Sheet piles identified	Partially	Unusual	Medium	High	Ensure that the inspection and monitoring process is added to the O&M manual Repair or replace sheet piles
	A3	Legal right to abstract water or discharge to river, or expiry of consent	Possible	Extreme	Very High	New consent applied for and achieved	Yes	Rare	Major	High	Approved Take & Discharge Resource Consents till May 2032

A4	Blocking of screens at intake, by debris or organic matter	Unusual	Major	High	A certified diver from Gisborne cleans screens 6 monthly, visual inspection of screens undertake regularly	Yes	Unusual	Major	High	If event occurs, arrange for divers (or diggers if appropriate) to clear the intake.
A5	Failure of raw water pipeline, due to deterioration or surges	Possible	Major	Very High	Condition Assessments undertaken in 2006, indicating useful life could end in 2021	Partially	Unusual	Major	High	Condition assessment indicated mainline replacement in 2021. carryout condition assessment of pipe and if required plan and prepare for future pipeline replacement.
A6	Failure of bridge crossings due to deterioration and seismic events	Unusual	Extreme	Very High	Storage on both side of bridge for short term shutdowns. Recent remedial work on pipe line has been undertaken. AFFCO processing can be shut down if required	Yes	Unusual	Minor	Low	If event occurs, install temporary pipe along the edge of the bridge.
A7	Failure of control equipment due deterioration and inadequate maintenance	Unusual	Minor	Low	All automatic control systems are able to be manual overridden to enable the plant to operate in the event of a control failure	Yes	Unusual	Minor	Low	If event occurs, replace equipment, and arrange for electrician to rewire electrical controls if applicable.
A8	Failure of surge tank, due to condition	Unusual	Medium	High	Monthly maintenance checks, Ability to fully isolate tank from pipeline if required if required	Yes	Unusual	Minor	Low	If event occurs, bypass surge tank and slow down pump ramping (up and down), slow pumping rate.
A9	Drought causing loss of water	Unusual	Major	High	Ability to shut down AFFCO works, contingency plans in place	Partially	Unusual	Major	High	Consider secondary sources of supply as a back up to primary source. If event occurs tanker water in as required.

Sedimentation, Coagulation and Flocculation

List what could happen that may cause drinking-water to become unsafe			*Risk without Measures*			*Is this under control?*		*Residual Risk*			*What could be done to improve?*
Risk Event	**Ref**	**Potential Cause of Risk Event**	**Likelihood of Risk Event**	**Consequence of Risk Event**	**Risk Level,**	**Measures in Place to Control Risk**	**Controlled? Yes / No/ Partial**	**Likelihood of Risk Event**	**Consequence of Risk Event**	**Risk Level,**	**Additional Measures to Control Risk Event**
Microbiological Contamination	T1	Floc not formed, due to pump failure or inappropriate dosing rate.	Possible	Medium	High	Adequate storage to enable flushing contaminated water from plant then reintroducing supply. Operators at plant every day. Continuous turbidity meters installed post flocculation, multiple pumps installed. Coagulantdosing based on raw water turbidity	Yes	Unusual	Minor	Low	If event occurs, check and if required manually adjust dose rates to create good floc. If dose pump failure, swap to standby dosing pump.
	T2	Poor chemical mixing preventing floc formation	unusual	High	Very High	Automatic dosing into mixing column based on source water turbidity, poor mixing will result in increased turbidity of treatedwater and will shut the plant down	Yes	Unusual	Minor	Low	
	T3	Coagulant chemical supply exhaustive	Unusual	Major	High	Operators on site daily and manually adjust dose and have good awareness of supply usage. Multiple NZ source available if there is an urgent requirement	Yes	Unusual	Minor	Low	If event occurs, order new stock from NZ supplier who can deliver fastest.
	T4	Poor quality of chemicals which do not provide adequate coagulation	Possible	Major	Very High	Each Alum batchis independently tested on arrival to NZ beforeuse, back up suppliers available. Monitoring of turbidity, to identify coagulation issues, trials for usage for PACL as an alternative forAlum underway	Yes	Rare	Medium	Moderate	Ensure O & M manual has purchasing procedures for chemicals from back up suppliers.
	T5	Sudden change in source water quality, due to storm event, or volcanic ash settling in river.	Likely	Major	Extreme	Plant fully alarmed, enabling operator to be at plant to adjust dosage well before critical dosage. Plant is either shut down if NTU reaches 1800, or productionrate is reduced. Look at PACL as an option during these times due toits robustness and low dosage requirement to treat high turbidity waters.	Partially	Possible	Minor	Moderate	Ensure the Operation Manual provides the relationships between source water quality and coagulant / flocculent demand, and optimum pH; and the relationship between ph caustic and chlorine. continue with assessment of alternative chemical to provide more consistent water quality

	T6	Poor Coagulation, due to inaccurate dosing levels, or poor chemical quality	Unusual	Major	High	Continuous turbidity monitoring, of water leaving the clarifiers, and sand filters, capacity of raw water delivery is unable to exceed treatment capacity	Yes	Unusual	minor	Low	If event occurs, complete jar tests, adjust dosing rate as required.

Chlorination

List what could happen that may cause drinking-water to become			*Risk without Measures*			*Is this under control?*		*Residual Risk*			*What could be done to improve?*
Risk Event	**Ref**	**Potential Cause of Risk Event**	**Likelihood of Risk Event**	**Consequence of Risk Event**	**Risk Level,**	**Measures in Place to Control Risk**	**Controlled? Yes / No/ Partial**	**Likelihood of Risk Event**	**Consequence of Risk Event**	**Risk Level,**	**Additional Measures to Control Risk Event**
Microbiological Contamination	CI1	Inadequate contact time due to short circuiting in contact tank	Likely	Major	Extreme	Continuous monitoring of FAC pH and Turbidity, automatic shutdown, and alarms. Injection of Chlorine prior to sand filters to ensure contact time is achieved	Yes	Rare	Minor	Low	
	CI2	Chlorine gas supply exhausted	Possible	Medium	High	Bulk chlorine and standby tank installed. FAC continuously monitored. WDC Chlorine Management Plan Report procedures	Partially	Unusual	Minor	Low	Ensure that the Chlorine Management Plan procedures are followed and the document is referenced to in the O & M manual. Assess automatic switch over between drums, and if suitable implement. If event occurs connect back-up chlorine tank, or use Calcium Hypochlorite.
	CI3	Under - chlorination due to incorrect set point	Possible	Major	Very High	Continuous monitoring of FAC, alarms and logging of chlorine levels	Yes	Unusual	Minor	Low	If event occurs, adjust Chlorine set-point
	CI4	Under - chlorination due to regulator failure	Possible	Major	Very High	Manually regulated, no automatic regulator, Continuous monitoring of FAC, alarms and logging of chlorine levels	Yes	Unusual	Minor	Low	If event occurs, install back up regulator
	~~CI5~~	~~Recontamination due to failure of rubber joint within boxed channel between sand filters and contact tank~~	~~Unusual~~	~~Major~~	~~High~~	~~Replacement of rubber boot carried out in 2011~~	~~Yes~~	~~Rare~~	~~Minor~~	~~Low~~	~~If event occure, sterilise and if required replace boot~~.
	CI6	Under - chlorination due to chlorine leak	Unusual	Major	High	Continuous monitoring of FAC, alarms and logging of chlorine levels, chlorine gas leak detection device. 24 hours water storage in network, back up chlorine supply on site	Yes	Rare	Medium	Moderate	If event occurs, follow WTP chlorine leak emergency procedures from Chlorine Management Plan.
Chemical Contamination	CI7	Over dosing of chlorine due to incorrect set point	Possible	Major	Very High	Continuous monitoring of FAC, alarms and logging of chlorine levels, auto Shutdown if flow stops	Yes	Unusual	Minor	Low	If event occurs, adjust Chlorine set-point
	CI8	Over dosing of chlorine due not having a regulator	Possible	Major	Very High	Continuous monitoring of FAC, alarms and logging of chlorine levels, auto Shutdown if flow stops	Yes	Unusual	Minor	Low	
	CI9	Formation of trihalomethanes due to chlorination prior to organic removal by filtration	Rare	Medium	Moderate	Testing For THMs have been undertaken regularly. Results show negligible THM's in water, at WTP and in reticulation. Agreed with DWA monitoring not required	Yes	Rare	Minor	Low	
oss of Supply	CL10	Damage to injector pipes along clarifiers	Unusual	Medium	High	Pipes relocated below walkways	Yes	Unusual	Minor	Low	If event occurs, replace injector pipes

Filtration

List what could happen that may cause drinking-water to become unsafe			*Risk without Measures*			*Is this under control?*		*Residual Risk*			*What could be done to improve?*
Risk Event	**Ref**	**Potential Cause of Risk Event**	**Likelihood of Risk Event**	**Consequence of Risk Event**	**Risk Level,**	**Measures in Place to Control Risk**	**Controlled? Yes / No/ Partial**	**Likelihood of Risk Event**	**Consequence of Risk Event**	**Risk Level,**	**Additional Measures to Control Risk Event**
Microbiological Contamination	F1	Inadequate filtration due to excessive sediment build up in media, or short circuiting within sand media causing blockage or carryover	Unusual	Medium	High	Headloss gauges to indicate when backwashing is required. Daily flushing of filters Continuously monitoring turbidity meters of water post filtration	Yes	Unusual	Minor	Low	If event occurs, back wash filters
	F2	Media loss from excessive backwashing rate	Possible	Medium	High	None - However suitable people to take core samples is currently being investigated	No	Possible	Medium	High	Undertake core sampling of media volume and condition. If event occurs, replace media when required.
	F3	Failure of backwash control valves	Unusual	Medium	High	Control valves replaced in 2012	Yes	Rare	Minor	Low	If event occurs, shutdown the effect filter and replace/repair valve/s as required.
	F4	Failure of particle removal due to floc carryover from high flows or sudden change of flow	Unusual	Medium	High	Daily backwashing of filters if required, Continuously monitoring of flow rate and water level through filters post filtration turbidity meters, plant limitations due to supply infrastructure not treatment processes	Yes	Unusual	Minor	Low	If event occurs, adjust flow rate and backwash.

	F5	Inadequate removal of particles to log level requirement for protozoa	Likely	Major	Extreme	Plant shut down activated by Scada if filters exceeds 0 3 NTU. Failing control valves replaced. NTU levels monitored with requirements of DWSNZ for enhanced individual filtration. Monitoring equipment regularly calibrated.	Yes	Rare	Medium	Moderate	If event occurs, pump waster to waste, adjust dosing rate as required.
Loss of Supply	F6	Inadequate back washing causing blockage of filters	Possible	Major	Very High	Automatic monitoring of filter flow rates /headloss and water level within filters to determine when backwashing is required.	Yes	Unusual	Minor	Low	If event occurs, monitor and adjust backwashing frequency as required.
	F7	Failure of backwash pump	Possible	Major	Very High	Replace pump if it fails	Yes	Unusual	Minor	Low	If event occurs, adapt another pump to enable backwashing, until replacement/repair completed, and isolate filter if failure occurs during backwashing. If motor failure install spare motor.
	F8	Failure of backwash control valves	Unusual	Major	High	Control valves replaced and automated in 2012	Yes	Rare	Minor	Low	If event occurs, isolate filter, and replace/repair valve

pH Adjust

List what could happen that may cause drinking-water to become			*Risk without Measures*			*Is this under control?*		*Residual Risk*			*What could be done to improve?*
Risk Event	**Ref**	**Potential Cause of Risk Event**	**Likelihood of Risk Event**	**Consequence of Risk Event**	**Risk Level,**	**Measures in Place to Control Risk**	**Controlled? Yes / No/ Partial**	**Likelihood of Risk Event**	**Consequence of Risk Event**	**Risk Level,**	**Additional Measures to Control Risk Event**
pH adjustment too High or Low	pH1	Incorrect dosing rate of caustic soda	Possible	Medium	High	Continuous monitoring of pH of water leaving the treatment plant, monitored by operational staff, caustic soda dosing is automated. pH monitoring is alarmed.	Yes	Unusual	Minor	Low	If event occurs, manually adjust dosing rate.
	pH2	Incorrect calibration	Possible	Medium	High	Calibration undertaken by WTP staff 3 monthly	Yes	Unusual	Medium	High	Ensure staff are trained to carry out calibration of pH probes and that procedures and timing is documented in the O & M manual
Loss of pH adjustment	pH3	Blocking of injection lines	Possible	Medium	High	Each time the dosing pump stops (approximately every 3 hours) the dosing lines and pump are flushed every with treated flushing water to prevent blocking. Regular flushing undertaken.	Yes	Unusual	Minor	Low	If event occurs, flush lines
	pH4	Dose pump failure	Possible	Medium	High	An identical dose pump is held within the water treatment plant which is installed should the operating pump fail. pH alarms trigger an alarm which enables the operators to assess the problem and replace the pump.	Yes	Possible	Minor	Moderate	If event occurs, install spare pumps.
Chemical Contamination	pH5	Illness in community due to leaching of metal from fittings into the water supply	Possible	Medium	High	pH dosing undertaken at plant to maintain ph within 7.8-8.0. compliant warning notices in the paper from the Ministry of Health twice per year until supply is proven to be non plumbosolvent.	Yes	Unusual	Minor	Low	

UV Disinfection

List what could happen that may cause drinking-water to become unsafe			*Risk without Measures*			*Is this under control?*		*Residual Risk*			*What could be done to improve?*
Risk Event	**Ref**	**Potential Cause of Risk Event**	**Likelihood of Risk Event**	**Consequence of Risk Event**	**Risk Level,**	**Measures in Place to Control Risk**	**Controlled? Yes / No/ Partial**	**Likelihood of Risk Event**	**Consequence of Risk Event**	**Risk Level,**	**Additional Measures to Control Risk Event**
Loss of Supply	UV1	Failure of UV treatment equipment	Possible	Medium	High	Suitable treatment to provide disinfection without the need of UV, multiple units in place should 1 fail	Yes	Rare	Minor	Low	Review and amend the O&M manual to bring it up to date and ensure it becomes an official working document. If event occurs, identify source of failure, replace faulty equipment or clean as required.
	UV2	Failure to meet DWSNZ, due to a change in log credit requirements of source water	Rare	Minor	Low	Monitoring and compliance procedures, existing treatment methods, liaison with DWA's. UV disinfection installed to provide additional certainty. Partially protected catchment	Partially	Rare	Minor	Low	Confirm log credit requirements to ensure compliance requirements.

	UV3	Colour increases to a level causing disinfection to be ineffective	Possible	Medium	High	UV transmissivity and intensity is monitored, Staff trained in taking samples and test procedures. DWSNZ able to be achieved without UV disinfection. Trials underway with PACL in conjunction with Alum which has improved colour removal tenfold	Yes	Rare	Minor	Low	Continue with trials and should the benefits of PACL prove suitable add Pacl as a combined coagulant with Alum or used on its own. If event occurs, improve coagulation to remove colour by changing coagulant.
	UV4	Flow through UV becomes excessive for disinfection	Possible	Medium	High	Flow rates monitored through UV, variable dosing rates achieved by way of dose pacing through adjusting the flow rate. Adequate sizing of plant to match treatment plant capability	Yes	Unusual	Minor	Low	If event occurs manually adjust flow rate.
	UV5	Turbidity of water exceeding parameters of the UV treatment equipment decreasing effectiveness	Possible	Medium	High	Coagulation, flocculation, filtration treatment with extensive monitoring prior to UV with alarms and shut- down systems in place should turbidity rise.	Yes	Rare	Minor	Low	If event occurs, re-assess lime dosing, and adjust as dosing rate as required.
	~~UV6~~	~~Power failure resulting in loss of disinfection capability~~	~~Likely~~	~~Medium~~	~~Very High~~	~~Generator on site has some issues due to its very old age . It is currently operational and there is a facility for a transportable plug in unit available~~	~~Partially~~	~~Possible~~	~~Medium~~	~~High~~	~~WTP Standby Generator requires replacement.~~
	UV7	Dose levels drop outside dosing parameters resulting in inadequate disinfection	Possible	Medium	High	UV Intensity is proportional to flow and is manually adjusted to suit. UV dosage is monitored continuously and alarmed should a lamp fail, or dosage output be inadequate for disinfection.	Yes	Rare	Minor	Low	If event occurs, inspect reactor and alarm for the cause, and repair as required, following O&M requirements from Manufacturer i e. clean quartz sleeves.

Pumps

List what could happen that may cause drinking-water to become unsafe			*Risk without Measures*			*Is this under control?*		*Residual Risk*			*What could be done to improve?*
Risk Event	**Ref**	**Potential Cause of Risk Event**	**Likelihood of Risk Event**	**Consequence of Risk Event**	**Risk Level,**	**Measures in Place to Control Risk**	**Controlled? Yes / No/ Partial**	**Likelihood of Risk Event**	**Consequence of Risk Event**	**Risk Level,**	**Additional Measures to Control Risk Event**
Loss of Supply	P1	Pump Mechanical Failure	Possible	Medium	High	Duty/stand-by pumps at each pump Station, vibration monitoring undertaken every 6 months of all pumps and maintenance carried out when required. Electric motors replaced at pump stations, filtration back washing pump, refurbished Sept 2009. Pump flow monitored in SCADA system. Visual checks taken when staff visit pump stations	Yes	Unusual	Minor	Low	If event occurs repair pumps, whilst running stand-by pumps.
	P2	Failure to due power cuts	Possible	Medium	High	Suitable storage available (24hours) for short term power cuts. Standby generators permanently housed onsite at both the Intake and boundary pump station.	Yes	Possible	Negligible	Negligible	If event occurs start generator
	P3	Electrical control equipment failure	Unusual	Medium	High	None, some electrical equipmentis star ing to age with limited maintenance. No shorts or failures or fuse trips have occurred to date	No	Unusual	Medium	High	Engage suitable qualified electrician/electrical engineer to inspect and assess the condition and safety of electrical control boards, cabling, and aging electrical control devices. Undertake maintenance and/or replacement of dangerous equipment or those with a high risk of failure as required. If event occurs, arrange for suitably qualified electrician to come in and repair.
Microbiological contamination	P4	Contamination due to inadequate disinfection upon completion of maintenance.	Possible	mediu m	High	Continuous chlorine dosing and monitoring at the treatment plant and Boundary station chlorine residual levels in reticulation. Contractors trained in disinfection requirements.	Yes	Unusual	Minor	Low	If event occurs refer to O&M manual.

Reticulation

List what could happen that may cause drinking-water to become unsafe			*Risk without Measures*			*Is this under control?*		*Residual Risk*			*What could be done to improve?*
Risk Event	**Ref**	**Potential Cause of Risk Event**	**Likelihood of Risk Event**	**Consequence of Risk Event**	**Risk Level,**	**Measures in Place to Control Risk**	**Controlled? Yes / No/ Partial**	**Likelihood of Risk Event**	**Consequence of Risk Event**	**Risk Level,**	**Additional Measures to Control Risk Event**
Microbiological Contamination	R1	Poor water quality due to inadequate flushing regime	Possible	Medium	High	Flushing undertaken by maintenance contractors as part of services contract	Yes	Unusual	Minor	Low	If event occurs, re-evaluate flushing regime.
	R2	Poor circulation resulting in build up of contaminants	Possible	Medium	High	Flushing undertaken by maintenance contractors as part of services contract	Yes	Unusual	Minor	Low	If event occurs, re-evaluate flushing regime.
	R3	Contamination due to inadequate disinfection upon completion of maintenance	Possible	Major	Very High	Continuous chlorine dosing and monitoring at the treatment plant, chlorine residual levels in reticulation	Partially	Unusual	Medium	High	Ensure O & M procedures have disinfection procedures for materials that have undergone maintenance and have risk of exposure to a contaminant.
Loss of Supply	R4	Failure of main delivery pipeline due to deterioration	Possible	Extreme	Very High	Condition Assessments undertaken (2006), water conservation measures and agreement to shut the AFFCO meat works. 3.5km trunk main replacement mitigates significant risk along worst section Asset management planning as part of LTP	Yes	Unusual	Medium	High	If event occurs, install temporary pipeline to by-pass effected area if required, or undertake repairs.
	R5	Reticulations pipeline breaks (detected or undetected) due to inadequate renewal program, deterioration and excessive pressure	Quite Common	Medium	Very High	Reticulation maintenance part of contract and procedures in place with QRS, hydraulic model and leakage detection projects carried out in 2007/2008/2014 to identify potential critical areas along with AM planning. Adequate storage available. All breaks recorded in CRS programme. Plans to install earthquake valves. Flow rate at WTP, and tank levels are monitored via telemetry.	Partially	Unusual	Medium	High	Consider methods to reduce pressure within the township, including replacing Tauwhara Tanks with tanks at lower location. If suitable prepare for replacement. If event occurs isolate area and either repair, or install temporary pipe.
	R6	Excessive leakage and high demand exceeding scheme capacity	Possible	Medium	High	Ability to shutdown AFFCO, Short term storage exceeds 24 hours. Leak detection undertaken recently, WC planning to repair leaks (Noted that Wairoa Population in decline rather than increasing)	Yes	Possible	Minor	Moderate	If event occurs, isolate area for repairs, or if required apply immediate water restrictions.

Storage

List what could happen that may cause drinking-water to become unsafe			*Risk without Measures*			*Is this under control?*		*Residual Risk*			*What could be done to improve?*
Risk Event	**Ref**	**Potential Cause of Risk Event**	**Likelihood of Risk Event**	**Consequence of Risk Event**	**Risk Level,**	**Measures in Place to Control Risk**	**Controlled? Yes / No/ Partial**	**Likelihood of Risk Event**	**Consequence of Risk Event**	**Risk Level,**	**Additional Measures to Control Risk Event**
Loss	S1	Catastrophic failure of tanks, due to poor condition/lack of maintenance	Unusual	Major	High	Multiple Storage tanks at each site to enable isolation of tanks if required, Reservoir condition assessment carried out in 2006.	Partially	Rare	Medium	Moderate	Carry out visual inspections of tanks on each visit assess according to the Visual Assessment Manual for Utility Assets. Ensure this inspection regime is covered in the O&M manual. If event was to occur isolate tank. Review condition on Tawhara tanks on a regular basis, determine remedial work or replacement plans and action as required.
	S2	Failure of tank filling controls causing overflow	Unusual	Medium	High	Telemetry system enables WTP personnel to receive overflow or over filling alarms. Daily monitoring of controls.	Yes	Unusual	Negligible	Negligible	If event occurs, switch off pumps, investigate cause and repair.
	S3	Leakage from tank walls due to deterioration of seismic activity	Unusual	Minor	Low	Reservoir Condition Assessment completed in 2006	Partial	Unusual	Minor	Low	Carry out visual inspections of tanks on each visit assess according to the Visual Assessment Manual for Utility Assets. Ensure this inspection regime is covered in the O&M manual. If event occurs undertake condition assessment

	S4	Inadequate storage for short term water shortages or maintenance shutdowns	Unusual	Major	High	Peak flow (Jan 09) = 14,000m3. AFFCO consumption = 8,400m3. Peak daily flow from Wairoa and Frasertown = 5,600m3. 5628m3 storage within network (plus 5000m3 at AFFCO). Storage for township exceeds 24 hours which is adequate. Leak detection complete 2014, and repairs programmed	Yes	Unusual	Minor	Low	If event occurs, advise public to conserve water
Microbiological Contamination	S5	Build up of sludge mainly from lime residue sedimentation and contaminants.	Unusual	Medium	High	Residual chlorine within water and FAC is monitored. Inspections undertaken regularly to assess sludge build up. Reservoirs cleaned 3 yearly	Yes	Unusual	Minor	Low	Consider changing to caustic to eliminating reservoir 3 yearly cleaning. If event occurs clean tank.
	S6	Ingress of contaminants and contaminated water through holes, gaps, and cracks, in the tanks and hatches	Quite Common	Major	Very High	Residual chlorine within water and FAC is monitored. Plans in place to install marine Hatches on all tanks	Partial	Quite Common	Medium	Very High	Install sealed marine hatches over all tank hatches. If event occurs, repair contaminant access point, and decontamination requirements.
Microbiological and Chemical Contamination	S7	Security Breech or vandalism	Rare	Major	High	[redacted]	Yes	Rare	Minor	Low	Install sealed marine hatches over all tank hatches. If event occurs, assess damage to equipment notify police, and review monitored water quality parameters (i.e. pH) carry out water quality tests.
Earthquake causing loss of supply	S8	Earthquake causing a major break in a pipeline causing Tawhara, Boundary and AFFCO reservoirs to drain rapidly	Rare	Major	High	Manual Isolation of the tanks to limit loss of water.	Partially	Rare	Medium	Moderate	Install earthquake shut off valves in various locations to each group of reservoirs as informed by expert supplier. If event occurs, install temporary above ground pipeline, and put in place water restrictions as required.

Other

List what could happen that may cause drinking-water to become unsafe			*Risk without Measures*			*Is this under control?*		*Residual Risk*			*What could be done to improve?*
Risk Event	**Ref**	**Potential Cause of Risk Event**	**Likelihood of Risk Event**	**Consequence of Risk Event**	**Risk Level,**	**Measures in Place to Control Risk**	**Controlled? Yes / No/ Partial**	**Likelihood of Risk Event**	**Consequence of Risk Event**	**Risk Level,**	**Additional Measures to Control Risk Event**
Loss of Supply Microbiological contamination	O1	Inadequate operational procedures	Possible	Major	Very High	A draft O & M manual is being followed but not yet finalised. A monitoring and sampling programme has been determined which fits the requirements of DWSNZ.	No	Possible	Major	Very High	Review and amend the O&M manual to bring it up to date and ensure it becomes an official working document once all upgrades have been completed no later than Jun 15. If event occurs review operation procedures, and amend as required.
Microbiological Contamination	O2	Failure to meet DWSNZ, due to a change in log credit requirements of source water	Rare	Minor	Low	Monitoring and compliance procedures, existing treatment methods, liaison with DWA's. UV disinfection installed to provide additional certainty. Partially protected catchment	Partially	Rare	Minor	Low	Confirm log credit requirements to ensure compliance requirements.
	O3	Inadequate monitoring for E.Coli, FAC, pH causing contamination to go unrecognised	Quite common	Major	Very High	Monitoring program is organised in advance of reporting period. Staff trained in taking samples and test procedures. Monitoring regime in place	Yes	Rare	Minor	Low	
	O4	Inadequate sampling techniques causing contamination to go unrecognised until illness occurs, or providing false quality data.	Possible	Medium	High	Staff are trained in taking samples. Analysis of samples occurs via IANZ accreditation procedures of laboratory.	Yes	Unlikely	Minor	High	If event occurs, ensure immediate additional training, review training requirements.
Systems Failure	O5	Inadequate staff training causing failure of treatment processes or operational systems	Quite common	Major	Very High	Staff are trained in operating equipment, and succession planning undertake, with former training now a competenttreatment plant operator, and cadet who assists at the treatment plant now gaining Diploma.	Yes	Unusual	minor	Low	If event occurs, ensure immediate additional training, review training requirements.

17. Appendix B - Annual Review Report

18. Appendix C – Future WSP Updates

Key areas to be addressed for the next version of WSP have been identified through reviewing against the template published by the Ministry of Health (based on guidelines for drinking water quality published by World Health Organisation). This gap analysis was completed by FH in early 2022 against the 2019 WSP. It is noted that the requirements now published by Taumata Arowai are different than what has been used in the gap analysis.

Status & recommendations	Template section	Template heading
Not available	**1**	**Commitment to drinking-water quality management**
Not available	1.1	Relationship of water safety plan to organisational policy and strategy
Not available	1.2	Recent non-compliances and council's commitment for improvement
Not available	1.3	Engaging stakeholders
Not available	1.3.1	Te mana o te Wai
Not available	1.4	Engaging community
Brief description available	**2**	**Assessment of the drinking-water supply system**
	2.1	Water supply system description and analysis (brief description of source, wtp and network)
Recommended to update the schematic to match with content and with more clarification around each CCP	2.1.1	System schematic
Is available. Needs to be reviewed to make it clearer	2.1.2	Description and analysis of system elements
Not available; not clear log removal target for each element of the supply	2.1.3	Microbiological log reduction values
It is recommended to be included if possible	2.2	Assessment of water quality data
	2.2.1	Raw water quality testing results
	2.2.2	Treated water quality testing results
Not adequate: should be written in details, as part of catchment risk assessment it is recommended to assess the risk of Cyanobacteria (it is not clear from the WSP if there is any confirmed risk of Cyanobacteria). If Catchment risk assessment showed medium to high risk of cyanobacteria; then Cyanobacteria management protocol should be written.	2.3	Catchment hazard and hazardous event identification and risk assessment
	3	**Hazard identification and risk management**
Available but the methodology is not current and not recommendable. In writing this plan old 2014 MoH Water Safety Plans risk methodology is used, which does not have associated certainties and limitations (might be not adequate to manage all risks)	2.3.1	Risk assessment methodology

Status & recommendations	Template section	Template heading
Recommended to update the risk table to be align with MoH latest risk assessment guidelines (2019) or other recommended methodologies. Current risk table might need some more details for source, each element of WTP and reticulation. It is recommended to consider residual risk and its acceptability in risk table and also identification of additional preventative measures.	2.3.2	Risk assessment table including identify hazards and hazardous events and maximum risk
	3	Preventive measures for drinking-water quality management
	3.1	Assessment of existing preventive measures and multiple barriers
	3.1.1	Calculation of residual risk
	3.1.2	Identification of additional preventive measures
Is available. Need to be reviewed after updating risk assessment table. Updating cost and dates will be required.	3.1.3	Drinking water improvement plan (cost, time frame)
Available. To be reviewed.	**4**	**Operational procedures**
It is available in other section of the WSP but will need to be reviewed. For example, UV has at least two thresholds for operational monitoring and CCP it should be one (when alarm is sent and when WTP shouts down).	4.1	Critical control points
Available. To be reviewed.	4.2	Operational procedures
Available. To be reviewed.	4.3	Operational monitoring and inspection
Available. To be reviewed.	4.4	Validation of equipment, processes and practice (how, when, who)
Available. To be reviewed.	4.4	Corrective actions
Not available	**5**	**Verification monitoring programme**
Sampling manual/plan not available?	5.1	Drinking-water quality monitoring
Not available	5.2	Consumer satisfaction
Not available	5.3	Short-term evaluation of results
Not available	5.4	Corrective actions- priority determinant identification program
Available, but may need more explanation on details of mitigation approaches and communication plans for each event. It is recommended to include more events in detail (plant failure due to power outage or flood.	**6**	**Management of incidents and emergencies**
	6.1	Incident and emergency response plans
Not available	**7**	**Documenting and reporting**
	7.1	Management of documentation and records
	7.2	Reporting
Not available	**8**	**Investigations**
Available but currently not included. It can be included in section 6 "management of incident and emergencies"	8.1	Investigative studies
Available but currently not included. It can be included in the "Audit section"	8.2	Long-term evaluation of results
Not available	**9**	**Audit of drinking-water quality management**
	9.1	Review by senior leadership

Council has also reviewed the WSP guidance published by Taumata Arowai. The future WSP will be revised with the following Table of Content in line with the new requirements. New information added from the gap analysis above will also be included.

Section	Sub Section	Comments
1. Our Commitment to Drinking Water	Organisational Policy and Commitment	To be reviewed and updated
	Roles and Responsibilities	To be reviewed and updated.
	Community Engagement	To be added
2. Water Supply Description	Water Supply System Description	Existing
	Source Infrastructure	Existing
	Treatment and Process	Existing
	Distribution Network	Existing
	Supply and Demand Characteristics	Existing
	Water Supply System Management	Existing
	Forward Works Programme	To be added
	Renewal Programme	To be added
3. Risk Management	Preventive Measures for Drinking Water Quality Management	Existing. To be reviewed to include all risks.
	Identification of Additional Preventive Measures	To be added
4. Barriers to Contamination		Existing
5. Critical Control Point Process Control		Existing
6. Drinking Water Quality Monitoring		To be added. Council also have access to raw water quality testing results.
7. Improvement Plan	Drinking Water Quality Management Improvement Plan	Existing
	Future WSP Updates	Existing
8. Incident Management	Management of Incidents and Emergencies	To be reviewed and updated.
	Incident and Emergencies Document	To be reviewed and updated.
9. Documentation and Reporting	Management of Documentation and Records	To be added
	Document Control and Management System	To be added
	Reporting	To be added
10. Appendices	Source water risk management plan	To be added. It is acknowledged that this is a significant undertaking due to the extent of the catchment. It will require guidance from Taumata Arowai and working with the Hawkes Bay Regional Council.
	Risk tables	Existing

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