Rūātoki Public Water Supply – Water Safety Plan

- Report Prepared for:

Whakatāne District Council

- Original Report Prepared by:

Pattle Delamore Partners Ltd

- Final July 2018

- Report Updated by:

Whakatāne District Council

- Version 2.00, September 2018

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Limitations:

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Executive Summary

Pattle Delamore Partners Ltd (PDP) has been engaged by Whakatāne District Council (WDC) to update the existing 'Rūātoki Water Supply Public Health Risk Management Plan, Final V4' (February 2011) for the Rūātoki Public Water Supply Scheme (Rūātoki Scheme).

This Water Safety Plan (WSP) (formerly known as Public Health Risk Management Plan, PHRMP) was prepared by PDP in collaboration with WDC to identify and manage events that could occur in the Rūātoki Scheme with potential to cause public health risks to consumers of the scheme.

The following were undertaken in the preparation of this WSP:

- Identifying components and operation of the Rūātoki Scheme.
- Identifying Contamination and Loss of Supply events that could occur in the scheme that could result in public health risks.
- Preparing Risk Tables to identify potential risks, by identifying existing and additional barriers to contamination and critical points in the scheme. In addition evaluate if the Preventative measures currently in place are able to reduce the risks were also identified.
- Preparing an Improvement Plan by introducing new preventative measures to manage risks that are not sufficiently managed.
- Identifying Critical Control Points (CCPs) in the scheme and limits within which the CCPs are operated to prevent contamination. Control actions to be carried out when CCPs operate outside these limits were also identified.
- Preparing Contingency Plans to mitigate events of acute health risk that may occur despite preventative measures being in place.

This report was prepared in line with the methodology recommended by the Ministry of Health for preparation of Water Safety Plans. Information used in this report was gathered from documents and reports belonging to the Whakatāne District Council, during site visits carried out by PDP to the Rūātoki water treatment plant, pump station and reservoir sites, and during a consultation workshop with WDC staff. Contributors to this report are listed in Section 11.0.

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1.0 Revision and Performance Assessment

Table 1: Revision Details

Version No.	Revision Details	Author	Date
V1	Public Health Risk Management Plan - submission to DWA	OPUS	23/08/2007
V2	Public Health Risk Management Plan – revised to account for non -conformances	OPUS	19/09/2007
V3	Public Health Risk Management Plan – revised with DWA recommendations	OPUS	03/03/2008
V4	Public Health Risk Management Plan – revised at the request of WDC	OPUS	28/02/2011
1.00	Prepared by PDP in collaboration with WDC, submitted to WDC for comments	PDP	08/02/2018
1.01	Modified with WDC comments and further updates	WDC/PDP	15/05/2018
1.02	FINAL Version release from PDP to WDC	PDP	30/07/2018
1.03	Updated Improvement Plans and submission to Drinking Water Assessor	WDC	17/08/2018
2.00	Approved by DWA with inclusion of 'Report on adequacy of a Drinking Water Supply's Water Safety Plan (RUA003_Rūātoki_WSPadequacy_200818_v1)	Toi Te Ora approval added by Michael Van Tilburg	13/09/2018

The Health (Drinking Water) Amendment Act 2007 requires drinking-water suppliers providing drinking-water to over 500 people to develop and implement WSPs.

WSPs are required to be revised and re-submitted to the Drinking Water Assessor (DWA) for approval every 5 years as a minimum. Accordingly, this plan was due for revision and approval by the DWA back in 2016! In recent times Council has increased in-house resources and will keep strict control of adhering to the regulatory requirements. It should be noted that Council treats this WSP as a live document and will be updated as required; Council will revise and resubmit this

WSP if there are significant changes to the operations or risks to the Rūātoki Scheme within the 5-year period.

A draft plan of this WSP was reviewed by the contributors to the workshop before submitting to the DWA for final approval.

The performance of this WSP is to be assessed annually by reporting on the following items:

- any risk events.
- non-compliances or near misses that have occurred.
- contingency plans that have been used.
- changes made to the scheme operation and components.
- progress made against the Improvement Plan.
- any new risks or improvements that are required to be made and people responsible for carrying them out.

The performance assessment, in the form of a short report, will be submitted by the Manager Three Waters to the Drinking Water Assessor by 31 July each year.

The following staff will be responsible for including any relevant items arising from this report into the Annual Plan, Water Asset Management Plan and Long Term Plans: Manager Three Waters, Team Leader - Three Waters Asset Management and Planning, Manager - Capital Projects, Team Leader - Three Waters Operations.

This WSP is to be linked to the Annual Plan, the Water Asset Management Plan and the Long Term Plan.

This WSP is to be read in conjunction with the 'Catchment Risk Assessment for Rūātoki Bore Water Supply, Whakatāne District Council' report (PDP, September 2017).

2.0 Supply Summary

Table 2: Rūātoki Scheme Summary	
Supply Details	
Supply Name	Rūātoki Community Water Supply
WINZ Community Code	RUA003
Supply Owner	Whakatāne District Council
General Manager Infrastructure	David Bewley
Manager Three Waters	Tomasz Krawczyk

Table 2: Rūātoki Scheme Summary	
Team Leader – Water Treatment Plant	Neal Yeates
Water Treatment Plant Operators	Ian Bowen Ross Dillon Bryan Vautier
Capital Projects Manager	Jim Finlay
Team Leader - Three Waters Assets Management and Planning	Michael Van Tilburg
Population Served by Supply1	560 People
Number of Connections2	194 Connections
Source Details	
WINZ Source Code	G02088 (Main), G00222 (Emergency)
Type of Source	One shallow bore (Approximately 8.5 metres below ground level (bgl), cased down to 6.6 metres bgl)
Consent No.	RC 62627 (Permit 22285)
Consent Expiry	30/09/2019
Maximum Consented water take:	1,000 m^3/d
Map Reference (NZTM 2000)	446167.97 E, 753709.66 N
Treatment Details	
WINZ TP code	TP00326
Treatment Processes	Chlorination, UV
Average Daily Demand (July 2015 – February 2018)[3]	372 m^3/day
Peak Daily Demand (July 2015 – February 2018)[3]	630 m^3/day
Distribution Details	
WINZ Distribution Zone Code	RUA003RU
Distribution Zone materials	95% Polyvinyl Chloride (PVC)

[1] Drinking-water Register New Zealand.
[2] WDC Correspondence, September 2017.
[3] WDC Correspondence, April 2018.

3.0 Introduction

The Rūātoki Scheme is owned and operated by WDC and supplies a population of approximately 560[1] people. The water is sourced from one bore supply and treated for bacteria and protozoa before being circulated to consumers.

Administration of the scheme is carried out at the Council head office located at Commerce Street, Whakatāne. Treatment plant operators are stationed at the main Whakatāne Water Treatment Plant located at Valley Road, Whakatāne and travel to the Rūātoki Scheme for routine testing and inspections and when required.

Key WDC personnel responsible for the management and operation of the scheme are as follows:

- General Manager Planning and Infrastructure (GM) – David Bewley
- Manager Three Waters (MTW) – Tomasz Krawczyk
- Manager Public Affairs (M-PA) – Ross Boreham
- Team Leader - Water Treatment Plant (TL-WTP) - Neal Yeates
- Water Treatment Plant Operator (WTP-O) – Ian Bowen / Bryan Vautier / Ross Dillon
- Team Leader - Three Waters Operations (TL-O) – Luke Shipton
- Team Leader - Three Waters Administration (TL-AS) – Helen Toby
- Team Leader - Three Waters Asset Management and Planning (TL-AM) - Michael Van Tilburg
- Asset Engineer - Three Waters (AE) – Diana Kim/ Joe Xie
- Senior Project Planner (SPP) – Nicholas Woodley
- Manager - Capital Projects (PM) – Jim Finlay
- Project Engineer - Three Waters (PE) – Leilani Salanguit

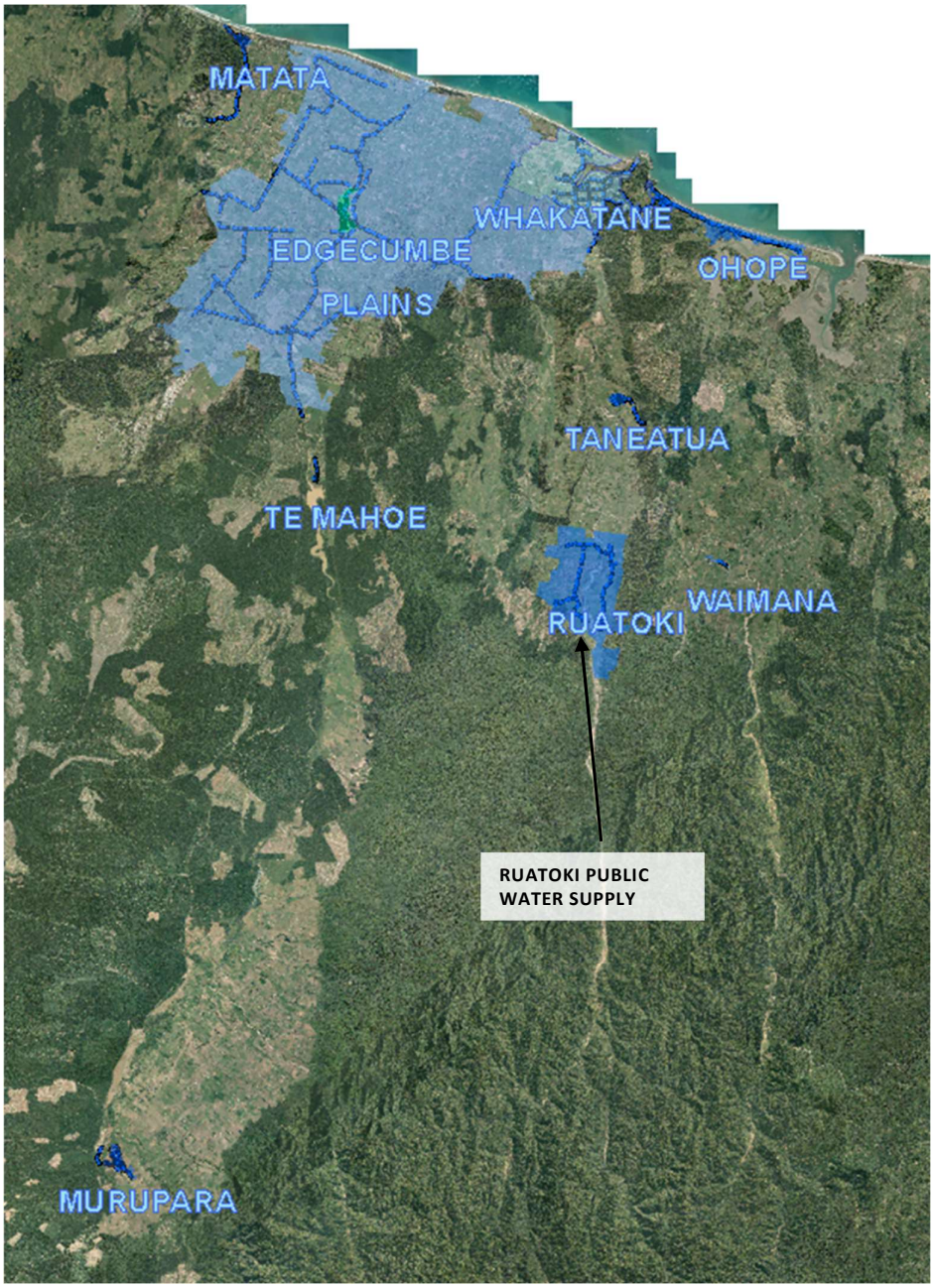


Figure 1: Whakatāne District

4.0 Description Rūātoki Water Supply

4.1 Scheme Details

The Rūātoki Scheme, originally established in the 1940's as a farm supply, was later reconstructed in the early 1990's to act as a fully metered domestic supply and is owned and operated by WDC. The scheme does not supply all residents within the Rūātoki water supply scheme boundary; there are currently 194 connections[4] serving an estimated population of 560 people[5] out of 400 properties and a population of 1,890 people. The remaining residents are on private water supplies including private bores and rainwater tanks. From a public health perspective, it is advisable that the remaining residents connect to the WDC water supply scheme.

A project was completed in 2014 funded through subsidies from Ministry of Health and Housing New Zealand to upgrade the water supply system and at the same time service some residents who were not connected to the scheme. This work included the upgrade of the water treatment plant (installing a UV unit and continuous monitoring equipment), increasing storage capacity of the reservoir (replacing the old 150m^3 timber tank with a 500m^3 steel tank) to provide more than 24 hour storage capacity, and extension of the network so that more residents could connect onto it. A new bore was also drilled near the existing well in August 2014.

The average daily demand and maximum peak demand between July 2015-February 2018 has been 372 m^3/day and 630 m^3/day respectively. The water take consent for the scheme is administered by the Bay of Plenty Regional Council (BOPRC) and the maximum consented take for the supply is 1,000 m^3/day. The consent (Consent Number 62627) expires in September 2019 whereby a new water take resource consent will be required.

[4] WDC Correspondence, September 2017

[5] Drinking-water Register New Zealand.

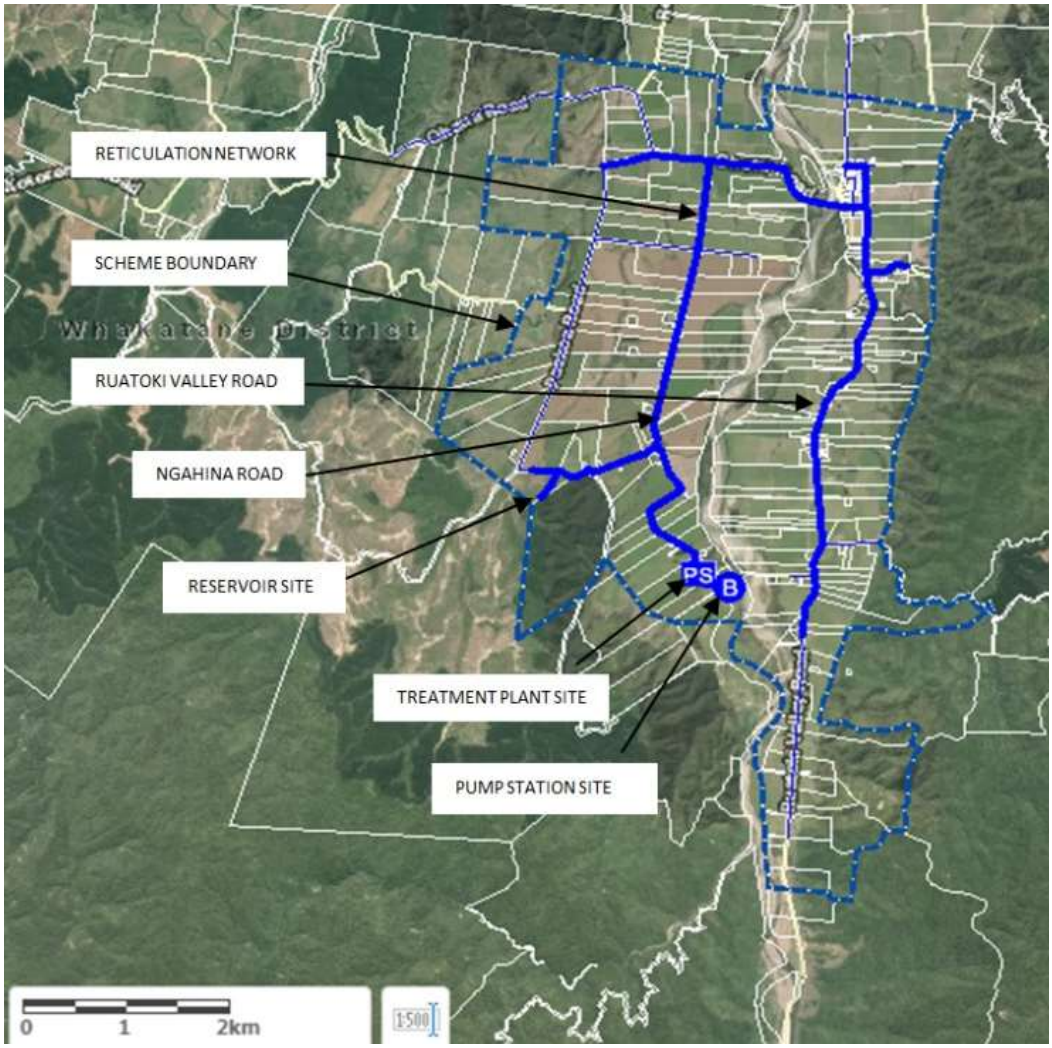


Figure 2: Rūātoki Water Supply Scheme

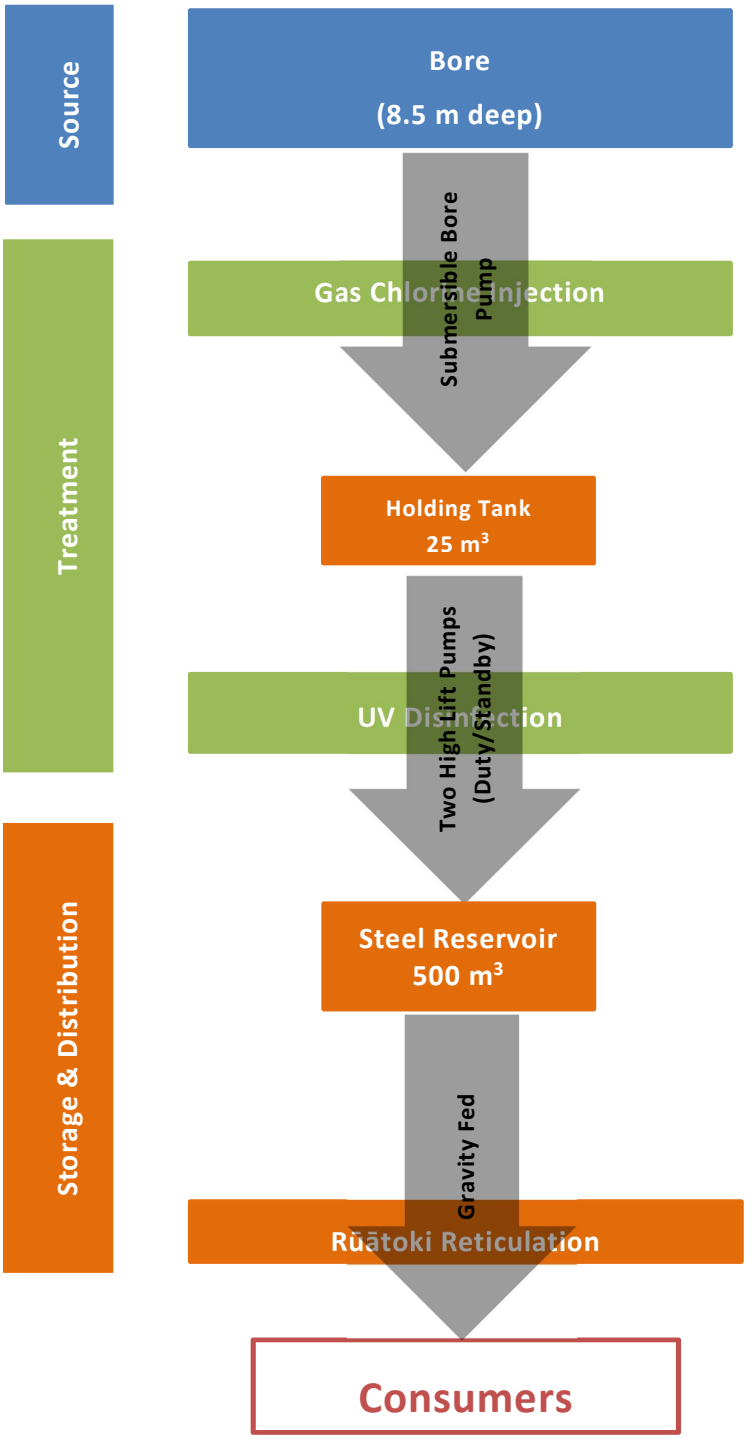


Figure 3: Schematic of Rūātoki Water Supply Scheme

4.1.1 Water Source and Catchment

Water is abstracted from a shallow bore 8.5 metres below ground level (m bgl) and cased down to 6.6 m bgl. Prior to February 2018 the bore was located on the Whakatāne River bank approximately 40 metres away from the river. As a result of extreme weather evens in February 2018 the river encroached onto the bore site resulting in breaking away of the bank exposing the bore casing. Emergency works have since been undertaken and WDC is working closely with MoH and the Bay of Plenty Regional Council to establish better protection arrangements for the bore site. Bore site prior to and after the February 2018 event is shown in Figures 4 and 5.

The old bore water supply remains connected to the reticulation network via manual isolation valves, and can be used as a backup source if required. The pump station/ treatment plant is located a few hundred meters away from the bore source on elevated ground.

A catchment risk assessment (CRA) carried out in September 2017 (PDP, September 2017) has determined that the bore recharges primarily from the Whakatāne River through the hydraulically connected gravel aquifer, acting as a bank infiltration system with recharge derived primarily from the Whakatāne River surface water catchment. Therefore, raw water quality is believed to be largely influenced by surface water changes from activities carried out in the upstream of the Whakatāne River catchment. High permeability of the surrounding soil has also indicated secondary recharge of the bores through groundwater seepage.

A localised groundwater capture zone of 200 metres from the bore water supply has been identified (Appendix C) and activities within this capture zone considered to have an effect on the bore water quality are primarily agricultural and stock grazing activities. No consented discharges or HAIL activities are present within the groundwater capture zone. An unconsented activity, a small piggery housing, is situated inside the 200 metre groundwater capture zone next to the pump station/ treatment plant. Activities carried out at this site are unknown and requires further investigation by WDC. Stock excrement within the immediate vicinity and any effluent from the piggery is considered a primary contamination risk.

Further information on the activities within the Whakatāne river catchment and localised groundwater capture zone can be found in the 'Catchment Risk Assessment for Rūātoki Bore Water Supply, Whakatāne District Council' report (PDP, September 2017).

Figure 4: Bore Head with Steel Log Deflector (Left) and Emergency Supply and Isolating Valves (Right), prior to February 2018 River Intrusion

Figure 5: Bore Head at height of February 2018 floods (Left) and Emergency works underway (Right)

A submersible bore pump supplies water to the scheme, its operation is dependent on reservoir water level; pump starts/stops are controlled by set maximum and minimum levels in the reservoir with the help of level sensors. Water is pumped to a 25 m3 holding tank situated at the pump station/ treatment plant site a few hundred metres away from the bore source.

An inspection carried out as part of the CRA in July 2017 identified some non-compliant features of the bore headworks according to the protected bore requirements of the DWSNZ 2008. These included absence of a stock fence that provides a 5 metre perimeter exclusion zone from the centre of the bore, testing of cable and gland seals for adequacy and the recommendation of elevating the bore headworks above the 1% AEP flood level. A steel enclosure covers the bore headworks and acts as a log/debris deflector to protect the bore head (Figure 4).

The February 2018 incident highlighted the extreme vulnerability of site to channel erosion. It is recommended that the bore site is moved to a secure location as soon as practicable and measures are put in place to protect the source. Protection of the source could include high frequency monitoring of site during extreme weather events in the short term, and working towards restoration of river bank and preventing further channel erosion in corporation with Bay of Plenty Regional Council in the long term.

The Rūātoki Scheme currently has an extreme risk of prolonged loss of supply. Tankered water has been used as a contingency during loss of supply events in the past. However, the scarcity of registered tankered water carriers in the district has made this option unfeasible, with the nearest registered water carrier with a valid registration situated in Tauranga.

Refurbishment works of the river embankment were previously carried out by the Bay of Plenty Regional Council in mid-2017, which proved ineffective against the February 2018 event.

It should be noted that a test bore was drilled away from the Whakatāne River bank during investigative work carried out by WDC to site a location for the new source in 2014; however, the water supply quantity and quality was deemed inadequate and the new bore was drilled in the current location in close proximity to the river.

The bore site is highly vulnerable to flooding due to its elevation and proximity to the Whakatāne River and is historically known to have been inundated by flood water. During heavy storm events access to the bore site is severely restricted.

The pump station/treatment plant site, which is situated at a higher elevation, has no recorded flooding historically.

Power supply to the site is irregular with the site losing power due to problems with the transformer supplying the area. During prolonged power outages a temporary generator owned by a local contractor is used to power the bore pumps and water treatment plant. The Rūātoki Scheme is at risk of prolonged loss of supply.

4.1.2 Treatment

The treatment plant consists of gas chlorination followed by UV disinfection treatment.

Bacterial Compliance: The gas chlorination and UV disinfection treatment available are capable of providing treatment to achieve full bacterial compliance requirements according to the DWSNZ 2008[6].

Protozoa Compliance: The protozoa treatment required was changed from a log credit of 3 to a log credit of 4 by the DWA in January 2018, based on the evaluation

[6] Drinking-water Standards for New Zealand 2005 (Revised 2008).

of the catchment risk assessment complete by PDP (2017)[7], subsequently Council sought that due to shallow groundwater/spring source that a log credit of 3 was more appropriate. As a result, in July 2018 the DWA issued an amended assignation of log credit 3 for protozoa compliance. The current treatment system provides a protozoa log credit of 3. To achieve a log credit of 4 the treatment plant requires an additional filtration process to be incorporated into the existing treatment process.

Raw water abstracted from the shallow bore source is historically known to have high levels of turbidity especially during high rainfall periods and is closely linked to the turbidity of the Whakatāne River at the time. Currently no filtration mechanism is installed to reduce high turbidity before undergoing disinfection; therefore, there is a risk of ineffective treatment of protozoa during periods of high turbidity. To mitigate this risk, during periods of elevated turbidity, the bore pump and water treatment plant shuts off resulting in loss of supply. Periods of high turbidity have resulted in boil water notices being circulated to residents of Rūātoki as a contingency measure.

Gas chlorination is provided via a chlorine gas cylinder with vacuum regulator/ chlorine injection and a weighing system. The 25m^3 holding tank after chlorine injection provides chlorine contact time before water is passed through the UV reactor.

A gas cylinder bottle weighs approximately 130kg which contains 70kg of chlorine gas. The cylinder is replaced once the weight reaches approximately 80kg. There are no additional chlorine cylinders stored on site; however, the cylinder weight is checked at least once a week by a treatment plant operator. Chlorine dose rate is set manually and there is no automatic flow proportional or water quality proportional dosing. Chlorine residual (Free Available Chlorine, (FAC)) leaving the treatment plant is monitored continuously and when it reaches outside operational limits the dose rate is adjusted manually to achieve the required FAC. During events that could change water quality such as during or immediately following storm events/earthquakes, treatment plant operators monitor the FAC levels frequently.

The UV disinfection unit has been designed to deliver a UV dose of 40 mJ/cm^2 which is dependent on the flow rate of water, UV transmittance UV(T), and UV intensity UV(I) provided by the unit of the UV supplied. Current the water treatment system monitors flowrate, turbidity, and UV(T) and adjusts the UV intensity accordingly. No pre-treatment of water is carried out before entry into the UV disinfection unit. If turbidity exceeds set limits the bore pump stops and no water is delivered to the UV disinfection unit. The UV disinfection unit is maintained regularly by cleaning lamp sleeve(s), UV intensity sensor and lamp surface to prevent build up and therefore reducing the intensity of UV provided by the unit.

[7] Catchment Risk Assessment for Rūātoki Bore Water Supply Report, PDP September 2017.

Regular maintenance and calibration of all water treatment plant equipment is carried out by WDC staff and recorded in the appropriate log books.

FAC, pH, Turbidity NTU, Flow and UV(I) are monitored continuously at the water treatment plant and the plant is designed to alarm when parameters exceed set limits. When certain parameters exceeded certain limits the plant also has the ability to automatically shut down by cutting off power to the bore pumps. During instances of automatic shut -down of the plant this can be manually overridden by water treatment plant operators to deliver water to the scheme provided appropriate procedures have been followed.

This is further discussed in Section 9.0 Process Control Summaries.

Figure 6: Rūātoki Treatment Plant housing UV Unit and Chlorine Cylinders (Left) and Holding Tank (Right)

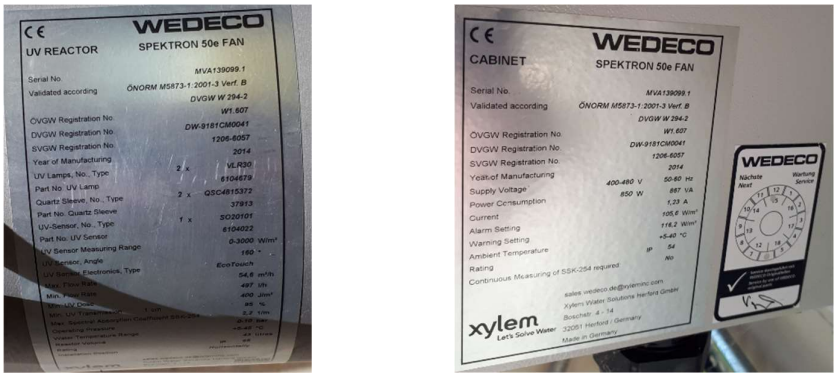


Figure 7: Ultra Violet Reactor and Cabinet name plates for Rūātoki

4.1.3 Storage and Distribution

Two high-lift pumps pump water from the holding tank through the UV unit to a steel reservoir located on Paekoa Road before being gravity fed to the Rūātoki reticulation system. There are no additional booster pumps in the system.

The reservoir has a storage capacity of 500 m^3 available which is sufficient to meet average daily demand and fire-fighting flows and provide 24-hour emergency storage.

A plastic tank of capacity 25 m^3 which was utilised as temporary storage during the construction of the steel reservoir remains adjacent to the new steel reservoir and can be used in emergency circumstances. This tank is connected to the system with appropriate valving to isolate it from the network when not in use.

Figure 8: Steel Reservoir Constructed 2014

The reticulation network consists of 16 km of water mains consisting of which 95% are Polyvinyl Chloride (PVC) pipes. There are 15.0 km of rider mains of which 74% are of PVC material with the majority of the pipes laid in the 1990's.

The Western and Eastern parts of Rūātoki (on either side of the Whakatāne River) is connected by a 100 mm water main of Galvanised Iron (GI) material, laid over the Ohotu bridge. As this is the only connection in reticulation between the Western and Eastern parts of Rūātoki and the bore and storage reservoir are situated in West Rūātoki, there is a risk that the residents of East Rūātoki could experience loss of supply in the case of failure of the GI water main. A storage tank on the East part of Rūātoki would lessen the risk of prolonged loss of supply in the case of an emergency.

A few sections of the Rūātoki distribution are currently not in use and are isolated form the reticulation network through valving. Flushing, disinfection and testing of these sections are required before connecting back into the network to prevent contamination through sediment accumulation. Furthermore, valving are to be

marked to prevent accidental connection of these sections to the existing water reticulation network.

The Rūātoki Township is not connected to a reticulated sewerage system and is on individual septic tanks. Therefore, the level of contamination of soil as a result of wastewater seepage is unknown.

An in-house water balance carried out for the year 2016/17 according to the International Water Association (IWA) guidelines showed that the percentage of real water losses in the system was 21% and the Infrastructure Leakage Index (ILI) was 2.0. The leakage rates are considered acceptable for the size of water distribution network. The reticulation network is operated at approximately 500 kPa pressure and there are currently no plans to carry out pressure management in the Rūātoki Scheme.

Although some routine maintenance is carried out, a majority of the day-to-day operational work consists of reactive maintenance. Attention is required to develop appropriate routine maintenance schedules, procedures and protocols to ensure the system is maintained to optimise the lifecycle of the assets.

Backflow prevention devices are installed on farm and commercial connections triggered by building consents, change of use consents and 'new water connection' applications. However not all farm connections have backflow prevention devices installed. Dual check valve manifold meters are installed in domestic connections.

Currently no routine testing of existing backflow prevention devices are carried out. A reticulation operator has recently obtained a certificate for backflow testing and is ready to undertake in-house testing once a backflow prevention policy has been adopted by the Council.

Some procedures are currently in place for third party contractors/developers working on reticulation network assets or delivery of extension of existing reticulation due to subdivision developments. However, these procedures need to be further developed, documented and strictly enforced in order to minimise risks arising from these works. It should be noted that the Rūātoki Scheme has limited future subdivision potential therefore relatively few instances where work will be carried out by third party contractors/developers on the network.

In the past, a number of illegal connections were discovered within the Rūātoki Scheme due to the isolated nature of this scheme. Although not seen as ongoing issue, Council will be implementing a policy for identifying and dealing with illegal connections.

4.1.4 Monitoring & Control of Scheme

A combined telemetry and SCADA (Supervisory Control and Data Acquisition) system is used to transmit data from the remote sites of the Rūātoki Scheme (Rūātoki pump station/ water treatment site and reservoir site) to the WDC main

control room at Valley Road, Whakatāne, where it is monitored and controlled by WDC staff.

Events causing signal failure from equipment such as power outages and malfunctioning of equipment trigger alarms via the SCADA/Telemetry system. Alarms can be seen on the control room monitors and are also delivered to operator mobile phones via text message.

Telemetry shows the bore pump status, flow rate from the bores and reservoir levels and the following parameters are continuously monitored for treated water quality leaving the treatment plant: Turbidity, pH, FAC, Flow, UV(I) and UV(T).

Reservoir levels are monitored with the use of level sensors. The two bore pumps operate on a duty standby basis according to pre-set minimum and maximum reservoir levels in order to fill the reservoirs.

Monitoring of water quality in the Rūātoki reticulation system is carried out through routine manual FACE sampling (FAC and E. coli). Sampling is carried out in accordance with the DWSNZ 2008 sampling schedule. As of October 2017, continuous online FAC monitoring has been introduced in the reticulation system in some schemes in Whakatāne in order to monitor residual chlorine in the distribution network. Continuous remote FAC monitoring within the township has been planned for the latter part of 2018.

Water quality in the reticulation is managed through routine maintenance such as mains flushing, through leak detection and through the use of backflow prevention devices on high risk and large users.

Monitoring and control of the system is further discussed in Section 9.0.

4.2 Changes to the Scheme since last WSP Report

The following significant changes have been carried out to the scheme since the previous WSP document:

- New bore source
  A new bore was drilled in close proximity to the Whakatāne River, approximately 10 metres away from the old bore. The old bore has been retained and can be connected to the existing reticulation in the event of an emergency supply.
- Treatment plant upgrades in 2014: Installation of UV disinfection unit, upgrade of the high lift pumps by the inclusion of variable speed drives, and installation of continuous monitoring equipment for chlorine, turbidity, pH and UV(I).
- Replacement of timber reservoir with steel reservoir in 2014.
  As part of the project, the original 150 m^3 timber reservoir had insufficient storage capacity (12 hours) and was therefore replaced by a 500 m^3 steel

reservoir that provides more than 24-hour storage to the community. WDC obtained an easement and constructed an access road to the reservoir.

- Extension of water mains to serve more properties
  Although the existing pipes had the required capacity to cope with increased demand, reticulation was extended in order to service properties which were not connected to the reticulation system. As part of the project, some class B uPVC pipes in bad condition were replaced.

5.0 Compliance with Drinking Water Standards

Bacterial, protozoal, chemical, radiological and cyanotoxin compliance requirements and compliance achieved for the year 2017/18 can be found in Table 4.

The Rūātoki Scheme received a MoH Grading of Ee, in 2007 was later downgraded to a Grading of Eb in 2012. Ministry of Health recommends a grading of at least Cc for a drinking water supply of this size. An explanation of the grading given can be found in Table 3.

Table 3: MoH Grading for Water Supply Schemes	
Source and Treatment Grading: Assessment based on source and treatment factors:	
A1:	Completely satisfactory, negligible level of risk, demonstrably high quality.
A:	Completely satisfactory, extremely low level of risk.
B:	Satisfactory, very low level of risk when the water leaves the treatment plant.
C:	Marginally satisfactory, low level of microbiological risk when the water leaves the treatment plant, but may not be satisfactory chemically.
D:	Unsatisfactory level of risk.
E:	Unacceptable level of risk.
Distribution Zone Grading: Assessment based on reticulation condition, management, and actual water quality:	
a1:	Completely satisfactory, negligible level of risk, demonstrably high quality; meets Aesthetic Guidelines and has ISO 9001:2000 accreditation.
a:	Completely satisfactory, extremely low level of risk.
b:	Satisfactory, very low level of risk.
c:	Marginally satisfactory, moderate level of risk.
d:	Unsatisfactory level of risk.
e:	Unacceptable level of risk.

Table 4: Rūātoki Compliance Criteria (DWSNZ 2008)						
Compliance Type/Location	**Section of DWSNZ 2008**	**Monitoring Parameters**	**Sampling Frequency**	**Samples per year**	**Compliance Criteria**	**Compliance 2017/18**
Bacterial Compliance						
Treatment Plant	Compliance Criterion 2A	FAC, pH, Turbidity	(per Section 4.3.2.1)	N/A	(per Section 4.3.2.1)	Non-Compliant
Distribution Zone	Compliance Criterion 6A	E. coli	13 samples per quarter[2]	Required: 52 Taken: 59	<1 E. coli per 100 mL sample	Compliant
Protozoal Compliance						
Treatment Plant	Section 5.16	Flow	Continuous	Flow not >16.50 l/s for more than 5% of compliance period		Non-Compliant
		UV Intensity (UV(I))	Continuous	UV(I) is not < 105.7 W/m^2 for >5% of compliance period. UV(I) is not < 84.56 W/m^2 (80%) for >= 3 continuous minutes.		
		Lamp outages	As required	N/A		
		UV Trans-missivity (UV(T))	Twice weekly	N/A		
		Turbidity	Continuous	Turbidity not >1.0 NTU for >= 5% of monitoring period. Turbidity not > 2.0NTU for >= 3 continuous minutes.		
P2D Compliance						
Treatment Plant	No priority 2 Determinands assigned to this scheme.					
Distribution Zone	No priority 2 Determinands assigned to this scheme.					
Radiological Compliance						
Treatment Plant	Section 9.4	Alpha and beta emitting radionuclides and radon-222	Once every 10 years	Last undertaken October 2016		Compliant
Cyanotoxin Compliance						
Not applicable to bore water.						

Notes: 1. Table 4.2a for Criterion 2B and population band of 501 – 5,000 with 13 maximum days between samples and 5 minimum days of the week used.

2. Table 4.3a and 4.3b for the population band of 501 – 5,000 with 11 maximum days between samples and 5 minimum days of the week used. Sampling sites and sampling frequencies are as per Sections 4.4.3 and 4.4.4.1 of the DWSNZ 2008 respectively.

6.0 Critical Points and Barriers to Contamination

By considering both the existing Barriers to Contamination and Critical Control Points of the scheme it is possible to highlight areas in the scheme that require improvements.

Barriers to Contamination that are present in the Rūātoki Scheme that eliminate, minimize or isolate contamination were identified and is presented in Table 4. A multi-barrier approach provides a robust system ensuring that processes are in place to reduce contamination at each stage of the scheme.

As defined by the water safety plan guides, barriers should be present to achieve the following:

- To stop contamination of raw water;
- To remove particles from water;
- To kill germs; and
- To prevent recontamination of treated water.

Critical Points are areas in the scheme where there is potential for contamination or loss of supply of water. These were identified and presented in Table 5.

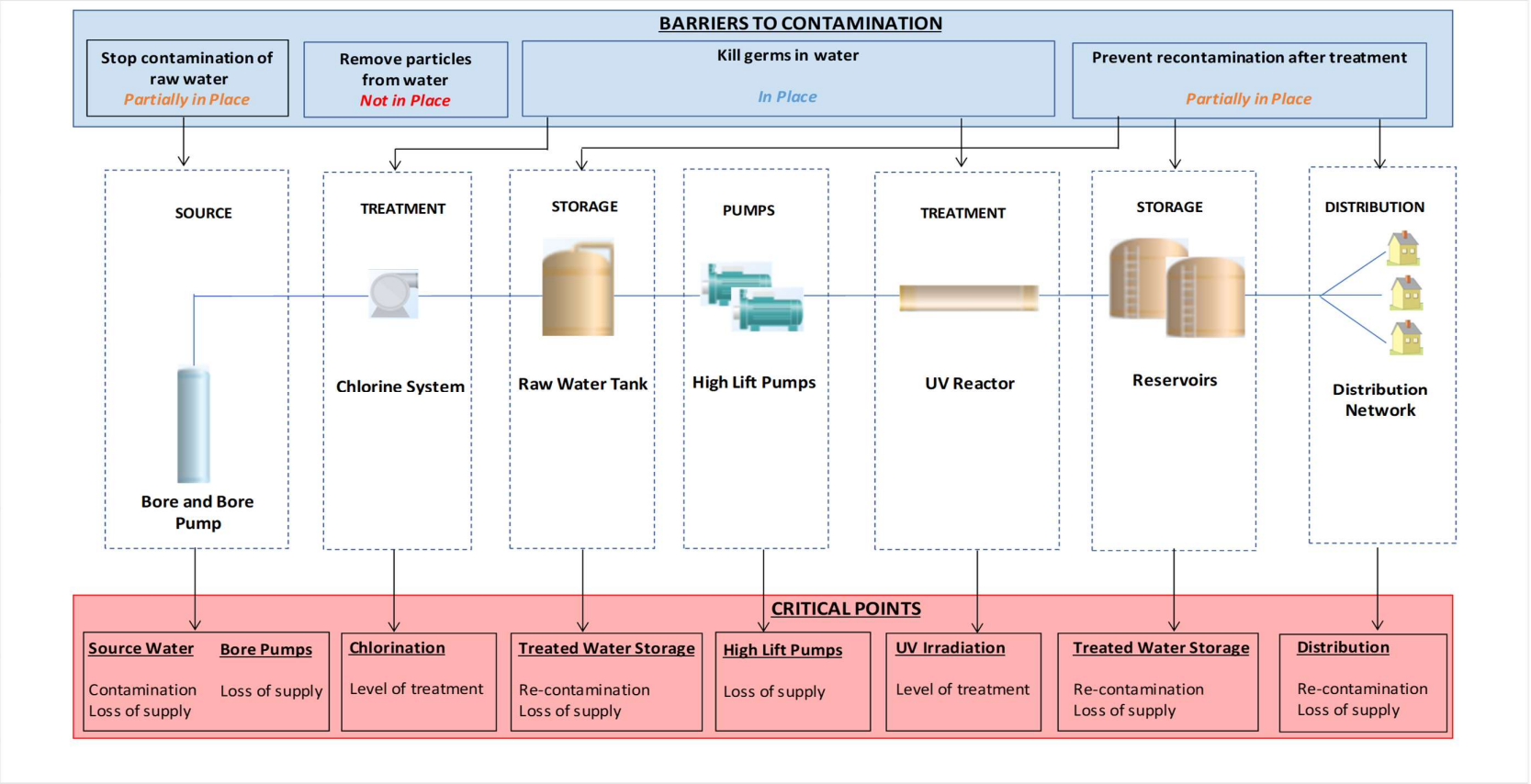


Figure 9: Barriers to Contamination and Critical Points of the Rūātoki Scheme

Table 5: Barriers to Contamination	
Barriers to:	**Actions/Supply elements contributing to the barrier**
Stop contamination of raw water (At Source) ***Partially In Place***	• **Security of groundwater source: *Not in place*.** Bank infiltration system with hydraulic connection to Whakatāne River, therefore heavily influenced by changes in river water quality. • **Abstraction point positioned and constructed to avoid contamination: *Not in place*.** Bore head has 1 metre concrete apron, however bore head situated under flood level. Fence surrounding bore (rail iron and wire) for flood protection washed away in February floods. Stock fence needs investigation and gland seals checked. • **Source protected from contamination: *Partially in place*.** Catchment risk assessment carried out to identify activities in the catchment; ongoing monitoring of activities required.
Remove particles from the water (Treatment) ***Not In Place***	• **Coagulation/Flocculation/Clarification: *Possible Requirement, Not in place***. Possible requirement to achieve log credit of 4. • **Dissolved air filtration: *Possible Requirement, Not in place***. Possible requirement to achieve log credit 4. • **Filtration: *Possible Requirement, Not in place***. Possible requirement to achieve log credit of 4.
Kill germs in water (Treatment) ***In Place***	• **Disinfection (Chlorine, UV): *In place*.** Currently achieves bacterial removal and a Protozoal removal of log credit 3.
Prevent recontamination after treatment (Storage & Distribution) ***Partially In Place***	• **Measures to stop contamination of storage tanks: *Partially in place***. Some measures in place. • **Maintenance of a disinfecting residual: *In place***. Continuous FAC monitoring at treatment plant. FAC leaving treatment plant maintained within target limits. FAC manually sampled at different points of distribution. • **Actions taken to avoid contamination during distribution: *Partially in place***. Some routine asset maintenance and asset replacements in place; these require further development along with current policies and procedures. • **Installation of backflow preventers: *Partially in place***. Farm and industrial connections: BFPs. Metered residential connections: double check valves. BFP Policy being developed.

Table 6: Critical Points	
Critical Point	**Description**
Groundwater bores: Contamination of source supply	• Highly variable source water quality: Shallow bore heavily influenced by surface water quality and activities in the catchment which is predominantly farming and agricultural, resulting in insufficient treatment downstream. • Possible contamination of bore water by surface water ingress due to non-conformance of bore head to DWSNZ 2008 standards. Risk increased due to site being inundated by flooding during heavy storm events. Minimum 5 metre stock fence exclusion zone is not achieved on all four sides.
Groundwater bores: Loss of source supply	• Failure of bore pump leading to loss of supply. • Security of source affected due to location of bore on the Whakatāne River bank which is vulnerable to flooding and bank erosion, and could result in prolonged loss of supply. • Restricted access to bore source during heavy storm events due to flooding of site. • Intermittent power supply to pump station and treatment plant.
Chlorine and UV treatment	• Insufficient chlorine dosing and UV treatment resulting in harmful microbiological contaminants remaining in water. • Overdosing of chlorine leading to chemical contamination of water. • Chlorination and UV disinfection provide treatment sufficient for complete bacterial removal, however, does not provide sufficient treatment for complete protozoal removal. Filtration treatment is required to remove particles from raw water and achieve a combined protozoa log credit treatment of 3 as assigned by the DWA (July 2018). High raw water turbidity at this site. • Insufficient maintenance of treatment equipment leading to failures and subsequent inadequate treatment. • Infrequent calibration and verification of equipment leading to false measurements of water quality.
High Lift Pumps	• Failure of high lift pumps leading to loss of supply.

Treated water storage	• Possible contamination of treated water storage in the concrete reservoir due to access by vermin and birds from gaps in the roof and overflow pipe. • Loss of structural integrity of reservoir leading to loss of supply.
Distribution system	• Loss of supply to the East of Rūātoki due to failure of 100mm GI main connecting the West and East of the distribution system. • Insufficient routine maintenance such as flushing resulting in build-up of contaminants in the system. • Inadequate backflow prevention provided resulting in contamination of water. Not all connections have backflow prevention and no testing of existing devices is carried out at present. • Failure of distribution system components such as pipes, valves and hydrants due to lack of routine asset renewals, resulting in contamination of water and loss of supply. • Inadequate maintenance procedures and policies in place to maintain the distribution system (including hygiene/disinfection procedures, procedures for contractors) resulting in contamination of distribution system. • Possible illegal connections leading to contamination of network.

7.0 Risk Assessment Tables

Based on the Barriers to Contamination and Critical Points identified in Section 6.0 it is possible to identify 'Risk Events' that could occur in the Rūātoki Scheme that has the potential to compromise public health by either contamination of water supply and/or loss of water supply.

These Risk Events are tabulated in the form of Risk Tables and grouped by Source, Treatment, Reservoirs and Distribution, and are found in Appendix A.

The '*Current Scenario*' section of the Risk Tables contain 'Preventative Measures' currently in place to prevent the Risk Event from occurring, and assesses the 'Current Risk' of the Risk Event occurring.

The '*To be Implemented*' section of the Risk Tables contain Preventative Measures that are to be implemented to reduce the Current Risk, and assesses the 'Residual Risk' of the Risk Event occurring once the new measures are implemented. The person/s responsible for the preventative measure/s to be implemented is also identified.

The Current Risk and Residual Risk were assessed according to the qualitative risk assessment methodology consistent with AS/NZS 4360:1999 Risk Management standard. A Likelihood scale (Table 7) and Consequence scale (Table 8) were defined and set by WDC staff according to how they perceived risks and the corresponding Risk Matrix (Table 9) was used to assign the level of Current Risk and Residual Risk as 'Low', 'Medium', 'High' or 'Extreme'.

Table 7: Likelihood Scale as Defined by WDC	
Almost Certain	Is expected to occur in most circumstances
Likely	Will probably occur (once in 1-2 Years)
Possible	Might occur (once in 5-10 Years)
Unlikely	Might occur (once in 10-20 Years)
Rare	Could occur (once in 50-100 Years)

Table 8: Consequence Scale as Defined by WDC				
	Loss of Supply	**Boil Water Notice**	**Illness**	**Operation Disruption**
Insignificant	Insignificant to none	None	No reported illness	Little disruption
Minor	Less than 1 hour	None. Aesthetic water quality event.	No reported illness	Manageable disruption
Moderate	Less than 4 hours	Up to 3 days. Water quality event that requires flushing.	No reported illness	Significant modification to normal operation
Major	Greater than 4 hours	Prolonged	Probable illness	Abnormal or cease of operation
Catastrophic	For 1 or more days	Prolonged	Severe illness and probable death	Complete failure of system

Table 9: Risk Matrix						
		Consequence				
		Insignificant	**Minor**	**Moderate**	**Major**	**Catastrophic**
Likelihood	**Almost Certain**	High	High	Extreme	Extreme	Extreme
	Likely	Medium	High	High	Extreme	Extreme
	Possible	Low	Medium	High	Extreme	Extreme
	Unlikely	Low	Low	Medium	High	Extreme
	Rare	Low	Low	Medium	High	High

8.0 Improvement Plan

The Improvement Plan lists improvements to the Rūātoki Scheme identified during the preparation of this WSP. Each item has been allocated to a person/department that will be responsible for its implementation (Table 10) and the date by which WDC intends to carry it out.

Improvements are listed in order of Priority as follows: High Priority (Table 11), Medium Priority (Table 12) and Low Priority (Table 13).

Priority was assigned by WDC based on the cost of implementation, the ease of implementation and the current risk to the Rūātoki Scheme if the improvements are not carried out.

Table 10: Persons Responsible for Improvement Plan Items

Person Responsible	Code
General Manager Planning and Infrastructure	GM
Manager Three Waters	MTW
Team Leader - Water Treatment Plant	TL-WTP
Water Treatment Plant Operator	WTP-O
Team Leader - Three Waters Operations	TL-O
Team Leader - Three Waters Administration	TL - AS
Team Leader - Three Waters Asset Management and Planning	TL-AM
Asset Engineer - Three Waters	AE
Manager - Capital Projects	PM
Project Engineer - Three Waters	PE
Manager Public Affairs	M-PA
Senior Project Planner	SPP

Table 11: Improvement Plan – High Priority Items

Priority	Risk Table No.	Area of Work	Work To be Implemented	Responsibility	Estimated Cost/Time	Due by Date
1	**S3.1 (PM1)**	**Managing activities in the catchment**	Carry out pesticide suite testing on raw water once every 5 years and compare to previous results to monitor any changes. If two consecutive 5 year periods have been monitored, pesticide suits could be carried out less frequently provided no changes in limits are observed.	TL-WTP	$500	October 2018
2	**R4.1 (PM1)**	**Access by animals/birds.**	Install a mesh on outlet of the overflow pipes at reservoir and contact tank	WTP-O	5 hours	October 2018
3	**T4.1 (PM1)**	**Inadequate calibration and maintenance of treatment plant equipment**	WDC to review calibration and maintenance procedures of treatment plan equipment and incorporate into Operations and Maintenance manual with appropriate Standard Operating Procedures (SOP)	TL-WTP / WTP-O	8 hours	October 2018
	T4.3 (PM2G)		Water Operators competence declaration have expired (to be carried out every 5 years, last carried out 2009). Arrangements for reassessment from DWA scheduled for August 2018.	TL-WTP / WTP-O	8 hours	October 2018
4	**S2.2 (PM3)**	**Bore-head Security**	Preferred option is to relocate bore site to preferred location with borehead at least 0.5 metres above 1% AEP flood level. This is unachievable in short term therefore initial works are: Carry out checks to determine adequacy of cable gland seals and bore head seals including replacing any deteriorating gaskets with water tight gaskets	TL-WTP	5 hours	December 2018
	S2.2 (PM2)		Investigate, in discussion with DWA, if the installation of a testable backflow preventer (double check) on the bore head is warranted due to inherent flooding issues. If required install testable backflow preventer (double check) on the bore head	MTW/AE/PE	$12,000	December 2018

Table 11: Improvement Plan – High Priority Items

Priority	Risk Table No.	Area of Work	Work To be Implemented	Responsibility	Estimated Cost/Time	Due by Date
5	**S3.1 (PM1)**	**Managing activities in the catchment**	WDC to liaise with pesticide application companies and make them aware of locations of water sources, and to be informed of pesticide drops in vicinity of water source.	SPP / AM	80 hours	December 2018
6	**D5.2 (PM1G)**	**Inadequate operating Procedures**	Review existing operating procedures and develop procedures that clearly define steps for each process, items to be recorded and objectives of the process, with reference to other documents.	MTW/TL-WTP/WTP-O	40 hours	December 2018
7	**D5.3 (PM1G)**	**Inadequate training**	Review staff certificates and undertake additional training / personnel development as needed.	TL-O	8 hours	December 2018
8	**T8.3 (PM2)**	**Water quality control, i.e.- Excessive colour, turbidity, temperature, water hardness**	Establish in-house protocols (SOP) for setting of set points and the testing of established set points, thus verifying alarms and plant shut down functionality. All details to be recorded.	TL-WTP / WTP-O	4 hours	January 2019
9	**S3.2 (PM1)**	**Cyan toxins in river water**	Develop a procedure to monitor cyanobacteria/cyan toxins in the river.	TL-WTP	2 hours	March 2019
10	**D5.2 (PM2G)**	**Inadequate operating Procedures**	Develop and implement disinfection procedures for WDC operations staff working on the water network; focus on preventing cross contamination when staff alternate on wastewater and water reticulation work.	TL-WTP/TL-O/TL-AS	4 hours	June 2019
11	**S1.3 (PM2)**	**Emergency Supply**	Maintain valve chamber containing valves that isolate the previous bore from the system and exercise these valves to ensure proper function during an emergency.	TL-O / TL-WTP	8 hours	June 2019
12	**T1.2 (PM1)** **T8.3 (PM1)**	**Water quality control, i.e.- Excessive colour,**	Investigate and cost the installation of adequate filtration or alternative system to treat water quality prior to entering UV system.	MTW / TL-WTP / AE / PE	60 hours	June 2019

Table 11: Improvement Plan – High Priority Items						
Priority	**Risk Table No.**	**Area of Work**	**Work To be Implemented**	**Responsibility**	**Estimated Cost/Time**	**Due by Date**
		turbidity, temperature, water hardness				
13	**S2.1 (PM1)** **S3.1** **T1.3 (PM1)**	**Managing activities in the catchment**	Monitor changes in activities in the catchment and modify catchment risk assessment where required with review of details Annually in June	AE / TL-AM	80 hours	July 2019
14	**S2.1 (PM3, PM4, PM5, PM6)** **S3.1 (PM4)**	**Managing activities in the catchment**	WDC to monitor activities within 250 metres of the water source. 1) To liaise with owners of the land on which bore site sits in order to limit livestock grazing. To also find out future plans that may change activity within the zone that may increase livestock grazing intensity. 2) To liaise with owner/s of piggery to find out activities carried out and discharges made. 3) To make landowner/s aware of the effects of activities around the bore on water quality. 4) To liaise with any business owners that have potential to discharge contamination. Tradewaste consents and building consents to act as triggers.	AE / TL-AM	240 hours	July 2019
15	**D5.1 (PM1G)**	**Poor planning of scheduled work by WDC staff and their contractors**	Where possible utilise WDC Asset Management System to maintain an up-to-date database of critical users such as dialysis patients/hospitals/businesses. Develop robust process for critical customer rating and updating data to maintain active list.	TL-AM	20 hours	July 2019
16	**S1.6 (PM1)** **S1.7 (PM1)** **S2.2 (PM1)**	**Natural disasters - Flooding and extreme storm events**	Investigate options to relocate bore site to a more secure location.	MTW / PM / SPP / TL-AM	$40,000	October 2019

Table 11: Improvement Plan – High Priority Items

Priority	Risk Table No.	Area of Work	Work To be Implemented	Responsibility	Estimated Cost/Time	Due by Date
	T1.2 (PM2)					
17	**S1.6 (PM2)** **S1.7 (PM2)**	**Natural disasters - Flooding and extreme storm events**	Develop a disaster management plan for the water supply which could be included as part of a wider disaster management plan for the district.	MTW / TL-O / TL-WTP	120 hours	December 2019
18	**S2.2 (PM1)**	**Insufficient protozoal treatment installed**	Refurbish bore heads to comply with DWSNZ 2008 and DWA requirements. Investigate and discuss with DWA the practicality of stock fence installation (due to the frequent flooding issues), to a minimum of 5 metres from the centre of the bore head.	MTW / TL-WTP / TL-AM	8 hours	November 2019
19	**S2.1 (PM2)** **S3.1** **T1.3 (PM2)**	**Managing activities in the catchment**	Catchment Risk Assessment undertaken September 2017. Programme activities to submit a catchment risk assessment to the DWA before 5 year period, for approval.	AE / TL-AM	240 hours	September 2022
20	**D1.1 (PM1G)**	**Contamination from backflow**	Develop and implement a backflow prevention policy to match device to risk level of activity, including testing requirements of the devices. This has political ramifications and will be difficult to implement thus long lead in time.	GM / MTW / M-PA / TL-AM	100 hours	December 2022
21	**S2.2 (PM1)**	**Bore-head Security**	Once all options for alternative water source have been explored programme relocate bore head to 0.5 metres above 1% AEP flood level after next LTP review	GM / MTW / M-PA / TL-AM / AE / PM	$250,000	March 2023
22	**T4.4 (PM1G)**	**Inadequate training of staff**	All treatment plant operators to complete appropriate qualification for water treatment plant. WDC to keep records of training and produce when requested.	TL-WTP / WTP-O	$13,000 for diploma	As required

Table 12: Improvement Plan – Medium Priority Items						
Priority	**Risk Table No.**	**Area of Work**	**Work To be Implemented**	**Responsibility**	**Estimated Cost/Time**	**Due by Date**
1	**WSP**	**WSP Review**	Undertake WDC internal review of the WSP annually and report on improvement plan works that have been undertaken.	MTW / TL-WTP / TL-O / AE / TL-AM	24 hours	June (annually)
2	**R4.1 (PM2)**	**Access by animals/birds**	Rodent stations have been installed, routine inspection of vermin/pest control to be included as part of reservoir inspection schedule	WTP-O	2 hours	September 2018
3	**D4.1 (PM3G)**	**Pressure fluctuations in the system**	Carry out a periodic water balance to identify levels of leakage in system.	AE	8 hours	August (annually)
4	**D1.1 (PM3G)**	**Contamination from backflow**	Review policy for withdrawing water from hydrants; specify the use of standpipes fitted with approved backflow preventers.	MTW / M-PA / AE / TL-O / TL-AM	4 hours	December 2018
5	**T4.2 (PM1)**	**Inadequate plant records and procedures**	Ensure all plant records such as manuals, drawings, procedures, emergency response plan, etc. are controlled documents within Council corporate record system and hard copy located at the Water Treatment Plant.	TL-WTP / WTP-O / TL-AS	20 hours + $500	March 2019
6	**T1.4 (PM2G)**	**Other - Insufficient pH treatment**	Plumb solvency - Inform wider community and consumers about the use of copper pipes and fittings (including lead jointing) for internal plumbing by circulating information flyer and notification on Council Website	M-PA / AE	40 hours + $1,000	April 2019
7	**S1.2 (PM2)**	**Power failure**	Investigate installing a control valve on the reservoir outlet to control water supply flow/pressure during power outages. Install Hydrant and non-return valve on outlet main for emergency village supply via tanker.	AE / PM	$15,000	December 2019

Table 12: Improvement Plan – Medium Priority Items						
Priority	**Risk Table No.**	**Area of Work**	**Work To be Implemented**	**Responsibility**	**Estimated Cost/Time**	**Due by Date**
8	**D1.1 (PM2G)**	**Contamination from backflow**	Circulate educational material to customers, especially those considered high risk, about risks of backflow prevention and ways of minimising the risk.	AE / M-PA	4 hours	December 2019
9	**D4.1 (PM1)**	**Pressure fluctuations in the system**	Identify problem pressure areas by carrying out hydraulic computer modelling and network analysis coupled with customer complaint records.	AE	$10,000	December 2022
10	**T1.4 (PM1)**	**Other - Insufficient pH treatment**	This applies if pH is below the DWSNZ pH range 7.0-8.5 (At workshop said pH below 7). Investigate options and benefits of installing pH correction.	TL-WTP / WTP-O / TL-AM / PE	48 hours	April 2020
11	**S1.2 (PM1)** **T3.1**	**Power failure**	Investigate the installation and/or provision of a dedicated generator for this site to provide minimum flow requirement during power outage. Investigate alternative source prior to adoption of this option. For the interim, install a dedicated generator plug-in point.	TL-AM TL-AM	24 hours $5,000	January 2020 July 2019

Table 13: Improvement Plan – Low Priority Items						
Priority	**Risk Table No.**	**Area of Work**	**Work To be Implemented**	**Responsibility**	**Estimated Cost/Time**	**Due by Date**
1	**T2.1 (PM1)**	**Damage to treatment plant equipment due to vandalism and/or vermin and animals.**	Access gate at treatment plant to be padlocked.	TL-WTP / WTP-O	2 hours	September 2018
2	**S2.2 (PM4)**	**Bore head Security**	Carry out CCTV inspection of bore casing to ascertain condition, as required.	TL-O / TL-WTP / TL-AM	$1,000	January 2019
3	**S1.9 (PM1)**	**Resource consent limitations**	Apply for new water take consent well ahead of expiry date of existing WSP - September 2019.	SPP / AE / TL-AM	$55,000	January 2019
4	**R4.4 (PM1)**	**Entry of contaminants due to reservoir design**	Check 'as-built' drawings and carry out a trial run to ensure reservoir can be isolated for cleaning or in case of contamination/loss of structural integrity. If not, programme for installation of appropriate valving to achieve this.	AE / PE	16 hours	February 2019
5	**D2.1 (PM1G)** **D2.1 (PM2G)** **D2.2 (PM3G)** **S1.3 (PM1)** **R2.1 (PM2)**	**Poor circulation in network** **Bore Pump failure**	Utilise Asset Management System to schedule and monitor preventative maintenance.	TL-AS / TL-O	20 hours	March 2019
6	**D2.2 (PM1)**	**Inability to isolate or shut down the system**	Carry out a routine maintenance plan for valve exercising with priority given to critical valves i.e.-those supplying a large or critical customer base, valves on rising and falling mains and those used for bore and reservoir isolation.	TL-AS / TL-O	12 hours	March 2019
7	**R4.3 (PM1)**	**Sediment/slime accumulation and**	Utilise Asset Management System to schedule and implement a CCTV inspection of reservoirs and vacuum cleaning programmes as required.	TL-AS / TL-O	4 hours	April 2019

Table 13: Improvement Plan – Low Priority Items						
		resuspension of accumulated sediment.				
8	**D5.1 (PM3G)**	**Poor planning of scheduled work by WDC staff and their contractors**	Maintain a systematic workflow procedure with control checks for the update of capital works arising from projects, subdivision work and daily replacements and renewals so that all paperwork is sent to the asset engineer for recording on Asset Management System and GIS.	AE / TL-AM	20 hours	April 2019
9	**D4.1 (PM5G)** **D5.1 (PM2G)**	**Pressure fluctuations in the system**	Develop and adopt internal procedure for maintaining an up-to-date Asset Management System and GIS system.	AE / TL-AM	40 hours	May 2019
10	**D6.1 (PM4G)**	**Third party contractor/developer work on WDC reticulation (not directly engaged by WDC)**	WDC to develop policy and procedure whereby Third party contractors/developers are made liable for any damages to the network to increase accountability	TL-O / AE / TL-AM	20 hours	December 2019
11	**S2.1 (PM7)** **S3.1 (PM5)**	**Managing activities in the catchment**	Liaise with Regional Council to list water take consent holders within vicinity and if applicable obtain groundwater monitoring results from these consent holders as a way of early warning of source contamination.	SPP / TL-AM	32 hours	December 2019
12	**R2.1 (PM1)**	**Loss of structural integrity of reservoirs**	Carry out condition assessment of steel reservoir by 2019 (installed 2014) and 7 yearly thereafter.	AE	$5,000	December 2019
13	**D2.2 (PM2)**	**Inability to isolate or shut down the system**	Undertake a programme of marking valve boxes for ease of location.	AE / TL-O	40 hours	December 2019
14	**D3.1 (PM2G)**	**Pipe, valve and hydrant failure due to age,**	Update water asset management plan as required and republish every 3 years.	TL-AM / AE	$4,000 Per system	June 2021

Table 13: Improvement Plan – Low Priority Items						
		condition and material of pipe				
15	**D3.1 (PM1G)**	**Pipe, valve and hydrant failure due to age, condition and material of pipe**	Develop asset renewals programme based on condition sampling and assessments, analysis of asset age, material, frequency of breakages and increase in maintenance costs. Asset renewals to prioritize critical assets such as rising mains/falling mains, pipes supplying a critical consumers or large consumer base, critical valves and hydrants.	AE / TL-AM	240 hours	June 2022
16	**D4.1 (PM4)**	**Pressure fluctuations in the system**	Once hydraulic models are completed and in-line with annual water balance calculations develop and implement leak detection programme	AE	$5,000	April 2023
17	**D6.2 (PM1)**	**Sediment/slime accumulation and resuspension of accumulated sediment.**	Undertake flushing, disinfection and testing of un-commissioned watermain pipeline within the water reticulation prior to commissioning.	TL-O / AE / TL-AM	48 hours	Hold item - Prior to Commissioning
18	**S2.1 (PM8)** **S3.1 (PM6G)**	**Managing activities in the catchment**	Team Leader - Three Waters Asset Management and Planning to provide input into next version district plan (WDC) and regional plan (BOPRC) with regards to protection of catchment; input into activities such as sediment control from earthworks and riparian strip management.	SPP / TL-AM	240 hours	December 2026

9.0 Process Control Summaries

Several parameters within the water supply scheme known as 'Control Parameters' are routinely monitored by the operators to ensure the system is operating within the prescribed 'Target Range'. When any of these Control Parameters exceed the Target Range and reach 'Action Limits' or 'Critical Limits', the operator/s are required to undertake 'Corrective Actions' to restore the system back to the prescribed Target Range.

Effective process control occurs when operators are aware of the Target Range, the Corrective Actions required to be taken and who is responsible for carrying them out. Therefore, it is recommended 'Process Control Summaries' are used as a guide by WDC treatment plant operators in day to day operations.

Table 14: Process Control Definitions	
Critical Control Points (CCP)	Points and processes in the Rūātoki Scheme that can be controlled to prevent contamination of water.
Control Parameters (CP)	Parameters that can be measured and monitored in order to determine if a process is performing as required.
Target Range	Desired range within which each CP is required to operate in the normal day-to-day operation of the system.
Action Limits and Critical Limits	When CPs reach these limits Corrective Actions are required to be carried out by persons responsible to bring CPs back within the Target Range.
Corrective Actions	Actions to be carried out when CPs reach Action Limits and Critical Limits.
Process Control Summaries (PCS)	Target Range, Action Limits and Critical Limits for CPs and a list of corrective actions to be taken when CPs reach Action Limits and Critical Limits, along with person/s responsible for carrying them out.

Figure 9 shows the Critical Control Points (CCPs) of the Rūātoki Scheme and the Control Parameters that are to be monitored and measured at each CCP.

Process Control Summaries have been prepared for the Treatment CCPs of the Rūātoki Scheme. Process control summaries have not been prepared for the Source, Storage and Distribution CCPs further to guidance from the DWA.

A description of each Treatment CCP can be found in Sections 9.1 (Chlorination) and 9.2 (UV Irradiation) and Appendix B sets out Process Control Summaries for each of the Treatment CCPs.

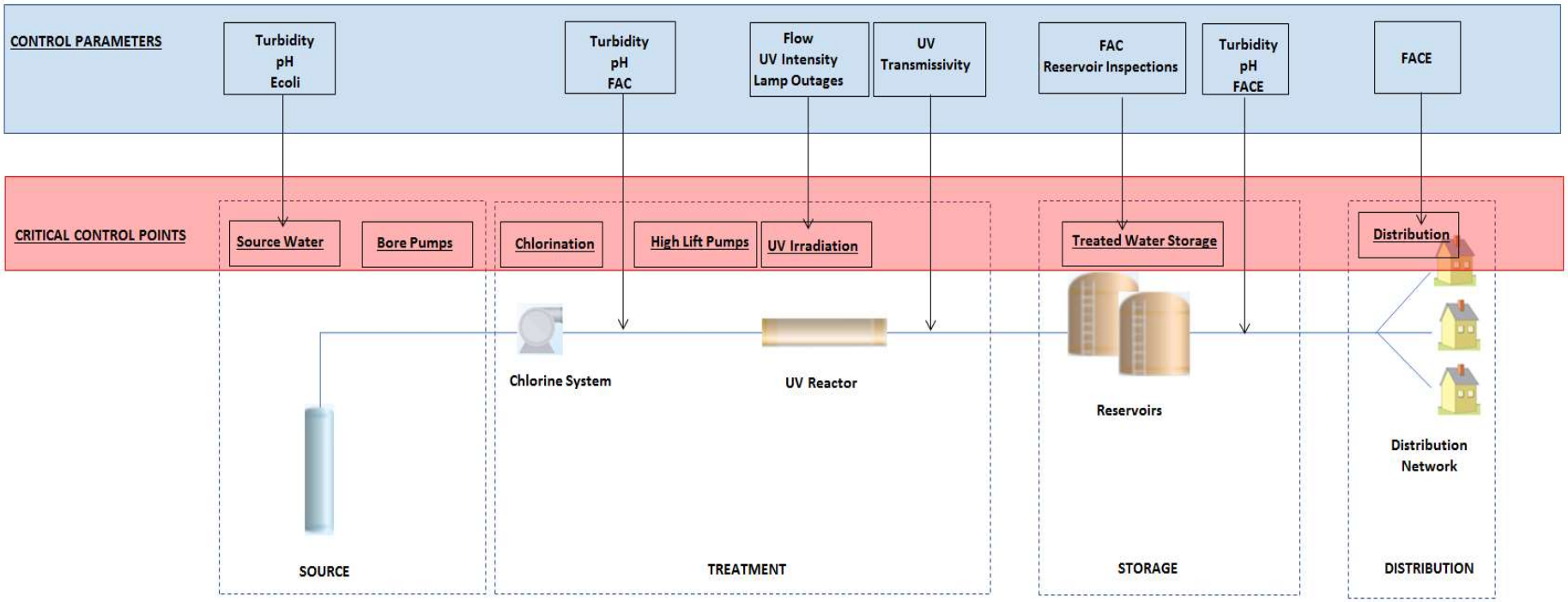


Figure 10: Critical Control Points and Corresponding Control Parameters for the Rūātoki Scheme for Source, Treatment, Storage and Distribution

9.1 Critical Control Point: Chlorination (Disinfection Treatment)

Process Objectives:

- Provide a primary disinfection critical control point to inactivate bacterial, viral and some protozoan pathogens that may have entered upstream of dosing point.
- Provide residual disinfection quality control pit to help inactivate pathogens entering downstream of the dosing point.

Process Location:

- Chlorine dosing system located downstream of raw water intake and before UV treatment unit.

Parameters and day-to-day monitoring:

- Turbidity (NTU units) – Continuous monitoring through turbidity meter connected to SCADA and Telemetry.
- pH (pH units) – Continuous monitoring through pH meter connected to SCADA and Telemetry.
- Free Available Chlorine (FAC, mg/L) – Continuous monitoring

Parameter Monitoring Points:

- All three parameters (Turbidity, pH and FAC) are monitored immediately downstream of the chlorine injection point and upstream of the UV reactor.
- An additional online FAC monitoring is located within distribution zone. This is an additional monitoring and not part of mandatory compliance.

Process Records:

- Manual: WTP Log book, weekly and monthly sheets, manual sampling sheets.
- Online: SCADA system to record and display data, 'Water Online' system to record scheduling/sampling information that can be accessed by the MoH for compliance.

Process Controller:

- Water treatment plant operator/s on duty.

Supporting Programmes:

- Checks and calibration of monitoring instruments.

- Periodic checks of reagents expiry date and discarding of outdated reagents.
- Training of operators of online instruments for turbidity, pH, FAC.
- Lab verification checks for *E. coli* with transgression reporting to Operator and DWA if results are outside DWSNZ 2008.

9.2 Critical Control Point: UV Irradiation (Disinfection Treatment)

Process Objectives:

- Provide a disinfection critical control point and primary protozoal removal and disinfection CCP to inactivate protozoan, bacterial and viral pathogens that may be present.

Process Location:

- UV treatment unit situated downstream of chlorine dosing system.

Parameters and day-to-day monitoring:

- Flow (m^3/hr) – Continuous monitoring through magnetic flow meter connected to SCADA via Telemetry.
- UV Intensity UV(I) (W/m^2) – Continuous monitoring through UV unit connected to SCADA via Telemetry.
- UV Transmissivity (UV(T)) (mw/sm^3) – Manual monitoring, once a month undertaken.
- Lamp outages (number of outages) – Per incident of occurrence.

Parameter Monitoring Points:

- All three parameters (Turbidity, pH and FAC) are monitored immediately downstream of the chlorine injection point and upstream of the UV reactor.

Process Records:

- Manual: WTP Log book, weekly and monthly sheets, manual sampling sheets.
- Online: SCADA system to record and display data, 'Water Online' system to record scheduling/sampling information that can be accessed by the MoH for compliance.

Process Controller:

- Water treatment plant operator/s on duty.

Supporting Programmes:

- Maintenance tasks at weekly, monthly, 3 monthly, 6 monthly and annual intervals.
- Training of operators in UV reactor operation at commissioning time and/or for new operators via established SOP.
- Scheduled validation (verification) and standardisation (calibration) of monitoring instruments.
- Lab verification checks for *E. coli* with transgression reporting to Operator and DWA if results are outside DWSNZ 2008.

10.0 Contingency Plans

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. WDC is responsible for implementation of the Contingency Plans when monitoring has identified the occurrence of a risk event.

If an event occurs despite preventive and corrective actions being in place, WDC is to consult with the Medical Officer of Health to assess the seriousness of the event.

Table 15: Contingency Plans

Event	Actions	Responsibility
Microbiological and/or Chemical contamination of source as a result of, but not limited, to the following: • High rainfall events • Change of activity in the catchment • Accidental spills	Plant to shut down by shutting off pumps when parameters exceed set limits (FAC, pH, Turbidity)	Operations
	Water to be diverted or sent to waste when parameters exceed set limits (FAC, pH, Turbidity)	Operations
	Isolate source – through turning the pump off.	Operations
	Carry out manual dosing – as per WTP reservoir dosing procedure.	Operations
	When directed by MTW or DWA notify customers using M-PA department appropriate communication plan e.g. Boil water notice. • High risk customers to be notified as a priority.	Public Affairs/ Operations
	Carry out increased monitoring according to DWSNZ 2008.	Operations
	Notify the DWA of event.	Operations
	Carry out following depending on nature of event: • Investigate changes to activities in the catchment. • If accidental spill contain the spill.	Operations
	Carry out flushing of reservoirs and distribution system that may be affected.	Operations
Following in water leaving treatment plant: E. coli, low FAC, High Turbidity, UV lamp outages, UV intensity low/high as a result of, but not limited to, the following: • Malfunctioning equipment/sensors	Plant to shut down by shutting off pumps when parameters exceed set limits (FAC, pH, Turbidity)	Automatic /Operations
	Inspect, verify and if necessary carry out maintenance on treatment plant equipment	Operations
	Recalculate dose rates for chlorine.	Operations
	Notify DWA of the event.	Operations
	Carry out increased monitoring according to DWSNZ 2008.	Operations
Following in distribution system: E. coli, low FAC, High Turbidity as a result of, but not limited to, the following: • Backflow into system • Insufficient FAC residual in water leaving treatment plant • Leaks in system • Inadequate maintenance of distribution system leading to slime build	Carry out appropriate actions when treatment parameters deviate from target limits (FAC, pH, Turbidity)	Operations
	Isolate parts of the system including reservoirs. Isolate sections of the distribution network and reservoirs through manual valve isolation.	Operations
	Carry out manual dosing of the network, where required.	Operations
	When directed by MTW or DWA notify customers using M-PA department appropriate communication plan e.g. Boil water notice. • High risk customers to be notified as a priority.	Public Affairs/ Operations
	Carry out increased monitoring according to DWSNZ 2008.	Operations
	Notify the DWA of event.	Operations
	Where appropriate, carry out flushing of reservoirs and distribution system that may be affected.	Operations

Table 15: Contingency Plans

Event	Actions	Responsibility
up, leaching and poor circulation.	Undertake the following depending on nature of event: • Identify and fix leaks in the system and instruct customers to carry out the same on private property reticulation. • Fix backflow preventers on offending connections and carry out routine backflow preventer testing.	Operations
Loss of Supply of Source Water: • Prolonged loss of supply due to leaks, insufficient storage, loss of reservoir structural integrity, unplanned maintenance, pump breakdown	Procedure for sourcing water from emergency supply: alternative groundwater/surface water supply or providing tankered water.	Operations
	When directed by MTW or DWA notify customers using Public Affairs Department appropriate communication plan e.g. Boil water notice. • High risk customers to be notified as a priority.	Public Affairs/ Operations
	Notify the DWA for loss of supply over 8 hours.	Operations
	Monitor reservoir levels.	Operations
Loss of Supply and Contamination of water due to natural disasters and high rainfall events	Undertake contingency plan as per civil defence emergency appropriate to the scenario.	Operations
	Procedure for sourcing water from emergency supply: alternative groundwater/surface water supply or providing tankered water.	Operations
	Increased monitoring according to DWSNZ 2008.	Operations
	Notify DWA of the event.	Operations
	Carry out inspections of the components of the intake/pumps, treatment plant, reservoirs and distribution system for structural integrity.	Operations

11.0 Methodology and Consultation

This WSP has been prepared consistent with the approaches recommended by the Ministry of Health.

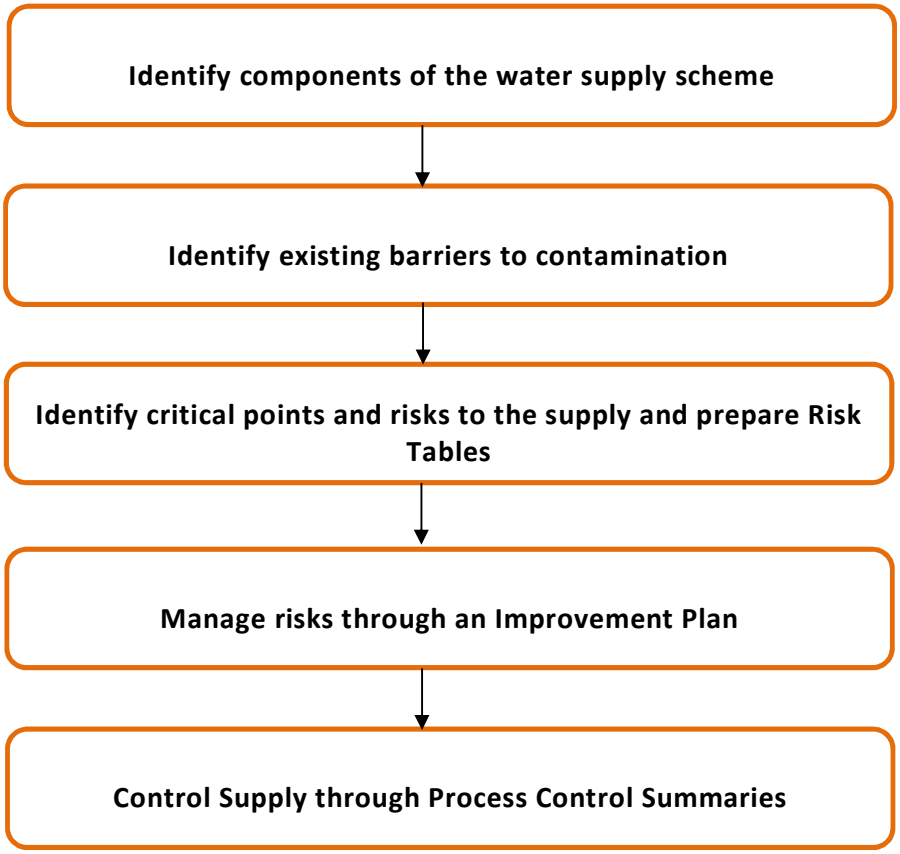


Figure 11: Methodology

The following supporting documents published by the Ministry of Health have been used in the preparation of this report:

- The series of "Water Safety Plan Guides for Drinking Water Supplies (2014)".
- The document "A Framework on How to Prepare and Develop Water Safety Plans for Drinking-water Supplies (2014)".

Information used in this report has been gathered as follows:

- Documents and reports:

- Water Asset Management Plans (WDC)
- Asset condition assessments for reservoirs and pipes (WDC)
- Various Council Policies and Procedures (WDC)
- Maintenance checklists and schedules (WDC)
- Council Annual Plan and Long Term Plan (WDC)
- Drinking Water Assessor Compliance Reports and PHRMP verification reports (DWA, Ministry of Health)
- Drinking Water Assessor Letter 'Rūātoki Plant (TP00326): Protozoal log credit requirement assignation – amended June 2018'
- Reservoir cleaning and structural assessments (WDC)
- Catchment Risk Assessment for Rūātoki bore Water Supply Report (September 2017, PDP)

- Site Visits carried out by PDP to the following locations on the 19th July 2017: Rūātoki treatment plant and pump station site, Rūātoki reservoir site (Appendix D: Rūātoki Scheme Reservoir Inspection Sheet).
- Consultation workshop carried out by PDP with participation of WDC, 30th of August 2017.

The consultation workshop was facilitated by Sala Ranasinghe (Senior Environmental Engineer) from PDP with the participation of key WDC personnel.

The following key WDC personnel participated in the workshop and contributed to the information provided in this report:

Michael Van Tilburg – Manager Three Waters Assets; Gareth Phillips – Manager Three Waters Operations (position held up till May 2018), Leilani Salanguit – Project Engineer; Neal Yeates – Team Leader Water Treatment Plant; Luke Shipton – Team Leader Operations; Joe Xie – Asset Engineer Three Waters .

The aim of the workshop was to identify risks to the Rūātoki Scheme as experienced by the operators of the scheme based on historical events and their knowledge of the scheme, and putting in place improvement measures to manage risks that are not currently managed.

The qualitative risk assessment was carried out using the AS/NZS 4360:1999 Risk Management Standard approach. A Likelihood scale and Consequence scale was defined and set by WDC staff according to how they perceived risks, and the corresponding risk matrix was used to assign risks to events.

The Improvement Plan was ranked by WDC in order of priority, taking into account current risks to the Rūātoki Scheme if not implemented along with the cost of implementation.

Appendix A: Rūātoki Scheme Risk Tables

Table 16: Source – Catchment and Bores

No	Cause	Indicators	Current Scenario			To Be Implemented		
			Preventative measures in place	Risk Managed?	Current Risk	Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)	Residual Risk	Responsibility
S1: EVENT: LOSS OF BORE WATER SUPPLY								
S1.1	Insufficient source water due to seasonal variations/drought (low levels in the river or water tables).	• Reduced or no flows. • Drop in system pressure. • Customer complaints about low pressure.	• Seasonal variations in bore water not experienced at this site.	Yes	Low (Rare x Minor)	N/A	N/A	N/A
S1.2	Power failure	• Power failure alarms. • Reduced or no flows.	• Frequent interruptions to 3 phase power. • No generator available on-site. High probability of theft if generator situated on this site due to storage of fuel. • Bore site has high flood waters – not advisable to have on-site generator. **PM1:** Generator hired from local contractor and taken to site when required. **PM2:** Sufficient storage available in reservoirs. **PM3:** Power failure is detected by SCADA via telemetry; alarms on the SCADA screen and text messages to operator phones	Partially	Extreme (Almost Certain x Moderate)	**PM1:** Investigate the installation and/or provision of a dedicated generator for this site to provide minimum flow requirement during power outage. Investigate alternative source prior to adoption of this option. For the interim, install a dedicated generator plug-in point. **PM2:** Investigate installing a control valve on the reservoir outlet to control water supply flow/pressure during power outages. Install Hydrant and non-return valve on inlet main for emergency remote filling	High (Almost Certain x Insignificant)	**PM1:** TL-AM **PM2:** AE / PM
S1.3	Bore pump failure	• Pump failure alarms. • Reduced or no flows.	**PM1:** Previous bore supplying the Rūātoki scheme is available to provide backup water during emergencies. PM2: Regular bore maintenance carried out.	Yes	Low (Possible x Insignificant)	**PM1:** Utilise Asset Management System to schedule and monitor preventative maintenance. **PM2:** Maintain valve chamber containing valves that isolate the previous bore from the system and exercise these valves to ensure proper function during an emergency.	Low (Possible x Insignificant)	**PM1:** TL-AS **PM2:** TL-AS

Table 16: Source – Catchment and Bores

No	Cause	Indicators	Current Scenario			To Be Implemented		
			Preventative measures in place	Risk Managed?	Current Risk	Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)	Residual Risk	Responsibility
S1.4	Damage to bore headworks and pumping equipment/wiring due to vandalism and/or vermin and animals.	• Visual damage to intake/pump equipment/ electrical cables. • Reduced or no flows from bore. • No signal or no readings received from equipment and/or equipment failure.	• No vandalism experienced at this site previously. • Electrical cabinet is not vermin proof. **PM1:** Access to site through two sets of farm gates. **PM2:** headworks covered with log/debris deflecting steel enclosure and locked onto the concrete. **PM3:** Rodent poison stations placed on site.	Partially	Medium (Unlikely x Moderate)	**PM1:** Install security fence around source.	Low (Unlikely x Moderate)	**PM1**: AE/PM
S1.5	Restricted access to bore site due to absence of right of access.	• Restricted access to site during normal operating conditions.	• Bore/treatment plant site situated on WDC owned land and WDC has no legal restrictions to access the site or the access road.	Yes	Low (Unlikely x Minor)	N/A	N/A	N/A
S1.6	Natural disasters – Flooding and extreme storm events.	• Restricted access to site. • Inability to operate and maintain equipment.	• Site prone to flooding during extreme storm events due to close proximity to Whakatāne River bank. Therefore, access to site severely restricted during flood events. • No flooding at the pump station/ treatment plant site. **PM1:** headworks covered with log/debris deflecting steel enclosure and locked onto the concrete	No	Extreme (Almost Certain x Major)	**PM1:** Investigate options to relocate bore site to a more secure location/to abstract better quality water. **PM2:** Develop a disaster management plan for the water supply which could be included as part of a wider disaster management plan for the district.	High (Likely x Minor)	**PM1**: MTW / PM / SPP / TL-AM **PM2**: MTW / TL-O / TL-WTP
S1.7	Natural disasters – slips and earthquakes.	• Restricted access to site. • Inability to operate and maintain equipment.	• Bore site close proximity to Whakatāne riverbank; current significant riverbank erosion poses risk of loss of supply.	No	Extreme (Almost Certain x Major)	**PM1:** Investigate options to relocate bore site to a more secure location/to abstract better quality water. **PM2:** Develop a disaster management plan for the water supply which could be included as part of a wider disaster management plan for the district.	High (Likely x Minor)	**PM1**: MTW / PM / SPP / TL-AM **PM2**: MTW / TL-O / TL-WTP
S1.8	Clogged bore screen/s	• Reduced or no flows.	• No historical issues at this site. **PM1:** Sufficient holding tank and reservoir storage available if maintenance required.	Yes	Low (Possible x Insignificant)	N/A	N/A	N/A

Table 16: Source – Catchment and Bores

No	Cause	Indicators	Current Scenario			To Be Implemented		
			Preventative measures in place	Risk Managed?	Current Risk	Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)	Residual Risk	Responsibility
S1.9	Resource consent limitations	• Loss of right to abstract water. • Increase in take compared to extraction limit granted.	• Consent expiring in 2019 and due for renewal. **PM1:** Consent management System currently in place to alert when consents are nearing expiration (CS/VU system).	Yes	Extreme (Unlikely x Catastrophic)	**PM1:** Apply for new water take consent well ahead of expiry date of existing WSP - September 2019.	High (Rare x Catastrophic)	**PM1:** SPP / AE / TL-AM
S2: EVENT: MICROBIAL CONTAMINATION OF BORE WATER								
S2.1	Discharge/leachate/runoff from the following activities in the catchment: **Agriculture:** Manure from grazing livestock, Manure fertiliser, silage leachate, dairy shed washwater, effluent spray irrigation, effluent ponds. **Forestry:** Sewage from sludge application. **Industry:** Wastewater discharges from industrial processes, biological washwater. **Human activities**: Wastewater discharge from human activities to land or water i.e. on-site disposal and septic tank. **Feral animals:** faecal matter. **Contaminated sites and landfill sites** **Other:** Stormwater runoff, construction sites, abandoned/unused bores	Water not compliant with DWSNZ 2008: • Median E. coli count over 12 months is more than 500/100 ml • Concentrations of health significant determinands, agrichemicals and other contaminants more than 50% of their MAV in the source water. • Unsatisfactory practices being used in farming and forestry activities, especially related to fertiliser application and sediment control.	• **Recharge zone:** Primary recharge from surface water and secondary recharge from 200 metre groundwater capture zone. **Activities**: in catchment predominantly farming and agricultural, with immediate vicinity of pump station site situated in a paddock, therefore primary risk from stock effluent and grazing animals. Primary microbiological risks considered to be from activities discharging to the Whakatāne river catchment and manure from grazing livestock in the groundwater capture zone and activities carried out in the piggery adjacent to pump station/treatment plant site. Catchment risk assessments have been carried out in 2008 and September 2017. Through the assessment, WDC has developed an understanding of the extent of the recharge zone and nature of activities in it. **PM9:** Business as usual - BOPRC to inform WDC of new discharge consents to the recharge zone (Tauranga river catchment and 200 metre groundwater capture zone) and WDC to provide comments on these consents. WDC to send BOPRC submissions opposing new applications for septic tanks within 200 metre groundwater capture zone.	Partially	Extreme (Likely x Major)	**PM1:** Monitor changes in activities in the catchment and modify catchment risk assessment annually. **PM2:** Submit a catchment risk assessment to the DWA every 5 years for approval. • **WDC to monitor activities within 250 metres of the water source:** **PM3:** To liaise with owners of the land on which bore site sits in order to limit livestock grazing. To also find out future plans that may change activity within the zone that may increase livestock grazing intensity. **PM4:** To liaise with owner/s of piggery to find out activities carried out and discharges made. **PM5:** To make landowner/s aware of the effects of activities around the bore on water quality. **PM6:** To liaise with any business owners that have potential to discharge contamination; Tradewaste consents and building consents to act as triggers. **Team Leader - Three Waters Asset Management and Planning to:** **PM7:** Liaise with Regional Council to list water take consent holders within vicinity and if applicable obtain groundwater monitoring results from these consent holders as a way of early warning of source contamination. **PM8:** Team Leader - Three Waters Asset Management and Planning to provide input into next version district plan (WDC) and regional plan (BOPRC) with regards to protection of catchment;	Medium (Rare x Moderate)	**PM1**: AE/TL-AM **PM2**: AE/TL-AM **PM3**: AE/TL-AM **PM4**: AE/TL-AM **PM5**: AE/TL-AM **PM6**: AE/TL-AM **PM7**: SPP/TL-AM **PM8**: SPP/TL-AM

Table 16: Source – Catchment and Bores

No	Cause	Indicators	Current Scenario			To Be Implemented		
			Preventative measures in place	Risk Managed?	Current Risk	Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)	Residual Risk	Responsibility
						input into activities such as sediment control from earthworks and riparian strip management.		
S2.2	Contamination of bore/well from surface ingress due to: • Inappropriate bore/ well head design, not complying with the standards set by DWSNZ 2008 and the DWA. • Bore headworks and pipework damaged. • Poor joints, cracks or corrosion, in the bore casing.	• Inspection of bore/well head shows non-compliance with DWSNZ 2008. • E. coli transgressions. • No system for backflow prevention. Inappropriate casing material selected, or old casing.	• Site inspection of the bore head identified some non-compliant features against the DWSNZ 2008 and DWA requirements. • Contamination risk through borehead ingress is increased due to flood vulnerability of the site. • No damage to bore headworks or pipework could be assessed visually. • Condition of casing deemed to be good as the bore was drilled in 2014.	Partially	Extreme (Likely x Major)	• <u>Option **1:**</u> **PM1:** Investigate options to relocate bore site to a more secure location/to abstract better quality water. OR • <u>Option **2:**</u> Refurbish boreheads to comply with DWSNZ 2008 and DWA requirements as follows: **PM1:** Investigate if stock fence to be installed, to a minimum of 5 metres from the centre of the bore head on all sides. **PM2:** Investigate, in discussion with DWA, if the installation of a testable backflow preventer (double check) on the bore head is warranted due to inherent flooding issues. If required install testable backflow preventer (double check) on the bore head **PM3:** Carry out checks to determine adequacy of cable gland seals and bore head seals including replacing any deteriorating gaskets with watertight gaskets. **PM4:** routine works • **PM 1:** Programme for annually Test of backflow preventer. • **PM 2:** Carry out CCTV inspection of bore casing to ascertain condition, as required.	Medium (Rare x Moderate)	**Option 1 - PM1:** MTW / PM / SPP / TL-AM **Option 2 - PM1:** MTW / TL-WTP / TL-AM **PM2:** MTW/TL-AM/PM **PM3:** TL-WTP **PM4 - PM1:** TL-O **PM4 - PM2:** TL-O / TL-WTP / TL-AM
S3.1	Discharge/leachate/runoff from the following activities in the catchment: **Agriculture**: Pesticides (including stock dip), chemical fertiliser, dairy shed washwater, stock effluent, effluent spray irrigation, effluent ponds, increase in turbidity from		Catchment Risk Assessment undertaken September 2017. • Primary chemical contamination risk from farming and agricultural activities carried out in the catchment and any chemical spills/discharges to the Whakatāne river catchment.	No	High (Unlikely x Major)	**Refer to S2.1.** Monitor changes in activities in the catchment and modify catchment risk assessment annually. Submit a catchment risk assessment to the DWA every 5 years for approval. **PM1G:** WDC to liaise with pesticide application companies and make them aware of locations of water sources and to be informed of pesticide drops in vicinity of water source.	Medium (Rare x Moderate)	**PM1G**: SPP / AE / TL-AM

Table 16: Source – Catchment and Bores

No	Cause	Indicators	Current Scenario			To Be Implemented		
			Preventative measures in place	Risk Managed?	Current Risk	Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)	Residual Risk	Responsibility
	soil and silt due to cultivation (tilling). **Forestry & Pesticides**: poison from feral animal control, 1080, cyanide, brodifacoum, fuel contamination from vehicles and fuel storage. **Industry and HAIL sites**: Chemical discharges depending on industry; underground fuel storage contamination, cyanide and metal contamination from ore extraction/mining, turbidity from open cast mining and quarrying. **Roading**: Asphalt, contamination due to fuel/ oil leaks and accidental spillages. **Other**: Contaminated/ landfill sites, Stormwater runoff, increased turbidity from construction sites, abandoned/unused bores		• Currently no chemical treatment carried out on source water, therefore high risk in the event of chemical contamination.			**PM2:** WDC to liaise with BOPRC as follows: 1) BOPRC to inform WDC of new discharge consents to the recharge zone (Tauranga river catchment and 200 metre groundwater capture zone) and WDC to provide comments on these consents. 2) WDC to send BOPRC submissions opposing new applications for septic tanks within 200 metre groundwater capture zone. **PM3:** Carry out pesticide suite testing on raw water once every 5 years and compare to previous results to monitor any changes. If two consecutive 5 year periods have been monitored, pesticide suits could be carried out less frequently provided no changes in limits are observed. **PM4:** WDC to monitor activities within 250 metres of the water source. 1) To liaise with owners of the land on which bore site sits in order to limit livestock grazing. To also find out future plans that may change activity within the zone that may increase livestock grazing intensity. 2) To liaise with owner/s of piggery to find out activities carried out and discharges made. 3) To make landowner/s aware of the effects of activities around the bore on water quality. 4) To liaise with any business owners that have potential to discharge contamination; Tradewaste consents and building consents to act as triggers. **PM5:** Liaise with Regional Council to list water take consent holders within vicinity and if applicable obtain groundwater monitoring results from these consent holders as a way of early warning of source contamination. **PM6:** Team Leader - Three Waters Asset Management and Planning to provide input into district plan (WDC) and regional plan (BOPRC) with regards to protection of catchment; input into activities such as sediment control from earthworks and riparian strip management.		**PM2:** AE / TL-AM **PM3:** TL-WTP / WTP-O **PM4:** AE/TL-AM **PM5:** SPP **PM6:** SPP/TL-AM

Table 16: Source – Catchment and Bores

No	Cause	Indicators	Current Scenario			To Be Implemented		
			Preventative measures in place	Risk Managed?	Current Risk	Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)	Residual Risk	Responsibility
S3.2	Conditions suitable for algal growth such as elevated nutrient levels, sunshine, warmth, still water.	• Development of visible algal blooms, complaints of symptoms consistent with toxin poisoning. • Health-significant determinands are more than 50% of their MAV in the source water. • Elevated levels of contaminants (nutrients and toxins) in source water.	**PM1:** BOPRC monitors cyanotoxin growth conditions upstream, and sampling was carried out by WDC 5 years ago and limits were found to be low. **PM2:** and WDC staff has had training to check algal bloom during low river water.	Partially	High (Unlikely x Major)	**PM1:** Develop a procedure to monitor cyanobacteria/cyanotoxins in the river.	Low (Possible x Insignificant)	**PM1**: TL-WTP
S3.3	Saline intrusion due to very deep bores with proximity to sea, increased drawdown due to elevated abstraction causing ingress of seawater.	• Reticulated water not compliant with DWSNZ 2008.	No historic issues with saline intrusion at this source.	Yes	Low (Rare x Minor)	N/A	N/A	N/A
S3.4	Mineral deposits in the catchment and recharge zone due to characteristics of the catchment.	• Reticulated water not compliant with (note heavy metals due to corrosion are excluded) DWSNZ 2008.	No historic issues with mineral deposits at this source.	Yes	Low (Rare x Minor)	N/A	N/A	N/A
S3.5	Contamination of bore/well during construction by cross contamination and by residues from drilling process (e.g. barium)	• Concentrations of chemical determinands more than 50% of their MAV.	Bore has been in operation for a few years, no historic issues associated with bore construction.	Yes	Low (Rare x Minor)	N/A	N/A	N/A

Table 17: Treatment – Chlorination and Ultra Violet Irradiation

No	Cause	Indicators	Current Scenario			To Be Implemented		
			Preventative measures in place	Risk Managed?	Current Risk	Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)	Residual Risk	Responsibility
T1: EVENT: INADEQUATE TREATMENT INSTALLED								
T1.1	Insufficient bacterial treatment installed	• High turbidity and E. coli levels	• Bacterial treatment complies with current DWSNZ 2008 requirements; Chlorination and Ultra Violet Irradiation treatment installed.	Yes	Low (Rare x Minor)	N/A	N/A	N/A
T1.2	Insufficient protozoal treatment installed	• High turbidity and E. coli levels	• Protozoa log credit 4 required, current only meets a log credit of 3. **PM1**: Turbidity monitored continuously at treatment plant; pumps stop when turbidity exceeds set limits.	Partially	Extreme (Possible x Catastrophic)	**PM1: Option 1:** Investigate the upgrade of treatment plant by installing filtration or alternative to achieve 4 log credits. AND; Refurbish bore headworks according to DWSNZ 2008 (See S2.2) **PM2: Option 2:** Investigate options to relocate bore site to a more secure location/to abstract better quality water.	Medium (Rare x Moderate)	**PM1:** MTW / TL-WTP / AE / PE **PM2:** MTW / PM / SPP / TL-AM
T1.3	Insufficient chemical treatment installed	• Chemicals exceed set MAVs	• No priority 2 determinands assigned. Catchment Risk Assessment undertaken September 2017. **PM1:** Activities in the catchment giving rise to chemical contamination identified by carrying out a catchment risk assessment every 5 years.	Partially	High (Unlikely x Major)	**PM1:** Monitor changes in activities in the catchment and modify catchment risk assessment annually. **PM2:** Submit a catchment risk assessment to the DWA every 5 years for approval.	Medium (Rare x Moderate)	**PM1:** AE / TL-AM **PM2:** AE / TL-AM
T1.4	Other – Insufficient pH treatment	• pH below 7 or pH above 8.5	• No pH correction installed, water pH approximately 6.1. • No lead or copper pipes known within network **PM1**: pH monitored continuously at treatment plant; pumps stop when pH exceeds set limits. **PM2:** Plumbosolvency notice circulated among customers every 6 months.	Partially	High (Possible x Moderate)	**PM1:** Investigate options to install pH correction. **PM2G:** Inform wider community and consumers about the use of copper pipes and fittings (including lead jointing) for internal plumbing by circulating information flyer.	Low (Rare x Insignificant)	**PM1:** PM/TL-AM **PM2G:** M-PA / AE
T2: EVENT: INADEQUATE PROTECTION OF TREATMENT PLANT SITE AND EQUIPMENT								
T2.1	Damage to treatment plant equipment due to vandalism and/or vermin and animals.	• Visual damage to treatment equipment/electrical cables.	• Bore and treatment plant at different locations. One gate for access which is not locked, however, no history of vandalism at this site.	Partially	Medium (Unlikely x Moderate)	**PM1:** Access gate at treatment plant to be padlocked.	Medium (Rare x Moderate)	**PM1:** TL-WTP / WTP-O

Table 17: Treatment – Chlorination and Ultra Violet Irradiation

No	Cause	Indicators	Current Scenario			To Be Implemented		
			Preventative measures in place	Risk Managed?	Current Risk	Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)	Residual Risk	Responsibility
		• No signal or no readings received from equipment and/or equipment failure.	**PM1:** Treatment plant equipment situated in a locked wooden buildings.					
T3: EVENT: POWER FAILURE TO TREATMENT PLANT SITE AND EQUIPMENT								
T3.1	Power failure.	• Power failure alarms, Reduced or no flows. • No signal or no readings received from equipment.	• Refer to S1.2 and S1.3.	Partially	Extreme (Almost Certain x Moderate)	Refer to S1.2 and S1.3.	High (Almost Certain x Insignificant)	
T4: EVENT: INADEQUATE CALIBRATION/VERIFICATION, MAINTENANCE, PROCEDURES, SAMPLING, TRAINING								
T4.1	Inadequate calibration, verification and maintenance of treatment plant equipment.		All monitoring equipment (i.e. pH, turbidity, FAC, UV sensors) are verified weekly and calibrated yearly according to procedures set in the DWSNZ 2008. **PM1:** Routine maintenance of chlorination equipment (Dosing regulator, dosing pump, chlorine injector, booster pump) according to manufacture specifications. Routine maintenance of UV equipment: flow rate controller, wiping of lamps, sleeve and sensor.	Yes	Medium (Unlikely x Moderate)	**PM1:** Review and update calibration and maintenance procedures of treatment plan equipment and incorporate into Operations and Maintenance manual with appropriate Standard Operating Procedures (SOP).	Low (Rare x Insignificant)	**PM1:** TL-WTP / WTP-O
T4.2	Inadequate plant records and procedures		• A set of procedures are documented and plant records are maintained for equipment calibration/verification and site visits. • Not all procedures are made available at each treatment plant site.	Partially	High (Unlikely x Major)	**PM1:** Ensure all plant records such as manuals, drawings, procedures, emergency response plan, etc. are controlled documents within Council corporate record system and hard copy located at the Water Treatment Plant.	Medium (Rare x Moderate)	**PM1:** TL-WTP / WTP-O / TL-AS

Table 17: Treatment – Chlorination and Ultra Violet Irradiation								
No	**Cause**	**Indicators**	**Current Scenario**			**To Be Implemented**		
			Preventative measures in place	**Risk Managed?**	**Current Risk**	**Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)**	**Residual Risk**	**Responsibility**
T4.3	Inadequate/incorrect sampling		**PM1:** Sampling carried out according to DWSNZ 2008 requirements and schedule is set up on a spreadsheet that triggers any inadequacies in sampling frequency, intervals and days of the week. **PM2:** WDC treatment plant operators trained and aware of correct sampling procedures. **PM3:** MoH approved accredited labs carry out testing of samples. **PM4:** Transgressions and non –compliances followed up as per DWSNZ 2008 requirements.	Partially	Medium (Unlikely x Moderate)	**PM1:** Review internal procedures and develop robust schedule sampling regime. **PM2G:** Water Operator's Competence declaration have expired (to be carried out every 5 years, last carried out 2009) Arrangements for reassessment from DWA scheduled for August 2018.	Medium (Unlikely x Moderate)	**PM1:** TL-WTP/ WTP-O **PM2G**: TL-WTP/ WTP-O
T4.4	Inadequate training of staff		Annual budget set aside for training. **PM1:** Three treatment plant operators with national diploma certificate and one treatment plant operator on the way to completing the certificate.	Partially	Medium (Unlikely x Moderate)	**PM1G:** All treatment plant operators to complete appropriate qualification for water treatment plant. WDC to keep records of training and produce when requested.	Low (Rare x Minor)	**PM1G:** TL-WTP / WTP-O
CHLORINATION								
T5: EVENT: MICROBIOLOGICAL CONTAMINATION DUE TO INADEQUATE CHLORINATION								
T5.1	Dosing malfunction (Dosing regulator and/or dosing pump, chlorine injector)	• FAC concentration below 0.2 mg/l. • E. coli detected in water leaving treatment plant.	**PM1:** Continuous FAC monitoring at treatment plant; alarm triggered outside normal operation range, plant shuts down if critical limits reached. **PM2:** Routine maintenance of dosing regulator, dosing pump, chlorine injector.	Yes	Low (Possible x Insignificant)	N/A	N/A	N/A
T5.2	Inadequate calibration of equipment (calibration of dosing regulator sensor)	• FAC concentration below 0.2 mg/l. • E. coli detected in water leaving treatment plant.	**PM1**: Equipment verified weekly and calibrated yearly; manual checks on calibration as per DWSNZ 2008.	Yes	Low (Rare x Insignificant)	N/A	N/A	N/A

Table 17: Treatment – Chlorination and Ultra Violet Irradiation

No	Cause	Indicators	Current Scenario			To Be Implemented		
			Preventative measures in place	Risk Managed?	Current Risk	Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)	Residual Risk	Responsibility
T5.3	Dosing regulator set point wrong or incorrect due to incorrect calculation	• FAC concentration below 0.2 mg/l. • E. coli detected in water leaving treatment plant.	**PM1:** Continuous FAC monitoring at treatment plant; alarm triggered outside normal operation range, plant shuts down if critical limits reached.	Yes	Low (Possible x Insignificant)	N/A	N/A	N/A
T5.4	High chlorine demand and poor dose control	• FAC concentration below 0.2 mg/l. • E. coli detected in water leaving treatment plant.	**PM1:** Continuous FAC monitoring at treatment plant; alarm triggered outside normal operation range, plant shuts down if critical limits reached. **PM2:** Frequency of testing increased during high water quality change periods e.g. rainfall, earthquakes. **PM3:** Water further treated with UV downstream.	Yes	Low (Possible x Insignificant)	N/A	N/A	N/A
T5.5	Chlorine supply exhausted	• FAC concentration below 0.2 mg/l. • E. coli detected in water leaving treatment plant.	• A gas cylinder bottle weighs approximately 130kg which contains 70kg of chlorine gas. The cylinder is manually replaced once the weight reaches approximately 80kg. (cylinders placed on a weighing scale and weekly weight recorded on board next to scales). • No chlorine cylinders stored on site. **PM1:** Continuous FAC monitoring at treatment plant; alarm triggered outside normal operation range, plant shuts down if critical limits reached. **PM2:** Water further treated with UV downstream.	Partially	Medium (Possible x Minor)	**PM1:** NIL - Install automatic chlorine changeover at site was considered but due to existing robust system it is deemed that the costs to install additional bottle not warranted.	Low (Unlikely x Minor)	N/A
T5.6	Inadequate chlorine supply from chlorine booster stations	• FAC concentration below 0.2 mg/l. • E. coli detected in water leaving treatment plant.	• No chlorine booster stations in the reticulation system. **PM1:** FAC leaving treatment plant maintained at 0.8 mg/L which is sufficient to last through the distribution system. **PM2:** Manual FACE sampling in distribution system according to DWSNZ 2008.	Yes	Low (Rare x Insignificant)	N/A	N/A	N/A

Table 17: Treatment – Chlorination and Ultra Violet Irradiation

No	Cause	Indicators	Current Scenario			To Be Implemented		
			Preventative measures in place	Risk Managed?	Current Risk	Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)	Residual Risk	Responsibility
T6: EVENT: CHEMICAL CONTAMINATION DUE TO OVER CHLORINATION								
T6.1	Overchlorination due to dosing malfunction, inadequate calibration, dosing regulator set point wrong	• FAC concentration is more than 50% of its MAV.	**PM1:** Continuous FAC monitoring at treatment plant; alarm triggered outside normal operation range, plant shuts down if critical limits reached.	Yes	Low (Possible x Insignificant)	N/A	N/A	N/A
T7: EVENT: MICROBIOLOGICAL CONTAMINATION DUE TO INSUFFICIENT CHLORINE CONTACT TIME								
T7.1	Short circuiting or lack of contact tank	• FAC concentration below 0.2 mg/l. • E. coli detected in water leaving treatment plant.	• Contact tank after chlorine injection. **PM1:** Manual FACE sampling in distribution system according to DWSNZ 2008.	Partially	High (Unlikely x Major)	**PM1:** Review distribution sample points to ensure points of higher risks are covered and develop sampling point schedule (e.g. points furthest away from treatment plant, dead ends and points of low usage, points of high draw off, service reservoirs, old pipework, low pressure areas).	Low (Rare x Minor)	**PM1:** TL-WTP/TL-O/AE / AM
T7.2	Connections off rising main	• FAC concentration below 0.2 mg/l. • E. coli detected in water leaving treatment plant.	• No connections off the rising main.	Yes	Low (Rare x Minor)	N/A	N/A	N/A
ULTRA VIOLET IRRADIATION								
T8: EVENT: MICROBIOLOGICAL CONTAMINATION DUE TO INSUFFICIENT ULTRA VIOLET DOSE								
T8.1	Insufficient UV intensity at the required wavelength due to inadequate cleaning and maintenance of: UV lamp, lamp sleeve, UV sensor	• E. coli detected in water leaving treatment plant. • Scale formation on sleeve and lamp. • Alarms activated for low UV intensity.	**PM1:** UV lamps changed regularly and spare lamps available on site. **PM2:** Regular maintenance of UV unit carried out by WDC staff (clean lamp sleeve and UV sensor lense and lamp surface) **PM3:** Annual full service carried out by manufacturer i.e. new hose work, diaphragms and O rings replacement, etc. **PM4:** UV intensity continuously monitored by sensors on the lamps; alarm triggered outside normal operation range, plant shuts down if critical limits reached.	Yes	Low (Rare x Insignificant)	N/A	N/A	N/A

Table 17: Treatment – Chlorination and Ultra Violet Irradiation								
No	**Cause**	**Indicators**	**Current Scenario**			**To Be Implemented**		
			Preventative measures in place	**Risk Managed?**	**Current Risk**	**Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)**	**Residual Risk**	**Responsibility**
T8.2	Insufficient exposure time to UV radiation due to poor flow rate control, incorrect dose calculation, or low water temperature.	• E. coli detected in water leaving treatment plant. • UV dose at wavelength of 240-290 nm is less than 400 J/m^2.	**PM1:** UV intensity continuously monitored by sensors on the lamps; alarm triggered outside normal operation range, plant shuts down if critical limits reached.	Partially	High (Possible x Moderate)	**PM1:** Recalculate dosage rates during varying water quality periods i.e.- high turbidity/colour, change in temperature	Low (Unlikely x Minor)	**PM1:** TL-WTP
T8.3	Water quality control, i.e.- Excessive colour, turbidity, temperature, water hardness		• No pre-treatment of water before entering UV system. • Plant auto-shut down on turbidity set points **PM1:** pH and turbidity continuously monitored at treatment plant.	Partially	High (Possible x Moderate)	**PM1:** Investigate and install adequate filtration system to treat water quality entering UV system. **PM2:** Establish in-house protocols (SOP) for setting of set points and the testing of established set points, thus verifying alarms and plant shut down functionality. All details to be recorded.	Low (Unlikely x Minor)	**PM1:** MTW / TL-WTP / AE / PE **PM2:** TL-WTP / WTP-O
T9: EVENT: MICROBIOLOGICAL CONTAMINATION DUE TO REVIVAL OF MICRO ORGANISMS								
T9.1	Revival of micro-organisms in the distribution system.	• E. coli detected in the distribution system.	**PM1:** Network is chlorinated and FACE in the distribution system is sampled.	Yes	Low (Rare x Insignificant)	N/A	N/A	N/A

Table 18: Reservoirs

No	Cause	Indicators	Current Scenario			To Be Implemented		
			Preventative measures in place	Risk Managed?	Current Risk	Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)	Residual Risk	Responsibility
R1: EVENT: LOSS OF SUPPLY DUE TO INSUFFICIENT STORAGE								
R1.1	Insufficient storage capacity to store treated water for daily demand.	Treated water storage levels unacceptably low. Reservoir telemetry indicates loss in levels. Decreased or no flow, loss of pressure in the system.	**PM1:** 24 hr storage currently available in reservoir. A 25 m^3 holding tank is also available on site if extra storage is required.	Yes	Low (Unlikely x Minor)	N/A	N/A	N/A
R2: EVENT: LOSS OF SUPPLY DUE TO STRUCTURAL FAILURE								
R2.1	Poor condition of reservoirs leading to leakages, collapse or loss of structural integrity.	Drop in reservoir levels do not match demand. Increased pump starts. Loss of supply. Insufficient pressure/flow for firefighting purposes.	Site inspection of reservoirs showed steel reservoir in good condition; constructed in 2014. **PM1:** Emergency storage of 25 m^3 available onsite via holding tank if required. **PM2:** Reservoir inspections carried out periodically.	Partially	Medium (Rare x Moderate)	**PM1**: Carry out condition assessment of steel reservoir by 2019 (installed 2014) and 7 yearly thereafter. **PM2**: Develop and implement a preventative maintenance programme for reservoirs.	Low (Rare x Minor)	**PM1**: AE **PM2**: TL-AS / TL-O
R2.2	Vandalism to reservoir structure	Loss of supply. Insufficient pressure/flow for firefighting purposes.	Situated on a hill accessible only by 4WD or climbing, difficult to access. Gate leading to reservoir at the bottom of the hill is locked. **PM1:** Ladder access to steel tank is locked.	Partially	Medium (Rare x Moderate)	**PM1**: Padlocked security fence to be installed at the reservoir site to restrict vehicle access and large animals.	Low (Rare x Minor)	**PM1**: TL-O
R3: EVENT: LOSS OF SUPPLY DUE TO INSUFFICIENT SOURCE WATER								
R3.1	Insufficient storage capacity to store additional treated water due to seasonal variations in source.	Treated water storage levels unacceptably low. Insufficient pressure/flow for firefighting purposes. Reservoir telemetry indicates loss in levels.	No seasonal variations in source water at this site, therefore no additional storage required.	Yes	Low (Unlikely x Minor)	N/A	N/A	N/A

Table 18: Reservoirs

No	Cause	Indicators	Current Scenario			To Be Implemented		
			Preventative measures in place	Risk Managed?	Current Risk	Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)	Residual Risk	Responsibility
R3.2	Failure of high-lift pumps pumping from treatment plant to reservoir	Pump failure alarms, Reduced or no flows. Insufficient pressure/flow for firefighting purposes.	**PM1**: Two high-lift pumps available and operate on duty/standby. **PM2**: Regular pump maintenance carried out.	Yes	Low (Unlikely x Minor)	**PM1**: Utilise Asset Management System to schedule and monitor preventative maintenance.	N/A	**PM1:** TL-AS
R4: EVENT: MICROBIAL AND/OR CHEMICAL CONTAMINATOIN OF STORED WATER								
R4.1	Access by animals/birds.	Visual evidence of animal and bird access i.e. feral animal droppings, birds' nests. Unexplained deterioration/change in water quality. FAC residual less than 0.2 mg/L and cannot be maintained and E. coli or coliforms detected in 100 mL of water.	Unable to check mesh on overflow pipe, was told by WDC staff that the overflow is meshed at the exit from the reservoir. **PM1:** FAC residual tested weekly. **PM2:** Reservoir site inspected once a month.	Partially	High (Rare x Major)	**PM1:** Install a mesh on the overflow pipe both at reservoirs and contact tank. **PM2:** Carry out maintenance of the site as required to prevent breeding of vermin/animals	Medium (Unlikely x Moderate)	**PM1:** WTP-O **PM2:** WTP-O
R4.2	Vandalism and sabotage, staff access	FAC residual less than 0.2 mg/L and cannot be maintained and E. coli or coliforms detected in 100 mL of water. Unexplained deterioration/change in water quality.	Reservoir can be accessed by foot by climbing the hill however this is considered unlikely. **PM1**: Disinfection procedures for staff to follow during sampling.	Partially	High (Unlikely x Major)	**PM1:** Padlocked security fence to be installed at the reservoir site to restrict vehicle access and large animals. **PM2:** Develop disinfection procedures for staff to follow during sampling. **PM3:** Staff to be tested for water borne diseases.	Low (Unlikely x Minor)	**PM1:** TL-O

Table 18: Reservoirs

No	Cause	Indicators	Current Scenario			To Be Implemented		
			Preventative measures in place	Risk Managed?	Current Risk	Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)	Residual Risk	Responsibility
R4.3	Sediment/slime accumulation and resuspension of accumulated sediment.	Visible slime/ sediment and customer complaints. FAC residual concentration less than 0.2 mg/L and E. coli or coliforms detected in 100 ml of water. High turbidity levels.	PM1: Reservoir inspections carried out in 2008 and 2015. PM2: FAC residual maintained, checked weekly PM3: Procedure for reservoir cleaning to include disinfection of equipment, appropriate isolation from network, minimising sediment stir up, etc.	Partially	Medium (Unlikely x Moderate)	**PM1:** Utilise Asset Management System to schedule and implement a CCTV inspection of reservoirs and vacuum cleaning programmes as required.	Low (Unlikely x Minor)	**PM1: TL-AS / TL-O**
R4.4	Entry of contaminants due to reservoir design	Deterioration of water quality following new installation. Change in water quality after rain events, increased turbidity. Concentration of copper, chromium or arsenic is more than 50% of its MAV.	Unable to check roof hatches during site inspection.	Partially	Medium (Unlikely x Moderate)	**PM1:** Check 'as-built' drawings and carry out a trial run to ensure reservoir can be isolated for cleaning or in case of contamination/loss of structural integrity. If not, programme for installation of appropriate valving to achieve this.	Low (Rare x Insignificant)	**PM1**: AE / PE
R5.1	Insufficient turnover (Short-circuiting)	E. coli or coliforms detected in 100 mL of water despite adequate FAC residual concentration.	Contact tank at treatment plant site after chlorine injection.		Low Rare x Insignificant)	N/A	N/A	N/A

Table 19: Distribution

No	Cause	Indicators	Current Scenario			To Be Implemented		
			Preventative measures in place	Risk Managed?	Current Risk	Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)	Residual Risk	Responsibility
D1: EVENT: MICROBIAL AND CHEMICAL CONTAMINATION DUE TO BACKFLOW INTO DISTRIBUTION NETWORK								
D1.1	Backflow from individual properties into the distribution system due to a pressure drop in the reticulated system/elevated pressure in individual premises, where the property has no/malfunctioning backflow prevention device	• E. coli or coliforms detected in 100 mL water sample. • Unexplained fluctuations in chemical and microbiological water quality. • Customer complaints of gross contamination of tap water.	• Backflow prevention policy is currently being developed by WDC • Rūātoki is a fully metered scheme therefore all residential connections fitted with dual check valves. • Testing of existing backflow preventers not currently carried out. • Domestic connections installed with dual check valves; during capital renewals projects and 'new connection' applications. • All new commercial and farm connections installed with backflow preventers adhering to NZ Building Code standards; triggered during building/ land use/ tradewaste consents or 'new connection' applications. Specific hydrants assigned for water withdrawal by contractors for ease of policing. Applications are made to the operations depot and water to be withdrawn using standpipes with fitted BFP device and water meter. **PM4G:** Operations department to discuss with building control department to include backflow prevention devices as part of the building control checklist when carrying out building inspections.	Partially	High (Unlikely x Major)	**PM1G**: Develop and implement a backflow prevention policy to match device to risk level of activity, including testing requirements of the devices. This has political ramifications and will be difficult to implement thus long lead in time. **PM2G:** Circulate educational material to customers, especially those considered high risk, about risks of backflow prevention and ways of minimising the risk. **PM3G:** Review policy for withdrawing water from hydrants; specify the use of standpipes fitted with approved backflow preventers.	Medium (Possible x Minor)	**PM1G:** GM / MTW / M-PA /TL-AM **PM2G:** AE / M-PA **PM3G:** MTW / M-PA / AE / TL-O / TL-AM

Table 19: Distribution

No	Cause	Indicators	Current Scenario			To Be Implemented		
			Preventative measures in place	Risk Managed?	Current Risk	Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)	Residual Risk	Responsibility
D2: EVENT: CHEMICAL AND MICROBIOLOGICAL CONTAMINATION DUE TO LACK OF ROUTINE MAINTENANCE								
D2.1	Poor circulation due to lack of hydrant and mains flushing programme.	• Accumulation of sediments in the system. • Parts of the distribution network containing water with low FAC.	• The current routine maintenance schedule is being reviewed by WDC. **PM1**: Flushing of dead ends in the network is currently being carried out in adhoc manner.	Partially	Medium (Possible x Minor)	**PM1G:** Carry out a routine maintenance plan for flushing of mains and hydrants with priority given to flushing dead ends and areas of poor circulation. **PM2G:** Utilise Asset Management System to schedule and monitor preventative maintenance.	Low (Rare x Insignificant)	**PM1G:** TL-AS/TL-O **PM2G:** TL-AS/TL-O
D2.2	Inability to isolate or shut down the system due to missing or failed valves.		**PM1:** Critical valves have been identified through a study carried out by OPUS in 2016.	Partially	Medium (Possible x Minor)	**PM1:** Carry out a routine maintenance plan for valve exercising with priority given to critical valves i.e. those supplying a large or critical customer base, valves on rising and falling mains and those used for bore and reservoir isolation. **PM2:** Undertake a programme of marking valve boxes for ease of location. **PM3G:** Utilise Asset Management System to schedule and monitor preventative maintenance.	Low (Rare x Insignificant)	**PM1:** TL-AS/TL-O / AE **PM2:** AE / TL-O **PM3G:** TL-AS / TL-O
D3: EVENT: LOSS OF SUPPLY AND CONTAMINATION OF SUPLY DUE TO LACK OF ROUTINE ASSET REPLACEMENT								
D3.1	Pipe, valve and hydrant failure due to age, condition and material of pipe.	• Low FAC.	• Currently reactive maintenance being carried out. **PM1**: AMP for 2017 prepared but data need verification and assessment. **PM2:** Pipe sampling has been carried out in certain areas. **PM3:** New Asset Management System implement recording maintenance carried out and cost of maintenance per asset.	Partially	Medium (Possible x Minor)	**PM1G**: Develop asset renewals programme based on condition sampling and assessments, analysis of asset age, material, frequency of breakages and increase in maintenance costs. Asset renewals to prioritize critical assets such as rising mains/falling mains, pipes supplying a critical consumers or large consumer base, critical valves and hydrants. **PM2G**: Update water asset management plan as required and republish every 3 years.	Low (Rare x Insignificant)	**PM1G:** AE / TL-AM **PM2G:** TL-AM / AE

Table 19: Distribution

No	Cause	Indicators	Current Scenario			To Be Implemented		
			Preventative measures in place	Risk Managed?	Current Risk	Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)	Residual Risk	Responsibility
D4: EVENT: CONTAMINATION DUE TO PRESSURE FLUCTUATIONS IN THE SYSTEM								
D4.1	Pressure fluctuations in the system due to: pipe failure, accidental penetration by contractors and leaks in the system, major fire events, Low pressure areas (hills/ extremities).		• Rūātoki is a fully metered scheme therefore all residential connections fitted with dual check valves. • GIS system for WDC reticulation network can be accessed online by public or contractors. **PM6G:** Procedures for third party contractors/developers that require them to obtain a Permit to Work before any work is carried out as part of resource consent. Only Council approved contractors to work on council reticulation.	Partially	High (Possible x Moderate)	**PM1**: Identify problem pressure areas by carrying out model network analysis coupled with customer complaint records. **PM2**: Carry out periodic hydrant testing exercises to test effects on pressure in the system. **PM3G**: Carry out a periodic water balance to identify levels of leakage in system. **PM4**: Once hydraulic models are completed and in-line with annual water balance calculations develop and implement leak detection programme **PM5G**: Develop and adopt internal procedure for maintaining an up-to-date Asset Management System and GIS system.	Low (Rare x Insignificant)	**PM1:** AE **PM2:** AE **PM3G:** AE **PM4:** AE **PM5G:** AE/TL-AM
D5: EVENT: CONTAMINATION AND LOSS OF SUPPLY DUE TO POOR PLANNING, INADEQUATE PROCEDURES AND INADEQUATE TRAINING								
D5.1	Poor planning of scheduled work carried out by WDC staff and their contractors.		**PM1**: Customer services department notified of work being carried out resulting in service disruption. **PM2**: Work carried out outside peak hours to ensure minimum disruption. **PM3:** Public announcements made on radio/ newspaper for major work. 24 hour letter drop notice given to smaller projects. Critical users (dialysis patients/hospitals) notified as a priority.	Partially	High (Possible x Moderate)	**PM1G**: Where possible utilise WDC Asset Management System to maintain an up-to-date database of critical users such as dialysis patients/hospitals/businesses. Develop robust process for critical customer rating and updating data to maintain active list. **PM2G**: Develop and adopt internal procedure for maintaining an up-to-date Asset Management System and GIS system. **PM3G**: Maintain a systematic workflow procedure with control checks for the update of capital works arising from projects, subdivision work and daily replacements and renewals so that all paperwork is sent to the asset engineer for recording on Asset Management System and GIS.	Low (Rare x Insignificant)	**PM1G:** TL-AM **PM2G:** AE/TL-AM **PM3G:** AE/TL-AM
D5.2	Inadequate operating Procedures.		**PM1:** Existing operations procedures are currently being reviewed and updated by WDC.	Partially	Medium (Possible x Minor)	**PM1G**: Review existing operating procedures and develop procedures that clearly define steps to be carried out for each process, items to be recorded, and objectives of the process, with reference to other documents.	Low (Rare x Insignificant)	**PM1G**: MTW/TL-WTP/WTP-O **PM2G**: TL-WTP/WTP-O/TL-AS

Table 19: Distribution

No	Cause	Indicators	Current Scenario			To Be Implemented		
			Preventative measures in place	Risk Managed?	Current Risk	Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)	Residual Risk	Responsibility
						PM2: Develop and implement disinfection procedures for WDC operations staff working on the water network; focus on preventing cross contamination when staff alternate on wastewater and water reticulation work.		
D5.3	Inadequate training of operations staff.		• Staff provided with relevant training. All staff hold appropriate certificate in water reticulation. • Tool box meetings carried out weekly.	Partially	Medium (Possible x Minor)	**PM1G**: Review staff certificates and undertake additional training / personnel development as needed.	Low (Rare x Insignificant)	**PM1G:** TL-O
D6: EVENT: CONTAMINATION AND LOSS OF SUPPLY DUE TO THIRD PARTY CONTRACTORS								
D6.1	Third party contractor/developer work on WDC reticulation (not directly engaged by WDC).		Some procedures currently in place however no recorded procedures or workflow. **PM1G**: implement procedures for third party contractors/developers that require them to obtain a Permit to Work before any work is carried out. **PM2G**: Contractors to submit disinfection procedures, Health and Safety plans, detailed design of work to be carried out **PM3G**: WDC to supervise subdivision work at critical stages such as pressure testing, disinfection, connection to the water main and backfilling, in the presence of the Engineer to the developer. Part of resource consent	Partially	Extreme (Possible x Major)	**PM4G**: WDC to develop policy and procedure whereby Third party contractors/developers are made liable for any damages to the network to increase accountability.	Medium (Unlikely x Moderate)	**PM4G:** TL-O/AE/TL-AM

Table 19: Distribution

No	Cause	Indicators	Current Scenario			To Be Implemented		
			Preventative measures in place	Risk Managed?	Current Risk	Preventative measures to be put in place ('G' reference after PM number refers to Generic item across all Whakatāne Water Safety Plans)	Residual Risk	Responsibility
D6.2	Connection of uncommissioned reticulated watermain.	• Accumulation of sediments in the system. • Parts of the distribution network containing water with low FAC.	• Future extension to water supply laid some years ago but not yet connected to the reticulation network (isolated by flanged plate).	Partially	Medium (Possible x Minor)	**PM1**: Undertake flushing, disinfection and testing of the parts of the water reticulation prior to commissioning.	Medium (Unlikely x Moderate)	**PM1:** TL-O / AE / TL-AM

Appendix B: Rūātoki Scheme Process Control Summaries

Chlorination – Performance Parameters

The alarms for each control parameter are set to ensure appropriate corrective action is taken before the performance parameters reach critical limits. The Target Range, Action limits and Critical limits are set within a percentage of the Maximum Acceptable Values (MAVs) set by DWSNZ 2008 for each performance parameter (FAC, pH, Turbidity).

Table 20: Chlorination – DWSNZ 2008 Limits and Process Performance Parameters

Limits		Performance Parameters		
		FAC (mg/L)	pH (pH units)	Turbidity (NTU)
DWSNZ 2008 Monitoring Parameters		<0.20 mg/L for >2% of 1 day	Guideline: Between 7.0 and 8.0	<1.0 NTU for >5% of 1 day
		>5.00		<2.0 NTU for 3 minutes of 1 day
Target Range	Low Limit	0.80		-
	High Limit	0.90		-
Action Limits	Low Alarm	0.40	5.5	-
	High Alarm	1.90	7.5	1.00
Critical Limits	Low Low Alarm	0.30	5.0	-
	High High Alarm	2.00	8.0	2.00

Plant automatically shuts down when 'Critical Limits' are exceeded.

Chlorination – Triggers and Corrective Actions

Corrective actions to be taken when trigger limits are reached:

Table 21: Chlorination - Triggers and Corrective Actions

Limits	Triggers	Corrective Actions
Target Range	During day to day monitoring or inspection.	• Adjust chlorine dosing rate manually until target range is achieved.
Action Limits	Alarms	• Treatment Plant Operator to turn plant off by turning off pumps remotely and travel to site to carry out an inspection. • Carry out a site inspection to investigate reason for turbidity and/or pH and/or FAC outside action limits: – Check Turbidity meter/ Rotometer / pH meter for any mechanical problems e.g. a jammed rotometer. – Check if chlorine dosing is correct or if the chlorine supply exhausted. – Carry out manual tests to obtain turbidity, FAC and pH readings to verify against turbidity meter/ chlorine analyser/ pH meter readings to check equipment is operating correctly. – Sample to be collected manual for additional E. coli test. • Verify online instruments with calibrate field equipment as per the Water Treatment Plants SOP and/or the manufacturer's instructions. • Carry out a visual check of borehead, treatment plant equipment and surrounding site for signs of vandalism. Check around borehead area and vicinity for any visible signs of contamination. • Adjust chlorine dosing rate manually until target range is achieved. • Increase monitoring frequency. • Once problem is identified and resolved, remote in from laptop disable appropriate alarm and set up the plant to run automatically. Alarms to be reset once plant has settled and returned within normal target range of operation. • Log incident in the water treatment plant log book. • Record event details, manual test results any re-calibration information in the water treatment plant log book.

Table 21: Chlorination - Triggers and Corrective Actions		
Limits	**Triggers**	**Corrective Actions**
Critical Limits	Alarms and/or plant shut down.	***Plant automatically shuts down when critical limits are exceeded for FAC, pH and turbidity*** • Water Treatment Plant operator to notify Water Treatment Plant Team Leader and Water Treatment Plant Team Leader to notify Three Waters Manager. • Travel to site, inspect, test and verify as per 'Action Limits' above. • Supply of water to the reservoir to be stopped while performance parameters are in the critical limit range and scheme to be supplied with compliant stored water using emergency storage or backup/alternative supply. • Carry out contingency plan as per civil defence emergency appropriate to the scenario. • Carry out transgression sampling according to section 4.3.9 of the DWSNZ 2008. • Increase monitoring frequency. • If there is a requirement for the plant to supply water to the scheme whilst performance parameters are in the critical limit range carry out the following: – Obtain approval from TL-WTP, MTW and DWA before supplying water to the scheme that may not satisfy DWSNZ 2008 limits. – Isolate alarms in order to operate the plant. – Confirm conditions of continued operation with the DWA and carry them out (i.e. boil water notice etc.). – Reinstate alarms so that the plant runs automatically once performance parameters are back to Target Range. • WTP-O to complete an incident report for the event, and the TL-WTP to develop a full transgression report.

UV Irradiation – Performance Parameters

The alarms for each control parameter are set to ensure appropriate corrective action is taken before the performance parameters reach critical limits. The Target Range, Action limits and Critical limits are set within a percentage of the Maximum Acceptable Values (MAVs) set by DWSNZ 2008 for each performance parameter (Flow, UV(I), UV(T)).

Table 22: UV Irradiation - DWSNZ Limits and Process Performance Parameters

Limits		Performance Parameters				
		Turbidity	**UV Flow**	**UV Intensity**	**UV Transmittance**	**UV Alarm**
DWSNZ Monitoring Parameters (Section 5.16)		>1.0 NTU for >5% of 1 month	>54.6m^3/hr (15.17 L/s) for >5% of 1 month	<105.6 W/m^2 for >5% of 1 month	<90.35 % for any sample	UV Dose <40 mJ/cm^2 for >5% of 1 month
		>2.0 NTU for any 3-minute period		<84.48 W/m^2 for any 3-minute period	5.16.1 (5.a.ii.B.) does not apply	UV Dose <32 mJ/cm^2 for any 3-minute period
					5.16.1 (5.a.ii.C.) does not apply	
Below parameters based on maximum achieved flows rates for Rūātoki determined by system pumps						
Target Range	**Low Limit**	-	-	>78.6 W/m^2	n/a – Not a CCP	-
	High Limit	0.50 NTU	34.2 m^3/hr	-		
Action Limits	**Low Alarm**	-	-	76.6 W/m^2		"Alarm"
	High Alarm	1.00 NTU	-	-		
Critical Limits	**Low Low Alarm**	-	-	**74.6 W/m^2**		**"Alarm"**
	High High Alarm	**2.00 NTU**	**>34.2m^3/hr**	-		
Plant automatically shuts down when critical limits are reached						

UV Irradiation – Triggers and Corrective Actions

Corrective actions to be taken when trigger limits are reached:

Table 23: Ultraviolet (UV) - Triggers and Corrective Actions

Limits	Triggers	Corrective Actions
Target Range	During day to day monitoring or inspection.	• Check reactor sensor and lamps during routine checking procedures. • Check UVT, turbidity and raw water quality.
Action Limits	During day to day monitoring or inspection.	• Treatment Plant Operator to turn plant off by turning off pumps remotely and travel to site to carry out an inspection. • If high turbidity, carry out a site inspection to investigate reason and rectify situation if possible: – Check Turbidity meter for any mechanical problems. – Carry out manual tests to obtain turbidity readings to verify against turbidity meter to check equipment is operating correctly. – Undertake manual test of field equipment against equipment calibrated at Whakatāne WTP as per the Water Treatment Plants SOP and/or the manufacturer's instructions. – Carry out a visual check of borehead, treatment plant equipment and surrounding site for signs of vandalism. Check around borehead area and vicinity for any visible signs of contamination. • Turn UV reactor to manual operation until plant has achieved normal range (monitored via SCADA). • Increase monitoring frequency. • Once problem is identified and where possible resolved, notify Water Treatment Plant Team Leader, Manager Three Waters and Drinking Water Assessor of transgression. • Log incident in the water treatment plant log book. • Record event details, manual test results any re-calibration information in the water treatment plant log book.

Table 23: Ultraviolet (UV) - Triggers and Corrective Actions		
Limits	**Triggers**	**Corrective Actions**
Critical Limits	Alarms and/or plant shut down.	***Plant automatically shuts down when critical limits are reached UV Intensity falls below 74.6 W/m²*** • Water Treatment Plant operator to notify Water Treatment Plant Team Leader and Water Treatment Plant Team Leader to notify Manager Three Waters. • Travel to site, inspect, test and verify as per 'Action Limits' above. • Carry out contingency plan as per civil defence emergency appropriate to the scenario. • Carry out transgression sampling according to section 4.3.9 of the DWSNZ 2008. • Increase monitoring frequency. • Supply of water to the scheme is stopped while performance parameters are in the critical limit range. • If there is a requirement for the plant to supply water to the scheme whilst performance parameters are in the critical limit range carry out the following: – Obtain approval from TL-WTP, MTW and DWA before supplying water to the scheme that may not satisfy DWSNZ 2008 limits. – Isolate alarms in order to operate the plant. – Issue a boil water notice when indicated by DWA – Reinstate alarms so that the plant runs automatically once performance parameters are back to Target Range. • WTP-O to complete an incident report for the event, and the TL -WTP to develop a full transgression report.

Appendix C: Rūātoki Scheme Localised Groundwater Capture Zone

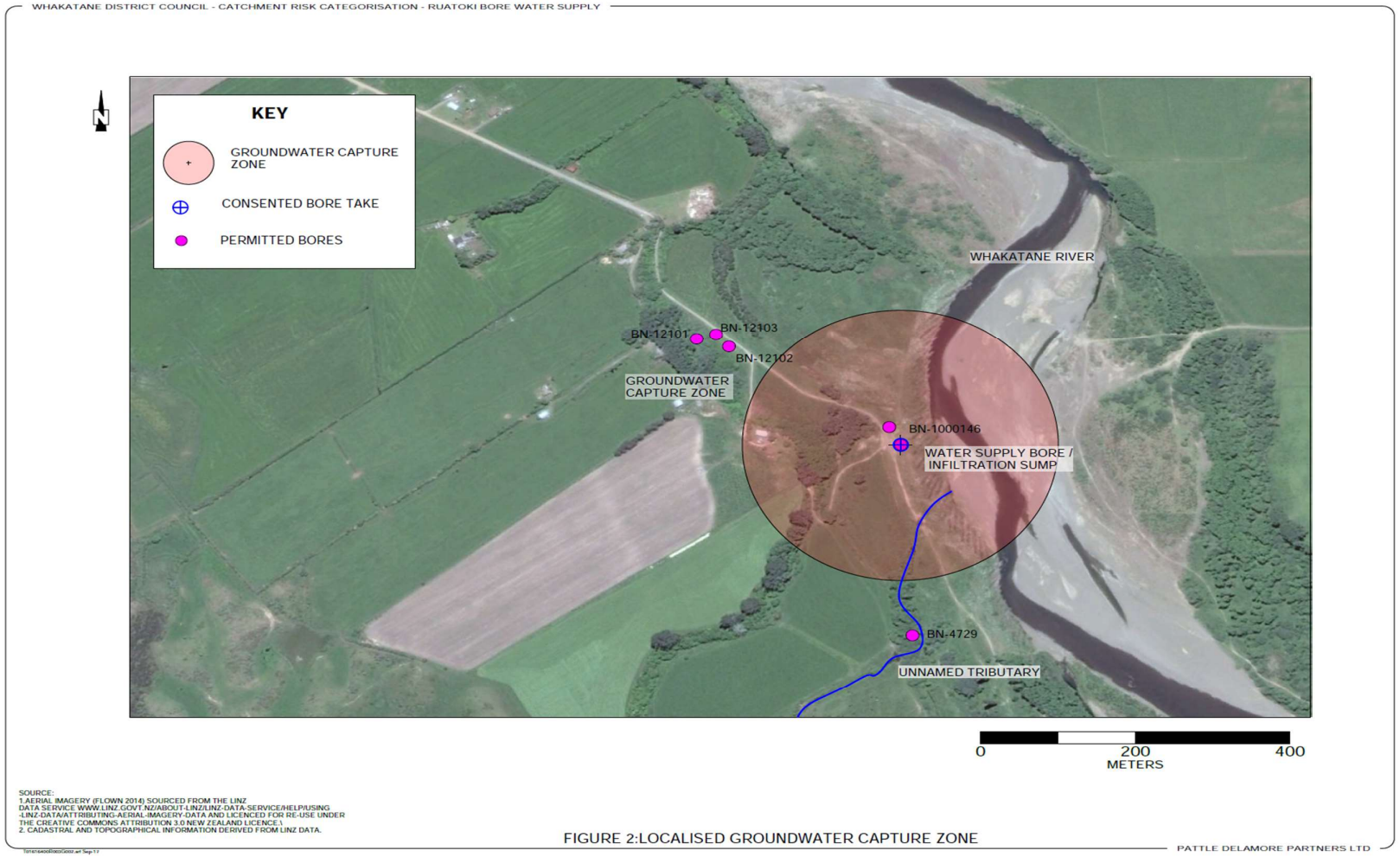


FIGURE 2:LOCALISED GROUNDWATER CAPTURE ZONE

Appendix D: Rūātoki Scheme Reservoir Inspection Sheet

Reservoir Inspection				
General Information				
Project:	Ruatoki Water Safety Plan			
Survey Carried out by:	Sala Ranasinghe			
Date of Site Visit:	17th July 2017			
Location of Reservoir/s:	Paekoa Road			
Number of Reservoirs on site:	1 Reservoir, 1 Holding Tank			
Client Details:	Whakatane District Council			
Assessment				
Access to reservoir:	Sealed road			
Security to reservoir site:	Padlocked gate at the bottom of Paekoa road, no gate at reservoir site.			
Security fence or stock fence?	No security/stock fence on site.			
Reservoir construction material (Concrete/Timber/Steel/Plastic/Other):	**Material:**	In service: Steel (500 m3)	**No:**	1
	Material:	Not in service: Plastic (250 m3)	**No:**	1
	Material:		**No:**	
	Material:		**No:**	
Condition of Reservoirs (Good/Average/Bad) please comment:	**Reservoir 1:**	Steel reservoir - Visual inspection, good condition, new reservoir installed in 2014, no visible leaks.		
	Reservoir 2:			
	Reservoir 3:			
	Reservoir 4:			
	Reservoir 5:			
	Reservoir 6:			
Evidence of human or animal access on site?	No evidence of human access, some small animal droppings found on site.			
Evidence of vandalism?	No visual evidence of vandalism.			
Any points of possible entry of animals into reservoir?	Visual inspection of reservoir roof didn't show possible points of entry of animals into reservoir. Overflow wasn't inspected, was told by operator that is it meshed from inside.			
Any signs of leaks?	No obvious signs of leak.			
Check reservoir roof	As above.			
Any reservoirs not being used?	250 m3 Plastic tank not in use, not connected to reticulation.			
Is ladder access restricted?	Ladder access to steel tank was padlocked and restricted.			
Are roof hatches designed to prevent rainwater ing	Wasn't able to confirm during site visit, WTP operator confirmed steel tank had padlocked roof hatches designed to prevent rainwater ingress.			
Are roof hatches padlocked?	As above.			
Photos				
Reservoir Structure				
Reservoir Roof				

Appendix E: Improvement Plan – Completed Projects

Table 24: Improvement Plan – Completed Items

Priority	Risk Table No.	Area of Work	Work To be Implemented	Responsibility	Comment	Date
Medium	**T4.3 (PM1)**	**Inadequate/incorrect sampling**	Review treatment plant sampling spreadsheet periodically for anomalies.	TL-WTP	completed	June 2018
Low	**D4.1 (PM6G) D6.1 (PM1G)**	**Third party contractor/developer work on WDC reticulation (not directly engaged by WDC)**	Develop and implement procedures for third party contractors/developers that require them to obtain a Permit to Work before any work is carried out. Part of engineering approval - Only Council approved contractors to work on council reticulation.	Contractors and AE / PE	Implemented	March 2018
High	**D6.1 (PM2G)**	**Third party contractor/developer work on WDC reticulation (not directly engaged by WDC)**	This is part of engagement of contractors. Contractors to submit disinfection procedures, Health and Safety plans, detailed design of work to be carried out and communications plan for affected customers to the relevant WDC staff for approval before work is carried out.	Contractors and AE / PE	Implemented	March 2018
High	**D6.1 (PM3G)**	**Third party contractor/developer work on WDC reticulation (not directly engaged by WDC)**	WDC to develop process for subdivision works at critical stages such as design, construction, testing and connection to the live reticulation system in the presence of the Engineer to the developer.	Contractors and AE / PE	Implemented	March 2018
High	**R4.2**	**Vandalism and sabotage, staff access**	Develop disinfection procedures for staff to follow during sampling.	TL-O	implemented	Assessed every 5 years by DWA (next assessment 2018)
High	**T7.1 (PM1)**	**Short circuiting or lack of contact tank**	Review distribution sample points to ensure points of higher risks are covered and develop sampling point	TL-WTP/TL-O/AE / TL-AM	completed	

Table 24: Improvement Plan – Completed Items						
Priority	**Risk Table No.**	**Area of Work**	**Work To be Implemented**	**Responsibility**	**Comment**	**Date**
			schedule (e.g. points furthest away from treatment plant, dead ends and points of low usage, points of high draw off, service reservoirs, old pipework, low pressure areas).			
Medium	**S2.1 (PM9)** **S3.1 (PM2)**	**Managing activities in the catchment**	WDC to liaise with BOPRC as follows: 1) BOPRC to inform WDC of new discharge consents to the recharge zone (Tauranga river catchment and 200 metre groundwater capture zone) and WDC to provide comments on these consents. 2) WDC to send BOPRC submissions opposing new applications for septic tanks within 200 metre groundwater capture zone.	Business as usual with resource consents	implemented	March 2018
Low	**D3.1 (PM3G)**	**Pipe, valve and hydrant failure due to age, condition and material of pipe**	Record condition of asset, maintenance carried out and cost of maintenance against each asset on the Asset Management System during routine maintenance/repair programmes in order to utilise this information in asset renewal programmes.	TL-AM / TL-O	Implemented with new Asset Management System	March 2018
Low	**D1.1 (PM4G)**	**Contamination from backflow**	Operations department to discuss with building control department to include backflow prevention devices as part of the building control checklist when carrying out building inspections.	AE / TL-AM	Discussions held - Part of building inspection process for consented works	July 2018

Appendix F: Rūātoki Plant (TP00326) Protozoal log credit assignation

Toi Te Ora Public Health
PO Box 2120
TAURANGA 3140

10 July 2018

Tomasz Krawczyk
Manager Three Waters
Whakatane District Council
Tomasz.Krawczyk@whakatane.govt.nz

Dear Tomasz

Ruatoki Plant (TP00326): Protozoal log credit requirement assignation – amended June 2018.

Whakatane District Council (WDC) has requested the DWA reconsider the log credit assignation based upon the research findings detailed in the *Gastrointestinal Protozoa, Research and Services reports for the New Zealand Ministry of Health'* study.

Previously WDC had nominated to use a catchment risk category approach as per section 5.2.1.1 of the Drinking-water Standards for New Zealand 2005 (Revised 2008) (DWSNZ) and provided the Pattle Delamore Partners Catchment Risk Assessment for Ruatoki Bore Water Supply, Whakatane District Council, Sep 2017 (A1212109)

The Survey method and information presented in the catchment risk assessment (CRA) is acceptable for determining the protozoal log credit requirements and to inform the water safety plan. The CRA stipulated a log credit of 4 and this was accepted by the DWA.

However, the Ministry of Health research findings indicate that a log credit of 3 is most appropriate for shallow groundwater/spring sources.

Therefore, based on the CRA and the Ministry of Health research findings the log credit requirement assigned to the Ruatoki Plant is 3.

The CRA identifies a number of recommendations that are expected to be addressed in the pending water safety plan.

The Drinking Water Online database will be updated to reflect that the Ruatoki Plant requires a minimum 3 log protozoa treatment.

If you have any questions about this assessment please contact me 07 577 3788.

Yours sincerely,
Grant King

Phone us on 0800 221 555 • enquiries@toiteora.govt.nz • www.toiteora.govt.nz

Drinking Water Assessor
Central North Island Drinking-water Assessment Unit – Toi Te Ora

cc: Leilani.Salanguit@whakatane.govt.nz
Michael.VanTilburg@whakatane.govt.nz
Diana.Kim@whakatane.govt.nz

Appendix G: Report on adequacy of a Drinking Water Supply's Water Safety Plan

CNIDWAU
Central North Island Drinking Water Assessment Unit

IANZ
ACCREDITED INSPECTION BODY

Report on adequacy of a Drinking Water Supply's Water Safety Plan

Drinking Water Supply

Rūātoki Public Water Supply

Central North Island Drinking Water Assessment Unit – Toi Te Ora
PO Box 2120
Tauranga 3110

Report Identifier

RUA003_Ruatoki_WSPadequacy_200818_v1

Executive Summary

Water Safety planning is internationally recognised as the most effective means of consistently ensuring the safety of a drinking-water supply Six principles underpin the foundation of effective water safety planning:

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

Under the Health Act, this supply falls into the category of a minor drinking water supply. Section 69Z of the Act requires that the supply have an approved and implemented water safety plan.

Recommendations – These are areas of the WSP where suggestions for improvement have been made that are not mandatory requirements. They do not affect approval of the plan.

The Rūātoki public water supply - Water Safety Plan (WSP) comprehensively sets out details of the water supply including descriptions, control points and critical control points, risk identification and assessment information, planned improvements, and corrective actions and contingency plans. It is acknowledged that the Rūātoki bore water source requires a significant review due to the effects and risks of river erosion. Whakatane District Council's (WDC) adoption of a more comprehensive approach to water safety planning is commendable and acknowledged by the Bay of Plenty and Lakes District Health Boards.

The WSP for Rūātoki public water supply has been approved with twelve recommendations.

Description of drinking water supply

The WSP describes a WDC owned and operated public water supply consisting of a shallow bore water source that is hydraulically linked to the Whakatane River. An older bore is used as an emergency back up. Treatment consists of gas chlorine with retention time and UV disinfection. Chlorine residual disinfection is maintained in the reticulation. Storage consists of a 500 m^3 steel reservoir. The population supplied is approximately 500 people. Known connections are metered and have a double check backflow prevention device. Storm events in 2017 caused significant river bank erosion which appears to have affected the bore water source leading to high turbidity events occuring during significant rain events in the catchment.

Adequacy of risk assessment methodology

Risk assessment methodology is based on a mixture of Ministry of Health Guides and the AS/NZS 4360:1999 standard. The methodology, scope and description of the water supply, including identification and description of critical point and critical control points is adequate.

Adequacy of risk identification and analysis

The population listed in table two is apparently derived from the drinking-water register. The water supplier is required under the Health Act to keep their registered water supply details, including population, up to date.

Recommendation 1: Evaluate the supplied population and complete a WS01 registration form if the population of the Waimana (or any other WDC) public water supply has significantly changed.

Public health risks are largely adequately identified and analysed. However, several references are made to the Drinking-water Standards for New Zealand 2005 revised 2008 (DWSNZ) Maximum Acceptable Values (MAV) (See plan sections S2.1, S3.2, S3.5, T1.3, R4.4). It is not obvious what general chemical monitoring has been undertaken or what is regularly undertaken, except for the 5 yearly pesticide suite referenced in the improvement schedule. It may be that general water chemistry is analysed currently but this is not set out in the water safety plan. This also includes the assessment and monitoring of disinfection by-products.

Recommendation 2: Evaluate what general chemical testing should be done, where and at what frequency.

The pH value of the water is described as being around 6 (see T1.4). This is outside the guideline value and is associated with increased risk of corrosion and dissolution of metals from reticulation construction materials and a building's plumbing fixtures that can be a health concern. Reference is made in the improvement schedule to investigate pH correction in April 2020 and "inform wider community and consumers about the use of copper pipes and fittings (including lead jointing) for internal plumbing by circulating information flyer and notification on Council Website".

It is acknowledged that the investigation into pH correction is associated with alternative water source investigations and council's long term planning but it is recommended that the education activity be completed as soon as possible.

Recommendation 3: Complete plumbosolvency education activity as soon as possible.

Adequacy of control measures (including Critical Points and Critical Control Points)

Preventative or control measures have been identified for most public health risks/events and are considered to be adequate. However, several areas were lacking in detail or not sufficiently covered.

Preventative measures around checks and maintenance (including scope, schedule and recording) of bore heads (S1.3), treatment instruments (including spare parts and critical spares T4.1)), and reservoirs (R2.1) is referred to in the water safety plan but it is not adequately detailed. WDC have advised verbally that these items are either largely in place or in development as part of the improvement schedule item for operational procedures. The checking and verification of supply processes after significant events or changes such as, near misses, weather events, or the return to business as usual after planned works or significant reactive maintenance should also be considered in the development of operational procedures.

Recommendation 4: Ensure procedures, that are under development, adequately cover (including scope, schedule and recording) the bore head, treatment instruments, and reservoir checks and maintenance that are referred to in the water safety plan.

Staff training and monitoring is referred to in the water safety plan but staff training is limited to improvement schedule items relating to operators being suitably qualified or relating only to reticulation operations (T4.4, D5.3). Training and competency assessment of operators in equipment operation and monitoring is listed as a supporting programme to the CCPs. Improvements are included around procedures but it is not clear how WDC ensures operators are competent. It is recommended that, for critical points, WDC has a system of ensuring staff are competent e.g., recording systems for formal training undertaken, and agreement and signoff on operational procedures.

Recommendation 5: Develop a training and competency system relating to critical point operations.

Reference is also made to "Staff to be tested for water borne diseases" (R4.2). The context or process around this is not detailed. It is recommended that this is further assessed and documented in the proposed "disinfection procedures for WDC operations staff working on the water network; focus on preventing cross contamination when staff alternate".

Recommendation 6: Assess and document the details around the proposed testing of staff for water borne diseases within the proposed disinfection procedures.

The risk items relating to inadequate calibration, verification and maintenance of treatment plant equipment (T4.1, T5.1) incorrectly reference weekly verification and calibrated yearly calibration.

Recommendation 7: Amend risk tables to be more general to accurately reflect that different methods have different timeframes e.g., some are three months or six months or defined by the manufacturer.

The water safety plan doesn't make reference to UV lamp breakage as a risk or what preventative or corrective actions are in place to manage this. WDC have verbally communicated that such procedures are in place, therefore they need to be included or referenced in the water safety plan.

Recommendation 8: Include preventative measures for UV lamp breakages and include or make reference to corrective actions in response to UV lamp breakages.

The previous version of the Ruatoki water safety plan had an improvement item relating to installation of an automatic chlorine changeover at site. This was later reviewed and not considered necessary. However, the risk table (T5.5) should be amended as this review is not in itself a preventative measure and not all preventative measures are included (WDC verbally communicated that spare cylinders were able to be obtained from nearby supplies).

Recommendation 9: Amend the error in the risk table and consider adding that chlorine cylinders can be obtained at short notice.

For the event chemical contamination due to over chlorination the only preventative measure is alarming and automatic shutdown (T6.1). While this is best practice and a critical control point, the relatively common occurrence of treatment plant chemical overdosing around the country has been demonstrated to occur despite alarms and automatic shut downs being in place. It is important for site-specific assessments be made to ensure that all practical physical, mechanical, electrical and personnel barriers are in place to reduce the risk of treatment plant chemical overdosing, in particular to prevent syphoning.

Recommendation 10: Review chemical dosing processes to ensure that all practical physical, mechanical, electrical and personnel barriers are in place to reduce the risk of treatment plant chemical overdosing

The identification and monitoring in relation to critical points and critical control points is considered adequate.

Corrective actions are not included in the risk tables against every event but are detailed for transgressions and monitoring equipment failure in the critical control point process summaries. The contingency plans also have some corrective actions.

Contingency plans are included for typical major events. WDC have communicated verbally that a council-wide incident response plan is in place and this includes roles and responsibilities and communication strategies. It is recommended that water safety plans have (or make reference to) adequate emergency response plans covering major events and natural disasters and adequately address communication with the public, emergency alternative treatment, water conservation and alternative water sources and distribution.

At an operational level, response plans could include supply-specific flushing plans for use during the event of a treatment plant chemical overdosing and noting the risk to customers near to treatment plants and the water delivery times to those connections.

Recommendation 11: Review the WDC incident response plan to ensure it adequate for drinking-water emergencies and formally reference it in the water safety plan.

Recommendation 12: Consider developing supply-specific flushing plans.

Adequacy of improvement schedule

An improvement schedule is included and appears to be aimed at addressing preventative measures, monitoring or corrective actions that are currently absent or ineffective. Many improvement schedule items cover multiple council-owned water supplies. The scope and detail of the improvement item is considered adequate.

Decision

WSP for Rūātoki public water supply has been approved.

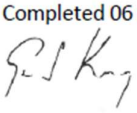
It is expected that the water supplier begin to implement this WSP within one month. The WSP approval remains in force for a maximum period of five years (earlier if otherwise stated in the WSP). Please be aware that if significant changes are made to either the processes used to treat water or to the raw water source, the WSP must be revised and re-submitted for approval by a drinking water assessor.

Information in this report will be provided to the Ministry of Health (in accordance with requirements of Section 69ZZZB of the Health Act).

Attachments

Nil.

Completed 06 September 2018



Grant King
Drinking Water Assessor
Central North Island Drinking Water Assessment Service – Toi Te Ora

Assessment Report Information

Report identifier	RUA003_Ruatoki_WSPadequacy_200818_v1
Drinking Water Assessment Unit (Inspection Body)	Central North Island Drinking Water Assessment Unit – Toi Te Ora PO Box 2120 Tauranga 3110 07 5773788
District Health Board	Bay of Plenty District Health Board
Drinking Water Assessor	Grant King
Assessment Date	20 August 2018
Description of assessment work	Assessment of adequacy of Water Safety Plan for: Supply: RUA003 Ruatoki 560 Zone: RUA003RU Plant: TP00326 Source: G02088 Ruatoki Bore (Main) Source: G00222 Ruatoki Well (Emergency)
Equipment Used	Drinking Water Online Database.
Water Supply Owner / Person Responsible	Whakatane District Council Tomasz Krawczyk , Manager Three Waters
Assessment method	Standard assessment as per Scope Procedure 3 Standard specified in Health Act 1956
Documents and Information	• Drinking Water Standards for New Zealand 2005 (revised 2008) • Ruatoki Public Water Supply –Water Safety Plan Draft Version 1.03, August 2018 T01616400R011 WSP Rūātoki_Final.docx, WDC OBJECTIVE FILE A1255080 • Catchment Risk Assessment for Rūātoki Bore Water Supply, Whakatāne District Council' report (PDP, September 2017).
Site of Assessment	Toi Te Ora, 510 Cameron road, Tauranga
Omissions from proposed assessment	Nil.
Sub-contracted work	Nil.
Document checked by:	Cameron Huxley Trainee Drinking Water Assessor Date 11/09/2018
Release of report authorised by:	Grant King IANZ Accredited Drinking Water Assessor Signature: G J King Date: **13/09/2018**

If you do not agree with the findings of this report a written appeal must be lodged with the Technical Manager, Peter Wood, PO Box 11036, Palmerston North 4440, within 2 months of receipt of this report. The Technical Manager will arrange for a review to be undertaken using the Ministry of Health appeals procedure.